Llywodraeth Cymru
Welsh Government

ARCADIS Design & Consultancy for natural and built assets

BRYNGLAS TUNNEL REFURBISHMENTS

Environmental Assessment Report

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Incorporating

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ABBREVIATIONS

AQMA	Air Quality Management Area
BAP	Biodiversity Action Plan
BS	British Standard
CEMP	Construction Environmental Management Plan
dB(A)	A weighted sound pressure level in decibels: the unit used for measuring traffic noise.
DMRB	Design Manual for Roads and Bridges
DRN	Detailed River Network
EAR	Environmental Assessment Report
EC	European Council / European Commission
EIA	Environmental Impact Assessment
EPA	Environmental Protection Act
EPR	Environmental Permitting Regulations
ES	Environmental Statement
EU	European Union
GCN	Great crested newt
ha	hectare
IAN	Interim Advice Note
JNCC	Joint Nature Conservation Committee
km	Kilometre
LAQM	Local Air Quality Management
LBAP	Local Biodiversity Action Plan
LNR	Local Nature Reserve
mph	miles per hour
NMU	Non-motorised user
NoD	Notice of Determination
NO_2	Nitrogen Dioxide
NO_x	Oxides of Nitrogen
OS	Ordnance Survey
PM	Particulate Matter
PM_{10}	Particulates (particles with a diameter of less than 10µg)
PPC	Pollution Prevention Control
PPE	Personal Protection Equipment
PPG	Pollution Prevention Guidelines
PPS	Planning Policy Statement
PRoW	Public Rights of Way
RoD	Record of Determination
SAC	Special Area of Conservation
SM	Scheduled Monument
SNCI	Site of Nature Conservation Importance
SPA	Special Protection Area
SPZ	Source Protection Zone
SSSI	Site of Special Scientific Interest
SWMP	Site Waste Management Plan

UK	United Kingdom
UK BAP	UK Biodiversity Action Plan
VMS	Variable Message Sign
WFD	Water Framework Directive
WML	Waste Management Licensing
ZTV	Zone of Theoretical Visibility
ZVI	Zone of Visual Influence

1 SUMMARY

The continued delivery of effective transport links and resilience of the highway network is crucial to the Welsh and wider UK economy and, for many, is essential in daily life. This Scheme will contribute to achieving this aim by protecting the Tunnel (and therefore the M4 route) from further deterioration and reduce the vulnerability of the structure, and risk to life, during major incidents, particularly those involving fire. In October 2013, a capital investment package totalling £617.5m was announced to support Wales Infrastructure Investment Plan priorities, of which the Brynglas Tunnel Refurbishments was included.

The condition of the Brynglas Tunnel is poor; the Tunnel is frequently reported as having safety related defects. Almost all of the Mechanical and Electrical (M&E) systems, as well as the sub-carriageways, carriageways, drainage and Tunnel linings have exceeded their design lives and are at significant risk of failure, whilst also causing the Tunnel to be non-compliant with current UK design standards.

Although titled as a refurbishment project, the Scheme involves highway maintenance activities and small scale improvement works. The Improvement component of the project includes the installation of a new fire hydrant and water main at the western extent of the Brynglas Tunnel (Malpas). In addition, an interceptor and pollution containment tank will also be installed at the eastern extent of the tunnel, adjacent to the River Usk. The other components of the project include maintenance works to both the Malpas and River Usk Viaducts and will involve resurfacing of the carriageway, joint repairs and re-strengthening activities.

The activities are anticipated to commence in late 2015/early 2016. A number of environmental constraints are associated with the Scheme and these are detailed in this document. The works are to progress through the non-statutory Environmental Impact Assessment process whereby an Environmental Assessment Report (EAR) is produced. However, the EAR will be issued to consultees for review (namely Natural Resources Wales (NRW) and Newport City Council (NCC)). As part of the scheme a Statement to Inform the Appropriate Assessment has also been drafted and presented separately.

1.1 Air quality

The assessment focused on the construction impacts of the works as there are no operational impacts as a result of the Scheme. The impact on construction has been assessed in accordance with DMRB Air Quality HA207/07. The construction impacts have been identified as being related to the diversion route and the potential dust generated during the works. In accordance with DMRB the locations of sensitive receptors within 200m of construction activities have been identified. In addition, an indication of the traffic flows that may use the diversion routes has been provided and a qualitative assessment of the impacts on air quality has been undertaken. The assessment has indicated that there is unlikely to be any significant impacts on local air quality due to increases in traffic on the A48 during the operation of the temporary diversions. No further assessment of air quality impacts is therefore required.

Prior to the construction works being undertaken a construction and environmental management plan (CEMP) should be finalised including the measures identified in this assessment.

1.2 Ecology & nature conservation

The chapter provides an assessment of the potential significant effects of the Scheme on Ecology and Nature Conservation for the three structures along the existing M4 between Junctions 25A and 26 (inclusive). A desk-based assessment and field surveys to underpin this were undertaken between March and August 2015. The assessment has been undertaken in accordance with DMRB Volume 11, Section 2, Part 5, with specific reference to IAN 130/10 in relation to the valuation of resources. A number of mitigation measures are required in relation to relevant policies and/or the legal protection afforded to reptiles, birds, otters, bats and ensuring that invasive species such as Japanese Knotweed are not spread. In addition, a number of documents have been identified as required to feature in the CEMP, including Japanese Knotweed Method Statement/ Mitigation Strategy and Pollution Control Plan. No significant effects upon nature conservation receptors are predicted during the construction phase of the

project, on the assumption that the mitigation measures proposed are implemented successfully. Given the nature of the works, as outlined in this document, no operational impacts are associated with the Scheme and therefore these have not been considered as part of the assessment.

1.3 Materials

The Materials Chapter addresses potential impacts resulting from the use of material resources and waste management associated with the Scheme. It also assesses potential embodied carbon impacts associated with material resources to be used and the management of waste. The chapter does not make reference to the material resources and waste associated with the operation and future maintenance of the Scheme and only makes reference to the material resources and waste associated with the maintenance and minor improvement works.

In addition, the assessment does not make reference to impacts associated with the offsite manufacture of products. These stages of the products' or material resources' life-cycles are outside the scope of this assessment due to the range of unknown variables associated with the extraction and manufacturing processes. A detailed assessment has been undertaken, as opposed to a simple assessment, in accordance with DMRB and IAN 153/11. Given the project capital costs for the Scheme, in line with IAN 153/11 it is categorised as a 'large new construction project' despite being a maintenance and improvement project.

The IAN 153/11 guidance requires identification of the environmental impacts associated with material resources use and waste, an assessment of waste arisings for the different phases of the Scheme and the measures which will be implemented to mitigate the impacts. The assessment has identified slight adverse impacts associated with the Scheme. Further work relating to the material resources to be used and the wastes to be produced during the works is ongoing. The SWMP and waste forecasts will require updating once the final bill of quantities becomes available and by the Principal Contractor during the works.

1.4 Noise & vibration

This chapter assesses the effects upon people of noise and vibration that is likely to be generated by the refurbishment works on the M4 Brynglas Tunnel and neighbouring viaducts. Construction works have the potential to generate noise and vibration at levels that may be disturbing to people and sensitive receptor locations. Construction-phase noise and vibration effects are, however expected to be of a temporary nature, occurring for the duration of the maintenance and improvement works. The noise assessment has been carried out in accordance with BS 5228-1. The noise predictions are based on construction information available at this stage. Out of necessity certain works on the M4 structures have to be carried out at night. Night-time works have the potential to be disturbing to local residents, particularly where works take place in close proximity to residential receptors. The works on the Malpas Viaduct and Brynglas Tunnel are essential work and will be temporary in nature.

Predictions presented in this report are based on construction information available at this stage and present a possible worst case by assuming all plant for each activity would be used simultaneously. The indicative predictions indicate that a significant effect is likely where works take place in close proximity to receptors, particularly at night.

The predictions are also based on the available information on construction programme and plant to be used at this stage. A more definitive method statement and list of plant will only be available once a contractor has been appointed to carry out the work. Assumptions have been made at this stage regarding mitigation measures that are possible.

The possibility of submitting a Section 61 Consent Application in terms of the Control of Pollution Act 1974 (could be considered). This would allow for more detailed noise predictions based on a detailed construction programme and method statement that would allow for selection of the most appropriate mitigation measures.

Noise control measures consistent with good working practices would be implemented during the construction phase in accordance with the principles of the “best practicable means” (BPM), as defined in the Control of Pollution Act (1974) would be used to reduce noise and vibration emissions throughout the construction period.

1.5 Effects on all travellers

This Chapter assesses the potential effects of the Scheme on vehicle travellers, as stipulated within Design Manual for Roads and Bridges (“DMRB”), Volume 11, Section 3, Part 9, ‘Vehicle Travellers’; and for ‘Non-Motorised Users’ (“NMUs”)[1], as required by DMRB, Volume 11, Section 3, Part 8, ‘Pedestrians, Cyclists, Equestrians and Community Effects’. A full description of the Scheme is given in Chapter 3: The Project.

As acknowledged in DMRB, the assessment of effects on all travellers are qualitative, subjective assessments which cover the 'view from the road' experienced by vehicle travellers, the potential for ‘driver stress’ and the effect on NMUs. The study area has been defined by the diversion route that will be in operation during the M4 motorway closures. The refurbishment of the River Usk Bridge, Brynglas Tunnel and Malpas Viaduct along the M4 motorway will take place between Junctions 25A and 26. The tunnel has two bores – eastbound and westbound, only one of the tunnel bores will be closed at any one time and the closures will take place at night and weekends.

During the closure of either tunnel bore the diversion route for traffic will be via the A48 Southern Distributor Road (SDR) to the south of Newport. The closure of the eastbound bore will result in the closure of the Junction 26 eastbound on-slip and the closure of the westbound bore will result in the closure of the Junction 26 westbound off-slip. All other junctions will remain fully operational during the closure of either tunnel bore. The assessment criteria has included: View from the road, Driver stress, Non-motorised users, Journey Length, Local Travel Patterns, Predicting Changes in Journey Lengths, Changes in Amenity, Community Severance, New Severance, Relief from Existing Severance. Based on the overall analysis of each of the criteria, and due to the short term and temporary nature of the Scheme and as the A48 SDR has low receptor sensitivity and is a strategic route designed to accommodate high volumes of traffic, together with the Management and Communication Plan which will seek to inform travellers of diversion and minimise the impact on travellers, the overall residual significance of effect will be Minor Adverse, this is considered to be Not Significant.

1.6 Community & private assets

This section provides an overview of information and likely impacts of the Scheme on people and communities. Specifically, the assessment will consider potential impacts relating to for example community facilities, private assets such as commercial and residential land uses, and impacts on the amenity of local residents and businesses (from, for example, the combination of environmental effects such as noise and air quality).

Given that the Scheme is to undertake maintenance and refurbishments of three structures, the assessment is confined to the construction phase only. The scope of the assessment for community and private assets extends to the following areas: impacts of the Scheme on community facilities (identified as social infrastructure including schools, healthcare provision, places of worship, leisure facilities and areas of formal and informal open space); impacts on private assets (identified as residential and commercial uses); and impacts on the amenity of local residents and businesses. Unlike other environmental topics, the sensitivity of socio-economic receptors to the Scheme is not determined by reference to designations or an objective standard. The importance or sensitivity of resources has therefore been categorised based on the type and value of the asset or facility affected by the Scheme, as shown in this document. The assessment has identified that the impacts arising from the Scheme in relation to the topic of Community and Private Assets are likely to be temporary in nature and therefore not significant.

[1] DMRB Volume 11 Section 3, part 8 refers to NMUs in full as ‘pedestrians, cyclists, equestrians’ and in short as ‘pedestrians and others’.

Prior to the commencement of construction works, a construction and environmental management plan (CEMP) will be prepared, setting out mitigation and other good practice measures as identified in the preceding paragraphs.

1.7 Road drainage & the water environment

The Chapter firstly describes the study area and the methodologies used to assess the potential significant effects of the proposed Development. Baseline conditions are described and details of consultations undertaken are provided, followed by a discussion regarding potential effects, taking into consideration embedded design measures. The conclusions from the assessment together with recommendations for further work are then provided and a list of references completes the Chapter. The proposed assessment scope has considered the following facets of the water environment local to the Scheme, in line with Volume 11, Section 3, Part 10 of the DMRB (HD/09) (Ref 11-1). Where an assessment has been scoped out justification is also presented. It is concluded that, given the design and mitigation measures proposed, during the repair and maintenance phase the overall impact on water environment receptors would be neutral. When repair and maintenance works are complete a new pollution control system at the Usk Bridge, would operate where no facility currently exists. This has the potential to result in a moderate beneficial effect on localised water quality in the River Usk.

1.8 Cumulative effects

Cumulative effects have been considered as part of the Scheme. These are defined as the result of multiple actions on environmental receptors or resources. There are principally two types of cumulative effect to be assessed: Type 1 - where different environmental impacts are acting on a given receptor, but are the result of one project; or Type 2 - where environmental impacts are the result of multiple projects in combination (including the project being assessed). The cumulative environmental effects during construction and operation are considered against the significance criteria set out in DMRB Volume 11, Section 2, Part 5, as presented in this document. These criteria could reflect beneficial or adverse effects. Cumulative effects are not anticipated. However, successful consultation between contracting parties will be required as works at Junction 28 of the M4 will be carried out during the same time period as works to the Tunnel and Viaducts. In addition, consideration will need to be given to the activities of Magor Brewery as permissions have recently been obtained from Newport City Council and Monmouthshire County Council to carry out closures of part of the A48/ SDR, Queensway Meadows and the Eastern Distributor Road to allow large pieces of brewery equipment to be transported to the brewery site from Newport Docks.

2 INTRODUCTION

2.1 The project

The Scheme involves the maintenance of three structures along the existing M4 between Junctions 25A and 26 (inclusive) with some minor improvement works. Works are proposed for the River Usk Viaduct, Brynglas Tunnel and Malpas Viaduct and detailed below in Sections 3.3.1, 3.3.2 and 3.3.3. Although titled "*Refurbishments*" the project is a combination of Maintenance and Improvement construction activities.

The locations of the existing structures are illustrated in Drawing 007-UA007844-001 and in close proximity to a small number of sensitive receptors including private dwellings as well as the River Usk Special Area of Conservation (SAC) and Site of Special Scientific Interest (SSSI). Although the works involve the maintenance of three separate structures along the existing M4, the construction phase activities are to be carried out as one Scheme within the same time frame.

Arcadis are the Employers Agent, advisors to the Welsh Government. The project will be run under a Design and Build (D&B) Contract. Welsh Government have also commissioned WSP/ Parsons Brinkerhoff to design the repair/ strengthening works required for the River Usk Viaduct. A Contractor has not yet been commissioned to carry out the construction-phase of the works. Given the nature of the contract, Arcadis have drafted this Environmental Assessment Report (EAR) and will then oversee the works undertaken by the Contractor once appointed. In the unlikely event of changes to the environmental assessment being required, this will be the responsibility of the Contractor. During this review the Contractor will take into account access limitations, preferred method of working and all other constraints/ environmental receptors identified in this document. The Contractor will be required to submit a Construction Environmental Management Plan (CEMP) and a Register of Commitments prior to works commencing on site.

2.1.1 Purpose of this report

This EAR summarises the environmental baseline conditions and the results of surveys recommended in the Scoping Report produced in June 2015 and issued to Newport City Council (NCC) and Natural Resources Wales (NRW) for information. It also identifies the potentially significant environmental effects of the Scheme and, where appropriate, mitigation measures.

This report has been prepared in accordance with the Design Manual for Roads and Bridges (DMRB) Volume 11: Environmental Assessment and associated documents (such as the relevant Interim Advice Notes (IANs)).

In addition, in order to comply with the Conservation of Habitats and Species Regulations 2010 (as amended), an Assessment of Implications on European Sites (AIES; in the form of a Statement to Inform Appropriate Assessment, SIAA) has also been drafted and presented as a separate document.

2.2 EIA Determination Process (Screening)

The Environmental Impact Assessment Directive 2011 (2011/92/EU) categorises the construction of roads as an Annex I or an Annex II project. Given that the scheme is not categorised as Annex I it therefore underwent screening against the Annex II criteria. Statutory Instrument 1999 Number 369, (cited in DMRB Vol 11, Section 2, Part 3) designates a relevant project as "a project for constructing or improving a highway where the area of the completed works together with any area occupied during the period of construction or improvement by requisite apparatus, equipment, machinery, materials, plant, spoil heaps or other such facilities exceeds 1 hectare (ha) or where any such area is situated in whole or in part in a sensitive area."

DMRB (Vol 11, Section 2, Part 3) states "*In general, if the Annex II project falls below the thresholds of size and outside of environmentally sensitive areas then it is considered not to be a relevant project and*

may be screened out of the formal EIA process. No determination decision is necessary, a Notice of Determination does not need to be published, and an Environmental Statement is not required."

DMRB allows Non-Statutory Environmental Reports to be developed which are in line with formal Environmental Statement requirements which are amended depending upon the nature of the project.

The EAR will include any potential impacts of the works associated with the construction- phase Maintenance activities for the project. The Brynglas Tunnel Refurbishments is a hybrid project. The Scheme includes a range of works which offer tangible improvements to the highway users. The EAR will be proportionate whilst maintaining a robust environmental assessment. A separate Record of Determination (RoD) has been produced to record the decision not to undertake a statutory EIA. This will lead to the production of a Notice of Determination (NoD) which will be used to inform the public of the decision. Although screened out from the formal EIA process, it is still possible that the project could have significant effects on the environment and therefore this environmental assessment is still being undertaken.

It should be noted at the time of writing that 2014/52/EC being currently under transposition and will be inplace during the construction-phase of the scheme.

2.3 Consultation

Consultation has been undertaken with the statutory stakeholders; namely Natural Resources Wales (NRW) and Newport City Council (NCC). In addition, the South Wales Trunk Road Agency (SWTRA) have also been contacted. The outcomes of these consultations are summarised in Table 2.1. A desk study and archaeological walkover of the scheme and surrounds was undertaken in 2015. Based on the outcomes of the cultural heritage assessment carried out, no consultation with CADW has been undertaken. The outcomes of the Cultural Heritage screening assessment have been presented in a separate document and provided in conjunction with this assessment report.

Table 2.1: Consultation

Statutory Stakeholder	Date	Summary of Response
NRW	4th December 2014	• Need for Flood Defence Consents identified. Review of anticipated scope of works.
	12th March 2015	• Project update and review of anticipated works and environmental assessment approach carried out.
	5th August 2015	• Project update, discussions surrounding the temporary works design and extent of coverage across the structure (the River Usk Viaduct).
	28th August 2015	• Scoping report issued for information and comment.
NCC	20th March 2015	• Introduction to the Scheme, anticipated level of assessment and works to be carried out.
	28th August 2015	• Scoping report issued for information and comment. • Content and efforts of environmental assessment considered to be acceptable.

3 THE PROJECT

3.1 Background to the project

The M4 operates as dual, 2-lane motorway in both directions through the Brynglas Tunnel and across the viaducts on either side. Either side of the Tunnel, beyond the two viaducts, the motorway returns to dual, 3 lane operation resulting in the Tunnel and associated viaducts being a major pinch point on the network. The Brynglas Tunnel first opened in, and has been in operation since, the late 1960s. It carries approximately 80,000 vehicles per day along the M4 motorway around Newport and is critical to the efficient mass movement of road traffic along the M4 route in South Wales. The condition of the Brynglas Tunnel is poor; the Tunnel is frequently reported as having safety related defects and recent safety inspections have noted seepage of the sub-carriageway up through the surfacing. Almost all of the Mechanical and Electrical (M&E) systems, as well as the sub-carriageways, carriageways, drainage and Tunnel linings have exceeded their design lives and are at significant risk of failure, whilst also causing the Tunnel to be non-compliant with current UK design standards.

The conditions of the Tunnel deteriorated during a HGV Tunnel fire in 2011, which caused significant damage to the westbound bore. The repairs undertaken were temporary, designed to allow swift re-opening of the Tunnel and M4 route, but these remain and are in urgent need of replacement. Failure of a critical system or the structure itself would require the immediate closure of the Brynglas Tunnel for essential repairs which would have a severe impact upon transport in the region and, in turn, on the Welsh Economy.

The improvements and maintenance works between junctions 25A and 26 of the M4 aim to improve the highway conditions for health and safety purposes, as well as undertaking essential maintenance works to ensure the carriageway remains sufficient for carrying the necessary volumes of traffic.

An EAR has been deemed necessary for the reasons outlined in Section 2.2 above. The works will include the need for night time working, temporary closures and the proximity of a number of potentially sensitive receptors. The works will be predominantly within the existing soft estate. However, in order for scaffolding to be fitted to the Viaduct (particularly at the River Usk) there will be the need to temporarily use some of the adjacent land which is owned by Newport City Council, namely Glebelands Recreational Ground.

3.2 Project Objectives

- Continued delivery of effective transport links and resilience of the highway network is crucial to the Welsh and wider UK economy.
- Protecting the Tunnel (and therefore the M4 route) from further deterioration and reduce the vulnerability of the structure, and risk to life, during major incidents, particularly those involving fire.
- To improve the condition of the Tunnel and to bring it in line with current UK design standards as currently non-compliant and the sub-carriageways, carriageways, drainage and Tunnel linings have exceeded their design lives and are at significant risk of failure.
- To improve the pollution protection measures for the River Usk.

3.3 Traffic Model

For the Brynglas Tunnel Refurbishment project, it has been assumed that the change in traffic flow will be temporary during night time closures (anticipated to be between 10pm and 6am, depending upon traffic flows) and will not involve the long-term permanent increase of traffic on surrounding roads or the M4 upon completion of the works. Therefore, traffic modelling has not been undertaken nor considered necessary given the nature of the Scheme. Although there will be the need for some temporary night time closures, this will only include one of the tunnel bores at any one time. Therefore, one directional traffic

flows will remain at all times but no contraflows will be put in place inside the tunnel for health and safety reasons. Although the exact number of night time closures has not been determined, it is anticipated that there would be a maximum of five closures in any one week and a maximum of four weekend closures (per tunnel bore) over the course of a 12 month period.

3.4 Project description

The project is located on the M4 between junctions 25A and 26, to the north of Newport, Figure 3-1. The primary purpose of the Scheme is to improve conditions for health and safety purposes and to also ensure the structures and continue to carry the levels of traffic which use the M4 on a daily basis. At present, the construction work is currently scheduled to commence on site in March 2016 and will continue for a 21 month duration.

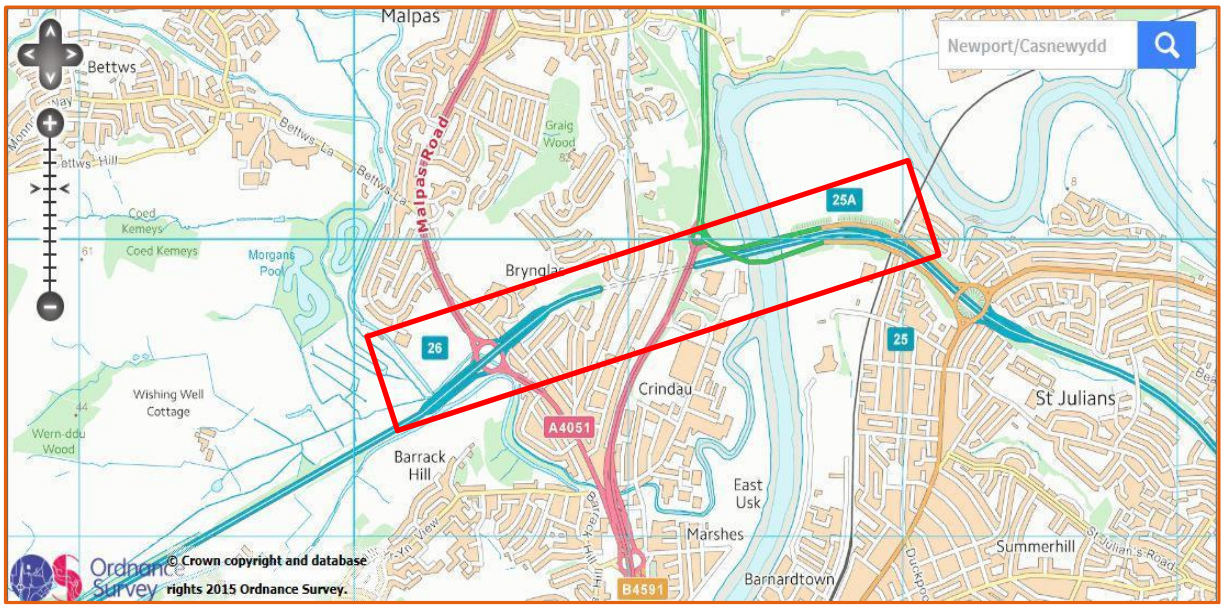


Figure 3-1 Site Location, between junctions 25A and 26.

Although the scheme is titled as a refurbishment project, it involves a combination of maintenance and improvement works which include:

3.4.1 Brynglas Tunnel Refurbishment

The Scope of works in relation to the highway drainage improvements and the installation of pollution control measures associated with the tunnel comprises:

- Installation of a hydrocarbon interceptor;
- Installation of a pollution containment tank;
- Fitting of a non-return flap valve to the existing outfall to prevent sediment entering into the highway drainage during periods of high tide; and
- Maintenance to the existing drainage which carries the current M4 highway runoff to the outfall to the River Usk.

Minor earthworks will be required on the existing M4 soft estate (accessed via the hard shoulder and emergency evacuation route from the Brynglas Tunnel) in order to install an interceptor and pollution containment tank. The installation of the interceptor and pollution containment tank will provide long-term, permanent protection measures for the River Usk in the event of a road traffic incident on the M4 carriageway. Currently the existing M4 highway drainage discharges directly into the River Usk with no treatment measures currently in place.

In addition, there will also be some improvements/repairs made to the existing drainage which leads to the outfall positioned on the western bank of the River Usk. A non-return flap valve will also be fitted to the existing drainage outfall as currently, as a result of the estuary tides, the existing drainage has become filled with sediment. Other works include:

- Replacement of carriageways (maintenance);
- Refurbishment of drainage system (maintenance);
- Replacement of Concrete Dado panels (maintenance);
- Replacement/repair of secondary lining panels and supports (maintenance);
- Repair of cracks to primary lining (maintenance);
- Add secondary cladding system to control seepage (maintenance);
- Repair/repointing of masonry wing walls (maintenance);
- Repairs to Cross-passageways – re-lining/waterproofing (maintenance);
- Provide a water supply to tunnel portals for fire-fighting (improvements);
- Installation of Video Accident Incident Detection (VAID) system, including cameras, control systems and power (improvements);
- Replacement of emergency telephones and other life safety systems (maintenance);
- Replace tunnel control system (maintenance);
- Replace tunnel signals (maintenance).
- Replacement of tunnel lighting (maintenance);
- Replace electrical supply cabling (maintenance);
- Provision of new control building (improvement). Two pre-fabricated cabinets will be installed immediately adjacent to the tunnel portal. The existing control building will be decommissioned but will not be demolished.

3.4.2 River Usk Bridge

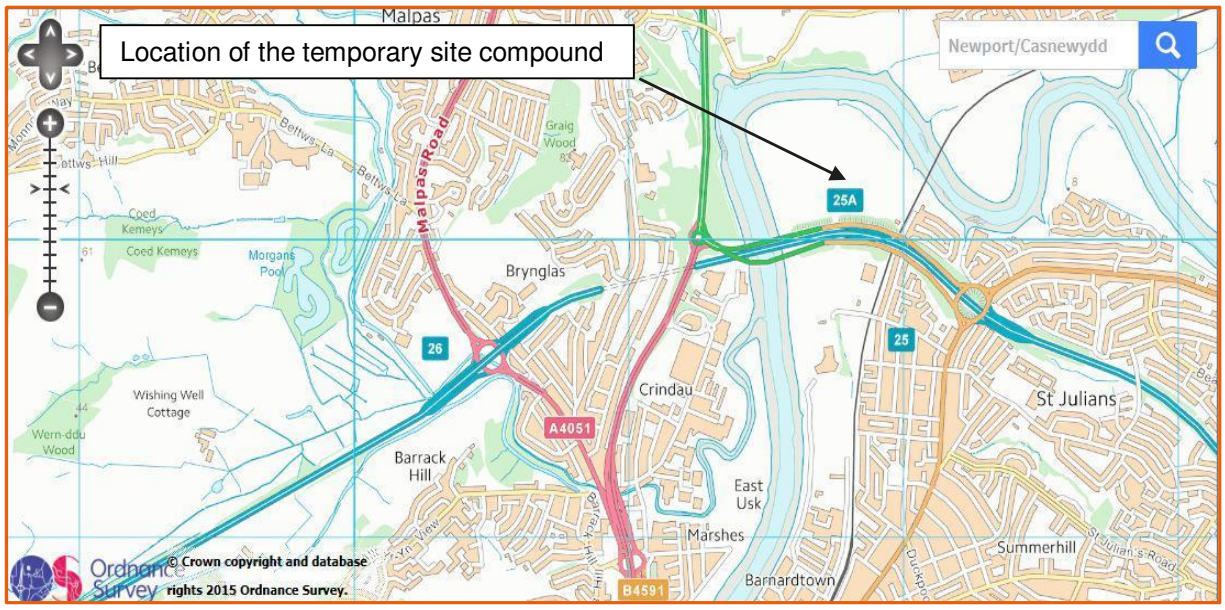
- Joint replacement including localised re-waterproofing and resurfacing (maintenance);
- Concrete repairs (including breaking out defective concrete) to the underside of the bridge deck (maintenance);
- Reinforcement repairs to the underside of the bridge deck (maintenance);
- Surface water drainage replacement (including the replacement of the non-return flap valve on the existing outfall);
- Parapet/verge repairs (maintenance):
- Localised concrete repairs to substructure and parapets (maintenance).

3.4.3 Malpas Viaduct

- Joint replacement including localised re-waterproofing and resurfacing (maintenance);
- Localised concrete repairs to substructure and parapets (maintenance).

3.5 Land take

A temporary site compound will be positioned on Glebelands Recreational Ground, on the eastern bank of the River Usk and more than 12m away from the top of the bank and outside of the SAC/SSSI boundary. The Scheme has been designed to avoid or minimise impacts on all environmental receptors, for example, by ensuring the temporary works platform (necessary to provide access to the underside of the River Usk Viaduct for maintenance and repairs), is fixed to the main structure and that no scaffolding is installed into the wetted channel of the River Usk.



Given the nature of the Scheme, much of the maintenance activities will be undertaken within the highway boundary from the carriageway and hard shoulder. However, some works will require access to the underside of the structures, and at the River Usk, temporary works will tie into the river banks.

There will be no permanent land take required for the Scheme.

3.6 Construction programme

The construction programme for site is envisaged as:

- Award of D&B Contract – February 2016.
- Start of design –February 2016.
- Estimated start on main site works – June/ July 2016.
- Completion of contract – December 2017/ January 2018.

3.7 Mitigation within Design

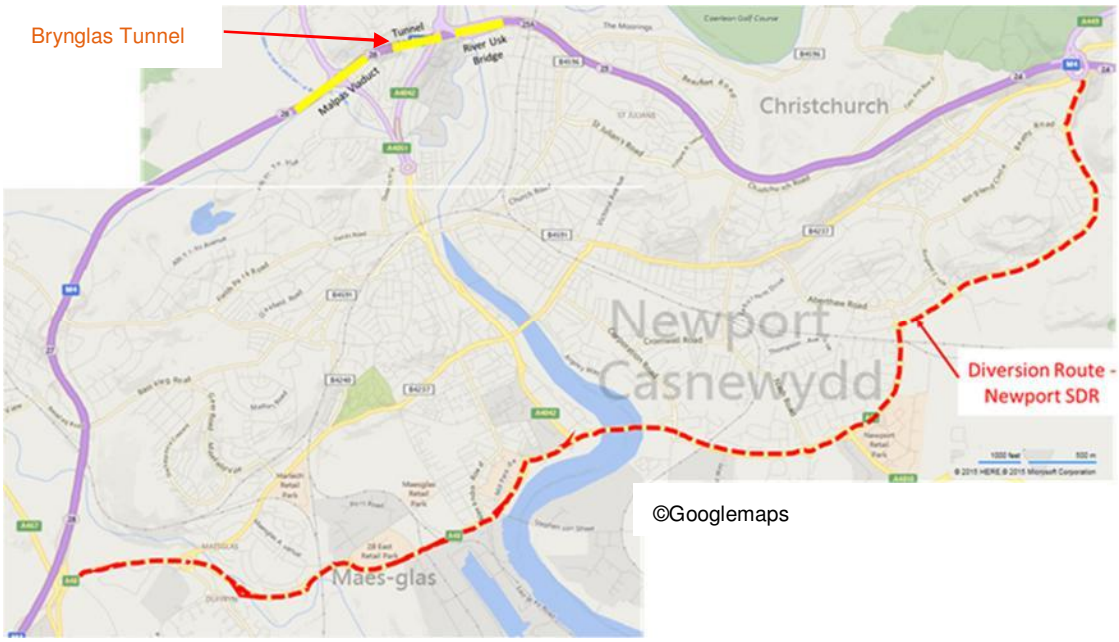
Mitigation and the protection of the River Usk is inherent in the design. Following on from a road traffic incident in 2011 it was acknowledged that greater pollution control/ protection measures are put in place for the River Usk as well as the need to replace components within the tunnel to reduce the vulnerability of the structure, and risk to life, during major incidents. Part of the scope of works will include the installation of a hydrocarbon interceptor, this will provide long-term protection measures during the daily operations of the M4. Other mitigation measures such as the decision to install a temporary working platform which can provide a contained area of works has been selected and working methods such as boat working have been avoided as an increase in the risk of debris entering into the River Usk would be

greater. The platform has been designed so that the working area can be contained and through the use of hydro-demolition all waste waters and materials can be captured and removed from site. The scheme includes a combination of short-term temporary mitigation measures to be implemented during the construction-phase and also long-term operational mitigation measures such as the installation of the interceptor. The programme has also been designed so that measures such as the interceptor are in place before further works to the live carriageway are undertaken, thereby providing further protection measures during the construction-phase

3.8 Alternatives Considered

As detailed above, there will be the need for some temporary night time closures in order for the works to be carried out. As a result and through consultation with NCC, the A48/ Southern Distributor Road (SDR) will be used as the diversion route (as shown in Figure 3-2). This is most appropriate diversion route to be utilised.

Figure 3-2 M4 Motorway Brynglas Tunnel Diversion Route



4 EAR METHODOLOGY AND SCOPE

4.1 Introduction

The requirement for assessment of the Scheme is dictated by the Highways Act and the EIA Directive and outlined in the DMRB. The scale, nature and requirements for the Scheme dictate that a proportionate approach to the assessment will be suitable, whilst maintaining compliance with the relevant legislation and a rigorous set of outcomes. DMRB is the accepted guidance on Environmental Assessment for road schemes.

This chapter will set the scope and provide an assessment of potential environmental impacts.

4.2 Scope of the Assessment

The Record of Determination (RoD) identified that a statutory EIA was not required, a Scoping Report was drafted and circulated in August 2015. This helped to define the scope of the EAR, the need for any baseline surveys and was prepared following liaison with statutory consultees. Through this process, it was concluded that due to the nature of the Scheme some of the topics listed in DMRB Volume 11 Section 3 could be scoped out. Although some topics such as landscape have been scoped out of the EAR there will be the need for further consideration during the design stage, construction and aftercare. The topic chapters scoped in/out of this EAR are presented in Table 4.1.

Table 4.1: Scope of Assessment

DMRB Volume 11 Chapter	Chapter in EAR	Comment
Air Quality	Yes	See Chapter 5
Cultural Heritage	No	The works are primarily located within the soft estate. Any assets which may have been present are likely to have been lost during the construction of the M4 motorway. Excavations and highway maintenance activities, as well as the installation of drainage and mechanical and electrical systems, have previously been undertaken in this area. In addition, the footprint and locations of the improvement activities are considered to be in areas previously disturbed during the construction of the M4 and localised activities. A desk study review and assessment has been undertaken by an experienced Archaeologist therefore providing justification for this topic to be scoped out.
Landscape & Visual Effects	No	The proposals principally constitute repairs to highway structures and re-surfacing, together with drainage and utilities works. The Scheme falls within the highway estate, as part of a landscape that is not designated for its landscape character/quality. Highways infrastructure already substantially defines the existing landscape character and views. Whilst small areas of vegetation would be cleared, a substantial part of the area identified for vegetation clearance currently comprises invasive plants, and landscape proposals will be developed and implemented for the areas affected. In summary, there are not anticipated to be significant landscape and visual effects and therefore the landscape topic will not be considered further as part of the assessment. Landscape design, however, will form an integral part of Scheme development and further information has been provided in Chapter 6, below.

DMRB Volume 11 Chapter	Chapter in EAR	Comment
Ecology & Nature Conservation	Yes	See Chapter 6
Geology & Soils	No	The works to be undertaken as part of the Scheme mostly comprise maintenance activities to existing highways structures. In addition to the maintenance activities, some improvements are proposed such as the installation of an interceptor, pollution containment tank, fire hydrants and a water main. The improvement works will take place within the existing highway soft estate. Given the nature of the works, significant impacts to geology and soils is not anticipated. Although this subject is to be scoped out, there will be some small scale trenching works associated with the improvement activities therefore some soil sampling will be undertaken to confirm the presence/ absence of any contaminated material. The results will then inform the Scheme design and the approach to works to be adopted. Excavated materials will be re-used within the Scheme after it has been demonstrated that they are suitable for use (both geotechnically and chemically). Any excess material will be disposed of offsite in an appropriate manner. In addition, where the temporary site compound is proposed, soil testing will be carried out prior to the set-up of the temporary compound and again upon removal to confirm the ground conditions have not changed over the course of the construction-phase, particularly as Glebelands Park is a Recreational Ground. The soil smapling results will be reported upon and if necessary further action taken. The findings will also sit in the CEMP and inform any temporary works design associated with the site compound and any other excavation locations.
Materials	Yes	See Chapter 7
Noise and Vibration	Yes	See Chapter 8
Effects on All Travellers	Yes	See Chapter 9- It should be noted that consideration has been given to navigational requirements along the River Usk within the works area. Through discussions with the Harbour Master a notice to all Mariners will be severed prior to works commencing. At the working location, this point of the River Usk is upstream of the major docks areas and does not receive large shipping or freight traffic. Navigation along the River Usk will be considered in the CEMP but is not detailed any further in this assessment.
Community and Private Assets	Yes	See Chapter 10
Road Drainage and the Water Environment	Yes	See Chapter 11
Cumulative Effects	Yes	See Chapter 12
Environmental Management Plan	Yes	See Chapter 13

The Scoping Report comprised mostly a desk based study, although for some topics an initial site visit had been carried out. The EAR has drawn upon the guidance presented in DMRB Volume 11.

Prior to the issuing of the RoD, consultation was undertaken with Newport City Council (NCC) and Natural Resources Wales (NRW). Consultation with statutory bodies will continue over the course of the project.

4.3 EAR Methodology

For each assessment topic the following activities were undertaken:

1. Desk study to obtain baseline evidence
2. Development of assessment scope and input to the Scoping Report
3. Further evidence gathering and site visits where appropriate
4. Assessment of likely significant effects (drawing upon DMRB Volume 11 Section 3)
5. Proposal of measures to mitigate any adverse effects identified
6. Production of chapter for this EAR

During the production of this EAR, NCC and NRW have been consulted to discuss the scheme proposals. Where appropriate, mitigation measures have been proposed and have been incorporated into the EAR and will also be included in the subsequent Construction Environmental Management Plan (CEMP). Table 4.2 highlights the data sources accessed for each chapter.

Table 4.2: Desk Study Sources

Chapter	Data Source
Air Quality	▪ Locations of Air Quality Management Areas (AQMAs). ▪ Local Authority monitoring data.
Ecology & Nature Conservation	▪ Magic.gov.uk ▪ Ordnance Survey Mapping and Aerial Photos ▪ South East Wales Biological Records Centre (SEWBReC)
Materials	▪ Information provided by Welsh Government.
Noise & Vibration	▪ Newport City Council- Environmental Health Officer.
Effects on All Travellers	▪ Welsh Transport Technology Consultancy. ▪ Morgan Vinci Ltd.
Community & Private Assets	▪ Ordnance Survey Mapping and Aerial Photos
Road Drainage & The Water Environment	▪ Preliminary design drawings (Halcrow, 2013) ▪ Environmental Constraints Plan (Halcrow, 2013) ▪ TAN15 Development Advice Map (Welsh Government, 2015) ▪ Flood Map for Planning (NRW, 2015) ▪ River Basin Management Plan - Severn River Basin District (EA, 2009) ▪ Usk Management Catchment Summary (NRW, 2015) ▪ Local Flood Risk Management Strategy (Newport City Council, 2014)

Chapter	Data Source
	▪ Newport Local Development Plan – Flood Risk Background Paper (Newport City Council, 2013) ▪ Consultation response from Newport City Council in their role as Lead Local Flood Authority (LLFA) ▪ Consultation response from NRW, including information regarding consented discharges, licenced abstractions, pollution incidences, surface and groundwater quality data and Product 4 flood packs for the Malpas Brook and River Usk

To supplement the information obtained through the desk study approach, several site visit assessments were undertaken. These were not deemed necessary or within the scope of the EAR for all chapters, but those completed are listed in Table 4.3.

Table 4.3: Site Visits and Surveys Completed

Chapter	Purpose	Date
Ecology & Nature Conservation	▪ Extended Phase 1 habitat survey. ▪ Great crested newt surveys. ▪ Daytime bat inspections. ▪ Dusk bat emergence surveys.	5th March 2015 23rd June 2015 23rd July 2015 25th August 2015
Noise & Vibration	Noise monitoring surveys for a 24 hour duration at six locations.	30th September 2015 1st October 2015

4.3.1 Assessment Techniques and Significance Criteria

Each topic chapter has drawn upon the latest guidance presented within the DMRB Volume 11 and appropriate Interim Advice Notes (IANs). The approach taken is set out in each chapter and draws upon best practice techniques, professional judgement and an approach proportionate to the size of the Scheme, likely impact and identified receptors. Significance criteria have also been drawn from DMRB and are discussed in each chapter where appropriate.

5 AIR QUALITY

5.1 Introduction

The Scheme involves the maintenance and refurbishment of three structures along the existing M4 between Junctions 25A and 26 (inclusive) as described in Chapter 3. Given the nature of the proposed work, there will be no operational air quality impacts, therefore the assessment is confined to the construction phase only.

During the construction phase, there is the potential for air quality impacts as a result of dust from construction activities, and from vehicle emissions relating to construction traffic. The impact of vehicles temporarily using the diversion route has also been considered.

5.2 Study Area

The study area is defined in the Design Manual for Roads and Bridges (DMRB) HA207/07 (Ref 5-1) which, in relation to construction dust, states;

The locations of any sensitive receptors within 200 m of a construction site should be clearly identified, such as housing, schools, hospitals or designated species or habitats within a Designated Site, so that mitigation measures to reduce dust emissions can be rigorously applied.

In relation to construction traffic DMRB states;

If construction is expected to last for more than six months, then traffic management measures and the effect of the additional construction vehicles should also be assessed as an additional scenario although this may need to be a qualitative assessment where details of traffic flows are not available.

It is anticipated that the construction duration will be 21 months, road closures will be in place overnight between 8pm until 6am, at these time a diversion route will be in operation along the A48. There will be a maximum of five closures in any one week, although it is not anticipated that the road will be closed on five occasions every week.

5.3 Methodology & Scope

5.3.1 Scope

The assessment will focus on the construction impacts of the works as there are no operational impacts as a result of the Scheme. The impact on construction shall be assessed in accordance with DMRB Air Quality HA207/07.

5.3.2 Methodology

Construction activities have the potential to generate dust emissions. In accordance with DMRB, the locations of sensitive receptors within 200m of construction activities have been identified (Figure 5-1).

In addition to the impact of the construction activities, there is also a potential impact on air quality from construction traffic and from traffic using the diversion routes. An indication of the traffic flows that may use the diversion routes has been provided and a qualitative assessment of the impacts on air quality has been undertaken.

Air Quality Criteria

The pollutants of concern in relation to road traffic (in relation to the diversion and construction traffic) are nitrogen dioxide and particulate matter (NO_2 and PM_{10}). There are two sets of ambient air quality criteria for the protection of public health, namely those set by the EU and transposed in to UK law by The Air Quality Standards Regulations 2010 and those implementing the UK National Air Quality Strategy (AQS).

The criteria set out in the AQS include standards and objectives for local authorities to work towards achieving. These apply in locations with relevant public exposure which are defined in the Department for Environment, Food and Rural Affairs' (Defra) technical guidance LAQM.TG(09).

The standards set by the EU are legally binding, mandatory limit values (LV) requiring national Government compliance. Failure in compliance (for a compliance agglomeration zone) can lead to infraction proceedings by the EU against the Member State.

Local air quality criteria relevant to the air quality assessment for the Scheme are summarised in Table 5-1. The key pollutants in relation to traffic are PM_{10} and NO_2.

Table 5-1: Relevant Air Quality Criteria (Human Health)

Pollutant	Criteria	Compliance Date	
		AQS Objective	EU Limit Value
NO_2	Hourly average concentration should not exceed 200 µg/m³ more than 18 times a year	31 December 2005	1 January 2010
	Annual mean concentration should not exceed 40 µg/m³	31 December 2005	1 January 2010
PM_{10}	24-hour mean concentration should not exceed 50 µg/m³ more than 35 times a year	31 December 2004	1 January 2005
	Annual mean concentration should not exceed 40 µg/m³	31 December 2004	1 January 2005

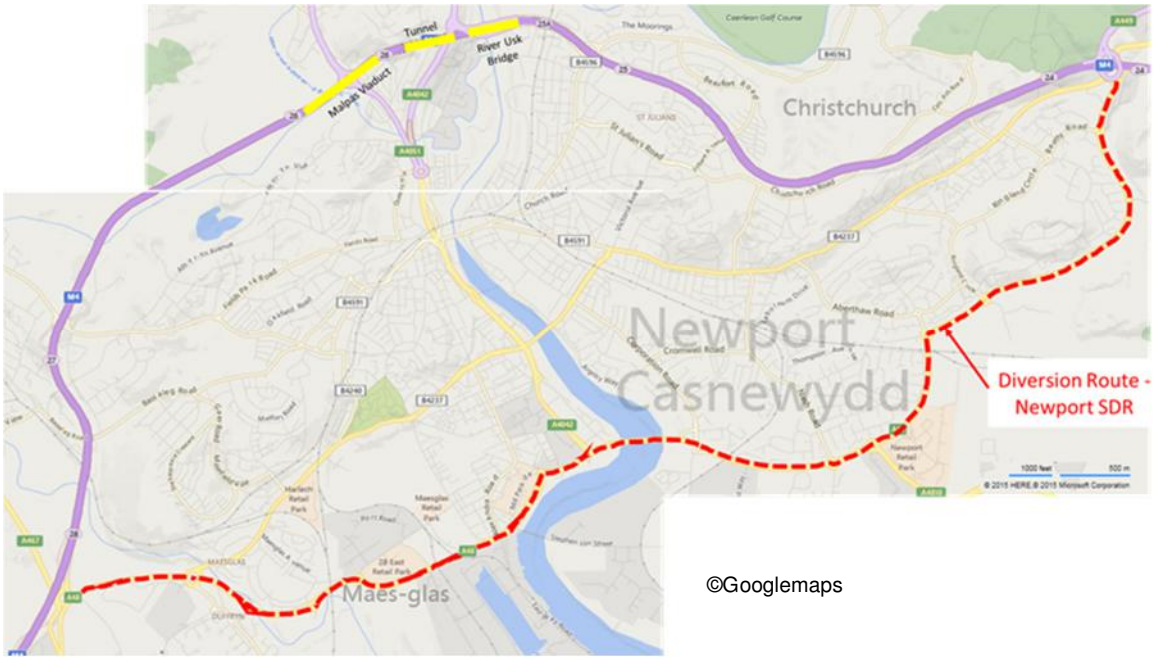
Receptors

Receptors that are potentially sensitive to changes in air quality are defined in DMRB HA207/07 as housing, schools, hospitals and designated species or habitats within a designated ecological site located within 200 m of Scheme affected roads or construction sites. Receptors within the construction dust study area (Figure 5-1) include approximately 450 dwellings, a nursery and the River Usk Special Area of Conservation (SAC) (refer to Chapter 7).

Diversion Route

The proposed diversion route is located between on the A48 between Junctions 24 and 28. As shown on Figure 5-2.

Figure 5-2 – Construction Diversion Route.



There is on average approximately 4,000 vehicles using the M4 during the periods the diversion will be in operation, it has therefore been assumed that these vehicles will be diverted along the A48 during the closures. Given that the closures will not be in place every day of the year the equivalent increase in the annual average daily traffic flow (AADT) i.e. the increase in traffic on the A48 averaged over an annual period will be much lower than 4,000 vehicles.

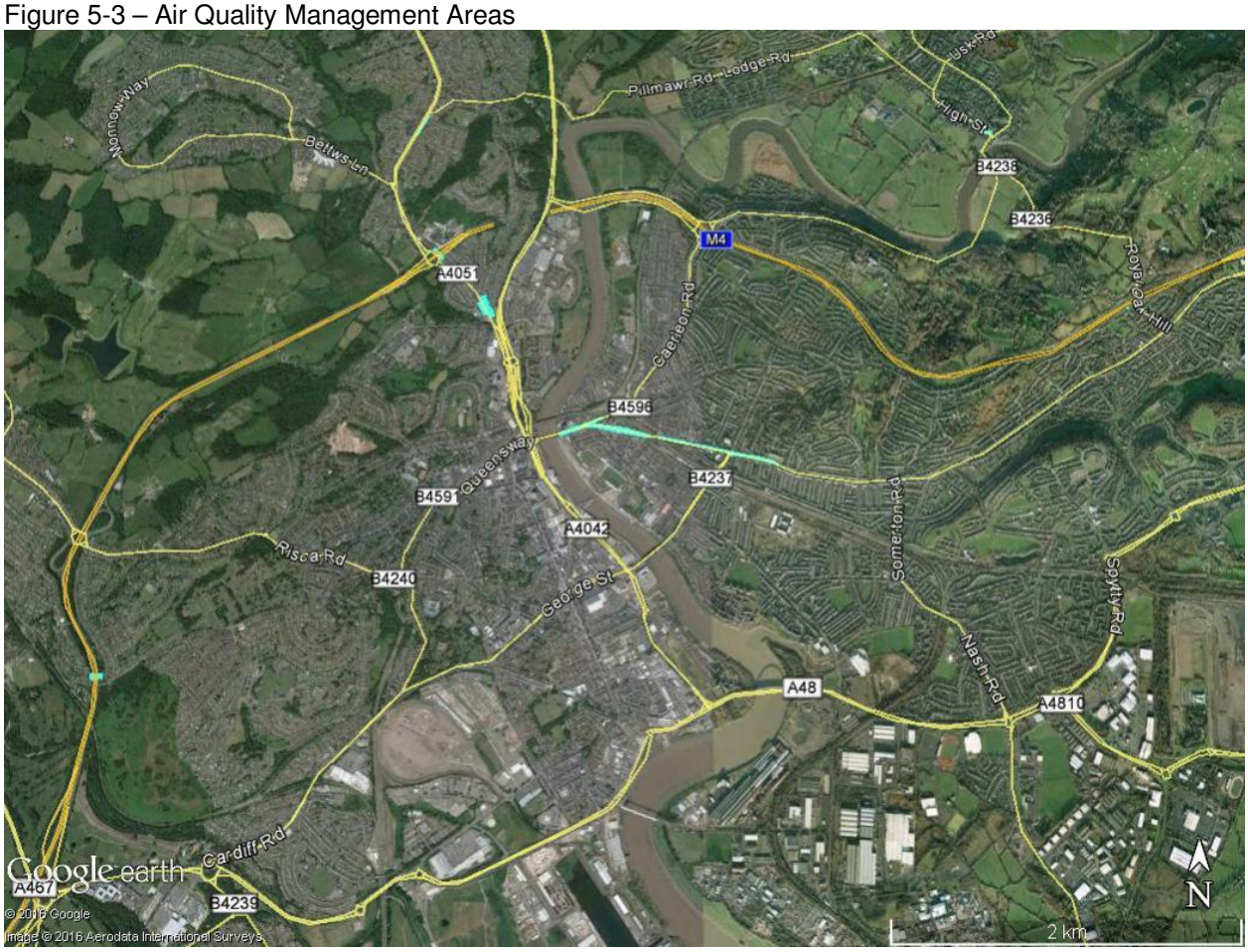
Given the changes in flow are not permanent and will only occur during the road closures during the construction period which are intermittent and short term, it is not anticipated that there will be any significant impacts on local air quality.

Construction vehicle numbers are not available. However, it is envisaged that construction vehicles will access the site via the M4, where there is a reduction in flows during the construction period due to the temporary diversion. Given the temporary nature of the construction vehicles, and the diversion of vehicles onto other routes, construction vehicle effects are not considered to be significant.

5.4 Baseline Conditions

The Scheme is located on the M4 between Junction 25A and 26, in the administrative boundary of Newport City Council (NCC). NCC has declared nine Air Quality Management Areas (AQMAs), a number of which are located close to the Scheme (Figure 5-3).

Figure 5-3 – Air Quality Management Areas



Note: AQMAs depicted by turquoise shading

In addition NCC also undertakes air quality monitoring in the area of the Scheme with an automatic monitoring stations located close to the M4. The stations monitor both nitrogen dioxide (NO_2) and particulates (the key traffic related pollutants).

NCC also operate a network of passive diffusion tubes used to monitor concentrations of NO_2, there are numerous monitoring sites located close to the Scheme and on the proposed diversion route. The 2013 annual mean concentrations are presented in Table 5-2 for the tubes located close to both the Scheme and the diversion route.

Table 5-2 – Nitrogen Dioxide Monitoring Results 2013.

NCC Site ID	Location	Site Type	Data Capture 2013 (Number of Months or %)	Annual mean concentration (2013)	Location of Monitoring in Respect to Scheme (M4/Diversion Route A48/Diversion route A4042/A4051).
Air Quality Strategy Objective 40µg/m³ Annual Mean.					
Junction 25A M4 Automatic Site	Junction 25A M4	Roadside	93%	**59.0**	M4
St Julians Automatic Site	St Julians	Urban background	90	22.0	M4
NCC6B	153 Malpas Road	Roadside	100	**42.5**	M4
NCC16A	40 Denbigh Road	Kerbside	100	**40.5**	M4
NCC19B	177 Malpas Road	Roadside	100	38.8	M4
NCC25B	Denbigh Road (M4 slip rd)	Kerbside	75	32.1	M4
NCC34	Malpas Depot 1	Kerbside	100	37.3	M4
NCC35	Malpas Depot 2	Kerbside	100	35.8	M4
NCC36	Malpas Depot 3	Kerbside	100	35.6	M4
NCC55	116 Alexandra Road	Kerbside	100	36.4	Diversion route A48

Bold exceedance of Annual Mean AQS Objective

The monitoring indicates that there were exceedances of the AQS objectives at locations close to both the Scheme and the proposed diversionary route in 2013.

5.5 Design, Mitigation & Enhancement Measures

In order to mitigate against the impacts of construction dust at receptors (Figure 5-1), Best Practice Measures (BPM) should be adopted. These measures should include techniques such as those outlined in the Institute of Air Quality Management (IAQM) best practice guidance (Ref 5-2). Given the nature of the works anticipated and that works within the Tunnel and associated with the River Usk Viaduct will be

in contained working areas, any fugitive emissions would be mostly controlled. Works to the Malpas Viaduct are anticipated to be to a lesser extent to those carried out to the other two structures. However, the following mitigation measures will further reduce the impacts especially at locations where the construction activities are being undertaken outside of the tunnel.

Site Planning

- No burning of waste materials on site;
- Plan site layout – machinery and dust causing activities should be located away from sensitive receptors;
- All site personnel to be fully trained;
- Trained and responsible manager on site during work times to maintain logbook and carry out site inspections;
- Visual inspections should be undertaken on a daily basis to determine whether there are any significant dust episodes as a result of the construction activities. Visual inspections to be increased in frequency during periods of dusty construction activities, with additional monitoring to be undertaken if required;
- Ensure adequate water supply on site to dampen down dust when necessary.

Construction Traffic

- All vehicles to switch off engines – no idling vehicles;
- Effective vehicle cleaning and specific wheel-washing on leaving site and damping down of haul routes, where there is potential for carrying dust or mud off the site;
- Routinely clean public roads and access routes using wet sweeping methods;
- All loads entering and leaving the site to be covered;
- No site runoff of water or mud;
- On-road vehicles to comply to set emission standards;
- All non-road mobile machinery (NRMM) to use ultra-low sulphur tax-exempt diesel (ULSD) where available and be fitted with appropriate exhaust after-treatment from the approved list;
- Ensure vehicles working on site have exhausts positioned such that the risk of re-suspension of ground dust is minimised (exhaust should preferably point upwards), where reasonably practicable;
- Minimise movement of construction traffic around site;
- Impose and signpost maximum speed limits;
- Inspect haul routes for integrity and instigate necessary repairs to the surface as soon as reasonable practicable, record all inspections in the log book.

Site Activities

- Minimise dust generating activities;
- Minimise the amount of excavated material stored on site;
- Ensure disposal of run-off water from dust suppression activities, in accordance with the appropriate legal requirements;
- Maintain all dust control equipment in good condition and record maintenance activities;
- Avoid double handling of material wherever reasonably practicable;
- Sheet or otherwise enclose loaded bins and skips;
- Minimise drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use fine water sprays on such equipment wherever appropriate;

- Use water as dust suppressant where applicable;
- Only use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays or local extraction;
- ensure mixing of cement, bentonite, grout and other similar materials takes place in enclosed areas remote from site boundaries and potential receptors;
- ensure slopes on stockpiles are no steeper than the natural angle of repose of the material and maintain a smooth profile;
- ensure equipment is readily available on site to clean any spillages and clean up spillages as soon as reasonably practicable after the event using wet cleaning methods;
- Cover, seed or fence stockpiles to prevent wind whipping where appropriate;
- Stockpiles should be located away from sensitive receptors as far as practicable;
- Re-vegetate earthworks and exposed areas;
- If applicable, ensure concrete crusher or concrete batcher has a permit to operate;
- Ensure bulk cement and other fine powder materials are delivered in enclosed tankers and stored in silos with suitable emission control systems to prevent escape of material and overfilling during delivery.

With the adoption of BPM measures as outlined above, the impact of construction activities could be reduced. The identified mitigation measures will be incorporated into the Construction Environmental Management Plan (CEMP), reflecting the requirements of best practicable means (BPM). The CEMP is to be prepared prior to commencement of works and will outline environmentally sensitive areas, mitigation measures to protect such areas, and method statements for specific construction activities. In accordance with DMRB, Figure 5-1 identifies the locations of receptors within 200m of the construction activities.

5.6 Assessment of Impacts

Construction Dust Impacts

With the adoption of BPM measures, construction dust impacts should not be significant.

Vehicle Emission Impacts as a Result of the Diversion Route

The diversion route will follow the existing A48 between junctions 24 and 28 of the M4. The diversions would temporarily reduce the number of vehicles on the M4,where there are several AQMAs (Figure 5-3). No AQMA's have been designated along the A48 and there is one monitoring location which is currently recording concentrations below the air quality strategy objectives. Although it is acknowledged that this diffusion tube will not be representative of concentrations on the whole of the A48, it is located on a busy junction and is therefore likely to be located in an area where concentrations are elevated as opposed to less congested areas of the A48.

It is not anticipated that there will be a significant impact on air quality as a result of the diversion given that they will be in place overnight when traffic volumes are relatively low. It is therefore unlikely that the increase in traffic would result in an exceedance of the AQS objectives based on the current monitored NO_2 concentrations. The impacts are temporary and are not considered to be significant.

Construction Vehicle Emission Impacts

It is envisaged that construction vehicles will access the site via the M4, where there is a reduction in flows during the construction period due to the temporary diversion. Given the temporary nature of the construction vehicles, and the diversion of vehicles onto other routes, construction vehicles emissions are therefore temporary and are not considered to be significant.

5.7 Conclusions & Recommended Further Works

The assessment has indicated that there is unlikely to be any significant impacts on local air quality due to increases in traffic on the A48 during the operation of the temporary diversions or construction vehicle emissions. No further assessment of air quality impacts is therefore required.

Prior to the construction works being undertaken, a CEMP should be finalised including the measures identified in this assessment.

5.8 References

Ref 5-1 The Highways Agency, (2007); Design Manual for Roads and Bridges, Volume 11 Environmental Assessment, Section 3 Environmental Assessment Techniques, Part 1, HA207/07 Air Quality, dated May 2007.

Ref 5-2 IAQM (2014) Guidance on the Assessment of Dust from Demolition and Construction

6 LANDSCAPE & VISUAL EFFECTS

6.1 Introduction

As stated in Section 4 above, landscape and visual effects have been scoped out from this assessment.

The proposals principally constitute maintenance/ repairs to highway structures and re-surfacing, together with drainage and utilities works. The Scheme falls within the highway soft estate, as part of a landscape that is not designated for its landscape character/quality. The existing highways infrastructure already substantially defines the landscape character and views. Whilst small areas of vegetation would be cleared, a substantial part of the area identified for vegetation clearance currently comprises invasive plants, and landscape proposals will be developed and implemented for the areas affected.

6.2 Study Area

The main locations that will require consideration regarding landscape comprise the following:

- the temporary site compound;
- the location of the water main at Malpas, where dense Japanese Knotweed is currently present;
- the location of the new hydro-carbon interceptor.

6.3 Mitigation & Enhancement Measures

The temporary site compound will be located at Glebelands Park. Prior to the site setup, the topsoil on site will be stripped and stored. Upon completion of the civil engineering works and following removal of the site compound, the topsoil will be spread and weed control carried out to ensure the site is returned to Newport City Council in an appropriate condition.

At Malpas, behind the properties on Pant Road, currently dense stands of Japanese Knotweed are present. The Knotweed will be subject to a weed control regime over the course of the construction-phase and will be continued by SWTRA. Once eradicated, it will be necessary to consider the appropriate landscape treatment, which could including seeding and/or planting. This will need to be agreed with SWTRA and Newport City Council.

In locations where seeding is agreed as the landscape treatment, species-rich native grass and wildflower mixes are proposed. In locations where tree and shrub planting is agreed as the landscape treatment, native species of local provenance are proposed. Any planting or seeding works will be agreed in advance with SWTRA and Newport City Council.

In summary, significant landscape and visual effects are not anticipated and therefore the landscape topic will not be considered further as part of the assessment. However, landscape design will form an integral part of Scheme development.

In the event of small scale landscaping works being required, these will be carried out in accordance with DMRB Volume 10 (Environmental Design) and MCHW Series 3000 (Landscape and Ecology).

7 ECOLOGY & NATURE CONSERVATION

7.1 Introduction

This chapter provides an assessment of the potential significant effects of the Scheme on Ecology and Nature Conservation. A desk-based assessment and field surveys to underpin this were undertaken between March and August 2015.

7.2 Study Area

A comprehensive desk study for the Scheme has been carried out. The study area for the desk study included the Scheme footprint and extended to 2 km from the Scheme for designated sites (up to 30 km for SACs designated for bats, in accordance with DMRB Volume 11, Section 4, Part 1), and up to 500m for records relating to notable species, local sites and habitats which may support species such as great crested newts (*Triturus cristatus*).

The study area used for the field surveys comprised the anticipated works footprint and any immediately adjacent land within the highways soft estate which may temporarily be impacted by the works. Where water bodies, or other potentially valuable habitats, were present beyond the highways boundary or at locations where protected species could pass through the site (such as along the banks of the River Usk), these were noted and, where appropriate, targeted for further surveys.

The results of the field surveys are reported in Appendix A, which presents the findings of the Extended Phase 1 habitat survey report, and Appendix B, which includes the survey information collected as part of the targeted species-specific works.

7.3 Methodology & Scope

7.3.1 Scope

The scope of this report is to provide an ecological assessment of the proposed maintenance and improvement activities for the three structures along the existing M4 between Junctions 25A and 26 (inclusive). The works discussed below are to be carried out as one Scheme within the same time frame. Refer to Chapter 3 for further project details.

7.3.2 Methodology

The assessment has been undertaken in accordance with DMRB Volume 11, Section 2, Part 5, with specific reference to IAN 130/10 in relation to the valuation of resources. This IAN has not been formally adopted in Wales due to discrepancies in legislation. However, all species of importance have been considered and have not been overlooked.

The receptors which have the potential to be associated with significant effects have been identified and valued. The value of nature conservation receptors or ecological resources has been determined in their geographical context according to Table 7-1.

The significance of impacts on receptors at different levels of value can be compared to the overall significance categories used in other DMRB topics, as set out in Table 7-2.

The assessment has been based on readily available web-based data, information provided by the local biological records centre and field surveys. As part this assessment, consideration has been given to the A48/ SDR diversion route in relation to potential impacts on ecology as there will be the temporary increase in traffic levels using this highway. The A48/ SDR has been designed to carry volumes of traffic using the M4 in the event of an incident or closure. The carriageway includes a clear span structure which it crosses the River Usk. Given the nature of the diversion route and that traffic diversions will be temporary no further consideration in relation to the River Usk and impacts upon Ecology and Nature Conservation will be given in this document.

Table 7-1: Resource Valuation (taken from IAN 130/10)

International or European Value

Natura 2000 sites including: Special Protection Areas (SPAs); potential SPAs (pSPAs); Special Areas of Conservation (SACs); candidate or possible SACs (cSACs or pSACs); and Wetlands of International Importance (Ramsar sites).

Biogenetic Reserves, World Heritage Sites and Biosphere Reserves.

Areas which meet the published selection criteria for those sites listed above but which are not themselves designated as such.

Resident, or regularly occurring, populations of species which may be considered at an International or European level where:

- the loss of these populations would adversely affect the conservation status or distribution of the species at this geographic scale; or
- the population forms a critical part of a wider population at this scale; or
- the species is at a critical phase of its life cycle at this scale.

UK or National Value

Designated sites including: Sites of Special Scientific Interest (SSSIs); Marine Protected Areas (MPAs) including Marine Conservation Zones (MCZs); and National Nature Reserves (NNRs).

Areas which meet the published selection criteria e.g. JNCC (1998) for those sites listed above but which are not themselves designated as such.

Areas of key/priority habitats identified in the UK Biodiversity Action Plan (BAP), including those published in accordance with Section 42 of the Natural Environment and Rural Communities Act (2006) and those considered to be of principal importance for the conservation of biodiversity.

Areas of Ancient Woodland e.g. woodland listed within the Ancient Woodland Inventory.

Resident, or regularly occurring, populations of species which may be considered at an International, European, UK or National level where:

- the loss of these populations would adversely affect the conservation status or distribution of the species at this scale; or
- the population forms a critical part of a wider population at this scale; or
- the species is at a critical phase of its life cycle at this scale.

Regional Value

Areas of key/priority habitats identified in the Regional BAP (where available); areas of key/priority habitat identified as being of Regional value in the appropriate Natural Area Profile (or equivalent); areas that have been identified by regional plans or strategies as areas for restoration or re-creation of priority habitats; and areas of key/priority habitat listed within the Trunk Road Estate BAP (TREBAP).

Resident, or regularly occurring, populations of species which may be considered at an International, European, UK or National level and key/priority species listed within the TREBAP where:

- the loss of these populations would adversely affect the conservation status or distribution of the species at this scale; or
- the population forms a critical part of a wider population; or
- the species is at a critical phase of its life cycle.

County or Unitary Authority Area Value:

Designated sites including: Sites of Importance for Nature Conservation (SINCs); County Wildlife Sites (CWSs); and Local Nature Reserves (LNRs) designated in the county or unitary authority area context.

Areas which meet the published selection criteria for those sites listed above but which are not themselves designated as such.

Areas of key/priority habitats identified in the Local BAP; and areas of habitat identified in the appropriate Natural Area Profile (or equivalent).

Resident, or regularly occurring, populations of species which may be considered at an International, European, UK or National level where:

- the loss of these populations would adversely affect the conservation status or distribution of the species across the County or Unitary Authority Area; or
- the population forms a critical part of a wider population; or
- the species is at a critical phase of its life cycle.

Local Value

Designated sites including: Local Nature Reserves (LNRs) designated in the local context.

Trees that are protected by Tree Preservation Orders (TPOs).

Areas of habitat; or populations/communities of species considered to appreciably enrich the habitat resource within the local context (such as veteran trees), including features of value for migration, dispersal or genetic exchange.

Table 7-2: Significance of Effects (taken from IAN 130/10)

Significance category	Typical descriptors of effect
Very Large	An impact on one or more receptor(s) of International, European, UK or National Value. NOTE: only adverse effects are normally assigned this level of significance. They should be considered to represent key factors in the decision-making process.
Large	An impact on one or more receptor(s) of Regional Value. NOTE: these effects are considered to be very important considerations and are likely to be material in the decision-making process.
Moderate	An impact on one or more receptor(s) of County or Unitary Authority Area Value. NOTE: these effects may be important, but are not likely to be key decision-making factors.
Slight	An impact on one or more receptor(s) of Local Value. NOTE: these effects are unlikely to be critical in the decision-making process, but are important in enhancing the subsequent design of the project.
Neutral	No significant impacts on key nature conservation receptors. NOTE: absence of effects, or those that are beneath levels of perception.

Desk based assessment

A review of currently available data was undertaken to identify potential constraints from the following sources.

- www.magic.gov.uk – The location of national and international nature conservation designated sites;
- South East Wales Biological Records Centre (SEWBReC) – for designated sites information of up to 2km (unless designated as SACs for bats) and records of protected or otherwise notable species of conservation concern with 500m of the proposed development site; and
- Ordnance Survey mapping and aerial photographs – the location of adjacent habitats including, in particular, water bodies.

In addition to the above, Newport City Council were contacted for the citations of any non-statutory designated sites within a 2km radius of the site, including County Wildlife Sites (CWS).

Field survey

An extended Phase 1 habitat survey of the site was undertaken on the 5th March 2015. The aim of the survey was to identify any habitats likely to be of conservation value, and to investigate the presence (or likely presence) of protected species of plants and animals, species of conservation concern, and invasive species.

The habitat survey involved identifying and mapping the dominant habitat types following the survey methodology outlined in the Phase 1 habitat survey handbook (Joint Nature Conservation Committee (JNCC), 2010). Dominant plant species were noted, as were any uncommon species or species indicative of particular habitat types, but there was no attempt to compile exhaustive species lists.

Botanical names follow Stace (2010). Any invasive plant species listed on Schedule 9 of the Wildlife and Countryside Act 1981 (as amended) that were identified during the survey were recorded.

The extended Phase 1 habitat survey also involved a critical assessment of the likely value of the terrestrial and aquatic habitats present for use by legally protected animal species and/or species of conservation concern.

The study area was assessed for its potential to support great crested newts. As part of the extended Phase 1 habitat survey, a search was made for water bodies within or immediately adjacent to the site. The water bodies were assessed, where possible, for their potential to support amphibians, including great crested newts. The value of terrestrial habitat within the site for use by foraging and hibernating amphibians was also assessed. Although no impacts are anticipated to waterbodies across the site, at the time it was anticipated that there could be some temporary loss of suitable terrestrial habitat in order to provide access for the works. Consequently, further targeted surveys were undertaken.

7.4 Baseline Conditions

7.4.1 Designated sites

The Scheme passes over the River Usk (Lower Usk) (at Grid Reference ST 314899) which is designated as a Special Area of Conservation (SAC) and a Site of Special Scientific Interest (SSSI). There are also three bat SACs in the wider area. The Wye Valley and Forest of Dean Bat Sites SAC is located approximately 22km to the north-east and the Wye Valley Woodlands SAC is located approximately 22km to the east. In addition, the Usk Bat Sites SAC is located approximately 30km to the north. Due to the proximity of the River Usk SAC, an Assessment of Implications of European Sites (AIES) has been drafted separately. The Severn Estuary Ramsar site, SPA and SAC is also located >8km to the south of the Scheme.

7.4.2 Non-Designated sites

Eighteen non-statutory designated Sites of Importance for Nature Conservation (SINCs) were identified within 1km of the Scheme. One SINC (Glebelands) spans the Scheme, and five are located immediately adjacent to, or in very close proximity to the Scheme (namely Brynglas Wood 208m west of Usk viaduct and covering part of the tunnel, Crindau Field 44m north-west of Usk viaduct, Gwastad Mawr 92m west of the Malpas Viaduct and the Monmouthshire and Brecon Canal (Crumlin Arm and the Main Arm, passing beneath the Malpas Viaduct)) and Allt-yr-yn SINC/ LNR/ Gwent Wildlife Trust Nature Reserve 943m south-west of the Malpas Viaduct. Glebelands Recreational Ground will house the temporary site compound, and therefore there will be some short-term impacts to this SINC.

7.4.3 Plants and habitats

A SEWBReC records search identified a number of protected plant species/ species of principal importance listed under Section 42 of the NERC Act (2006) located within 1km of the Scheme, including Bluebell (*Hyacinthoides non-scripta*), Red-tipped Cudweed (*Filago lutescens*) and Red Hemp-nettle (*Galeopsis angustifolia*). The majority of these records were associated with Gwasted Mawr SINC.

SEWBReC also provided a number of records of 'notable' plants (including species regarded as 'Locally Important', LBAP species and UK Red Data Book-listed species) located within or in close proximity to the Scheme. These again related to the Gwasted Mawr SINC, Allt-yr-yn SINC/ LNR/ Gwent Wildlife Trust Nature Reserve, and also the Glebelands SINC, and included Compact Brome (*Anisantha madritensis*), Chives (*Allium schoenoprasum*), Hog's Fennel (*Peucedanum officinale*), Good-King-Henry (*Chenopodium bonus-henricus*) and Charlock (*Sinapis arvensis*).

During the extended Phase 1 habitat survey (full report is presented in Appendix A), a range of habitat conditions were found to be present within and adjacent to the Scheme boundary. Such habitats included

mudflats within the channel of the River Usk, which is crossed by the River Usk Viaduct and currently carries the M4. The mudflats are exposed at times of low tide. Mudflats are characterised by high biological productivity and abundance of organisms, but low diversity, with few rare species. Intertidal mudflats are considered a Priority Habitat for Conservation of Biological Importance in Wales (NERC Act, 2006).

Areas of neutral semi-improved grassland were also found during the survey (see Figure 1 in the Extended Phase 1 habitat report presented in Appendix A). These grassland areas were dominated by species such as Couch species (*Elymus sp.*), Creeping Bent (*Agrostis stolonifera*) and Sea Beet (*Beta vulgaris subsp. Maritima*), as well as areas supporting Common Reed (*Phragmites australis*). Amenity grassland areas at both the eastern and western extents of the Scheme were found to be species-poor, intensively managed and supported Perennial Rye-grass (*Lolium perenne*), Creeping Buttercup (*Ranunculus repens*) and White Clover (*Trifolium repens*).

Particularly at the eastern extent of the Scheme corridor, but at locations throughout, patches of dense Bramble (*Rubus fruticosus* agg.) and scrub were also identified.

Along the southern extent of the M4, forming part of the Monmouthshire & Brecon Canal corridor, sections of broad-leaved woodland were also identified. Species present included mature Ash (*Fraxinus excelsior*), semi-mature Alder (*Alnus glutinosa*), Pedunculate Oak (*Quercus robur*) and Hazel (*Corylus avellana*). Canals are considered a Priority Habitat for Conservation of Biological Importance in Wales (NERC Act, 2006)

The Monmouthshire & Brecon Canal at Malpas supports marginal and aquatic vegetation including Common Reed, Common Water Star-wort (*Callitriche marginata*), Yellow Flag Iris (*Iris pseudacorus)* and Marsh Marigold (*Caltha palustris*).

Passing beneath the Monmouthshire & Brecon Canal is the Malpas Brook, which flows through the centre of Junction 26. At the far western extent of the Scheme, the Malpas Brook comprises a stone substrate with a wooded riparian zone. Japanese Knotweed (*Fallopia japonica*) was identified on both banks of the watercourse. Where the Malpas Brook flows through Junction 26, the channel becomes canalised, and has been previously subject to heavy engineering. Rivers are considered a Priority Habitat for Conservation of Biological Importance in Wales (NERC Act, 2006).

No rare or uncommon plant species were observed during the survey. Glebelands SINC is the only site anticipated to be impacted by the works (albeit temporarily) as no other works will take place within any other designated sites. Overall, the habitats within the working area (including Glebelands Park) are considered to be of no more than 'Local' value for nature conservation, given their position either within the M4 soft estate or being immediately adjacent to the highway boundary.

7.4.4 Invasive Species

SEWBReC held a number of records for invasive plant species, listed under Schedule 9 of the Wildlife and Countryside Act 1981 (as amended), located within or in close proximity to the Scheme. These records are associated with the M4, the A4042 Usk River Bridge, Gwasted Mawr SINC, Allt-yr-yn SINC/ LNR/ Gwent Wildlife Trust Nature Reserve, the Monmouthshire & Brecon Canal and the Glebelands SINC and include:

- Japanese Knotweed.
- Sea-buckthorn (*Hippophae rhamnoides*).
- Indian Balsam (*Impatiens glandulifera*).
- Japanese Rose (*Rosa rugosa*).
- Rhododendron (*Rhododendron ponticum*).

Japanese knotweed was recorded in numerous locations within the Scheme boundary during the Phase 1 survey (see Figure 1 in the Extended Phase 1 habitat report presented in Appendix A). It is an offence under Schedule 9 of the Wildlife and Countryside Act to cause the spread of this species. Key locations

where Knotweed is known to be present include: both the east and west banks of the River Usk; significant, dense stands of Knotweed at the rear of the properties on Pant Road (immediately to the south of the Malpas Viaduct); along the banks of Malpas Brook; and immediately adjacent to the Malpas Viaduct to the south of the existing M4 along the woodland edge. Stands of Japanese Knotweed were also identified infrequently on the existing M4 soft estate.

Indian Balsam is known to be present on the M4 westbound verge at Malpas (at the far eastern extent of the works). The verges are not to be impacted by the construction-phase activities. However, the water main which will be installed along the back of Pant Road will require working within a Knotweed infested/contaminated area. Given the nature of the proposed works in this location, and the dense stands of Knotweed present, invasive species will be considered further in this assessment.

7.4.5 Invertebrates

SEWBReC provided a number of records of protected invertebrate species/species of principal importance listed under Section 42 of the NERC Act (2006) located within 500m of the Scheme. This included one white-clawed crayfish (*Austropotamobius pallipes*) record (from 1999) originating from Gwasted Mawr SINC. In addition, web-based searches also revealed records of white-clawed crayfish in the Malpas Brook (which is located outside of the elevated works area).

The majority of invertebrate records represented large wainscot (*Rhizedra lutosa*) records originating at Haisbro Avenue, Newport. SEWBReC also provided a number of records of 'notable' invertebrate species (including LBAP and UK Red Data Book listed species) located within or in close proximity to the Scheme. These records originated from the Gwasted Mawr SINC, Allt-yr-yn SINC/ LNR/ Gwent Wildlife Trust Nature Reserve and the Glebelands SINC, and included variable damselfly (*Coenagrion pulchellum*) and moth species such as orange footman (*Eilema sororcula*) tansy plume (*Platyptilia ochrodactyla*) and scarlet tiger (*Callimorpha dominula*).

During the survey, no species of interest were identified, which is to be expected given the time of year in which the survey was carried out. However, a range of habitat conditions were found to be present in areas adjacent to the existing M4, although outside of the anticipated working area (e.g. along the Brecon and Monmouthshire Canal). Nevertheless, given the location and nature of the proposed works and habitats which will be impacted, no significant adverse impacts on invertebrate species are anticipated as a result of the Scheme, therefore invertebrates will not be considered any further within this assessment.

7.4.6 Fish (including eels)

The fish species (including eels) present within the River Usk contribute to its SAC and Severn Estuary Ramsar site designation. The fish species assemblage present within the River Usk includes sea lamprey (*petromyzon marinus*), brook lamprey (*lampetra planeri*), river lamprey (*lampetra fluviatilis*), twaite shad (*alosa fallax*), Atlantic salmon (*salmo salar*), bullhead (*cottus gobio*) and allis shad *(alosa alosa).* The River Usk is known to be an important watercourse for migratory fish species such as eels (*Anguilla anguilla*) which are present in the Severn Estuary. As no works are to be undertaken inside the wetted channel (defined as the river channel below Mean High Water (MHW) (i.e. the mean of mean high water springs (MHWS) and mean high water neaps (MHWN)), fish are not anticipated to be impacted by the works. The definition of wetted channel has been provided by NRW in 2015 for another highway project in South Wales. In addition, there is unlikely to be any night-time working carried out directly above the River Usk (and on the temporary works scaffold), and therefore the wet channel will not be lit; as a result, impacts or disturbance to migratory fish are considered unlikely. If any night-time working is required then the CEMP will ensure suitable mitigation measures are in place to avoid disturbance from task lighting. Species such as eels are known to be impacted by noise and light and therefore mitigation measures will be implemented and a sensitive approach to lighting requirements on site taken.

Given the targeted nature of the works (joint maintenance and carriageway resurfacing), and that the viaduct carries the existing M4 with high traffic volumes, it is considered unlikely that there will be any additional significant noise or vibration in the area as a result of the works. In the unlikely event of a

notable increase in localised noise and vibration during the construction-phase, this would be temporary in nature and given the strong compulsion of migratory species to reach their spawning grounds it is considered there is a very low risk that there would be any significant adverse impacts on the fish populations associated with the River Usk and Severn Estuary in the long-term.

To ensure compliance with other legislation, extensive pollution control measures will also be put in place over the course of the works to ensure no discharging or depositing of materials within the River Usk. As a result of no works taking place inside the wetted channel, limited activities to cause disturbance, and stringent protection measures, no significant adverse impacts on fish species are anticipated and therefore they will not be considered any further in this assessment. The River Usk SAC and Severn Estuary Ramsar have, however, been given further consideration in the Statement to Inform the Appropriate Assessment (SIAA).

7.4.7 Amphibians (great crested newts)

The SEWBReC desk study search revealed one great crested newt (*Triturus cristatus*) record (from 2002), located approximately 0.8km north of the Scheme (at National Grid Reference ST 305905). The desk study also revealed a number of records for common frog (*Rana temporaria*), common toad (*Bufo bufo*), smooth newt (*Lissotriton vulgaris*) and palmate newt (*Lissotriton helveticus*) (from 1999-2014) located within 1km of the Scheme. The majority of these records were associated with Gwastad Mawr SINC, Kimberley Park, the Brecon and Monmouthshire Canal and Allt-yr-yn SINC/ LNR/ Gwent Wildlife Trust Nature Reserve. Great crested newts are fully protected under the Conservation of Habitats and Species Regulations 2010 and the Wildlife & Countryside Act 1981 (as amended).

The eastern extent of the Scheme corridor in the vicinity of the River Usk Viaduct did not comprise suitable habitat for use by great crested newts, particularly given the high tidal range of the River Usk. At the rear of Pant Road, immediately to the west of the Brynglas Tunnel, a shallow small ditch was identified with aquatic vegetation present, such as Duckweed and Common Water Starwort. In addition, disused sections of the Brecon and Monmouthshire Canal were also identified as providing potentially suitable habitat conditions for use by breeding great crested newts. The disused canal sections comprised large areas of Common Reed and other aquatic plant species (these could not be effectively identified as they were located on the opposite side of the Canal along a section which was not accessible). In addition, to the north of the Malpas Viaduct and adjacent to the canal, there were large areas of marshy grassland comprising suitable foraging habitat for great crested newts, and to the south of the Malpas Viaduct, a small pond area was also identified. However, this was heavily shaded and was considered likely to dry out at certain times of year; it also contained limited amounts of aquatic vegetation.

On 23rd June 2015, eDNA samples were taken from the waterbodies located immediately adjacent to the Scheme to confirm presence/ absence of great crested newts. Although the waterbodies adjacent to the Scheme were not anticipated to be directly impacted by the works, potential impacts were anticipated in relation to the surrounding suitable terrestrial habitats. Upon completion of the eDNA sampling (which confirmed the absence of great crested newts) the scope of works was confirmed and working area confined to the existing soft estate whereby no impacts to suitable terrestrial habitat or any waterbodies will be sustained. Consequently, no significant adverse impacts on amphibians are anticipated, and they will therefore not be considered any further in this assessment.

7.4.8 Reptiles

The SEWBReC records search revealed a number of slow-worm (*Anguis fragilis*), grass snake (*Natrix natrix*) and adder (*Vipera berus*) records (from 1999-2013), located within 1km of the Scheme. The majority of these records were associated with Gwastad Mawr SINC, Kimberley Park, the Monmouthshire & Brecon Canal, Allt-yr-yn SINC/ LNR/ Gwent Wildlife Trust Nature Reserve and Herbert Road, Newport. Reptiles are protected against killing and injuring under the Wildlife and Countryside Act 1981 (as amended).

Along the edges of the dense Bramble scrub on the western bank of the River Usk, small grassland edges provide some limited suitable habitat for use by reptiles. However, given the proximity to the River Usk and its high tidal range, combined with the extensive existing management of this location of the soft estate, it was considered unlikely to support a stable reptile population.

Due to the residential gardens present along Pant Road, the compost heaps and the unmanaged vegetative strip (which is now dense with Japanese Knotweed), it is considered possible (though unlikely) that a small number of common reptiles, in particular slow worms, could be present. Given the isolated, heavily urban surrounds, and the small ditch separating the properties and the proposed working area, it is considered unlikely that reptiles would be present in large numbers, if at all.

The riparian woodland along the Malpas Brook and along the Brecon and Monmouthshire Canal would provide suitable foraging opportunities for Grass Snake (*Natrix natrix*). These areas are not to be impacted as part of the works.

Overall, the potential for reptiles to be present within the Scheme corridor has been assessed as low, and they are unlikely to be present within the working area, particularly as the verges along the existing M4 at Malpas (which is the only section of verge considered suitable for reptiles) are not to be impacted and these areas are isolated and elevated as part of the viaduct structures. In the unlikely event that reptiles are encountered during the works on site, the works will be reviewed and if a capture and relocation exercise required then this will be carried out. Given the timescales involved and the nature of the works, if reptiles are encountered, they will be relocated into suitable adjacent habitat to the scheme away from the working area. Fencing will be installed if considered necessary. A watching brief by an experienced ecologist is recommended. No significant adverse impacts on reptiles are anticipated, and therefore reptiles will not be considered further in this assessment.

7.4.9 Birds

SEWBReC provided a number of notable bird records (including LBAP and RSPB Welsh Red and Amber listed birds) located within or in close proximity to the Scheme. These records originated from the Gwasted Mawr SINC, Allt-yr-yn SINC/ LNR/ Gwent Wildlife Trust Nature Reserve, the Glebelands SINC and the Brecon and Monmouthshire Canal, and included Eurasian teal (*Anas crecca*), water rail (*Rallus aquaticus*), long-tailed tit (*Aegithalos caudatus*) and house martin (*Delichon urbicum*). Birds and their active nests are protected under the Wildlife and Countryside Act 1981 (as amended), making it an offence to damage or disturb an active nest.

The viaduct structures provide a number of suitable ledges and fissures that could provide potential nesting opportunities for birds. However, given the volumes of traffic, disturbance and associated updraft, the tunnel is not considered suitable for use by breeding birds.

Areas within the soft estate and immediately adjacent to and beneath the structures (for example, areas of scrub) provide suitable nesting opportunities for breeding birds. However, heavy traffic and high levels of disturbance again reduce the suitability of some of these areas. Common bird species were observed along the Brecon and Monmouthshire Canal during the survey. The bird assemblage along the Scheme corridor is considered to be of 'Local' value to nature conservation. The suitability of the channel banks of the River Usk for qualifying bird species has been considered further in the AIES Screening Report in relation to the Severn Estuary SPA and Ramsar. Mitigation to ensure legal compliance such as undertaking site clearance during the nest season will still need general consideration and incorporated into the programme of works and supervision carried out where appropriate. However, no significant long-term impacts are anticipated in relation to birds and therefore will not be considered any further in this assessement.

7.4.10 Dormice

No records of dormice were identified during the desk study, and no evidence of their presence was discovered during the survey. The woodland corridor along the Brecon and Monmouthshire Canal was

considered potentially suitable for use by dormice, with the presence of Hazel. However, there will be no site clearance required at this location, so dormice will not be considered any further in this assessment.

7.4.11 Water Voles

SEWBReC provided three water vole (*Arvicola amphibius*) records (from 1984-2012) located within 1km of the Scheme. These records were associated with the Monmouthshire & Brecon Canal (including where it passes under the M4), Malpas Brook (part of which is designated as a SINC), Gwastad Mawr SINC and various locations along the A4042 and the M4.

The Malpas Brook and the Brecon and Monmouthshire Canal were both identified as providing suitable habitat for water voles during the surveys which have been carried out to date. Water voles are protected under the Wildlife and Countryside Act 1981 (as amended). During the survey, no field signs confirming presence/absence were identified. Given this, the nature of the works to be undertaken at the Malpas extent of the Scheme, and the proposed working area, water voles will be given no further consideration in this assessment.

7.4.12 Otters

SEWBReC held a number of otter (*Lutra lutra*) records (from 1984-2014) located within 1km of the Scheme. The majority of these records were associated with the Monmouthshire & Brecon Canal (including where it passes under the M4), Malpas Brook (part of which is designated as a SINC), Gwastad Mawr SINC and various locations along the A4042 and the M4. Otters are fully protected under the Conservation of Habitats and Species Regulations 2010 and Wildlife and Countryside Act 1981(as amended).

The River Usk provides suitable foraging habitat for otters, and is designated as a SAC, in part, due to its otter population. The mudflats and grassland immediately adjacent to the River Usk offer limited suitability for lying-up and resting sites, particularly given the tidal regime of the River Usk. Although the areas of dense scrub may provide areas of temporary shelter for otters, the eastern bank in particular is frequently used by dog walkers.

The Malpas Brook and the Brecon and Monmouthshire Canal both provide suitable habitat for otters. However, during the survey, no field signs confirming presence/absence were identified.

Although no potential otter holts were identified during the survey, surveys will continue to be undertaken to confirm/presence absence of otters and given that they are a qualifying feature of the River Usk SAC will be given further consideration in this assessment. Given the watercourses present along the Scheme corridor, including the River Usk SAC (of which otters are one of the qualifying features), the conditions are considered to be potentially of ‘County’ value to the local otter population. No significant long term impacts are anticipated in relation to otters. However, mitigation measures will be required.

7.4.13 Badgers

SEWBReC provided no records of badger (*Meles meles*) within 500m of the Scheme. Surveys also confirmed the absence of badgers along the Scheme corridor. Therefore, badgers will be given no further consideration in this assessment.

7.4.14 Bats

The SEWBReC desk study revealed a number of common pipistrelle (*Pipistrellus pipistrellus*), soprano pipistrelle (*Pipistrellus pygmaeus*), noctule bat (*Nyctalus noctula*), whiskered/Brandt's bat (*Myotis mystacinus/ brandtii*), lesser horseshoe bat (*Rhinolophus hipposideros*), brown long-eared bat (*Plecotus auritus*) and Daubenton's bat (*Myotis daubentonii*) records located within 2km of the Scheme. The

majority of these records were associated with Barack Hill and the Brecon and Monmouthshire Canal, and various locations in Newport, including the conurbations of Malpas, Caerleon and Bettws. These records included: one brown long-eared bat and one unidentified bat roost record associated with residential properties located in the Newport conurbations of Bettws and Caerleon; one noctule bat roost record from the section of the Brecon and Monmouthshire Canal referred to as 'Fourteen Locks'; and a lesser horseshoe roost located at Llantarnum Abbey, Cwmbran, all of which are located more than 1km from the Scheme.

Although there are several SACs located within 30km of the Scheme which are designated for their bat populations, the structures on-site are unsuitable for use by the qualifying interest species, i.e. lesser and greater horseshoe bats.

Both the Malpas and the River Usk viaducts were identified as being potentially suitable for use by other roosting bat species (albeit low potential). Although the structures form part of the existing M4, and are thus subject to high volumes of traffic, noise and vibration, access points and features which could be utilised by roosting bats were identified and further surveys considered appropriate.

In summary, the daytime inspections identified a number of potential features suitable for use by roosting bats (albeit low potential). Dusk emergence surveys confirmed the absence of roosting bats in the River Usk Viaduct structure, which re-emphasized the findings of the daytime inspections. As part of the internal inspections/daytime assessment of structures, the inside of the Malpas Viaduct structure (in places) was considered potentially suitable for use by hibernating bats. Although the works to be carried out are not considered to have any impacts on roosting bats in the unlikely event that they are present, the Malpas structure is considered to be of 'Local' Value to roosting bats a further inspections recommended to confirm the absence of hibernating bats in early 2016.

7.4.15 Other Mammals

SEWBReC provided two records for hedgehog (*Erinaceus europaeus*), listed as a species of principal importance under Section 42 of the NERC Act (2006); these originated from Lambert Street and Herbert Road, Newport. Hedgehogs are very unlikely to be present within the footprint of the works given the elevated nature of the structures and isolated location of the small section of land behind the properties on Pant Road. Given the tidal regime and nature of the habitat conditions present along the banks of the River Usk, hedgehogs are also considered likely to be absent from the works footprint. Hedgehogs may be present beyond the working area on the western bank of the River Usk, but will not be impacted by the works. The location of the temporary construction site at Glebelands currently comprises amenity grassland with limited habitats present to support other mammal species. This area is also prone to high levels of disturbance as a result of local sports activities and dog walkers. Based on this, hedgehogs will not be considered any further in this assessment.

7.5 Design, Mitigation & Enhancement Measures

7.5.1 Embedded Mitigation

Where possible, the Scheme has been designed to avoid or minimise impacts on ecological receptors, for example, by ensuring the temporary works platform (necessary to provide access to the underside of the River Usk Viaduct for maintenance and repairs), is fixed to the main structure and that no scaffolding is installed into the wetted channel of the River Usk.

Given the nature of the Scheme, much of the maintenance activities will also be undertaken within the highway boundary from the carriageway and hard shoulder. However, some works will require access to the underside of the structures, and at the River Usk, temporary works will tie into the river banks. In addition, a temporary site compound will be positioned on Glebelands Recreational Ground, although this will be more than 12m away from the River Usk on top of the bank and outside of the SAC/SSSI boundary.

7.5.2 Mitigation

Plants and Habitats

It would be appropriate to ensure that any vegetation removal is minimised as far as possible. In addition, it would also be appropriate to adopt best practice pollution control measures to ensure that retained habitats are not adversely affected by dust created during construction, and that runoff or other spillages do not enter watercourses such as the River Usk SAC. Control measures will be incorporated within the CEMP and will detail measures to be put in place to safeguard the river Usk, particularly in relation to sediment runoff and any fugitive particulate matter/ substances.

Where the temporary site compound is to be located on Glebelands Recreational Ground, topsoil will be stripped and stockpiled, and then reinstated upon removal of the compound (see Section 6 above). At present it is proposed to re-spread the turves using the existing seedbank and review whether over-seeding is required. Land take will be kept to a minimum, and habitats will be reinstated upon completion of the works (refer to Section 6, Landscape above). Access routes to be used by site personnel and delivery vehicles will be clearly demarcated on site to ensure wider areas of the SINC are not impacted by the works. Glebelands SINC is designated as being a large site on a former landfill comprising mostly of amenity grassland, and to the north of the site, woodland and scrub. The SINC forms part of the River Usk Corridor. As part of the aftercare works, the reinstated grassland area will be regularly inspected and, where necessary, spot-weed control measures implemented to ensure that conditions are returned to their previous state (refer to Section 6, Landscape above).

Invasive Species

Given the location of the water main at Malpas, and the dense Japanese Knotweed present within the working area, it will be necessary to ensure stringent pollution control measures are put in place in order to prevent the spread of any Japanese Knotweed into the surrounding area. Measures will include the use of boarding to reduce the risk of spreading of Japanese Knotweed by site equipment and personnel. In addition, stringent decontamination measures will be put in place to ensure any equipment and individuals working in this location do not spread any Knotweed. No contaminated material will be removed from the working area. A method statement outlining the approach to works will be drafted and submitted to Newport City Council and NRW to confirm and agree the approach to works. This will also feature in the CEMP.

Birds

All birds, their nests and eggs are afforded protection under the Wildlife and Countryside Act 1981 (as amended). As part of a programme of advanced works, all suitable nesting habitat (scrub, shrubs and trees) will be removed in January or February 2016, before the main bird nesting season (March to August inclusive), taking into consideration any other mitigation requirements. Should the clearance of bird nesting habitat not be possible to this timescale, precautionary mitigation measures to avoid impacts upon nesting birds will be applied. Given the nature of the works and location within the existing M4 soft estate, as well as the availability of alternative, better quality nesting and foraging habitat in the wider area, no significant impacts on the local bird population are anticipated. In addition, scaffolding will be erected in winter 2015/2016 outside of the bird nesting season.

Otters

Although no otter holts (or resting sites) have been identified during surveys to date, otters do use the watercourses and canal present within the Scheme corridor. Significant disturbance to otters in the locality is considered unlikely, particularly as night-time working directly above the watercourse on the scaffold/temporary works is not anticipated. Works to the live carriageway under night-time closures are

unlikely to result in significant disturbance given the existing levels of background noise and lighting associated with the existing M4. Despite impacts being considered as unlikely, the following precautionary mitigation measures are proposed that will be incorporated within the CEMP.

- Baffles to prevent direct light spill to water courses will be fitted to all floodlighting equipment. This particularly applies to the site compound at Glebelands Recreational Ground and during any night-time working on the live carriageway (during night time closures), when light could spill out onto the River Usk and areas beneath the Viaduct.
- Fencing and covering of any excavations will be ensured. In addition, the site compound and works areas will be secured to ensure that otters cannot gain access.
- Footpaths and Public Rights of Way (PRoWs) will remain open for use throughout the duration of the works, and therefore otters will continue to have access along the banks of the River Usk and be able to safely pass beneath the M4/ Malpas Viaduct.
- Night time working above the River Usk is not anticipated, some night time works such as carriageway resurfacing as part of the maintenance activities will occur. However, these works will be based on the live carriageway, in an area which is already well-lit with one way traffic remaining in operation during any night time closures. No night time working will take place directly above the River Usk on the scaffolding or on the channel banks.

Bats

The nature of the works may result in some disturbance of roosting/ hibernating bats (if present) inside the Malpas Viaduct Structures. Although no works will take place inside the Malpas Viaduct structure, works will include joint repairs and resurfacing of the carriageway. As a result, there is the potential for some small-scale disturbance to take place, although this is considered extremely limited, particularly given the existing levels of disturbance caused by the M4.

Although no evidence of roosting bats was recorded during the summer surveys, further surveys/ inspections of the structures are recommended during the winter to confirm presence/absence of hibernating bats. In the unlikely event of hibernating bats being confirmed as present, the site activities may need to be timed to avoid the winter months when bats are present. If the rescheduling of works is not possible, it will be necessary to liaise with NRW and review whether works can take place under an agreed method statement or licence. Works to the joints will be carried out on the carriageway (deck side). Where works on the carriageway will be carried out (under night closures) during the summer months, bats will be foraging at night therefore further reducing the risk of disturbance. However, during the summer 2015 inspections and surveys absence of roosting bats was confirmed.

In the event of further surveys confirming the absence of bats using the Malpas Viaduct structure, no mitigation measures will be required. Despite the findings of the surveys carried out to date, it is recommended that a licensed bat worker is on standby during the works in the unlikely event of roosting bats being encountered. In addition, it should be noted that no buildings are to be demolished as part of the works, such as the existing Control Building at the western portal.

Reptiles

Some habitat manipulation works are undertaken as a precautionary approach in the unlikely event of reptiles being present in the small vegetated area which will be cleared to house the interceptor and behind the properties behind Pant Road. Additional measures will need to be put in place when working behind Pant Road due to the presence of dense stands of Knotweed. The likely reptile mitigation will include, but will not be limited to:

Vegetation within the footprint of proposed works will be cut in phases. Phase 1:

- Grassland and ruderal vegetation will be strimmed to a height of approximately 10-15cm with care by an experienced sub-contractor during the active reptile period (April-September). In the event of Knotweed being present, vegetation should be cut down by hand.

- Scrub and small trees will be cut down to ground level (tree and scrub removal should be managed in accordance with mitigation for nesting birds) and carried out during the winter months.
- All arisings are to be removed from the main working areas but will be used to create brash piles which can be used by reptiles, amphibians, small mammals and invertebrates.

The area will be left undisturbed for approximately 3 -4 days. The Phase 2 vegetation works will then proceed:

- All vegetation will be strimmed to ground level and the top soil removed in the presence of an Ecological Clerk of Works (ECoW).
- During this vegetation clearance period, all other debris present must also be removed with care.
- In the unlikely event that any reptiles are encountered during the works, they will be relocated to an area of suitable habitat to the north of the existing M4 along the Public Right of Way. All works will be carried out under a watching brief as a precautionary approach.

7.5.3 Enhancement

Due to the scope of the works, opportunities for enhancement measures are limited, but consideration will be given to ensuring the soft estate is reinstated and reseeded using a wildflower seed mix appropriate for the local area, and only native species of local provenience are used in any landscape planting. As part of the works, it is proposed that a long-term treatment programme is developed to eradicate Japanese Knotweed from the working areas. The future landscaping of these small areas will be reviewed upon the successful removal of Japanese Knotweed from the area, and further detailed in the CEMP. The Contractor will need to liaise with Newport City Council and SWTRA to confirm any approach to reinstatement.

7.6 Assessment of Residual Impacts

7.6.1 Construction

Plant and Habitats

Some habitat areas will be temporarily lost during the construction phase of the Scheme, including an area of Glebelands Recreational Ground (approximately 0.3ha), the area to house the interceptor and pollution containment tank, as well as the footprint of the trench to accommodate the water main behind the properties on Pant Road. It is not anticipated that these losses will result in significant impacts to the habitat resources in the local area, not least because all areas will be reinstated upon completion of the works.

Other potential impacts upon habitats comprise incidental pollution or dust deposition; these impacts are indirect, and temporary in nature. In addition, extensive mitigation measures will be put in place as discussed above. For the reasons outlined, no significant impacts on the local plants and habitats within the Scheme are anticipated.

Invasive species (namely Japanese Knotweed)

Providing stringent mitigation measures are put in place to ensure that Japanese Knotweed is not spread across the Scheme and into adjacent habitat areas, there should be no significant impacts to surrounding wider areas as a result of working in an area contaminated with Japanese Knotweed. In addition, long-term positive benefits may be gained (particularly behind Pant Road) through the proposed eradication of Japanese Knotweed. Japanese knotweed/ contaminated materials will not be removed from site. They will remain in-situ and be subject to further treatment.

Birds

The main Scheme works have been programmed to begin in March 2016; therefore, the limited site clearance works will be undertaken outside of the bird nesting season. The existing vegetation to be removed is small in area and abuts the existing M4. Given the availability of alternative nesting habitat in the wider area, no significant impacts on the local bird population are anticipated. Measures will be put in place to ensure that birds to do not start to nest on the scaffolding structure spanning the River Usk, such as plastic spikes to deter perching and access. Given the works area will be sheeted to contain any debris, and securely contained to remain water tight, nesting birds are not anticipated to be an issue during the construction-phase.

Otters

Minor temporary disturbance of otters may result from the works, but this impact is not anticipated to be significant, and precautionary measures (to be incorporated within the CEMP) will minimise the likelihood for impacts. No licence in relation to otters is considered necessary.

Bats

It is not anticipated that there will be any permanent or temporary loss of roosting sites for bats as a result of the Scheme. Some minimal short-term disturbance may occur during the construction phase. However, works will be timed at the Malpas extent of the Scheme to ensure activities do not take place during the bat hibernation season in the event of bats being confirmed as present during the further surveys. In the unlikely event of hibernating bats being confirmed as present at Malpas, timings of the works will ensure that Scheme will not result in a significant impact upon bats.

7.6.2 Operation

It is not anticipated that any impacts on ecology will extend into the operational phase of the Scheme as no increases or long-term changes to traffic volumes are anticipated as a result of the works. Therefore operational impacts have not been considered as part of this assessment. Long-term benefits for the River Usk SAC/ SSSI will be provided through the provision of improved drainage and pollution control/ protection measures.

7.7 Conclusions & Recommended Further Works

7.7.1 Summary of Results

Extended Phase 1 habitat survey

The survey confirmed the presence of a range of habitat types potentially suitable for supporting a number of protected species including bats, badgers, great crested newts, reptiles, otters and breeding birds. Consequently, further targeted surveys were undertaken, where appropriate. Given the nature of the Scheme (repairs and maintenance to the existing M4 carriageway and structures), there is anticipated to be limited impact upon the surrounding area and ecological receptors.

Great crested newts

Overall, the HSI assessment of all waterbodies did not identify any ponds/ ditches of a good or excellent condition. The Brecon and Monmouthshire Canal was assessed as being of an Average quality (scoring 0.65), with the other two waterbodies being assessed as Poor quality (ponds 1 and 2 scored 0.37 and 0.41 respectively). Given the timescales associated with the Scheme, eDNA sampling of the waterbodies was undertaken during which absence of great crested newts was confirmed. As the scope/extent of works changed upon completion of the water sampling, great crested newts have not been given any further consideration as none of the waterbodies, and suitable adjacent terrestrial habitat, will be impacted by the works.

Bats

Internal inspections of the River Usk Viaduct abutments were carried out to confirm presence/absence of roosting bats. In addition, an assessment of the structures was also undertaken and features identified which had the potential to support roosting bats. Where the absence of roosting bats could not be confirmed, dusk emergence surveys were carried out. The structures were considered to be of low potential, with no evidence of roosting bats found. The full bat report has been appended to this document, see Appendix B. The Malpas Viaduct was identified as having some potential for use by hibernating bats. Depending upon when works are programmed, further inspections over winter months may be required.

Reptiles

Surveys were not undertaken of the small section of grassland which will house the interceptor and pollution containment tank at the eastern extent of the tunnel given the size of the area and significant levels of disturbance this section of the soft estate receives through cutting and mowing, the installation of utilities and a gantry. In addition, the high tidal regime of the River Usk limits the suitability of surrounding habitat. As a precautionary approach, a detailed mitigation plan will be included in the CEMP to avoid harm and minimise potential impacts of works on reptiles in the unlikely event that they are present. A small-scale habitat manipulation exercise is recommended to displace any reptiles that are present (although considered unlikely).

7.7.2 Mitigation Measures and Recommended Further Works

As outlined in Section 6.5, a number of mitigation measures are required in relation to relevant policies and/or the legal protection afforded to reptiles, birds, otters, bats and ensuring that invasive species such as Japanese Knotweed are not spread. Further targeted bat surveys are considered to be necessary for the voids inside the Malpas Viaduct structures depending upon the proposed timing of works. In addition, the following documents will be produced and implemented alongside the CEMP:

- Japanese Knotweed Method Statement/ Mitigation Strategy.
- Pollution Control Plan.

7.7.3 Conclusions

No significant effects upon nature conservation receptors are predicted during the construction phase of the project, on the assumption that the mitigation measures proposed are implemented successfully. Given the nature of the works, and as outlined in Section 7.6.1, no operational impacts are associated with the Scheme and therefore these have not been considered as part of the assessment.

The potential for significant impacts upon five ecological receptors has been considered in the assessment:

- Plants and Habitats (including Glebelands SINC and the River Usk SSSI).
- Invasive species (namely Japanese Knotweed).
- Birds.
- Otters.
- Bats.

Of these, the potential for significant effects were identified for the listed receptors and mitigation measures proposed in Section 7.5 above. In each case, it is considered that the mitigation measures will reduce any potential impacts such that they are not significant (i.e. an absence of effects, or no perceivable effects) and on this basis, the overall significance category for effects upon Ecology and Nature Conservation is **Neutral**.

8 MATERIALS

8.1 Introduction

This chapter addresses potential impacts resulting from the use of material resources and waste management associated with the Scheme. It also assesses potential embodied carbon impacts associated with material resources to be used and the management of waste.

This chapter does not make reference to the material resources and waste associated with the operation and future maintenance of the Scheme. This chapter makes reference to the material resources and waste associated with the maintenance and minor improvement works of the Scheme.

In addition, this assessment does not make reference to impacts associated with the offsite manufacture of products. These stages of the products' or material resources' life-cycles are outside the scope of this assessment due to the range of unknown variables associated with the extraction and manufacturing processes.

The term 'materials' was introduced within the Design Manual for Roads and Bridges ("DMRB") Volume 11 in August 2009 (Ref 8-1) and embraces the main material resources required for the maintenance and improvement works of the Scheme and maintenance/ improvement works -related wastes.

In October 2011, Highways England (formerly the Highways Agency) (HE) issued the Interim Advice Note (IAN) 153/11 (Guidance on the Environmental Assessment of Material Resources) (Ref 8-2). For the purpose of this EAR, the Highways England IAN 153/11 will be referred to in the absence of a Wales specific IAN being available at the time of writing. IAN 153/11 outlines an approach for the consideration of material resources use and waste as part of statutory and non-statutory environmental impact assessment (EIA) process for new construction, improvement and major maintenance. The terms 'material resources' and 'waste' are addressed more fully below:

a. material resources include primary raw materials, such as aggregates and minerals, and manufactured construction products which include recycled and secondary aggregates. Many material resources originate offsite, purchased as construction products, and some arise onsite such as concrete; and
b. waste is defined in Article 1(a) of the European Waste Framework Directive 2008/98/EC (Ref 8-3) as 'any substance or object in the categories set out in Annex I which the holder discards or intends to discard or is required to discard'. The term holder is defined as the producer of the waste or the person who is in possession of it and the term producer is defined as anyone whose activities produce waste. Waste can be further classified as hazardous, non-hazardous or inert.

The way in which material resources are used throughout the EIA process is known as the Material Resource Flow. A simplified flow diagram representing the flow of material resources and the management of waste is shown in Figure 8-1.

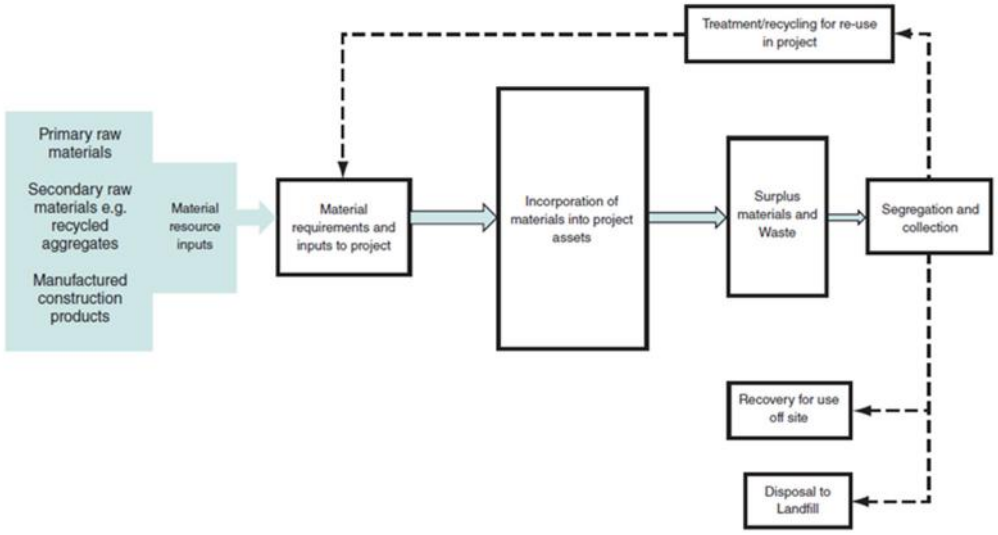


Figure 7-1 Project material flow diagram from IAN 153/11

In October 2014, HE issued IAN 69/14 (Designing for Maintenance) (Ref 8-4) which stated that 'the design process must include consideration of how the highway and associated structures are to be maintained and ultimately demolished in the future". Whilst not presenting an assessment process, the IAN does provide guidance on what should be considered during the design process with regard to maintenance.

This assessment of materials covers the requirements for the maintenance and improvement works related material resources, waste treatment, transportation and final disposal for the maintenance of the Scheme. This includes impacts on landfill and waste infrastructure sites (landfill sites and waste management facilities) capacities; as well as the impact on the environment from the use of material resources and the generation of wastes, together with measures to mitigate these impacts.

Application of the waste hierarchy (shown in Figure 8-2) provides a protocol to reduce waste generation at source and reduce the volume of waste that has to be sent to landfill through reuse and recycling.

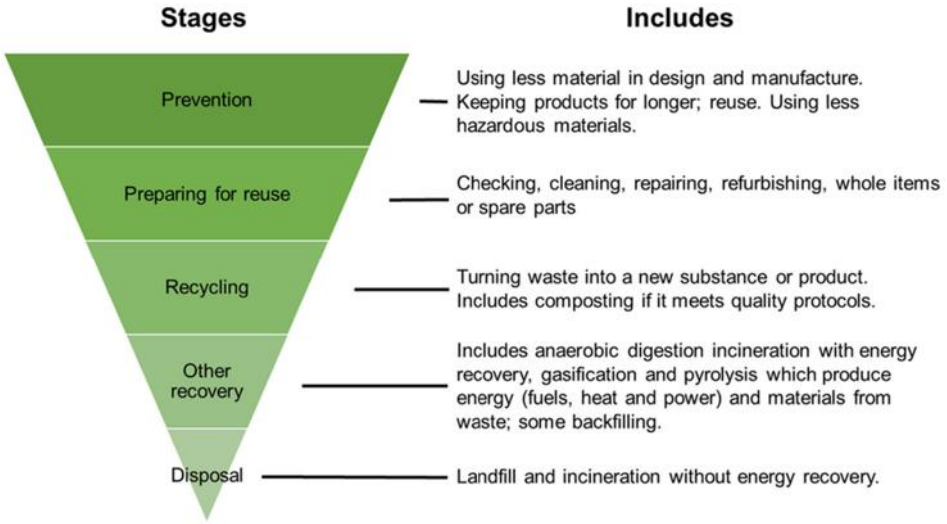


Figure 7-2 Waste hierarchy

The waste hierarchy ranks waste management options according to what is best for the environment. It gives priority to prevention, then preparing it for reuse, then recycling, then recovery, and last of all disposal (e.g. landfill).

Another consideration is the proximity principle, which advocates that waste should be disposed of (or otherwise managed) close to the point at which it is generated, thus aiming to achieve responsible self-sufficiency at a regional or sub-regional level.

By adhering to the waste hierarchy and proximity principle, wherever practicable, throughout the maintenance and operational phases of the Scheme, the Scheme will minimise the environmental impacts of any wastes that are produced.

The Scheme will be designed, in line with the requirements of IAN 69/14, to minimise the need for significant further refurbishment and maintenance.

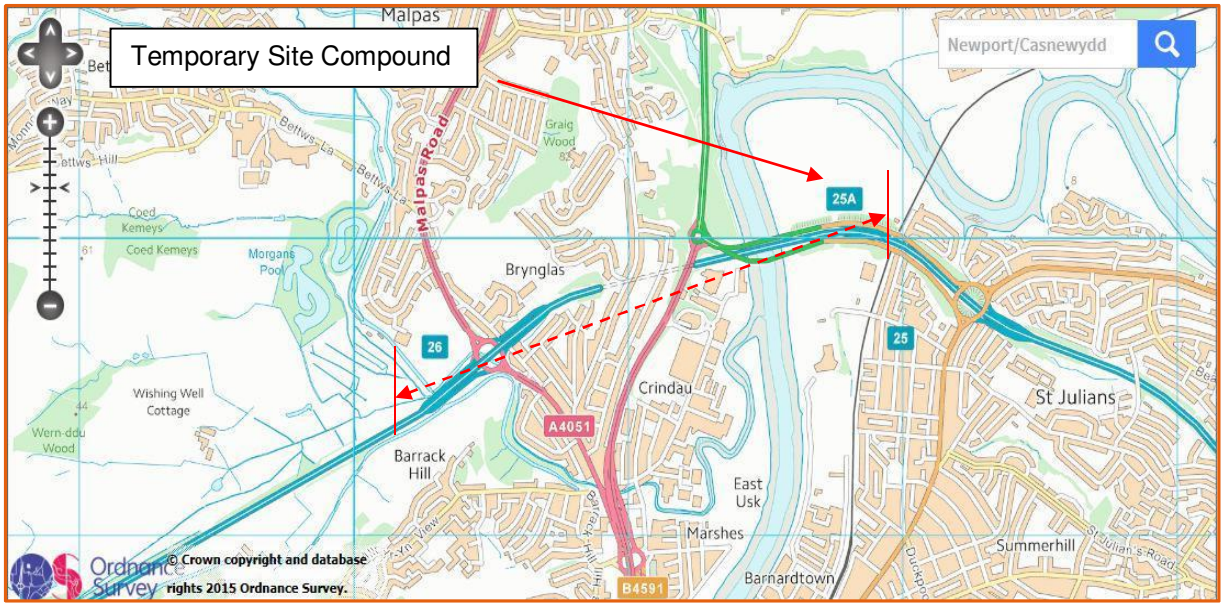
This chapter details the methodology followed for the assessment, and summarises the regulatory and policy framework relating to material resources and waste management. Following this, the baseline, design and mitigation, and residual effects of the Scheme are discussed for the whole Scheme. Cumulative effects are then discussed, followed by limitations of the assessment. Finally, a summary table is provided.

A Preliminary Site Waste Management Plan (SWMP) is presented in Appendix C1.

8.2 Study Area

The study area would encompass the spatial area over which the Scheme would be expected to have an effect. It will be necessary to define two study areas, one for material resources and one for waste.

Figure 8-2 The study area: existing M4 between Junctions 25a and 26, study area also includes the recreation ground at Glebelands.



Material resources will, wherever possible, be sourced either locally or regionally. Where this is not possible, material resources will be sourced from the whole United Kingdom (UK) market. In response to this, baseline data will be presented on the demand for material resources for the whole of the UK.

In respect of assessment in relation to waste, the study area comprises the area within the Scheme limits of all three of the structures, the Malpas Viaduct, the River Usk Viaduct and the Brynglas Tunnel. The Study Area will extend to the waste management infrastructure located in South East Wales and the temporary site compound which will be installed at the Glebelands Park site. The potential impact of increased vehicle movement associated with the egress of waste arisings from the Scheme on the highways network will also be included.

The waste infrastructure sites (landfills and waste management facilities) that may potentially accept waste arisings from the Scheme within the described study area have been included in the assessment.

While the waste assessment does not include the promotion and operation of the waste infrastructure sites in these areas, the sites included in the SWMP have been confirmed by the local authorities to have the capacity and capability to manage the waste produced by the Scheme, as well as valid licences and permits.

8.3 Methodology

8.3.1 Scope

The scope of this report is to provide a materials assessment of the proposed maintenance and improvement activities for the three structures along the existing M4 between Junctions 25A and 26 (inclusive). The works discussed below are to be carried out as one scheme within the same time frame. Refer to Chapter 3 for further project details.

8.3.2 Methodology

General approach

Detailed assessment has been undertaken, as opposed to a simple assessment, in accordance with DMRB and IAN 153/11. Given the project capital costs for the Scheme, in line with IAN 153/11 it is categorised as a 'large new construction project' despite being a maintenance and improvement project.

The IAN 153/11 guidance requires identification of the environmental impacts associated with material resources use and waste, an assessment of waste arisings for the different phases of the Scheme and the measures which will be implemented to mitigate the impacts.

Throughout this chapter, material resources will be addressed first, followed by waste.

Typical types and quantities of material resources to be used (e.g. concrete and steel) and waste arisings from the maintenance and improvement phases have been forecast using the design information and professional judgement and are included in the assessment.

Quantities of material resources used have been forecast using SmartWaste KPIs, WRAP's wastage rates and professional judgement due to a need to carry out more detailed design. The assessment of key material resources to be used has been made against UK-wide material demand/procurement data. This presents a reasonable worst case scenario for material resources as the Scheme will most likely be utilising less material resources than forecasted and applying a market-wide procurement policy, allowing international markets to be accessed if necessary.

The identification of potential waste infrastructure sites (that could receive wastes being produced by the Scheme) has been carried out through the interrogation of the Environment Agency (EA) Environmental Permitting Regulations (EPR) database (Ref 8-5) which is used throughout the UK. The assessment considers the capacity of landfill sites and material treatment facilities within the study area.

The heavy goods vehicle (HGV) movements associated with material resources and waste arisings has been assessed quantitatively and the subsequent effects on the vehicular capacity of the existing highways network have been assessed. HGV movements associated with the material resources and waste arisings have been based on deliveries and collections of 8 wheel tippers (20 tonnes or 15m^3 based on average capacity accounting for voids).

Environmental value (sensitivity) is not covered by the IAN 153/11 and there is no accepted criteria for value (sensitivity) of resource for material resources and waste. In the absence of such guidance, the materials assessment has been undertaken using professional judgement. The assessment criteria used for assessing environmental value (or sensitivity) and typical descriptors are in Table 8-1, Table 8-2 and Table 8-4.

The sensitivity for material resources use is based on the availability of the resource and whether its use in the Scheme could result in significant depletion. For example, high sensitivity might pertain to a rare material resource that is not available locally or available locally in very limited amounts, such that the scarcity of the required material resource could be significantly depleted. Conversely, a low sensitivity of material resource may be considered as one that is very common locally or that primarily comprises reused, recycled or recovered material resources such that its use would contribute to waste reduction targets and the avoidance of the use of primary material resources.

The sensitivity for waste infrastructure sites is based on available local waste infrastructure capacity and the waste volumes generated by the Scheme compared with the total waste generation in the study area. For example, a high sensitivity waste infrastructure site could be considered to have very limited capacity for the waste type requiring treatment and/or disposal. Also, high sensitivity could be awarded when the waste volumes generated by the Scheme could contribute to an excess of 5% of the total waste generation in the study area. A low sensitivity of waste infrastructure sites would be where there were large or numerous waste infrastructure sites within the study area with high capacity to deal with the waste arisings. Also, a low sensitivity could be awarded when the waste volumes generated by the Scheme would contribute to less than 1% of the total generation in the study area.

Table 8-1 Assessing environmental value (or sensitivity) and typical descriptors

Value (sensitivity)	Typical descriptors
High	• Low capacity of existing highways network to accommodate any increases in HGV movements resulting from the flow of material resources and wastes to and from the Scheme. • High scarcity of required material resource. • High importance and rarity, national scale. Limited materials reuse, recycling and or recovery. Recycling of waste is less than 50%. • Limited waste capacity expected within the study area. • Waste volumes generated by the Scheme contribute to an excess of 5% of the total generation in the study area.
Medium	• Medium capacity of existing highways network to accommodate any increases in HGV movements resulting from the flow of material resources and wastes to and from the Scheme. • Medium scarcity of required material resource. • High or medium importance and rarity, regional scale. Moderate materials reuse, recycling and or recovery. • Waste volumes generated by the Scheme contribute to greater than 1% but less than 5% of the total generation in the study area. • Moderate waste capacity within the study area expected.
Low	• High capacity of existing highways network to accommodate any increases in HGV movements resulting from the flow of material resources and wastes to and from the Scheme. • Low scarcity of required material resource. • Low or medium importance and rarity, local scale – high materials reuse, recycling and or recovery. • Waste volumes generated by the Scheme are easily managed within the study area without significant increases in quantity (less than 1% of the total generation in the study area). • High waste capacity within the study area expected.

For this assessment, the estimated types and quantities of material resources to be used and waste arisings from the Scheme have been utilised to identify the likely magnitude of impacts against the available material resources and waste capacity. The level at which the various waste arisings from the Scheme can be managed in accordance with the waste hierarchy has also been taken into account. Professional judgement has been applied to determine the likely significance of effects.

Table 8-2 Magnitude of impact and typical descriptors

Magnitude of impact	Typical criteria descriptors
Major adverse	• Loss of resource and or quality and integrity of resource; severe damage to key characteristics, features or elements. • Significant amount of waste generated; likely to exceed current waste management capacity within the study area and require transport outside the study area. • Generation of large volumes of hazardous and inert waste which is managed for disposal using methods lower down the Waste Hierarchy (e.g. offsite in landfill or incineration with energy recovery).
Moderate adverse	• Loss of resource, but not adversely affecting the integrity; partial loss of or damage to key characteristics, features or elements. • Moderate amount of waste generated; may exceed current waste management capacity within the study area and require transport outside study area. • Generation of moderate volumes of hazardous and inert waste which is managed for disposal using methods lower down the Waste Hierarchy (e.g. offsite in landfill or incineration with energy recovery).
Minor adverse	• Some measurable change in attributes, quality or vulnerability; minor loss of, or alteration to, one (maybe more) key characteristics, features or elements. • Small amount of waste generated; unlikely to exceed current waste management capacity within the study area and require transport outside the study area. • Generation of small volumes of hazardous and inert waste which is managed for disposal using methods lower down the Waste Hierarchy (e.g. offsite in landfill or incineration with energy recovery).
Negligible adverse	• Very minor loss or detrimental alteration to one or more characteristics, features or elements. • Insignificant amount of waste generated; very unlikely to exceed current waste management capacity within the study area and require transport outside the study area. • Generation of negligible volumes of hazardous and inert waste which is managed for disposal using methods lower down the Waste Hierarchy (e.g. offsite in landfill or incineration with energy recovery).
No change	• No loss or alteration of characteristics, features or elements; no observable impact in either direction. • Waste generated does not exceed current waste management capacity within the study area. • No generation of hazardous waste and inert waste.

As an additional part of the assessment, the quantification of the embodied carbon impacts of different materials has also been carried out. This provides another means to assess the magnitude of impact associated with the Scheme material resources requirements.

The magnitude of the environmental impact has been assigned through an assessment of the embodied carbon emissions as a proxy of environmental effects associated with the material resources used on the Scheme.

The embodied carbon dioxide emissions of a material resource is the total carbon dioxide equivalent emissions released prior to it leaving the factory gate. 'Carbon' is used as short hand to refer to the basket of six greenhouse gases (GHGs) recognised by the Kyoto Protocol. GHGs are converted to carbon dioxide equivalents (CO_2e) based on their global warming potential per unit as compared to one unit of carbon dioxide (CO_2).This would normally include extraction or harvesting, the manufacturing process and any pre-distribution transportation (shown in Figure 7-3). It does not include the CO_2 emissions associated with transport from the factory gate to site, construction activities, future maintenance or decommissioning. This boundary condition is known as 'cradle-to-gate'.

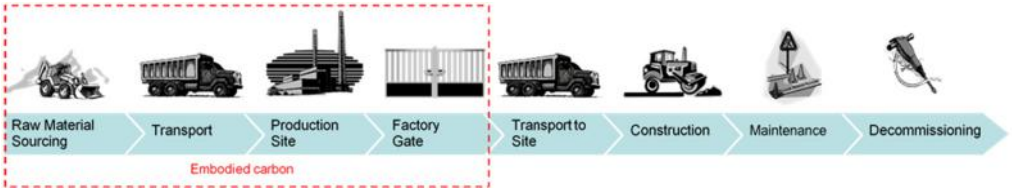


Figure 8-3 Diagrammatic representation of the measure of embodied carbon in relation to material life cycle

The scale of magnitude in Table 8-3 has been used to assess the magnitude of impact associated with the Scheme's material resources requirements. Whilst there is no publically available guidance, the scale in Table 8-3 is based on benchmark data from previous road projects from HE and informed by professional knowledge.

Table 8-3 Scale of magnitude for assessing embodied carbon (CO2e) of material resources

Scale of magnitude of impact	Total CO_2e of material resources (tonnes)
Major	> 40,000
Moderate	20,000 – 40,000
Minor	5,000 – 20,000
Negligible	1,000 – 5,000
No change	< 1,000

Defining the baseline

Material resources baseline conditions have been established through desktop research. However, as material resources data are not available for the study area, the quantitative assessment has been based on available material resources data for the UK.

Waste baseline conditions have been established through desktop research, including the interrogation of key databases such as the Survey of Construction and Demolition Waste in Wales (Ref 8-6), and the EA EPR database:

c. the Survey of Construction and Demolition Waste in Wales has been used to present the baseline construction, demolition and excavation (CD&E) waste baseline for the study area; and

d. the EA EPR database has been used to present the total CD&E waste infrastructure capacity (landfill and waste management facilities) within the study area.

Design and mitigation

The choice of maintenance and improvement works' material resources use and possibilities for waste reduction have been considered during the preliminary design phase and will be addressed by the detailed design phases of the Scheme. The waste hierarchy illustrates that implementing waste minimisation at the preliminary and detailed design phases is the most effective option for reducing waste generated on a Scheme. The mitigation to be applied is presented in Section 8.5.3 below.

Assessing impacts

The significance of effect that the material resources use, waste arisings from CD&E phases and the mitigation measures (e.g. waste reuse, recycling and or recovery) will have on the receptors is informed by the sensitivity of the affected receptor and the magnitude of impact on the receptor.

The sensitivity of receptor, magnitude of the impact and the significance of effect are assessed using the criteria provided in Table 8-4.

Table 8-4 Significance of effects

Magnitude of impact	Sensitivity of receptor		
	High	**Medium**	**Low**
Major adverse	Large or Very large adverse	Moderate or Large adverse	Slight or Moderate adverse
Moderate adverse	Moderate or Large adverse	Moderate adverse	Slight adverse
Minor adverse	Slight or Moderate adverse	Slight adverse	Neutral or Slight adverse
Negligible adverse	Slight adverse	Neutral or Slight adverse	Neutral or Slight adverse
No change	Neutral	Neutral	Neutral

8.4 Baseline Conditions

8.4.1 Material resources

'Primary aggregate' "is the term used for aggregate produced from naturally occurring mineral deposits and used for the first time" (British Geological Society, 2014).

'Secondary aggregates' as defined by Aggregain (a free Sustainable Aggregates information service provided by the WRAP Aggregates Programme) are derived from a very wide range of materials that may be used as aggregates. Many arisings of secondary materials have a strong regional character.

'Recycled aggregates', as defined by Aggregain, can be sourced from a variety of materials arising from construction and demolition (concrete, bricks, and tiles), highway maintenance, excavation and utility operations.

The Mineral Products Association identifies the annual tonnage of aggregates (including crushed rock, sand and gravel, land won, marine and recycled aggregates) and concrete (including cementitious

materials, ready-mixed concrete and concrete products) presented in Table 8-5. The International Steel Statistics Bureau (ISSB) identifies the annual UK demand of steel.

Table 8-5 Key material resources annual demand (UK)

Material resource	Quantities (tonnes)
Steel	10,700,000
Concrete	70,000,000
Aggregates	200,000,000

Given the high levels of UK supply and demand for the key material resources required for the Scheme (steel, concrete, aggregates) the sensitivity of this receptor is judged to be low.

8.4.2 Waste

The total CD&E waste arisings in South East Wales (inclusive of Caerphilly, Glamorgan, Gwent, Mid Glamorgan, Monmouthshire, Newport, South Glamorgan, Torfaen, Vale of Glamorgan, Tredegar, Rhondda Cynon Taff, and West Glamorgan) for 2012 is estimated to be 1,437,350 tonnes per year. Of this total, 675,555 tonnes are recycled to produce graded and ungraded aggregates and 560,567 tonnes are soil. The majority of other waste generated is mixed waste (143,735 tonnes)

In addition, the total construction and demolition hazardous waste generated in South East Wales in 2012 is estimated to be just over 30,000 tonnes per year. Of this total, the majority of hazardous waste generated is mineral waste (30,000 tonnes) with the remainder being chemical preparation waste and mixed waste.

The predominant waste management method is South East Wales is preparation for reuse off-site. Recycling is the second most common management method, being the largest contributors to this recycling rate (in terms of waste types mixtures) bricks, tiles and concretes.

The capacity of waste infrastructure sites that could potentially receive CD&E waste arisings from the Scheme has been assessed using data gained from the EA EPR database. Only information from permitted sites has been included in the assessment. Table 8-6 details the annual waste infrastructure capacities from sites taking CD&E waste within the study area.

Table 8-6 Annual CD&E waste capacity within the study area

Areas	Waste capacity (tonnes)
Caerphilly	455,995
Glamorgan	1,291,119
Gwent	1,459,139
Mid Glamorgan	632,498
Monmouthshire	139,998
Newport	109,499
Vale Of Glamorgan	4,999

Areas	Waste capacity (tonnes)
Rhondda Cynon Taff	327,539
Total	**4,420,786**

A non-exhaustive list of waste infrastructure sites is included in Appendix C1. The ability for waste arisings to be deposited at these sites will be dependent on the conditions imposed on the sites by the relevant licence or permit. There may be other facilities in the vicinity of the Scheme that may be used.

8.5 Design, Mitigation & Enhancement Measures

This section summarises the anticipated material resources use of the Scheme and the anticipated waste arisings generated by the Scheme during the maintenance works, based on design information and professional judgement. The residual effects of such use and generation (incorporating proposed mitigation) are assessed below.

8.5.1 Material resources

Material resources required for the Scheme will consist of inert materials (including concrete), soils and stones, metals, cabling and insulation material. Although the reuse of materials will be maximised, the delivery of the raw materials will still be needed for the maintenance and improvement works.

Aggregates will be required for structures, drainage and road pavement maintenance and improvements. These can be either primary aggregates, such as sand, natural gravels and rocks; secondary aggregates such as incinerator bottom ash aggregate; or recycled aggregates, such as recycled concrete.

The extraction of primary aggregates (e.g. sands and gravels) and lime from quarries will deplete finite material resources. Secondary (or recycled) aggregates may not always have the lowest impact on the environment and material resources will be selected based on a consideration of all relevant impacts. The choice of whether to use primary or secondary aggregates (or a combination of both) will be made taking into consideration a combination of factors including material resources source, specification, production and transport. These factors will inform the use of secondary or recycled aggregates over primary aggregates having regard to the environmental impact.

Using SmartWaste KPIs and professional judgement, the material resources likely to be needed for the maintenance and improvements phase of the Scheme have been forecast. These forecasts are likely be refined and subject to change as the Scheme's works progress. For that reason, the forecasts have been made on a reasonable worst case scenario basis, informed by professional judgment and KPI's from tunnel projects.

The material resources presented in Table 8-7 are the estimated quantities to be needed for the maintenance and improvement works of the Scheme.

The choice of material resources use and possibilities for waste reduction have been considered during the design and will be addressed by the Scheme. The waste hierarchy illustrates that implementing waste minimisation at the design phases are the most effective options for reducing waste generated on a Scheme.

Table 8-7 Estimated material resources required for the Scheme (based on SmartWaste KPIs)

Material resource	Quantities (tonnes)
Steel	81
Concrete	4,317
Aggregates	1,720
Total	**6,118**

Highway network

Using the design information, it is currently estimated that some 408 HGV movements are estimated to be needed to transport the material resources needed for the maintenance and improvement works of the Scheme. This is equivalent to approximately one HGV movement per day.

Embodied carbon content of material resources

The total embodied carbon has been calculated using HE Carbon Calculation for Major Projects (CCMP) (Highways England, 2013). This provided a figure of approximately 1,029 tonnes of CO2e.

Table 8-8 provides details for the embodied carbon contained within the material resources presented.

Table 8-8 Embodied carbon content of material resources required for the Scheme

Material resources	Total estimated embodied carbon (tonnes of CO_2e)
Steel	118.26
Concrete	902.25
Aggregates	8.94
Total	**1,029.46**

Table 8-9 summarises the material resources use during the CD&E phases of the Scheme, following the requirements of IAN 153/11.

Table 8-9 Summary of material resources use

Scheme activity	Material resources required for the Scheme	Estimated quantities of material resources required (tonnes)	Additional information on material resources
Site remediation / preparation earthworks	N/A (no site remediation /preparation earthworks are being carried out)	N/A	N/A (no site remediation /preparation earthworks are being carried out)
Demolition	N/A (significant material resources are not required for demolition)	N/A	N/A (significant material resources are not required for demolition)
Construction	N/A (no construction is being carried out)	N/A	N/A (no construction is being carried out)
Maintenance and improvements	Replacement of carriageways, refurbishment of drainage system, replacement of concrete dado panels, replacement/repair of secondary lining panels & supports, repair of cracks to primary lining, add secondary cladding system to control seepage, repair/repointing of masonry wing walls, re-lining/waterproofing, provide a water supply to tunnel portals for fire-fighting, drainage attenuation & treatment, installation of Video Accident Incident Detection (VAID) system, , replacement of tunnel control system; replacement of tunnel signals, parapet/verge repairs, replacement of tunnel lighting, replacement of electrical supply cabling, provision of new control building and reinforcement repairs.	Steel - 118.26 tonnes Concrete - 902.25 tonnes Aggregates - 8.94 tonnes Other material resources such as cabling, lighting, etc will also be required but it has not been possible to estimate the quantities of these material resources at this stage.	"Designing out waste" principles have been considered throughout the design process in order to minimise the quantity of material resources required for the Scheme. Most material resources will be transported by road onto the Scheme's construction compound, using the existing highway network. The transport of material resources onto site, whether for immediate use from source or from the construction compound, will be reviewed by the appointed Contractor on an ongoing basis to ensure efficiency in delivery and to avoid undue pressure on the road network. This will be supported by the further development and implementation of the CEMP.

8.5.2 Waste

The waste arisings forecast from the demolition, maintenance and improvements works, shown in Table 8-10 and Table 8-11, include arisings from the demolition/ repair works of the structures. These forecasts will be refined as the Scheme progresses.

It is anticipated that a total of around 2,952 tonnes of waste will be produced, of which 1,905 tonnes are mixed construction waste (65% of the tonnage) and 863 tonnes are inert waste (29% of the tonnage).

Table 8-10 Estimated demolition waste arisings from the Scheme

Waste type	European Waste Code (EWC)	Estimated quantities (tonnes)
Hazardous	17 09 03*	7.96
Discarded electrical and electronic equipment	20 01 36	0.43
Furniture	20 03 07	0.05
Total		**8.44**

Table 8-11 Estimated maintenance and improvements waste arisings from the Scheme

Waste type	European Waste Code (EWC)	Estimated quantities (tonnes)
Packaging	15 01 06	7.41
Liquids	16 10 02	18.07
Concrete	17 01 01	431.78
Bricks	17 01 02	3.76
Inert	17 01 07	255.51
Timber	17 02 01	82.19
Metals	17 04 07	12.14
Soils	17 05 04	172.01
Hazardous	17 09 03*	1.69
Mixed	17 09 04	1,905.66
Canteen / Ad-hoc waste	20 03 01	33.11
Furniture	20 03 07	0.10
Total		**2,926.08**

Highway network

The total waste arisings will result in over 226 HGV movements based on collections by 8 wheel tipper. This is equivalent to less than one HGV movement per day.

The summary of CD&E waste arisings forecast following the requirements of IAN 153/11 is described in Table 8-12.

Table 8-12 Summary of waste arisings from the Scheme

Scheme activity	Material resources required for the Scheme	Estimated quantities of material resources required (tonnes)	Additional information on material resources
Site remediation / preparation earthworks	N/A (no site remediation /preparation earthworks are being carried out)	N/A	N/A (no site remediation /preparation earthworks are being carried out)
Demolition	N/A (significant material resources are not required for demolition)	N/A	N/A (significant material resources are not required for demolition)
Construction	N/A (no construction is being carried out)	N/A	N/A (no construction is being carried out)
Maintenance and improvements	Replacement of carriageways, refurbishment of drainage system, replacement of concrete dado panels, replacement/repair of secondary lining panels & supports, repair of cracks to primary lining, add secondary cladding system to control seepage, repair/repointing of masonry wing walls, re-lining/waterproofing, provide a water supply to tunnel portals for fire-fighting, drainage attenuation & treatment, installation of Video Accident Incident Detection (VAID) system, , replacement of tunnel control system; replacement of tunnel signals, parapet/verge repairs, replacement of tunnel lighting, replacement of electrical supply cabling, provision of new control building and reinforcement repairs.	Packaging – 7.41 tonnes Liquids -18.07 Concrete – 431.78 Bricks -3.76 Inert -255.51 Timber – 82.19 Metals 12.14 Soils -172.01 Hazardous -1.69 Mixed – 1,905.66 Canteen / Ad-hoc waste – 33.11 Furniture – 0.10 Japanese knotweed	The removal and disposal of any quantities of Japanese knotweed and hazardous waste arisings will be managed through the SWMP and the CEMP and in line with legislation. Due to the relatively small amounts of hazardous waste expected to be present and the implementation of the mitigation measures detailed in this chapter, in accordance with best practice, significant impacts or effects are unlikely. Waste arisings will be transported by road, using the existing highway network.

8.5.3 Mitigation

Relevant mitigation measures to reduce the impacts of material resources use and waste arisings from the Scheme are identified below and would also be incorporated into the Construction Environmental Management Plan (CEMP) produced for the Scheme. The CEMP will require the Principal Contractor to:

- maximise opportunities for the potential reuse and recycling of all material resources and waste;
- sort and segregate waste into different waste streams; and
- manage materials to maximise the environmental and Scheme benefits from the use of surplus materials.

The responsibility to secure compliance with the CEMP lies with the Welsh Government. However, the Principal Contractor will have a responsibility to finalise and comply with any requirements laid out in the CEMP and to manage all material resources and waste arisings appropriately.

Relevant to this chapter is the Preliminary SWMP (Appendix C1) which will be further developed by the Principal Contractor and form part of the mitigation measures of particular relevance to material resources and waste.

The objective of the SWMP is to ensure appropriate treatment, handling and disposal of waste arising from the Scheme. The Preliminary SWMP has been developed in line with the current best practice guidance provided on WRAP's website (Ref 8-7). The further development and implementation of the objectives of the Preliminary SWMP will be secured through the delivery of the CEMP.

The SWMP will identify:

- the volume and tonnes of excavated materials and other waste streams and volume and tonnes (for example concrete, soils, and plastics) likely to be produced from the Scheme, to establish the potential for reuse (on or offsite) and recycling;
- opportunities for waste minimisation and management;
- possible options for designing out waste;
- the most significant opportunities to increase reuse and recycling rates (termed "Waste Recovery Quick Wins") and the realistic recovery rates for each waste type;
- waste to landfill targets to work towards the aim of recovering at least 70% by weight of non-hazardous construction and demolition waste in order to reflect the Welsh Government's aspirations and current government policy;
- suitable waste management contractors and record appropriate licences, permits, waste transfer notes and hazardous waste consignment notes;
- appropriate site practices such as how waste materials will be segregated and the measures that will be used for raising awareness among site operatives for waste reduction, reuse and recycling; and
- the method for measuring and auditing CD&E waste to enable more effective waste management through the setting of performance targets for segregation, recycling, and monitoring sub-contractors.

The waste minimisation practices that can be adopted for the identified key waste streams in the Scheme include:

- excavation waste and aggregates (concrete, soils and inert materials): non contaminated spoil may be crushed onsite for aggregate and reused for back-fill and landscaping; and
- the reduction of packaging material through the procurement process, take back schemes, and the separation of packaging material for reuse.

Any excavation waste used for the Scheme would need to be proven 'suitable for use' by adoption of acceptance criteria and would be used under either the Environmental Permitting (England and Wales) Regulations 2010 (as amended) or The Definition of Waste: Development Industry Code of Practice (Contaminated Land; Applications in Real Environments ("CL:AIRE"), March 2011).

Any soils generated through the small scale trenching works associated with the improvement activities will be stripped, appropriately stored onsite and reused on the Scheme.

Due to the dynamic nature of the Scheme's maintenance and improvement works, opportunities to reuse excavated materials (within areas of the Scheme which have a requirement for these excavated materials to be reused as fill) will have to be addressed on an ongoing basis. This objective will be secured by the further development and delivery of CEMP.

The process for the identification, handling and removal of controlled and hazardous wastes, incorporating suitable risk assessments and method statements will be developed further by the Principal Contractor.

The Principal Contractor will also be encouraged to apply good practice to source materials from suppliers with responsible sourcing certification (as far as practicable). To this end, contractors will adopt the BES 6001 Responsible Sourcing of construction products standard.

The procurement process shall ensure that materials are ordered so that the timing of the delivery (e.g. 'just in time' deliveries), the quantity delivered and the storage are optimised to reduce opportunity for oversupply and damage on site.

Material resources will be stored to minimise the potential of damage or wastage. Measures will include off-ground storage e.g. on pallets, remaining in original packaging, protection from rain or collision by plant or vehicles. The material resources storage area will be secured during out of hours to prevent unauthorised access.

In addition, material resources will be ordered, where possible, in sizes to prevent wastage e.g. in form of off cuts and waste to be able to be returned to the original supplier e.g. plastic pipe.

Table 8-13 provides a description of mitigation measures and how these measures will be implemented, measured and monitored during the CD&E phases. This table has been produced in adherence to the requirements of IAN 153/11.

Table 8-13 Mitigation measures report matrix

Scheme activity	Potential impacts associated with material resources use / waste management	Description of mitigation measures	How the measures will be implemented, measured and monitored
Site remediation / preparation earthworks	N/A (no site remediation /preparation earthworks are being carried out)	N/A	N/A (no site remediation /preparation earthworks are being carried out)
Demolition	N/A (significant material resources are not required for demolition)	N/A	N/A (significant material resources are not required for demolition)
Construction	N/A (no construction is being carried out)	N/A	N/A (no construction is being carried out)
Maintenance and improvements	**Temporary**: Transportation of CD&E materials and waste. Utilisation of waste infrastructure sites. **Permanent**: Depletion of finite natural resources e.g. aggregate for construction. Decreased landfill capacity.	Where practicable, specification and procurement of material resources will utilise those that are: locally sourced; use local skilled labour to install; are low in carbon, environmental and user health impact; durable; include recycled materials; and are responsibly sourced. Adoption and implementation of the CEMP to ensure that consideration is given to material requirements throughout the maintenance and improvements and that vehicle movements are kept to a practicable minimum. Adoption of 'Just in time delivery' to alleviate space constraints for storage,	Implemented throughout the design process and appropriate use of procurement documentation to ensure management, designs, and initiatives are used to deliver waste minimisation. Measured and monitored through implementation of the CEMP and SWMP.

Scheme activity	Potential impacts associated with material resources use / waste management	Description of mitigation measures	How the measures will be implemented, measured and monitored
		site congestion and provision of safe, secure and protected material storage areas. Adoption of the waste hierarchy. Careful quality control during the maintenance and improvement works. Cover excavated material to ensure run off of any contaminated water does not occur.	

8.6 Assessment of Impacts

8.6.1 Material resources

The depletion of finite material resources could occur through extraction of primary aggregates (e.g. sands and gravels). Drainage and signage products will be procured with consideration of the environmental impacts associated with their manufacture, as well as other considerations such as design, carbon footprint, energy consumption, long-life performance, visual impacts, durability and cost. It is anticipated that both concrete and steel will include a measurable recycled content in their manufacture. Maximum reuse of site-won materials will be secured through the implementation of the CEMP. Quantitative assessment of key material resources to be used by the Scheme (aggregates, concrete and steel) during the maintenance and improvement works has been made against UK wide material production data, presented in Table 8-14. Given the high levels of UK supply and demand, the sensitivity of this receptor is judged to be low.

Table 8-14 Key material resources production (UK) vs Scheme's demand

Material resources	UK production (annual 2013) (tonnes)	UK production (duration of Scheme, based on 2013 figures) (tonnes)	Scheme's demand (total tonnes)
Steel	10,700,000	14,247,123	81
Concrete	70,000,000	93,205,479	4,317
Aggregates	200,000,000	266,301,370	1,720

The Scheme will, where possible, maximise the reuse of site-won materials and procure material resources with a high recycled content percentage. As such, the impact on material resources resulting from the Scheme is assessed to be negligible adverse. No buildings or structures are to be demolished as part of the scheme.

Using preliminary design information, 407 HGV movements are estimated to be needed for the material resources during the maintenance and improvement works of the Scheme. This is equivalent to one HGV movement per day. Due to the high vehicular capacity of the highway network within the study area and its capacity to accommodate increases in vehicle movements anticipated to be required to transport materials to the site, the sensitivity of this receptor is judged to be low.

There is likely to be a very minor negative impact on the available HGV carrying capacity of the highways network as a result of increased HGV movements carrying material resources to the Scheme. As such, the magnitude of impact on the highways network is assessed to be negligible adverse.

As an additional part of the assessment, the magnitude of impact of the embodied carbon contained within the main material resources to be used on the Scheme is assessed to be negligible. In addition, through the maximising of the amount of material resources and waste to be reused onsite the overall demand for materials from offsite sources could be reduced to neutral.

Taking into consideration the sensitivity of receptors and magnitude of impacts described above, the significance of effect on both the highways network resulting from materials being transported to the Scheme and material resources is assessed to be slight adverse.

8.6.2 Waste

There will be some small scale trenching works associated with the improvement activities. However, the Scheme is designed to minimise excavation volumes. This approach should minimise excavation volumes and enable excavation waste (except where contaminated) to be reused onsite where conditions and Scheme requirements allow. It is anticipated that the cut and fill balance of the Scheme will enable opportunities for the reuse of site-won materials.

If the logistics of the Scheme determine that clean soils will have to be transported offsite for reuse then a very high recycling rate can be expected (>95%).

The mitigation section of this chapter describes how the impacts of waste arisings are minimised in relation to recycling and/or reusing inert and non-hazardous waste onsite. The mitigation is secured by the requirements of the CEMP and SWMP.

Table 8-15 shows estimated CD&E waste arisings forecast as a percentage of annual CD&E waste arising during the maintenance and improvement works of the Scheme and total waste capacity within the study area. The table presents a reasonable worst case scenario and demonstrates that there is sufficient waste capacity to manage all estimated CD&E waste arisings from the Scheme.

The waste infrastructure within the study area has the capacity to manage all waste arising from the Scheme so the need for HGV movements outside of the study area will be minimised. As such, the magnitude of impact on the highways network is assessed to be negligible adverse.

It is likely that small volumes of waste arising from the Scheme will be sent to landfill, leading to a minor loss of the void space within the landfill sites within the study area. Despite this, there is likely to be a very high reuse of site won materials and the waste management facilities within the study area have suitable capacity to manage wastes arising from the Scheme. Therefore the magnitude of impact on the associated waste infrastructure is assessed to be negligible adverse.

Table 8-15 Estimated total CD&E waste arisings VS CE&E waste capacity and CD&E baseline arisings

Estimated total waste arisings from the Scheme (tonnes)	Waste capacity (tonnes)	Baseline waste arisings within the study area (tonnes)	Estimated waste arisings from the Scheme as a % of total waste arisings in the study area
2,926.08	4,420,786	1,467,350	0.20%

Using the design information, approximately 226 HGV movements are estimated to be needed for the waste during the maintenance and improvement (refurbishment) works of the Scheme. This is equivalent to less than one HGV movement per day.

Due to the high vehicular capacity of the highway network in the study area and their capacity to accommodate increases in vehicle movements anticipated to be required to move waste arisings offsite, the sensitivity of this receptor is considered to be low.

There is likely to be a very minor detriment to the highway network as a result of increased HGV movements carrying waste from the Scheme. The waste infrastructure within the study area has the capacity to manage all waste arising from the Scheme so the need for HGV movements outside of the study area will be minimised. As such, the magnitude of impact on the highways network is assessed to be negligible adverse. The majority of the site vehicles will be using the existing M4 to access the tunnel during the night time closures. Where access to other sections of the scheme are required, local road networks will be used to access the Malpas extent of the scheme from the site compound.

Taking into consideration the sensitivity of receptors and magnitude of impacts described above, the significance of effect on both the highway network and waste infrastructure resulting from wastes arising from the Scheme is assessed to be slight adverse.

8.7 Conclusions & Recommended Further Works

A tabular summary of the significance of overall impacts is to be provided below in Table 8-16.

Table 8-16 Material resources and waste arisings impacts summary table

Impact description		Receptor affected	Mitigation measure	Significance of impact
Temporary impacts	Transportation of CD&E materials to site	Highway network	Minimise lorry movements through maximising reuse of materials onsite	Slight adverse
	Transportation of CD&E waste offsite	Highway network	Minimise lorry movements through maximising reuse of materials onsite	Slight adverse
	Use of the waste management facility capacity with the study area	Waste infrastructure	Scheme design minimising waste Effective delivery and adherence to Scheme's CEMP, and SWMP	Slight adverse
Permanent impacts	Depletion of finite material resources e.g. aggregate for construction	Material resources	Reuse of site-won materials where possible. Use of recycled and secondary aggregates where possible	Slight adverse
	Decreased landfill capacity	Waste infrastructure	Scheme design minimising waste Effective delivery and adherence to Scheme's CEMP, and SWMP	Slight adverse

Further work relating to the material resources to be used and the wastes to be produced during the works is ongoing. The SWMP and waste forecasts will require updating once the final bill of quantities becomes available and by the Principal Contractor during the works.

8.8 REFERENCES

Ref 8-1	Department for Transport (2008) HA 200/08 Design Manual for Roads and Bridges, Volume 11, Section 1: Aims and Objectives of Environmental Assessment
Ref 8-2	Highways England (2011) Interim Advice Note 153/11: Guidance on the Environmental Impact Assessment of Materials
Ref 8-3	Directive 2008/98/EC European Waste Framework Directive [2008] OJ L 312/3
Ref 8-4	Highways England (2011) Interim Advice Note 69/14: Designing for Maintenance
Ref 8-5	Environmental Permitting (England and Wales) Regulations 2010. SI 675
Ref 8-6	Natural Resources Wales, Survey of Construction & Demolition Waste Generated in Wales 2012
Ref 8-7	Waste and Resources Action Programme, WRAP - http://www.wrap.org.uk/

9 NOISE & VIBRATION

9.1 Introduction

This chapter assesses the effects upon people of noise and vibration that is likely to be generated by the refurbishment works on the M4 Brynglas Tunnel and neighbouring viaducts. Construction works have the potential to generate noise and vibration at levels that may be disturbing to people and sensitive receptor locations. Construction-phase noise and vibration effects are, however expected to be of a temporary nature, occurring for the duration of the maintenance and improvement works.

The chapter outlines the study area, the existing environment and the assessment methodology. It also sets out relevant planning policy, mitigation, inter-relationship effects and cumulative effects.

The principal construction noise and vibration sources predicted as a result of the construction of the Project and to be assessed include the following:

- Refurbishment of the Brynglas Tunnel
- Maintenance works on the Malpas Viaduct and slip roads
- Repairs to the River Usk viaduct
- Installation of a water supply pipe on Malpas Road, Pant Lane and Pant Road
- Installation of a water supply pipe along the hardshoulder of the M4
- Installation of a water supply pipe across the M4 (night-time works)
- Drainage works at Junction 25A on the M4.

Construction noise and vibration impacts are likely from the use of fixed and mobile plant required for the construction and demolition activities. Noise and vibration impacts are also likely from the movement of construction vehicles within the works area and on the public road network. The extent and significance of noise and vibration effects would depend on the nature and location of heavy plant and vehicles in relation to receptors and the time of day that construction works are carried out.

By necessity certain works on the M4 will need to take place at night during closure of the M4. Only essential works will take place at night and where possible all other works will be carried out during daytime hours.

9.2 Planning Policy, Guidance and Legislation

9.2.1 National Policy

Planning Policy Wales – Technical Advice Note 11

Planning Policy Wales Technical Note 11 (TAN 11- Noise) (Ref 9-1) indicates that, when assessing a proposal for residential development near a source of noise, local planning authorities should determine into which of the four noise exposure categories (NECs) the proposed Development site falls, taking account of both day and night-time noise levels.

TAN 11 states that Local planning authorities must ensure that noise generating development does not cause an unacceptable degree of disturbance. In the case of industrial development, for example, the character of the noise should be taken into account as well as its level. Sudden impulses, irregular noise or noise which contains a distinguishable continuous tone would require special consideration.

TAN 11 also indicates that general guidance on acceptable noise levels within buildings can be found in BS 8233: 1987, that was updated in 2014 (Ref 9-2).

British Standard 5228:2009 +A1: 2014

Construction noise impacts have been assessed in accordance with BS 5228 2009 +A1:2014 "Code of practice for noise and vibration control on construction and open sites" – Part1: Noise (Ref 9-3). BS5228: - Part 1 provides recommendations for basic methods of noise and vibration control relating to construction and open sites.

BS5228: - Part 1: Noise provides guidance and recommendations on methods for the calculation of construction noise and the consequential assessment of its impact on those exposed to it.

In addition the Standard makes reference to the legislative background regarding noise control on construction sites, and gives recommendations for basic methods of noise control. The standard provides suitable methods for the calculation of noise from construction activities, including information regarding noise levels from a range of construction equipment.

BS 5228: - Part 1, Annex E gives different methods of guidance on significance of noise effects from construction, and recommends the ABC method to establish construction noise limits.

The ABC method involves rounding the existing ambient noise levels to the nearest 5dB for the appropriate time period (night, evening/weekends or day) and then comparing these levels to the total noise level, including construction noise. If the total noise level exceeds the existing rounded value, then a significant effect is deemed to have occurred. This can be seen more clearly in Table 9-1.

Table 9-1 Threshold of Significant Effect at Dwellings from Construction

Assessment Category and Threshold Value Period	Threshold Value, in decibels (dB)		
	Category A	Category B	Category C
Night-time (23:00 – 07:00)	45	50	55
Evenings and weekends	55	60	65
Daytime (07:00 – 19:00) and Saturdays (07:00 – 13:00)	65	70	75

- *Category A is the threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are less than these values.*
- *Category B is the threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are the same as Category A values.*
- *Category C is the threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are higher than Category A values.*

If the existing ambient noise levels are higher than the threshold values presented in Table 9-1 then a significant effect is deemed to have occurred if the total L_{Aeq} noise level for the period increases by more than 3dB due to construction activity. The ABC method should only apply to residential receptors.

For non-residential receptor buildings such as schools, health care facilities, places of worship and educational facilities, the 2 dB to 5 dB significance criteria in BS5228 will be used whereby construction noise is deemed to be potentially significant if the total noise (pre-construction ambient plus site noise) exceeds the pre-construction ambient noise by 5 dB or more, subject to lower cut-off values of 65 dB, 55 dB and 45 dB $L_{Aeq, T}$ from site noise alone, for the daytime, evening and night-time periods.

BS5228 Annex E also provides threshold trigger levels above which there is a responsibility on the developer to provide noise insulation or a scheme to facilitate temporary re-housing. This would involve finding alternate accommodation for affected residents at times when noise levels will be very high, i.e. regularly exceeding 85 dB(A) during the daytime. The standard suggests that noise insulation should be

provided if the trigger levels shown in Table 9-2 are predicted to be exceeded for a period of ten or more days of working in any fifteen consecutive days, or for a total of days exceeding 40 in any six month period.

Table 9-2 Construction noise triggers for noise insulation and temporary re-housing

Period	Time	Averaging time, T	Noise Insulation Trigger Level	Temporary Re-housing Trigger Level
Monday to Friday	07.00 – 08.00	1 h	70	80
	08.00 – 18.00	10 h	75	85
	19.00 – 22.00	3 h	65	80
	22.00 – 07.00	1 h	55	75
Saturday	07.00 – 08.00	1 h	70	80
	08.00 – 13.00	5 h	75	85
	13.00 – 14.00	1 h	70	75
	14.00 – 22.00	3h	65	70
	22.00 – 07.00	1h	55	65
Sunday & Public Holidays	07.00 –21.00	1 h	65	75
	21.00 – 07.00	1 h	55	65

Based on the threshold limits for significance in Table 9-1 and the construction noise triggers for noise insulation and temporary re-housing in Table 9-2, the criteria for assessing the magnitude of construction noise effects are set out in Table 9-3 and Table 9-4. The magnitude of effect criteria in Table 9-3 are consistent with the criteria presented in BS5228:2014.

Table 9-3 Magnitude of effect – construction noise

Magnitude of Effect	Construction Noise
High	Daytime noise levels at houses in excess of 75 dB L_{Aeq} (10 hour)
Medium	Daytime noise levels at houses in the range between 65 to 75 dB L_{Aeq} (10 hour)
Low	Daytime noise levels at houses in the range between 55 to 65 dB L_{Aeq} (10 hour)
Negligible	Daytime noise levels at houses below 55 dB L_{Aeq} (10 hour)
No effect	Daytime noise levels at houses below 45 dB L_{Aeq} (10 hour)

Table 9-4 Significance of effect – construction noise

Significance of Effect	Receptor Sensitivity			
Magnitude	**High**	**Medium**	**Low**	**Negligible**
High	Major	Major	Moderate	Minor
Medium	Major	Moderate	Minor	Negligible
Low	Moderate	Minor	Negligible	Negligible
Negligible	Minor	Negligible	Negligible	Negligible

BS 5228 2009 +A1 2014, Part 2: Vibration (Ref 9-4) provides guidance in relation to the effects of construction vibration upon the surroundings. Vibration, even of a very low magnitude, can be perceptible to people. Vibration nuisance is frequently associated with the assumption that, if vibration can be felt then damage is inevitable. However, considerably greater levels of vibration are required to cause damage to buildings and structures. Typically levels of 0.3mm/s may just be perceptible, and levels above 10mm/s may result in cosmetic damage to buildings.

Local and Regional Policy

Newport City Council indicates that unless otherwise agreed by the local planning authority:

- Construction work involving piling should be carried out between 8.00am and 5.00pm, Monday to Friday only, and not on Saturdays, Sundays or Bank Holidays
- Construction work other than piling should be carried out between 8.00am and 6.00pm, Monday to Friday and 8.00am and 1.00pm on Saturdays.
- Prior approval is required for any construction taking place outside permitted times and on Sundays and Bank Holidays.

9.3 Assessment Methodology

The noise assessment has been carried out in accordance with BS 5228-1 (Ref 9-3). The noise predictions are based on construction information available at this stage. The A48/ SDR which will be used as the temporary diversion route during night time closures is indicated to carry 34000 vehicles per day. An additional 4000 vehicles would not trigger DMRB criteria for noise. DMRB indicates that a 25% increase in traffic would result in a 1dB increase in noise. Traffic increase would be 11.8%. Noise change in terms of DMRB therefore not significant. Road closures are also sporadic (not continuous/ every night) and has therefore been scoped out and will be given no further consideration as part of this assessment.

9.4 Baseline Noise Assessment

Baseline noise monitoring locations, as indicated on Figure 9-1, were agreed with Jonathan Keen, Environmental Health Officer (EHO) at Newport City Council. Noise surveys were carried out for 24 hours at six locations on 30 September and 1 October 2015 at the locations indicated on Figure 9-1.

The 24 hour survey data provides for the diurnal differences in ambient noise levels and the noise data has been presented to indicate typical daytime (0700-1900), evening (1900-2300) and night-time noise levels (2300-0700).

Baseline surveys were carried out using the following instruments as listed in Table 9-5:

Table 9-5 Noise Survey Instrumentation

Location	Instrument	Serial Number
NM1	Rion NL52	00732075
NM2	Rion NL52	00451268
NM3	Rion NL52	00732098
NM4	Rion NL52	01032449
NM5	Rion NL52	00320643
NM6	Rion NL52	00620872

All instruments were calibrated at the start and at the end of the survey period and zero drift was observed. Weather conditions were suitable for noise surveys with calm conditions (no wind) and dry conditions.

The baseline survey data has been presented in Table 9-6 against the averaging times produced in Table 9-2. The full set of baseline data is included in Appendix D.

Table 9-6 Baseline Noise Survey Data

Location NML1					
Time Period	$L_{Aeq,T}$	L_{Amax}	L_{Amin}	L_{A10}	L_{A90}
0700 - 0800	62.2	74.1	55.9	63.4	60.2
0800-1800	62.2	99.1	53.6	62.3	58.4
1800-1900	59.8	82.5	54.1	61.0	57.7
1900-2200	57.5	83.1	46.0	58.9	54.6
2200-2300	54.6	69.1	46.8	56.6	51.1
2300-0000	53.3	67.4	39.8	56.1	47.7
0000-0100	52.5	69.3	38.4	55.8	45.3
0100-0200	52.3	69.0	35.5	56.1	44.2
0200-0300	52.5	64.1	37.6	56.2	45.2
0300-0400	52.6	63.5	37.7	55.8	45.9
0400-0500	54.8	72.6	37.6	57.7	48.8
0500-0600	59.0	78.7	47.9	61.1	55.2
0600-0700	61.6	85.9	53.6	62.7	58.7

Location NML2					
Time Period	**$L_{Aeq,T}$**	**L_{Amax}**	**L_{Amin}**	**L_{A10}**	**L_{A90}**
0700 - 0800	66.4	73.6	60.6	68.0	64.3
0800-1800	66.3	85.3	49.2	67.9	63.6
1800-1900	62.0	74.3	42.9	65.2	55.5
1900-2200	60.8	72.7	36.4	64.7	51.2
2200-2300	61.3	70.7	37.3	64.9	52.1
2300-0000	62.3	77.4	43.4	65.8	53.5
0000-0100	65.3	72.8	52.1	68.0	60.4
0100-0200	67.3	74.9	56.8	69.2	64.2
0200-0300	68.2	77.5	61.5	69.5	66.3
0300-0400	67.0	77.9	61.1	68.4	65.3
0400-0500	67.4	88.7	61.6	68.8	65.3
0500-0600	67.6	79.5	60.1	69.2	65.4
0600-0700	66.6	85.1	60.4	68.2	64.5
Location NML3					
Time Period	**$L_{Aeq,T}$**	**L_{Amax}**	**L_{Amin}**	**L_{A10}**	**L_{A90}**
0700 - 0800	63.5	77.2	57.6	64.7	61.5
0800-1800	61.8	84.4	54.7	63.1	59.4
1800-1900	61.1	76.9	56.2	62.3	59.0
1900-2200	59.4	83.6	51.1	60.6	56.9
2200-2300	56.9	83.8	48.8	57.7	53.2
2300-0000	54.6	65.5	44.5	57.1	50.7
0000-0100	55.1	66.7	38.0	58.3	49.2
0100-0200	53.4	83.3	41.3	56.0	47.6
0200-0300	53.4	63.9	36.5	56.3	47.9
0300-0400	54.1	65.1	42.5	56.9	49.0
0400-0500	56.8	75.2	45.2	59.4	52.0
0500-0600	60.7	71.9	51.5	62.7	57.6
0600-0700	62.5	75.5	55.9	64.0	60.1
Location NML4					
Time Period	**$L_{Aeq,T}$**	**L_{Amax}**	**L_{Amin}**	**L_{A10}**	**L_{A90}**
0700 - 0800	59.7	78.5	51.8	60.0	53.0
0800-1800	59.0	81.8	48.1	58.8	51.3

1800-1900	58.2	77.9	50.5	56.8	52.0
1900-2200	61.6	86.3	49.8	59.1	51.4
2200-2300	54.6	71.6	47.5	54.2	49.3
2300-0000	50.7	72.7	47.3	50.9	48.8
0000-0100	49.0	52.7	46.2	50.0	47.9
0100-0200	48.2	53.7	45.8	49.1	47.2
0200-0300	48.5	50.9	46.0	49.3	47.7
0300-0400	49.0	53.3	46.4	49.8	48.0
0400-0500	49.7	58.6	46.3	50.6	48.6
0500-0600	53.4	70.4	48.4	53.8	50.6
0600-0700	55.5	73.4	50.4	55.8	52.5
Location NML5					
Time Period	**$L_{Aeq,T}$**	**L_{Amax}**	**L_{Amin}**	**L_{A10}**	**L_{A90}**
0700 - 0800	58.0	69.4	51.1	59.2	56.3
0800-1800	57.1	87.4	51.4	58.2	55.2
1800-1900	57.5	86.7	51.0	58.5	55.0
1900-2200	55.7	81.5	42.3	57.2	53.0
2200-2300	52.2	60.4	43.0	54.4	48.7
2300-0000	51.6	65.1	38.0	54.1	46.4
0000-0100	50.7	65.2	36.7	53.8	43.7
0100-0200	49.9	60.4	34.8	52.9	42.9
0200-0300	49.6	64.4	34.5	52.7	42.7
0300-0400	50.7	60.6	35.4	53.4	44.3
0400-0500	52.5	62.4	39.1	55.0	47.3
0500-0600	54.7	71.1	45.7	56.8	51.3
0600-0700	57.3	73.7	50.3	58.6	55.2
Location NML6					
Time Period	**$L_{Aeq,T}$**	**L_{Amax}**	**L_{Amin}**	**L_{A10}**	**L_{A90}**
0700 - 0800	63.1	75.7	57.2	64.7	60.8
0800-1800	63.2	84.4	54.1	65.1	60.2
1800-1900	62.2	75.8	52.0	64.4	59.0
1900-2200	60.4	79.7	48.6	62.5	56.7
2200-2300	58.1	72.1	47.5	61.3	52.4
2300-0000	55.9	73.3	41.4	59.0	49.6

0000-0100	55.0	75.2	41.2	58.5	47.1
0100-0200	55.1	72.2	39.5	59.0	45.5
0200-0300	57.0	78.0	39.5	60.6	47.0
0300-0400	56.8	69.2	39.2	60.4	47.5
0400-0500	58.3	73.7	42.6	61.6	50.9
0500-0600	60.8	81.1	48.3	63.4	55.9
0600-0700	62.6	76.7	53.6	64.5	60.0

The baseline survey data has also been analysed to consider the appropriate Threshold Value Category at each monitoring location as set out in Table 9-1. In accordance with Annex E of BS5228, the ambient noise levels have been rounded off to the nearest 5 dB. The relevant threshold values for each receptor location are set out in Table 9-7.

Table 9-7 Threshold of Significant Effect at Receptor Locations

Period	LAeq.T	ABC Category	Significant Noise Level	Noise Limit $L_{Aeq,T}$
Location NML 1				
Daytime 0700-1900	60	A	65	75
Evening 1900-2300	55	B	60	65
Night-time 2300-0700	55	C	55	60
Location NML 2				
Daytime 0700-1900	65	B	70	75
Evening 1900-2300	60	C	65	65
Night-time 2300-0700	65	C	55	65
Location NML 3				
Daytime 0700-1900	60	A	65	75
Evening 1900-2300	60	C	65	65
Night-time 2300-0700	60	C	55	60
Location NML 4				
Daytime 0700-1900	60	A	65	75
Evening 1900-2300	60	C	65	65
Night-time 2300-0700	50	C	55	55
Location NML 5				
Daytime 0700-1900	55	A	65	75
Evening 1900-2300	55	B	60	65

Period	LAeq.T	ABC Category	Significant Noise Level	Noise Limit $L_{Aeq,T}$
Night-time 2300-0700	55	C	55	60
Location NML 6				
Daytime 0700-1900	65	B	70	75
Evening 1900-2300	60	C	65	65
Night-time 2300-0700	60	C	55	65
*Shaded blocks indicate that ambient noise levels exceed the Threshold of Significance				

The baseline survey data indicates that the ambient noise levels are predominantly influenced by road traffic noise on the M4 and on local roads. In particular noise levels in the evening and at night are elevated by road traffic with night-time Thresholds of Significance falling in exposure category C.

9.5 Construction Noise Predictions

Noise predictions have been carried out considering construction information and details of plant to be used as available at this stage. The construction method statement and details of plant to be used will be refined once a contractor has been appointed to carry out the proposed works. The construction and dismantling activity noise levels have been predicted with distance from source using the measured $L_{Aeq\ 1hr}$ and the following formula as described in BS5228 (Ref 9-3):

Kh = 20 * log10 (R/10)
Where

- Kh = the correction for propagation across hard ground
- R = the distance to the receptor location
- 10 = the distance in metres at which the sound pressure level from the plant has been measured, as recorded in the Tables in BS5228.

The assessment has used the typical noise levels for the various items of plant when in use at a reference distance of 10m, as taken from tables within BS 5228 (Ref 9-3), as identified in Appendix D. The sound pressure level for each noise source and the percentage of the working day (known as percentage on-time) that such plant normally operates enable a noise level to be calculated at an identified receptor. Construction plant would not normally operate continually throughout the working day.

Predicted daytime noise levels have been calculated based on the above information. The predictions have followed a cautious approach in that the worst-case assumption has been applied. In calculating the noise levels it has been assumed that the ground would be hard, and no attenuation has been included.

9.6 Discussion of Results

9.6.1 Provision of Water Supply

Construction works will involve some small scale site clearance works which are likely to take several days (no more than four) and installation of a water supply pipe on Pant Lane and along the motorway behind the houses on Pant Road. These works will be carried out during the daytime.

The Tables in Appendix D indicate that where works take place immediately adjacent to houses on Malpas Road, predicted noise levels have the potential to exceed 75dB(A) and therefore mitigation in the form of acoustic screening will be required.

Acoustic screening would be expected to reduce the noise levels by 10dB, which would reduce the noise levels to below 75 dB(A). The works on the water main will be transient in nature and noise impacts at specific receptors will be of relatively short duration.

In addition to the above works, there will also be a water supply pipe provided in the hard shoulder of the M4 and across the M4 Westbound and Eastbound. These works can only take place at night to ensure the safety of the workforce and motorists. The Table in Appendix D indicate that the night-time works on installing water pipes on the M4 will result in noise levels of up to 71.8 dB(A) at receptors along Pant Road and at Aston Crescent. A **significant** effect is therefore indicated.

Mitigation in the form of acoustic screening will be required, which would be expected to reduce the noise levels by 10dB, to noise levels of 61.8 dB(A). A night-time noise limit of 60dB(A) is suggested at these receptor locations based on the noise survey data for NML5. The predictions are based on the assumption that all plant will run simultaneously. In reality the road saw, pneumatic breaker and vibrating roller would not be operated simultaneously and noise levels are likely to be below 60dB(A) with screening in place.

Further mitigation such as selecting quieter plant will also need to be considered.

As part of the works at Malpas, the existing control building is to be decommissioned but it will be not be demolished. Therefore no further consideration has been given to works associated with this structure. Two pre-fabricated cabinets are to be installed to house the new communication system. Impacts associated with their construction is anticipated to be negligible particularly given the levels of traffic using the existing M4.

9.7 Tunnel Renovations

The works on the tunnel will be confined to within the tunnel and therefore construction noise impacts will be minimal. This assessment has however presented noise impacts considering works taking place at the tunnel portals.

The Tables in Appendix D indicate that predicted noise levels will generally be below 60 dB(A) at the closest receptors even with works taking place at the tunnel portals. The noisiest works are however associated with the carriageway reconstruction and excavation, with a noise level of 76.3 dB(A) predicted at Aston Crescent. Provision of acoustic screening at the tunnel portals would reduce the noise level to 66.3 dB(A). The predictions assume that the pneumatic breakers, excavator with a mounted breaker, road planer and road planer will all operate simultaneously. In reality the works will be phased and the plant would not all be used simultaneously. Works at the tunnel portal will also be partially screened and therefore predicted noise levels are likely to be below 60dB(A).

Noise impacts at nearby receptor locations from works inside the tunnel is considered **not significant**.

9.8 Drainage Works

The installation of drainage at Junction 25A will involve daytime and night-time works. The daytime works, including temporary sheet piling are predicted to be below 75 dB(A).

Night-time works on clearing vegetation on the verges is predicted to generate a highest noise level of 61.4 dB(A) at Waterside Court. Baseline survey data at NML2 indicates that ambient noise levels at night are above this level and a night-time limit of 65 dB(A) is suggested.

New verge drainage will also be installed at night and predicted noise levels are indicated to be below 60 dB(A). Noise impacts at nearby receptor locations drainage works are considered **not significant**.

9.9 River Usk Bridge

Repair works to the River Usk Viaduct (including resurfacing of the carriageway) is likely to take place over weekends and at night. The noise impacts from these works have therefore been assessed against a suggested night-time noise limit 65 dB(A) at Waterside Court and 60 dB(A) at Glassworks Cottages.

Appendix D indicates that unmitigated noise levels for the breakout of existing joints (the noisiest construction activity) could reach 70.9 dB(A) at Waterside Court. With appropriate acoustic screening in place predicted noise levels would be below the suggested noise limit of 65 dB(A). Noise impacts from activities such as joint breakout are therefore considered **significant** at Waterside Court.

Unmitigated construction noise levels for all activities are predicted to be below 60 dB(A) at Glassworks Cottages.

9.10 Malpas Viaduct

Works on the Malpas Viaduct, including carriageway resurfacing, are likely to take place over weekends and at night. The noise impacts from these works have therefore been assessed against a suggested night-time noise limit 65 dB(A) at the Ibis Hotel, 60 dB(A) at receptors on Malpas Road and Pant Road and 55dB(A) at receptors on Aston Crescent based on ambient noise survey data presented in Table 9-7.

On Malpas Road a highest noise level of 70.3 dB(A) is predicted for concrete repairs and cathodic protection. The predictions assume a free-field for propagation of noise from the works to receptors. Mitigation in the form of acoustic screening will need to be provided to reduce the predicted noise levels to below 60 dB(A). The closest receptors on Malpas Road are however located at a lower level that the M4 and will be partly in the shadow zone of the M4. Actual noise levels will however be lower than the predicted level.

At the Ibis Hotel a highest noise level of 73.6 dB(A) is predicted which is above the suggested noise limit of 65 dB(A). Mitigation in the form of acoustic screening would need to be provided. Acoustic screening would however have limited benefit to upper floors of the hotel. The façade of the hotel and the glazing would have been specified to mitigate against the high traffic noise levels above 60dB and L_{Amax} levels up to 79 dB. The hotel is also likely to have mechanical ventilation and windows of the rooms would be able to be kept closed. Possible mitigation options are considered in Section 9.11.

Work on the carriageway of the Malpas Viaduct will take place relatively close to receptor locations. On Malpas Road a highest noise level of 76 dB(A) is predicted for grit blasting the existing road deck. Mitigation in the form of acoustic screening will need to be provided.

At Pant Lane a highest level of 76 dB(A) is predicted for grit blasting the existing road deck. Mitigation in the form of acoustic screening will need to be provided.

For all works on the Malpas Viaduct, predicted unmitigated noise levels at Aston Crescent are below 55dB(A).

Works on the Malpas Viaduct therefore have the potential to be **significant** at the closest receptors, particularly at night. Additional mitigation such as the selection of quieter plant and less intrusive methods will need to be considered.

9.11 Mitigation of Construction Noise

In accordance with good working practices, the principles of “best practicable means” (BPM), as defined in the Control of Pollution Act (1974) (Ref 9-5) would be used to reduce noise and vibration emissions throughout the construction period. This would incorporate the use of measures to control noise and vibration that do not unreasonably inhibit the work, and the use of working methods that result in minimum effects compatible with normal working practices.

Noise control measures consistent with good working practices would be implemented during the construction phase. Noise and vibration control measures would be implemented within a Construction Environmental Management Plan (CEMP) in consultation with Newport City Council.

Particular care would be required in the vicinity of residential properties, for example by using quieter, well maintained plant working close to receptors. Liaison with the EHO at Newport City Council would take place prior to commencement of construction to ensure that appropriate and adequate means of mitigation are applied throughout the construction work. The submission of a Section 61 Consent Application in terms of the Control of Pollution Act 1974 (Ref 9-5) could be discussed. This would allow for consideration of a detailed construction programme and method statement that would allow for selection of the most appropriate mitigation measures.

Routine forms of noise and vibration control would be implemented during all phases of construction work. Control measures routinely applied in this way are likely to include the following:

- Only essential work will take place over weekends and night-time. These are works that are only possible to carry out during closure of the M4.

- Adhere to relevant standards, such as BS 5228 -1 (Ref 9-3) and BS5228-2 (Ref 9-4) to control noise and vibration on site.

- Careful selection of plant and construction methods. Only plant conforming to relevant national, EU or international standards, directives and recommendations on noise and vibration emissions would be used.

- Temporary noise barriers would be used to reduce noise levels where appropriate and practicable. Such measures can be particularly appropriate for stationary or near-stationary plant such as pneumatic breakers, piling rigs and compressors. Barriers would be located as close to the plant as possible and, in order to provide adequate attenuation, would have a mass per unit area of at least 7 kg/m^2.

- All vehicles and mechanical plant used for the purpose of the work shall be fitted with effective exhaust silencers and shall be maintained in good and efficient working order and operated to minimise noise emissions.

- All compressors and generators shall be "sound reduced" models fitted with properly lined and sealed acoustic covers which shall be kept closed whenever the machines are in use, and all pneumatic percussive tools shall be fitted with mufflers or silencers of the type recommended by the manufacturers.

- All machines in intermittent use shall be shut down in the intervening periods between works or throttled down to a minimum. Lorry engines would be switched off when vehicles are stationary. Noise emitting equipment which is required to run continuously shall be housed in a suitable acoustic enclosure.

- Percussive piling would only be used where no other suitable system is available.

- Plant and equipment liable to create noise and/or vibration whilst in operation would, as far as reasonably practicable, be located away from sensitive receptors and away from walls reflecting towards sensitive receptors.

- Where reasonably practicable, fixed items of construction plant would be electrically powered in preference to diesel or petrol driven.

- Machines in intermittent use would be shut down or throttled down to a minimum during periods between works. Static noise emitting equipment operating continuously would be housed within suitable acoustic enclosure, where appropriate.

- All generators and compressors would be 'sound reduced' models fitted with acoustic lining/sealed acoustic covers where appropriate. All ancillary pneumatic percussive tools would be fitted with mufflers or silencers as recommended by the manufacturer.

- Reversing alarms incorporating one of more of the features listed below or any other comparable system would be used where reasonably practicable:
    - Highly directional sounders;
    - Use of broad band signals;
    - Self-adjusting output sounders; and
    - Flashing warning lights.

9.12 Conclusion

Out of necessity certain works on the M4 structures have to be carried out at night. Night-time works have the potential to be disturbing to local residents, particularly where works take place in close proximity to residential receptors. The works on the Malpas Viaduct and Brynglas Tunnel are essential work and will be temporary in nature.

Predictions presented in this report are based on construction information available at this stage and present a possible worst case by assuming all plant for each activity would be used simultaneously. The indicative predictions indicate that a **significant** effect is likely where works take place in close proximity to receptors, particularly at night.

The predictions are also based on the available information on construction programme and plant to be used at this stage. A more definitive method statement and list of plant will only be available once a contractor has been appointed to carry out the work. Assumptions have been made at this stage regarding mitigation measures that are possible.

The possibility of submitting a Section 61 Consent Application in terms of the Control of Pollution Act 1974 (could be considered). This would allow for more detailed noise predictions based on a detailed construction programme and method statement that would allow for selection of the most appropriate mitigation measures.

Noise control measures consistent with good working practices would be implemented during the construction phase in accordance with the principles of the “best practicable means” (BPM), as defined in the Control of Pollution Act (1974) would be used to reduce noise and vibration emissions throughout the construction period.

9.13 References

Ref 9-1 Technical Advice Note (Wales) 11 – Noise (TAN 11) (Welsh Assembly Government, 1997)

Ref 9-2 Sound insulation and noise reduction for buildings - code of practice. BS8233: 2014. (British Standards Institute, 2014)

Ref 9-3 Code of practice for noise and vibration control on construction and open sites – Part 1: Noise. BS 5228:2009 +A1 2014. (British Standards Institute, 2014).

Ref 9-4 Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration. BS 5228:2009 +A1 2014. (British Standards Institute, 2014).

Ref 9-5 Control of Pollution Act (1974).

10 EFFECTS ON ALL TRAVELLERS

10.1 Introduction

This Chapter assesses the potential effects of the Scheme on vehicle travellers, as stipulated within Design Manual for Roads and Bridges ("DMRB"), Volume 11, Section 3, Part 9, 'Vehicle Travellers' (Ref 10-1); and for 'Non-Motorised Users' ("NMUs")[2], as required by DMRB, Volume 11, Section 3, Part 8, 'Pedestrians, Cyclists, Equestrians and Community Effects' (Ref 10-2). A full description of the Scheme is given in Chapter 3: The Project.

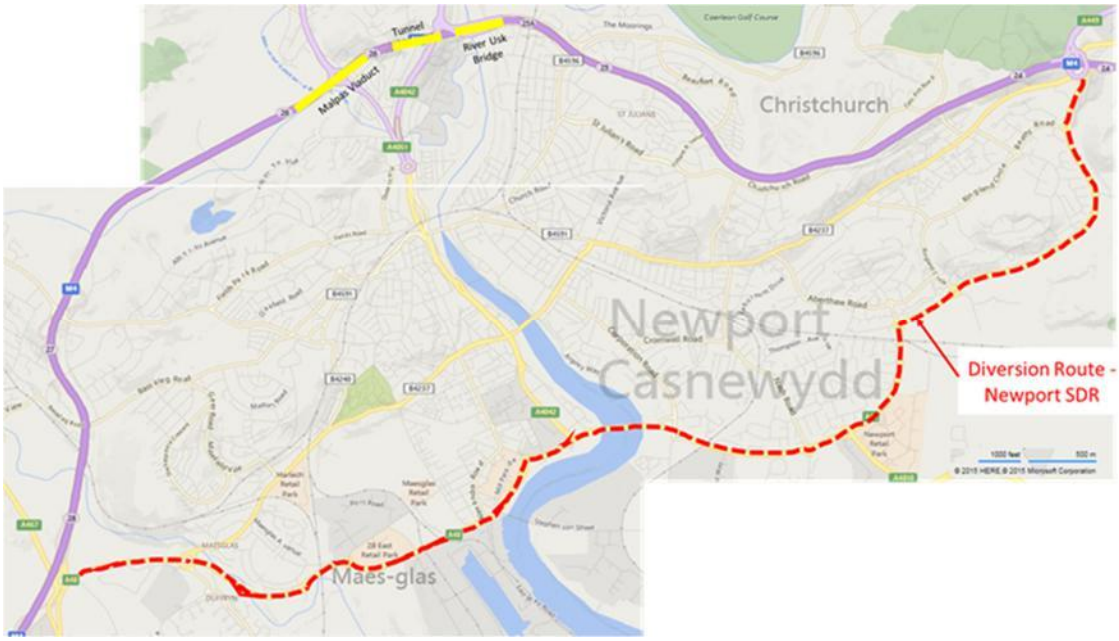
As acknowledged in DMRB, the assessment of effects on all travellers are qualitative, subjective assessments which cover the 'view from the road' experienced by vehicle travellers, the potential for 'driver stress' and the effect on NMUs.

10.2 Study area

The study area has been defined by the diversion route that will be in operation during the M4 motorway closures. The refurbishment of the River Usk Bridge, Brynglas Tunnel and Malpas Viaduct along the M4 motorway will take place between Junctions 25A and 26. The tunnel has two bores – eastbound and westbound, only one of the tunnel bores will be closed at any one time and the closures will take place at night and weekends.

During the closure of either tunnel bore the diversion route for traffic will be via the A48 Southern Distributor Road (SDR) to the south of Newport (as illustrated in Figure 10-1). The closure of the eastbound bore will result in the closure of the Junction 26 eastbound on-slip and the closure of the westbound bore will result in the closure of the Junction 26 westbound off-slip. All other junctions will remain fully operational during the closure of either tunnel bore.

Figure 10-1 M4 Motorway Brynglas Tunnel Diversion Route



All non-local (Newport) through traffic will be diverted onto the A48 SDR, westbound traffic will be directed to leave the motorway at Junction 24 and will re-join the motorway at Junction 28 and vice versa for

[2] DMRB Volume 11 Section 3, part 8 refers to NMUs in full as 'pedestrians, cyclists, equestrians' and in short as 'pedestrians and others'.

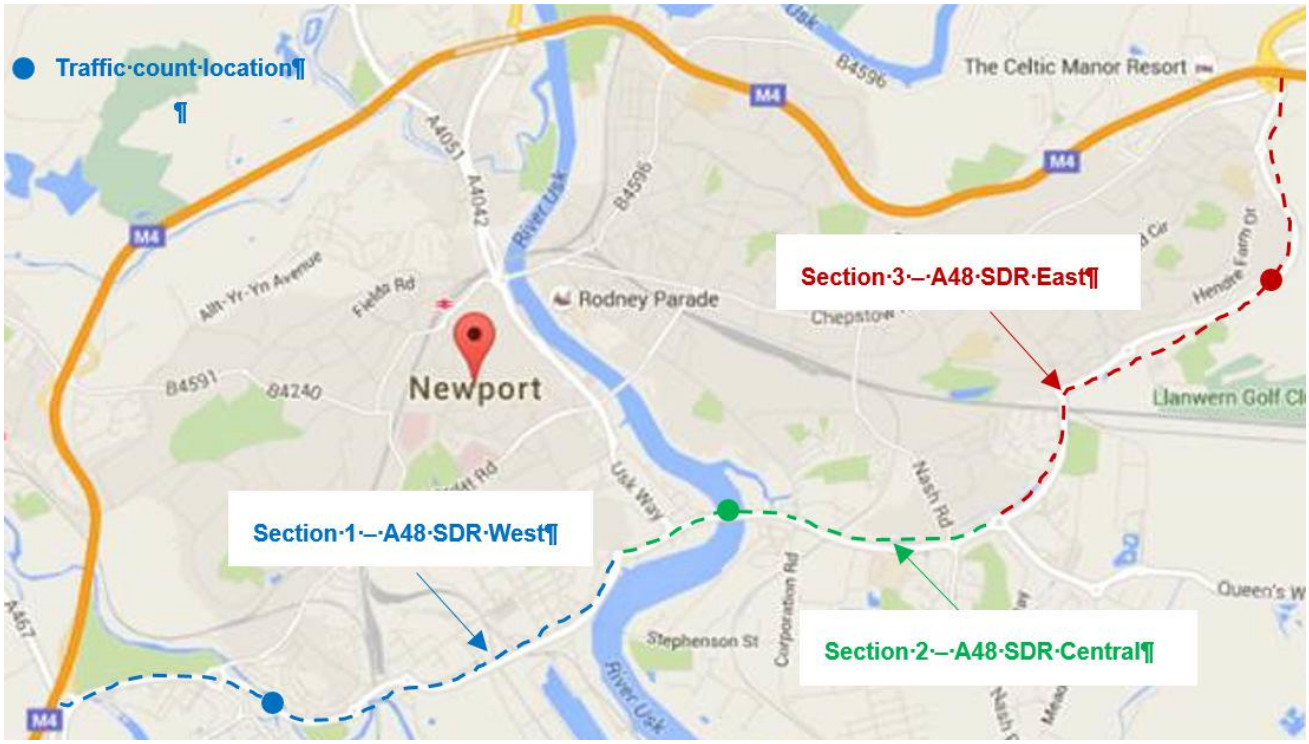
eastbound traffic. However, the closure of the tunnel bores also has the potential to result in local traffic taking alternative routes through the city to join the motorway.

The A48 SDR extends from M4 junction 24 Coldra roundabout in the east to Pont Ebbw roundabout in the west (within the vicinity of M4 junction 28) and is a dual carriageway. The A48 SDR carries approximately 34,000 vehicles per day (Ref 10-3)[3]. The A48 SDR is subject to a 50 mph speed limit along the majority of its length. The SDR provides access to Newport city centre, the docks and a number of retail and industrial parks. A shared cycle/ footway is located adjacent to the carriageway along its length and dedicated pedestrian/ cycling crossings are located along the route. There are at least four pedestrian/ cyclist bridges, five signal controlled crossings, an underpass and at least two uncontrolled crossings, together with uncontrolled crossings points on the minor arms of the roundabout junctions along the A48 SDR.

For the purpose of the assessment of traffic flows the SDR diversion route has been split into three sections as shown in Figure 10-2 and detailed as follows:

- **Section 1** – A48 SDR West (Tredegar Park roundabout to Mill Parade roundabout);
- **Section 2** – A48 SDR Central (Mill Parade roundabout to Nash Road roundabout); and
- **Section 3** – A48 SDR East (Nash Road roundabout to Coldra roundabout).

Figure 10-2 Study Area



10.3 Methodology

10.3.1 Scope

The scope of this report is to provide an assessment of effects on all travellers of the proposed maintenance and improvement activities for the three structures along the existing M4 between Junctions 25A and 26 (inclusive) as during the closure of either tunnel bore traffic will be diverted from the M4 onto

[3] Department for Transport Count Point Data. Count Point Reference 99826. Location between A48 SDR between M4 Junction 28 and Ebbw Bridge Roundabout. Annual Average Daily Flow (AADF) two-way 33,820 total traffic and 1,947 HGVs, which represents 6% of traffic flow.

the A48 SDR to the south of Newport. The works are to be carried out as one Scheme within the same time frame. Refer to Chapter 3 for further project details.

Consultation with key stakeholders was undertaken in August 2015 with highways officers from Newport City Council. A scoping note setting out the proposed assessment approach was issued to Newport City Council on 20th August 2015 (see Appendix E). Newport City Council has been engaged with throughout the development of the Scheme.

10.3.2 Methodology

General Approach

The methodology to assess the effects of the Scheme on all travellers is qualitative, and taken from DMRB (Ref 10-1 and 10-2) and is based on professional judgement to indicate the significance of effects on identified receptors, based on the value or sensitivity of the receptor and the magnitude of the predicted impact (including timescale – permanent or temporary). The combined use of these separate subject assessment frameworks is prescribed in Interim Advice Note ("IAN") 125/09 'Supplementary guidance for users of DMRB Volume 11 'Environmental Assessment'' (Ref 10-4), Section 2.2.

10.3.3 Assessment Criteria

Vehicle travellers

View from the road

Chapter 2 of DMRB Volume 11, Section 3, Part 9 (Ref 10-1), entitled 'View from the Road', suggests that benefits can be experienced by drivers as a result of the construction of new roads in areas of "high quality scenic landscapes", with "views 'out from the road' providing interest and helping to alleviate driver stress." Conversely, if a new road passes through heavily industrialised or other visually unattractive areas, this can constitute an adverse effect, and may cause an increase in driver stress. Whilst DMRB refers to 'new roads', the principles will be applied to assessing the impact on drivers view from the road as a result of temporary diverting from the M4 motorway onto the A48 SDR as proposed as part of the Scheme.

Paragraph 2.6 of DMRB (Volume 11, Section 3, Part 9) (Ref 10-1) allows schemes to be placed in one of four categories as part of the subjective review: 'no view' (the road is deep in a cutting); 'restricted view' (frequent cutting or structures cutting the view); 'intermittent view' (road at ground level but with shallow cuttings or barriers at intervals); and 'open view' (the view extending over many miles). These categories have been determined to provide an assessment of the surrounding landscape, i.e. the view beyond the confines of the highway.

Driver stress

Chapter 3 of DMRB Volume 11, Section 3, Part 9 (Ref 10-1) is entitled 'Driver Stress', and centres around the assessment of driver stress, which is defined as "the adverse mental and physiological effects experienced by a driver traversing a road network" (paragraph 3.1), which could be influenced by factors such as "road layout and geometry, surface riding characteristics, junction frequency, and speed and flow". In combination, induced feelings of "discomfort, annoyance, frustration or fear, culminating in physical and emotional tension" are said to potentially reduce the safety of a journey.

DMRB suggests driver stress is comprised of:

- Frustration, associated with a driver's inability to drive at a consistent speed, such as the speed limit (due to congestion), with frustration increasing as traffic speeds fall, or at junctions and road works;
- Fear of potential accidents, which may be associated with the presence and proximity of other vehicles, inadequate sight and stopping distances, poor lighting, road works and poor surfacing, with feelings compounded during adverse weather; and
- Route uncertainty, primarily associated with inadequate signing and information.

DMRB notes that the available research does not permit a detailed assessment of driver stress, and instead the assessor should use a simple three-point descriptive scale (low, moderate or high) to assess driver stress utilising the assessment framework for driver stress on dual-carriageway roads (as shown in Table 10-1). The assessment framework equates slowing speeds and increasing flow with elevated driver stress, but does not include the other elements mentioned above which contribute to driver stress.

Table 10-1 Description of Driver Stress of Dual-Carriageway Roads

Average peak hourly flow per lane, in flow units/1 hour	Average Journey Speed km/hr		
	Under 60	60-80	Over 80
Under 1200	High[4]	Moderate	Low
1200-1600	High	Moderate	Moderate
Over 1600	High	High	High

A qualitative assessment considers driver stress in the 2016 Do Minimum option (no drivers diverting and using the M4 motorway) and 2016 Do Something option (drivers diverting onto the A48 SDR) and the 'net effects' of change attributable to the Scheme. DMRB states that 'the assessment should be made for the worst year in the first fifteen after opening', but as the Scheme will only result in the temporary diversion of traffic on the A48 SDR and will not involve the long-term permanent increase of traffic on surrounding roads or the M4 upon completion of the works, an assessment of driver stress in 2016 has been undertaken.

As set out in Section 3 of this report traffic modelling has not been undertaken nor considered necessary given the nature of the Scheme, hence no average speed data is available for either the Do Minimum or Do Something options. Hence a qualitative assessment has been undertaken based on the DRMB assessment taking into consideration average Sunday peak hourly flow per lane and other contributory factors which contribute to driver stress as listed above.

Non-motorised users

The assessment of the Scheme effects on (NMUs) in accordance with the guidance set out in DMRB Volume 11, Section 3, Part 8 (Ref 10-2).

Journey Length, Local Travel Patterns

Chapter 2 of DMRB Volume 11, Section 3, Part 8 (Ref 10-2), sets out a methodology for 'assessing how a scheme might affect the duration or distance of pedestrians' and others' journeys'. The guidance states that the method 'may need to be adjusted depending on the complexity of existing travel patterns, the likely impact of the scheme and the assessment stage reached'.

As the Scheme will only result in the temporary diversion of traffic on the A48 SDR, predominately at night and during the limited number of weekend closures and will not involve the long-term permanent increase of traffic on surrounding roads or the M4 upon completion of the works, it has been considered appropriate to undertake a qualitative assessment of the effect of journey length and local travel patterns, taking into account location of key community facilities.

Predicting Changes in Journey Lengths

Chapter 3 of DMRB Volume 11, Section 3, Part 8 (Ref 10-2), sets out a methodology 'for predicting changes in journey lengths and patterns. 'Journey length' here is used to cover both the distance travelled and time taken' for pedestrians. Figure 1 within Chapter 3 presents approximate correlations between mean pedestrian delays, traffic flows and the main types of crossing facility, which can be used to assess changes in journey time caused either directly by a scheme. As the Scheme will not result in

[4] 'Moderate' in urban areas

the long-term permanent increase of traffic on the A48 SDR or any other route, a qualitative assessment of the effect on journey length has been undertaken.

Changes in Amenity

Chapter 4 of DMRB Volume 11, Section 3, Part 8 (Ref 10-2), defines amenity 'as the relative pleasantness of a journey'. The guidance states that amenity is 'concerned with changes in the degree and duration of people's exposure to traffic – fear/safety, noise, dirt and air quality and the impact of the road itself – primarily any visual intrusion associated with the scheme'.

The guidance states that a descriptive approach should be employed, which provides an indication of the change in amenity and the number of journeys affected, the guidance also states that the impact should include a reference to forecast traffic flows. The guidance states that 'whilst the volume and composition of traffic are very important determinants of amenity, other factors should also be taken into account. For pedestrians, these factors include footpath width and distance from traffic, any barriers between pedestrians and vehicle traffic, and the quality of any street furniture and planting'. As the Scheme will not result in the long-term permanent increase of traffic on the A48 SDR or any other route, a qualitative assessment of the effect on journey length has been undertaken.

Community Severance

Chapter 4 of DMRB Volume 11, Section 3, Part 8 (Ref 10-2), states that 'changes in journey times and amenity for pedestrians and others may be such that they affect adversely or beneficially, the degree to which a locality is subject to 'community severance'.' It defines community severance 'as the separation of residents from facilities and services they use within their community caused by new or improved roads or by changes in traffic flows'. As the Scheme will not result in the long-term permanent increase of traffic on the A48 SDR or any other route, a qualitative assessment of the effect on journey length has been undertaken.

New Severance

This has been scoped out of the assessment as the Scheme will not result in any new severance, as the diverted traffic will use the existing dual-carriageway that is designed to accommodate a high volume of vehicular traffic. Moreover, NMU infrastructure is provided along the A48 SDR to provide crossing facilities for both pedestrians and cyclists, including under and overbridge crossings.

Relief from Existing Severance

This has been scoped out of the assessment as the Scheme will not have a long term, permanent effect on traffic flows.

10.3.4 Assumptions

As part of the assessment, it has been assumed that:

- The refurbishment will be of the River Usk Bridge, Brynglas Tunnel and Malpas Viaduct along the M4 motorway between Junctions 25A and 26;
- The contract period for the refurbishment works is 104 weeks from February 2016. Hence the closures are expected to take place across 21 months between April 2016 and December 2017;
- The closures will take place at night and at weekends;
- The night time closures are permitted a maximum of five nights of any one week. The night closures are permitted only during the following times:

  Monday – Thursday: 20:00 – 06:00

  Friday: 22:00 – 06:00

  Saturday: 20:00 – 06:00

  Sunday: 22:00 – 06:00

- There are a maximum of four weekend closures per bore (eight potential one-way weekend closures in total), which are permitted between 20:00 on Saturday through to 06:00 on Monday;
- During the closures the diversion route for traffic will be via the A48 SDR; and
- For the purpose of the assessment it is assumed that all traffic that would otherwise travel through the Brynglas Tunnel during the permitted closure will divert onto the A48 SDR. This represents a worst case as there will be a proportion of trips on the M4 that will not divert, as well as a proportion of travellers will travel at different times in order to avoid the closure of the Brynglas Tunnel and a proportion of local traffic that will use alternative routes through to city.

10.4 Baseline Conditions

10.4.1 Baseline Traffic Data

Traffic data has been obtained for the M4 and A48 SDR. Table 10-2 summarises the sources and the nature of the baseline information. The location of the baseline information is shown in Figure 9-2.

Table 10-2 Source Baseline Traffic Data

Highway Section	Data Source	Data Type
M4	Welsh Transport Technology Consultancy	MIDAS (Motorway Incident Detection and Automatic Signalling) traffic count data January – December 2014. Site reference 4238 (immediately west of the tunnel).
		MIDAS Categorised Flow of Vehicles for M4/4223/A, w/c 6th January 2014
Section 1 – A48 SDR West	Morgan Vinci Limited	2014 Annual Average Daily Traffic Flows
Section 2 – A48 SDR Central		
Section 3 – A48 SDR East		

As the tunnel bore is permitted to be closed any five nights in any one week the effect of the diverted traffic on the A48 SDR on Friday night, Saturday night, Sunday night have been assessed separately to the Monday – Thursday average (for the purpose of the assessment the Monday to Thursday night traffic flows have been averaged). Background traffic movements on a weekend typically vary to weekday flows and the Friday closures will operate at different times to the Monday to Thursday night closures.

It should also be noted for example where the assessment refers to Monday night, traffic flows between 20:00-00:00 on Monday have been obtained together with traffic flows between 00:00-06:00 on Tuesday morning, this principle has been applied to the assessment for all night time closures.

One-way Annual Average Daily Traffic (AADT) flows have been obtained for the A48 SDR from three traffic count sites, one within each of the assessed sections of the A48 SDR. The 2014 AADT flows for Section 1, 2 and 3 are 13,000, 16,000 and 9,000 respectively.

As only AADT traffic flows for the A48 SDR are available at the time of the assessment, the approximate traffic flows along the A48 SDR during the closure times have been calculated by determining the proportion of the AADT traffic flows on the M4 motorway using the motorway at the closure times. Table 10-3 shows the percentage of AADT flows along the M4 at each closure time. These factors have been applied to A48 SDR traffic flows to calculate the traffic flows along the A48 SDR at each of the closure times.

Table 10-3 Base Year 2014 Proportion of AADT Flows at the Closure Times

Closure Times	Proportion of AADT flow
Monday – Thursday: 20:00 – 06:00	13%
Friday: 22:00 – 06:00	8%
Saturday: 20:00 – 06:00	11%
Sunday: 22:00 – 06:00	9%

It should be noted that the average daily traffic flows on a Sunday have been used to assess the impact of the weekend closures, as only AADT flows are available on the A48 SDR. Moreover, traffic flows during the night time closures have been assessed separately.

Morgan Vinci Limited have advised that traffic flows on a Sunday are approximately 60% of the Monday to Friday flows, so the AADT flows have been reduced accordingly. It should be noted that the AADT traffic flows will already account for Sunday traffic flows within the average flows. However, for the purpose of the assessment it is deemed appropriate to use this factor as the lower base year traffic flows will account for a higher percentage increase with the addition of the diverted traffic flows. This factor has not been applied to the Sunday night closures, as the night closure traffic flows include Monday traffic also.

Morgan Vinci Limited have advised that Heavy Goods Vehicles (HGV) on average account for 15% traffic flows along the A48 SDR and this proportion has been applied in the assessment. The base year average one-way total traffic flows along the assessed highway sections are presented in Table 10-4 and HGV flows are shown in Table 10-5.

Table 10-4 Base Year 2014 Average One-way Total Traffic Flows

Highway Links	Average One-way Total Traffic Flows				
	Average Monday – Thursday 20:00 – 06:00	Average Friday 22:00-06:00	Average Saturday 20:00-06:00	Average Sunday 22:00-06:00	Average Sunday
Section 1 – A48 SDR West	1,670	1,060	1,431	1,211	7,800
Section 2 – A48 SDR Central	2,056	1,305	1,761	1,491	9,600
Section 3 – A48 SDR East	1,156	734	990	839	5,400

Table 10-5 2014 Base Year Average One-way HGV Traffic Flows

Highway Links	Average One-way HGV Traffic Flows				
	Average Monday – Thursday 20:00 – 06:00	Average Friday 22:00-06:00	Average Saturday 20:00-06:00	Average Sunday 22:00-06:00	Average Sunday
Section 1 – A48 SDR West	251	159	215	182	1,170
Section 2 – A48 SDR Central	308	196	264	224	1,440
Section 3 – A48 SDR East	173	110	149	126	810

The number of total vehicles and HGV traffic that will be diverted onto the A48 SDR during the proposed refurbishment works of the River Usk Bridge, Brynglas Tunnel and Malpas Viaduct when the Brynglas

Tunnel will be closed has been obtained from the MIDAS recorded 2014 traffic flow data along the M4 motorway.

As only one of the tunnel bores will be closed at any one time, for the purpose of the assessment the average of the eastbound and westbound traffic flows have been calculated and used in the assessment.

The MIDAS traffic flow data did not separate out HGV flows, so analysis of the categorised flow of vehicles during the week commencing 6th January 2014 have been analysed and the percentage of HGVs for the permitted closure times extracted and applied within the assessment. The percentage of HGVs on the M4 motorway flows are presented in Table 10-6.

Table 10-6 M4 Motorway Percentage HGV Traffic Flows

Closure Times	Average HGV Percentage
Monday – Thursday 20:00 – 06:00	23%
Friday 22:00 – 06:00	26%
Saturday 20:00 – 06:00	7%
Sunday 22:00 – 06:00	20%
Sunday	4%

Table 10-7 presents the average one-way 2014 total traffic and HGV flows (average eastbound and westbound) that will divert from the M4 motorway onto the A48 SDR during the permitted closure times.

Table 10-7 2014 Forecast Diverted Motorway Traffic

	Average Total Traffic	Average HGVs
Monday – Thursday 20:00 – 06:00	4,795	1,103
Friday 22:00 – 06:00	3,043	791
Saturday 20:00 – 06:00	4,107	288
Sunday 22:00 – 06:00	3,478	696
Total Sunday Daily Flow	31,037	1,241

Vehicle travellers

View from the road

The view of the M4 motorway between junctions 24 and 28 from drivers is considered to have 'intermittent views', as the motorway is generally at road level throughout this section and has some open views, such as at Malpas and the view to Caerleon north of the motorway. However views are restricted along other parts of this section of the motorway, such as at Highcross. At present it is considered that the 'view from the road' on the A48 SDR is intermittent as the road passes through a largely built up/ urban environment, but in parts open up with views of the River Usk and Severn Estuary. It should be noted that the majority of closures will take place at night, hence when it is dark.

Driver stress

The assessment considers the effect of drivers at the closure times of the M4 motorway, hence at night and on weekends. In general driver stress between Junctions 24 and 28 of the M4 in this area is affected by the capacity of the Brynglas Tunnel, which results in journey unreliability, congestion and consequently driver delay. This is most evident at the peak times, however the unreliability of this section of the motorway network can cause driver stress. At night driver stress along the motorway network is generally

low. The 2014 peak hour (16:00-17:00) Sunday total traffic on the M4 motorway was 2,756. Applying the assessment framework for motorways as set out in DMRB, a flow per lane of 1,378 (assuming two lanes – as the motorway varies between two and three lanes along this section) and assuming an average speed of 50mph (80kph), driver stress is considered to be moderate. Moreover, the delays on this section of the motorway are observed to occur on weekends.

Analysis of the M4 motorway traffic flows illustrate that the peak hour on a Sunday is 16:00-17:00, which represents 9% of the total daily flow. This factor has been applied to the 2014 A48 SDR Sunday total flows to determine the peak 2014 Sunday traffic flows, which have been calculated on Section 1, 2 and 3 to be 663, 816 and 459 respectively across both lanes, hence the flow per lane across both sections is considered to be 332, 408 and 230. The speed limit is 50 mph (80 km/h) on the A48 SDR along this section, hence applying the driver stress assessment framework set out in Table 10-2 the driver stress level is considered to be moderate both on a Sunday and at night.

Non-motorised users

For the effect on non-motorised users, this relates to those currently using the SDR. Generally a wide shared cycle/ footway is located adjacent to the carriageway along its length and dedicated pedestrian/ cycling crossings are located along the route. There are at least four pedestrian/ cyclist bridges, five signal controlled crossings at key junctions along the route, one underpass and at least two uncontrolled crossings, together with uncontrolled crossings points on the minor arms of the roundabout junctions along the A48 SDR. Part of the shared cycle/ footway between Corporation Road and Mendalgief Road forms part of the National Cycle Network Route 4, which provides an east-west cycle route through Newport. There are number of retail outlets (including the Newport Retail Park, Tesco and Morrisons) located along the A48 SDR, as well the Newport International Sports Village and Newport Stadium. South of the A48 SDR is a large industrial area, including the docks and there are new residential developments currently taking place. The existing amenity is considered to be poor, due to the high traffic volume and because the shared cycle/footways are located immediate adjacent to the carriageway.

10.5 Design, Mitigation and Enhancement Measures

This section sets out the mitigation measures proposed to minimise the potential effects. The proposed mitigation measures during the construction phase will be managed and monitored as part of the CEMP.

A Management and Communication Plan will be prepared by the contractor in consultation with Newport City Council, Welsh Government and South Wales Trunk Road Agency outlining appropriate measures to encourage travellers to avoid the route, to encourage travel at different times and to minimise the impact on travellers. Within the plan there will be a strong emphasis on communicating the closures to travellers in advance, detailing appropriate signage and communications, as well as management measures, such as only implementing the closures after traffic flows are below a defined threshold.

The Management and Communication Plan will consider the proposed M4 Junction 28 works which will be occurring in or around March 2016 and will outline the necessary joint-working and communications to minimise the impact on all travellers.

10.6 Assessment of Impacts

10.6.1 2016 Refurbishment Year Traffic Flows

The closures are anticipated to commence in 2016. The base year 2014 traffic flows have been factored to the 2016 by applying a factor derived from the Trip End Model Presentation Program (TEMPRO). TEMPRO presents the output of the National Trip End Model (NTEM), which forms part of the National Transport Model (NTM).

TEMPRO has a policy based approach where the growth in housing and economic activity reflects the predictions expected through the planning system (strategic growth and committed developments). The growth rates therefore include allowances for background traffic growth through increases in car ownership as well as construction of committed developments. Therefore any committed development

traffic has been assumed to be included through the application of the growth rates, and a separate assessment of these flows has not been undertaken.

The most recent NTM dataset (6.2) has been used to obtain growth rates. The Growth Factor for 2014 to 2016 for Newport for weekday off-peak (00:00 - 06:59 & 19:00 - 23:59) is 1.0269. The Growth Factor for a Saturday and Sunday (all times) are 1.0270 and 1.0277 respectively. The resultant 2016 refurbishment year total traffic flows are presented in Table 10-8 and HGV flows in Table 10-9.

Table 10-8 2016 Refurbishment Year Predicted One-way Total Traffic Flows

Highway Links	Average One-way Total Traffic Flows				
	Average Monday – Thursday 20:00 – 06:00	Average Friday 22:00-06:00	Average Saturday 20:00-06:00	Average Sunday 22:00-06:00	Average Sunday
Section 1 – A48 SDR West	1,715	1,088	1,469	1,245	8,016
Section 2 – A48 SDR Central	2,111	1,340	1,808	1,532	9,866
Section 3 – A48 SDR East	1,187	754	1,017	862	5,550

Table 10-9 2016 Refurbishment Year Predicted One-way HGV Traffic Flows

Highway Links	Average One-way HGV Traffic Flows				
	Average Monday – Thursday 20:00 – 06:00	Average Friday 22:00-06:00	Average Saturday 20:00-06:00	Average Sunday 22:00-06:00	Average Sunday
Section 1 – A48 SDR West	257	163	220	187	1,202
Section 2 – A48 SDR Central	317	201	271	230	1,480
Section 3 – A48 SDR East	178	113	153	129	832

The M4 motorway traffic flows have been factored to 2016 refurbishment year using TEMPRO and are presented in Table 10-10.

Table 10-10 2016 Forecast Diverted Motorway Traffic

	Average Total Traffic	Average HGVs
Monday – Thursday 20:00 – 06:00	4,924	1,132
Friday 22:00 – 06:00	3,125	812
Saturday 20:00 – 06:00	4,218	295
Sunday 22:00 – 06:00	3,574	715
Sunday	31,897	1,276

Diversion of Traffic Flows

The impacts of diverted traffic on the traffic flows on each highway section assessed along the A48 SDR in 2016 have been assessed. Table 10-11 presents the increase in diverted traffic on the A48 SDR total traffic flows and HGV flows in Table 10-12. It is important to note that the increases are high due to the low traffic flows using the A48 SDR during the night and weekends. Moreover these impacts represent a

worst case as there will be a proportion of trips on the M4 that will not divert and a proportion of travellers will travel at different times in order to avoid the closure of the Brynglas Tunnel.

Table 10-11 Refurbishment Total Traffic Diversion Impacts

Highway Links	Increase in Total Traffic Flows				
	Monday – Thursday 20:00 – 06:00	Friday 22:00-06:00	Saturday 20:00-06:00	Sunday 22:00-06:00	Average Sunday
Section 1 – A48 SDR West	6,639	4,213	5,688	4,819	39,913
Section 2 – A48 SDR Central	7,034	4,465	6,027	5,106	41,763
Section 3 – A48 SDR East	6,111	3,878	5,235	4,436	37,446

Table 10-12 Refurbishment HGV Traffic Diversion Impacts

Highway Links	Increase in HGV Traffic Flows				
	Monday – Thursday 20:00 – 06:00	Friday 22:00-06:00	Saturday 20:00-06:00	Sunday 22:00-06:00	Average Sunday
Section 1 – A48 SDR West	1,390	976	516	902	2,478
Section 2 – A48 SDR Central	1,449	1,013	567	945	2,756
Section 3 – A48 SDR East	1,311	926	448	844	2,108

Vehicle travellers

View from the Road

The diversion will result in a change in the 'view from the road', as travellers will be diverted from the M4 motorway onto the A48 SDR as part of the Scheme. On the M4 motorway vehicle travellers experience intermittent views at present between Junctions 24 and 28 and it is deemed that the 'view from the road' is also intermittent along the A48 SDR at present.

On this basis, it is considered that the Scheme will have a **negligible** impact and **Not Significant** on the basis that the type of view for vehicle travellers is considered to be the same for travellers diverted onto the A48 SDR and hence there will be no effect on the 'view from the road' for travellers. It is important to note there are no proposed measures to be delivered along the diversion route (A48 SDR) nor any permanent changes to the M4 motorway that will impact on the 'view from the road', hence there will be no impact on the 'view from the road' following completion of the Scheme.

Driver Stress

The diversion of the M4 motorway traffic onto the A48 SDR will result in an net adverse effect on driver stress both for drivers diverting from the motorway onto the A48 SDR and for drivers using the A48 SDR, as a result of route certainty, longer journey times (greater distance, slower speeds and a greater number of junctions) and potential congestion, particularly during the weekend closures, using professional judgement based on a comparison of the 2016 do-minimum and Do-something options. Moreover the lower speeds limits on the A48 SDR (50 mph along the majority of the route) and hence a longer journey time, compared to a free-flowing motorway, has the potential to adversely impact on driver stress.

The result of the increase in traffic volumes along the A48 SDR in the refurbishment year (2016) are presented in Tables 9-11 and 9-12. The 2016 Sunday peak hour traffic flows on Sections 1, 2 and 3 of the SDR are 681, 839 and 472 vehicles per hour respectively. With the addition of the 2016 average one-way traffic flow from the M4 motorway at this time of 2,832 vehicles, the peak hour A48 SDR Sunday traffic flows would be 3,514, 3,671 and 3,304 total vehicles on Sections 1, 2 and 3, hence 1,757, 1,836 and 1,652 total vehicles per lane (based on two lanes). Applying the DMRB assessment framework (Table 9-2), for a 50 mph dual carriageway (80 km/hr), these traffic flows would result in a high driver stress on all three sections of the route.

It is considered that the impact of diverting traffic onto the A48 SDR would have a **Major** magnitude of change and the effect **Moderate Adverse** and **Significant** effect, although minimised with the implementation of the Management and Communication Plan. It is important to note that the traffic flows used in the assessment represent a worst case and assumes all motorway traffic will divert on the A48 SDR. Moreover, the A48 SDR is a high standard dual carriageway, which is designed to accommodate high volumes of traffic, there will be no permanent change in driver stress as a result of the Scheme and the Scheme will result in beneficial impacts in terms of reducing traveller stress in the longer term.

Non-motorised users

Journey Length, Local Travel Patterns

A number of key facilities are located along the A48 SDR mainly employment and retail. The additional of the diversion traffic to the A48 SDR is considered to result in no change to journey length or local travel patterns for NMUs, as the diversion of traffic will not result in any temporary closure of public footpaths, footways or cycle ways along the diversion route. Moreover, it is not expected that pedestrians or cyclists will change travel patterns, as the majority of closures will take place at night when there are typically fewer pedestrians and cyclists and the weekend closures are limited. Additionally there are a number of segregated foot/cycle bridges across the route, an underpass and a number of signal controlled crossing which would not be effected by the Scheme, with the exception of increased waiting time at the signal controlled crossings. It is considered that diverting traffic onto the A48 SDR would have a **Minor** magnitude of change on journey length and the effect would be **Minor Adverse** and **Not Significant** with the implementation of the Management and Communications Plan. It is important to note that this effect will be of a short-term duration and there will be no permanent change in journey length as a result of the Scheme.

Predicting Changes in Journey Lengths

The increased traffic flows along the A48 SDR may result in increased pedestrian, cyclist or other users delay at-grade crossing along the diversion route (the A48 SDR), and hence could have an adverse impact on journey lengths. However, there are a number of segregated foot/cycle bridges across the route, which would not be affected by the increase in traffic volumes and the majority of closures will take place at weekends. It is considered that diverting traffic onto the A48 SDR would have a **Minor** magnitude of change on journey length and the effect would be **Minor Adverse** and **Not Significant** with the implementation of the Management and Communications Plan. However, this effect will be of a short-term duration and there will be no permanent change in journey length as a result of the Scheme.

Changes in Amenity

The existing amenity is considered to be poor, due to the high traffic volume and dominance of traffic along the road. The diversion of traffic from the M4 motorway during the Scheme would adversely affect amenity due to the increased traffic flows using the A48 SDR, as detailed in Tables 10-11 and 10-12. Table 10-7 shows that on a Sunday some additional 31,897 vehicles could be travelling along the A48

SDR resulting in a total flow of 37,446 vehicles, compared to the 2016 forecast flows along the A48 SDR without the addition of the diversion traffic of 5,550 vehicles. The effect of the diversion of traffic during the night would have a lesser impact, due to less traffic diverting and the smaller background traffic flows.

It is considered that diverting traffic onto the A48 SDR would have a **Major** magnitude of change due to peoples increased exposure to traffic and the adverse impacts of this, such as fear of safety, increase noise and air quality but the effect would be **Minor Adverse** given that the route is not particularly sensitive to change, as it is a dual-carriageway designed to carry high volumes of traffic and **Not Significant** with the implementation of the Management and Communications Plan. This effect will be of a short-term duration and there will be no permanent change in journey length as a result of the Scheme.

Community Severance

The increase in traffic is considered to adversely affect the amenity of the A48 SDR for NMUs, however the additional of the diversion traffic is not considered to result in any change to journey length or local travel patterns, as the diversion of traffic will not result in temporary closure of public footpaths, footways or cycle ways along the diversion route and the majority of closures will take place at night when there are typically fewer pedestrians and cyclists. The weekend closures will have the most adverse impact on community severance, due to the volume of traffic that will be diverted onto the A48 SDR. Overall the impact of the diverted traffic will adversely impact on community severance and the magnitude of impact is considered to be **Moderate** due to peoples increased exposure to traffic, but the effect would be **Minor Adverse** given that the route is not particularly sensitive to change, as it is a dual-carriageway designed to carry high volumes of traffic and **Not Significant** with the implementation of the Management and Communications Plan. Moreover, this effect will be of a short-term duration and there will be no permanent change in journey length as a result of the Scheme.

10.7 Conclusions and Recommended Future Work

Based on the overall analysis of each of the criteria, and due to the short term and temporary nature of the Scheme and as the A48 SDR has low receptor sensitivity and is a strategic route designed to accommodate high volumes of traffic, together with the Management and Communication Plan which will seek to inform travellers of diversion and minimise the impact on travellers, the overall residual significance of effect will be **Minor Adverse**, this is considered to be **Not Significant**.

10.8 References

10-1 Highways Agency (1993) The Design Manual for Roads and Bridges (DMRB). Volume 11, Section 3, Part 9, ‘Vehicle Travellers’

10-2 Highways Agency (1993) The Design Manual for Roads and Bridges (DMRB). Volume 11, Section 3, Part 8, ‘Pedestrians, Cyclists, Equestrians and Community Effects’

10-3 Department for Transport www.dft.gov.uk/traffic-counts/cp.php

10-4 Highways Agency (2009) .Interim Advice Note (“IAN”) 125/09 ‘Supplementary guidance for users of DMRB Volume 11 ‘Environmental Assessment’’

10-5 Highways Agency (2008) The Design Manual for Roads and Bridges (DMRB). Volume 11, Section 2, Part 5 HA 205/08 ‘Assessment and Management of Environmental Effects’

11 COMMUNITY AND PRIVATE ASSETS

11.1 Introduction

This section provides an overview of information and likely impacts of the Scheme on people and communities. Specifically, the assessment will consider potential impacts relating to for example community facilities, private assets such as commercial and residential land uses, and impacts on the amenity of local residents and businesses (from, for example, the combination of environmental effects such as noise and air quality).

Given that the Scheme is to undertake maintenance and refurbishments of three structures, the assessment is confined to the construction phase only.

11.2 Study Area

The study area will encompass the spatial area within the Scheme limits of all three of the structures – the Malpas Viaduct, the River Usk Viaduct and the Brynglas Tunnel – together with any other land to be acquired or used by the Scheme (notably the temporary site compound which will be installed at the Gleblands Park Recreational Ground.

A wider study area will be used to consider the potential impact of the Scheme on the amenity of local residents and businesses, and this will equate to study areas used for other environmental topics notably noise and air quality. With regard to air quality, for example, a study area extending 200m from the construction site is proposed to consider the impact of the Scheme on sensitive receptors such as housing, education or healthcare facilities.

11.3 Methodology & Scope

11.3.1 Scope

The scope of the assessment for community and private assets extends to the following areas:

- Impacts of the Scheme on community facilities (identified as social infrastructure including schools, healthcare provision, places of worship, leisure facilities and areas of formal and informal open space);
- Impacts on private assets (identified as residential and commercial uses); and
- Impacts on the amenity of local residents and businesses.

Areas that have been scoped out of the assessment are community severance/accessibility (all Public Rights of Way will be maintained and kept open over the course of the works) and socio-economic impacts (for example job creation), which is not considered to be applicable here.

11.3.2 Methodology

Unlike other environmental topics, the sensitivity of socio-economic receptors to the Scheme is not determined by reference to designations or an objective standard. The importance or sensitivity of resources has therefore been categorised based on the type and value of the asset or facility affected by the Scheme, as shown in Table 11-1 below.

Table 11-1 Sensitivity/ Criteria Table

Importance/ sensitivity of resource or receptor	Criteria
High	• Residential properties • Buildings used by the community such as education and healthcare facilities, community centres and places of worship • Open space or recreational facilities that are of national importance (for example National Trails)
Medium	• Land associated with residential or commercial sites, for example gardens • Community land, open space or recreational facilities of regional significance
Low	• Derelict or unoccupied buildings that are not the subject of a current planning permission • Community land, open space or recreational facilities of local significance (for example pocket parks, playing fields)

Professional judgment will be applied in determining whether or not an effect is likely to be significant. A summary table setting out the assessment of impacts is provided in Table 11-2 below.

Table 11-2 Magnitude/ Criteria Table

Magnitude of Impact	Criteria
Major	• Demolition of buildings or significant permanent loss of land (>50% of total footprint) • Complete severance of access
Moderate	• Moderate loss of amenity (between 15% to 50% of total footprint) • Major severance of access
Minor	• Minor loss of land (<15% of total footprint) • Some partial or temporary severance of access
Negligible	• Very slight change from the baseline conditions
No Change	• No discernible change from the baseline conditions

11.3.3 Surveys

No surveys were undertaken as part of this assessment.

11.4 Baseline Conditions

This section describes the various relevant land-uses within the vicinity of the Scheme.

Residential areas within the vicinity of the tunnel include that of Brynglas, located above and to the north of the tunnel, with a population of some 300 people focused along Brynglas Road, Brynglas Drive and the Bryn Bevan housing estate. A further residential area is located to the south of the M4 in the vicinity of Junction 26, clustered around Malpas Lane, Ross Street, Pant Road and Aston Crescent. A small area of terraced housing is located off Albany Street, to the east of the A4042 and south of the M4.

Commercial uses in the vicinity of the Brynglas Tunnel, Malpas and Usk Viaducts are found primarily in the Albany Industrial Estate located on the western bank of the River Usk, to the south of the motorway. This area, focused around Albany Street, comprises a number of commercial uses include electrical businesses, wholesalers and transport related companies. To the north of junction 26 of the M4 there is a cluster of commercial uses along Malpas Road, including the 103-bedroom Ibis Hotel.

Community uses in the vicinity of the Scheme relate primarily to Glebelands Park, which forms part of the St Julian's Recreation Ground. The recreation ground is divided into two by the M4 (part of the River Usk Viaduct) which passes over the site, with the northern portion, Glebelands Park, located within a bend of the River Usk and accessible to local people for walking and informal recreation. The St Julians Bowling Club operates from the Glebeland pavilion. The portion of the recreation ground to the south of the M4 includes the Newport Indoor Bowls Centre. Education uses include the Glan Usk Primary School, located to the south of the St Julians Recreation Ground and a nursery school located off Albany Road to the south of the M4.

Vehicles will be diverted onto the A48 SDR during the proposed Brynglas Tunnels refurbishment works. The A48 SDR extends from M4 junction 24 (Coldra roundabout) in the east to Pont Ebbw roundabout in the west, in the vicinity of the M4 junction 28.

From the Coldra roundabout, the A48 SDR passes the Bishpool and Llanwern areas of Newport, with primarily residential areas to the north of the road and agricultural land to the south. Milton Junior School and Llanwern High School are located within 500m of the A48 SDR. From Llanwern, the A48 SDR skirts to the west of the site of the former Llanwern steel works, and heads towards the River Usk. The residential area of Liswerry is located to the north of the road, with industrial, commercial and leisure land uses to the south, including Spytty Retail Park, the Newport International Sports Village and Spytty Park Leisure Centre.

From the western bank of the River Usk, the A48 SDR passes to the south of the residential area of Pillgwenlly and to the north of Alexandra Docks and associated industrial and commercial uses. The A48 SDR crosses the Swansea to London Paddington railway line and the Ebbw River, with the residential areas of Maesglas to the north and Duffryn to the south of the road at this point. Maesglas Primary and Nursery School and Duffryn Junior School are located within 500m of the A48 SDR.

Prior to its junction with the M4, the A48 SDR passes to the north of a business park which includes businesses such as the Office for National Statistics and the Intellectual Property Office. The National Trust property of Tredegar Park is located to the south of the A48 at the junction 28 roundabout.

11.5 Design, Mitigation & Enhancement Measures

Relevant mitigation measures for this topic are identified below and would also be incorporated into the Construction Environmental Management Plan (CEMP) produced for the Scheme:

- Appropriate induction would be given to ensure contractors act considerately in relation to local residents, particularly for any works taking place at night. It is proposed that all main contractors will be required to sign up and adhere to the Considerate Constructors Scheme which promotes good practice on construction sites;
- Appropriate information concerning works and possible traffic diversion measures will be provided, including adequate signage;
- Appropriate information relating to the temporary use of the Glebelands Park area to locate the construction compound will be provided;
- The area of Glebeland Park to be used to house the construction compound will be reinstated to its current condition following the works. It should be noted that this location has been used previously to house temporary site compounds associated with works in the local area.

Information relating to mitigation measures for the loss of amenity for local residents and businesses as a result of other environmental effects (notably relating to air quality and noise and disturbance effects) can be found in the relevant sections of this EAR.

11.6 Assessment of Impacts

Given the nature of the refurbishment and maintenance works, no long-term or permanent effects are anticipated.

Temporary effects arising from the works are considered to comprise:

- A reduction in recreational space available at Glebelands Park. The principal impact will be on walkers and other users of the Park, however the numbers of users are not considered to be significant and alternative recreation areas exist within the locality;
- Impacts on local residents and businesses as a result of construction work (primarily noise and air quality). The air quality assessment does not consider there to be any significant effects as a result of the Scheme. Temporary disturbances to local residential properties may occur whilst undertaking of certain activities. However, mitigation measures will be put in place to minimise effects; and

Vehicles will be diverted onto the A48 SDR during the proposed Brynglas Tunnels refurbishment works. Diversions will be restricted to night-time closures and a maximum of eight one-way weekend closures. As such, the diversion routes will be utilised largely at night, when there are typically low numbers of pedestrians and cyclists using the A48 SDR. The diversion of traffic will not result in the temporary closure of public footpaths, footways or cycle ways along the diversion route.

11.7 Conclusions & Recommended Further Works

The assessment has identified that the impacts arising from the Scheme in relation to the topic of Community and Private Assets are likely to be temporary in nature and therefore not significant.

Prior to the commencement of construction works, a construction and environmental management plan (CEMP) will be prepared, setting out mitigation and other good practice measures as identified in the preceding paragraphs.

12 ROAD DRAINAGE AND THE WATER ENVIRONMENT

12.1 Introduction

This Chapter of the EAR presents information on the likely significant effects on the water environment.

The Chapter firstly describes the study area and the methodologies used to assess the potential significant effects of the proposed Development. Baseline conditions are described and details of consultations undertaken are provided, followed by a discussion regarding potential effects, taking into consideration embedded design measures. The conclusions from the assessment together with recommendations for further work are then provided and a list of references completes the Chapter.

12.2 Study Area

The study area has been defined to include all land within the Scheme boundary, in addition to the wider catchments of water bodies potentially affected by the Scheme, for example, watercourses that are crossed by or receive discharges of highway runoff from the Scheme, up to a distance of 1km. Water quality, pollution incidences and details of abstractions and discharges were also identified within a 1km radius of the Scheme boundary.

The study area was determined with reference to guidelines within the Design Manual for Roads and Bridges (DMRB), and is considered to be sufficient for the inclusion of all potentially affected water receptors.

12.3 Methodology & Scope

12.3.1 Scope

The proposed assessment scope has considered the following facets of the water environment local to the Scheme, in line with Volume 11, Section 3, Part 10 of the DMRB (HD 45/09) (Ref 12-1). Where an assessment has been scoped out justification is provided below.

Groundwater Quality

An assessment of the effects of discharges of runoff from the highway on groundwater quality has been scoped out of the assessment. The importance/sensitivity of the underlying aquifer unit is classified as High. However, runoff from the works areas would not be discharged to groundwater and given the nature and the relatively small scale of the proposed works, it is concluded that the Scheme would not result in any significant effect on groundwater resources.

Surface Water Quality

HD 45/09 outlines methodologies for assessing the potential of routine discharges of highway runoff to result in pollution of receiving surface watercourses. A method for assessing the pollution risk associated with an accidental spillage (acute pollution) is also included.

These assessments have been scoped out as:

- No additional drainage outfalls are proposed
- The works proposed involve repair and renewal of existing drainage systems and will introduce a new pollution control system at the Usk Bridge, where no facility currently exists. Proposals include provision of a full Class 1 oil/hydrocarbon separator with sufficient capacity for storage of suspended oils, an emergency spill containment facility and storage tank to contain tunnel maintenance wash

water and firefighting water runoff and the replacing of a tide proof, non-return flap valve to the headwall of the existing outfall to the River Usk.

Given the nature of the proposed works, in combination with a proposed drainage system that represents betterment, with regard to pollution control, over the existing system, it is concluded that the Scheme would not result in any significant adverse effect during the operational phase, with a potential positive impact achieved through pollution prevention measures being installed to protect the river Usk. The potential for, and mitigation of, temporary construction phase effects on surface water quality, which include pollution of surface waterbodies with materials such as silt, cement/concrete, oils and hydrocarbons associated with construction activities and the temporary storage of construction material and plant, is considered in Sections 12.5 and 12.6.

Flood Impacts

HD 45/09 highlights the potential for highways Schemes to result in flood impacts associated with:

- Construction in the floodplain,
- Restrictions to in channel flow hydraulics, causing increased water levels, due to construction of temporary or permanent in channel structures, and
- Local changes to catchment drainage patterns due to the introduction of paved areas that, without attenuation, would result in an increase in the rate at which rainfall runoff reaches receiving water bodies.

Local changes to catchment drainage patterns have been avoided as existing drainage systems and outfalls would be retained (subject to repair works and cleaning where necessary) and there would be no new temporary or permanent construction in the floodplain. Further assessment of these two flood impacts has therefore been scoped out. In consultation with NRW it has been confirmed that the Scheme does not need to be supported by a stand-alone Flood Consequences Assessment. However, the creation of a working platform over the River Usk at the Usk Viaduct has the potential to result in restriction of flow in a large flood event with flood risk consequences. This aspect has therefore been subject to more detailed assessment in Section 12.6.

12.3.2 Methodology

The assessment has consisted of a desk based study to characterise the baseline water environment within the study area. The desk study has been informed by published and internet-based information sources, supplemented with responses to direct consultation requests to key bodies, including NRW, the Lead Local Flood Authority (Newport City Council) and South Wales Trunk Roads Agency (SWTRA).

Following characterisation of the water environment baseline the potential for the Scheme to impact on water environment receptors and their attributes has been assessed using a methodology drawn from the Water Environment section of the DMRB (Ref 12-1). This method comprises a number of stages. The first stage involves making a judgement as to the value (or sensitivity) of identified receptors, which is assigned to one of the categories defined in Table 12-1.

Table 12-1 Criteria for Determining the Value (Sensitivity) of the Hydrological and Surface Water Resources (Ref 12-1)

Sensitivity	Criteria	Typical Examples	
Very High	Attribute has a very high quality, importance and rarity on a regional or national scale	Surface water:	European Union (EU) designated salmonid/cyprinid fishery.
			Watercourse achieving *WFD* class 'High'.
			Site protected under EU or United Kingdom (UK) wildlife legislation (Special Area of Conservation, Special Protection Area, Site of Special Scientific Interest, Ramsar site).
			Supports a public potable water supply to a large community.
		Flood risk:	Designated washland or a large and active floodplain where there is high potential for flooding of a large number (> 100) of residential properties and infrastructure.
High	Attribute has a high quality, importance and rarity on a local scale	Surface water:	Watercourse achieving *WFD* class 'Good'.
			Major cyprinid fishery.
			Species protected under EU or UK wildlife legislation.
			Supports industrial or agricultural abstraction of > 500 m^3/day or supports a private water supply of potable water to a small community.
		Flood risk:	Floodplain or defence protecting between 1 and 100 residential properties or industrial premises from flooding.
Medium	Attribute has a medium quality, importance and rarity on a local scale	Surface water:	Watercourse achieving *WFD* class 'Moderate'.
			Water feature that supports an abstraction for agricultural or industrial use of between 50 and 499 m^3/day, or supports a private water supply of potable water to an individual property.
		Flood risk:	Floodplain or defence protecting 10 or fewer industrial properties from flooding.
Low	Attribute has a low quality, importance	Surface water:	Watercourse that is not a fishery, achieving *WFD* class 'Poor'.

Sensitivity	Criteria	Typical Examples	
	and rarity on a local scale		Supports an abstraction for agricultural or industrial use of < 50 m^3/day. Does not support a public or private potable water supply.
		Flood risk:	Floodplain within limited constraints and a low probability of flooding of residential and industrial properties.

The magnitude of change (or impact) on the baseline condition is then assigned considering the scale/extent of change and the nature and duration of the impact. Definitions of magnitude are provided in Table 12-2, which drawn from from the DMRB (Ref 12-1), with reference also made to the paper Practical Methodology for Determining the Significance of Impacts on the Water Environment (Mustow et al, 2005) (Ref 12-2).

Table 12-2 Criteria for Determining the Magnitude of Impact on the Hydrological and Surface Water Resources (Ref 12-1, 12-2).

Magnitude of Impact	Criteria	Typical Example	
Major adverse	Results in loss of attribute and/or quality and integrity of the attribute	Surface water:	Loss or extensive change to a fishery.
			Loss or extensive change to a Nature Conservation Site. Change in the *WFD* class of a river reach or pollution of a potable source of abstraction.
		Flood risk:	Increase in peak flood level (1% annual probability) > 100 mm, or increasing the risk of flooding to >100 residential properties.
Moderate adverse	Results in effect on integrity of attribute, or loss of part of attribute	Surface water:	Partial loss in productivity of a fishery Pollution of a non-potable source of abstraction.
		Flood risk:	Increase in peak flood level (1% annual probability) > 50 mm, or increased flood risk to < 100 residential properties.
Minor adverse	Results in some measurable change in attribute quality or vulnerability	Surface water:	Discharges to a watercourse that result in no significant loss of quality, fishery or biodiversity value.
		Flood risk:	Increase in peak flood level (1% annual probability) < 50 mm or

Magnitude of Impact	Criteria	Typical Example	
			increasing the risk of flooding to < 10 industrial properties.
Negligible	Results in effect on attribute, but of insufficient magnitude to affect the use or integrity	The proposed development is unlikely to affect the integrity of the water environment.	
Minor beneficial	Results in some beneficial effect on attribute or a reduced risk of negative effect occurring	Flood risk:	Reduction in peak flood level (1% annual probability) > 10 mm.
Moderate Beneficial	Results in moderate improvement of attribute quality	Flood risk:	Reduction in peak flood level (1% annual probability) > 50 mm.
Major Beneficial	Results in major improvement of attribute quality	Surface water:	Removal of existing polluting discharge, or removing the likelihood of polluting discharges occurring to a watercourse.
		Flood risk:	Reduction in peak flood level (1% annual probability) > 100 mm.

The overall significance of effects is then derived by combining the value (sensitivity) of the receptor with the magnitude of the impact (change), as illustrated in Table 12-3.

Where more than one significance outcome is possible, professional judgement is used to determine which is most appropriate, on a case by case basis and ensuring regard to the precautionary principle.

Table 12-3 Criteria for Determining the Significance of Effects on the Hydrological and Surface Water Resources

		MAGNITUDE OF IMPACT			
		Negligible	**Minor**	**Moderate**	**Major**
SENSITIVITY OF ATTRIBUTE	**Very High**	Neutral	Moderate	Large	Very Large
	High	Neutral	Slight/Moderate	Moderate/Large	Large/Very Large
	Medium	Neutral	Slight	Moderate	Large
	Low	Neutral	Neutral	Slight	Moderate

12.3.3 Surveys

No surveys were undertaken to inform this assessment.

12.4 Baseline Conditions

12.4.1 Surface Water Features

There are three named waterways located in the study area namely the Malpas Brook (also known as the Bettws Brook), the River Usk and the Monmouthshire and Brecon Canal (M&BC). The Malpas Brook is classed as an Ordinary Watercourse upstream of the M4 crossing and is located at the western extent of the Scheme. The M&BC flows adjacent to the Malpas Viaduct and the River Usk is a Main River flowing beneath the Usk Bridge at the western extent of the Scheme. In addition there are a number of unnamed drainage ditches at the western extent of the Scheme to the north of the existing M4.

To the M4 crossing, the Malpas Brook drains a catchment area of approximately 24km^2. Its catchment is relatively rural and has an average drainage slope of 100.9m/km. The River Usk drains a freshwater catchment area that exceeds 1,000km^2 and at the bridge crossing is tidally dominated. The tidal range is approximately 8m and the river has a channel width at high water of approximately 130m. The study area receives an average annual rainfall of approximately 1070mm.

12.4.2 Groundwater

The study area is underlain by sandstone geology of the Ragland Mudstone and Maughans formations, with superficial deposits of clay and silt local to the River Usk (Ref 12-3). Bedrock aquifers are classified as Secondary A, defined as permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. There are no Groundwater Source Protection Zones in the study area.

12.4.3 Water Quality

Surface Waters

With regard to the existing water quality of local waterbodies, data is available for the River Usk, the Malpas Brook and the M&BC, which are monitored under the requirements of the Water Framework Directive (WFD) by NRW.

The River Usk is designated as a Heavily Modified Waterbody which is applied to watercourses that have been substantially changed in character as a result of physical alterations by human activity. Its current ecological potential is classified as Moderate and its chemical quality achieves Good status. The waterbody has been assigned the objective of achieving Good Ecological Potential by 2027. It is also noted that the river has a tidal regime that supports a 'Good' quantity and dynamics of flow.

The Malpas Brook achieves Moderate ecological quality and it is noted that the watercourse does not support a good quantity/dynamics of flow. The chemical quality of this waterbody does not require assessment. An objective has been set to achieve Moderate ecological status by 2027.

The M&BC, classified as an Artificial Waterbody, achieves Good ecological potential but its chemical water quality fails to meet WFD objectives due to an exceedance of a priority hazardous substance (Tributyltin compounds).

NRW provided records of substantiated pollution incidents having an effect on the water environment within a 1km radius of the Scheme. A total of five incidents were recorded, with three specific to the M4 motorway (at Junctions 26, 25A and 25) all of which resulted in a minor impact. These involved pollution by sewage materials, oils/ fuel and firefighting runoff.

Groundwater

The current quantitative quality of the WFD groundwater unit that underlies the study area (the SE Valleys Eastern Devonian Old Red Sandstone), which considers factors such as the impacts of abstraction and the water balance, achieves WFD 'Good' status. Its chemical quality is also classified as Good, with no apparent upward chemical trends.

12.4.4 Flood Risk

Baseline flood risk data has been gathered in consultation with NRW and the LLFA.

Historical Flooding

The LLFA report that they have no records of flooding instances along the Malpas Brook upstream of the M4, but note that the M&B canal is prone to leaking in some places, leading to boggy ground locally. The very large sluice gate situated to the immediate north west of Junction 26 of the M4 has been lowered in the past to protect the Barrack Hill area from tidal flooding but this is a very rare occurrence. NRW supplied a map showing the approximate extent of flooding during an event dating to December 1981 (See Figure 12-1) but supplied no further information regarding this event.

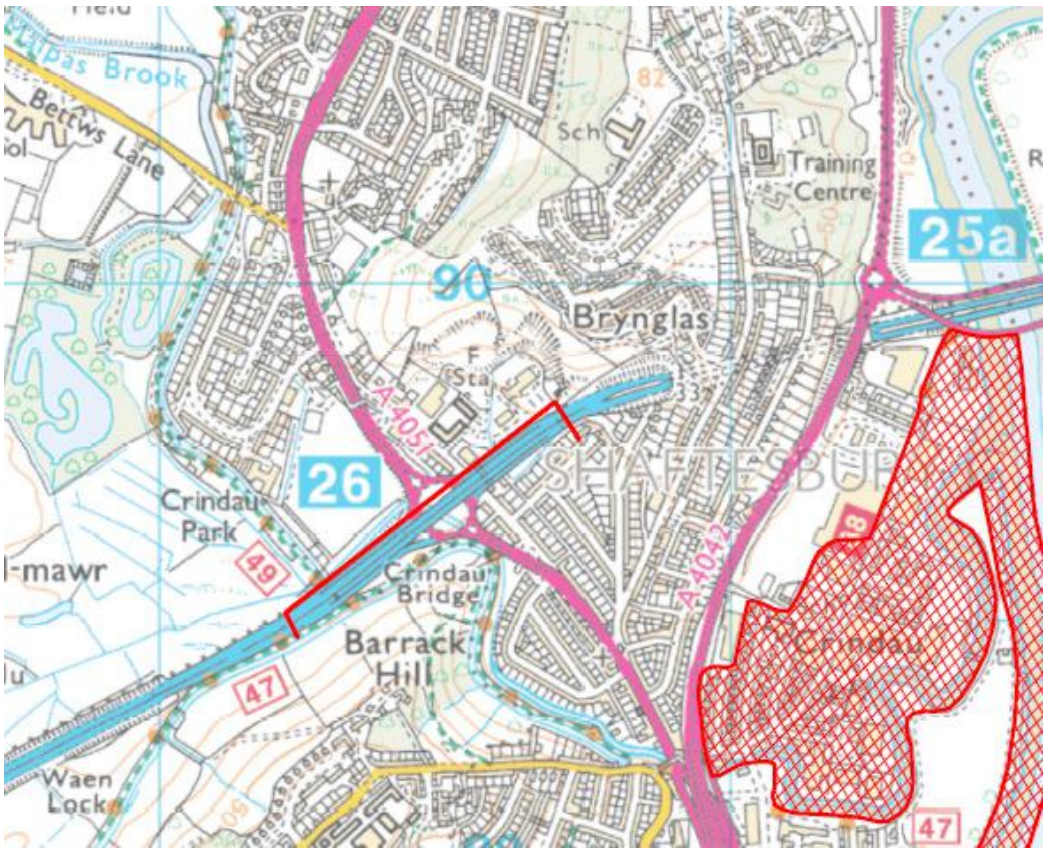


Figure 12-1 NRW Historical Flood Map (approximate flood extent shown as red hatch)

WG and NRW Flood Maps

The WG (TAN 15) Development Advice Map (DAM) (Figure 12-2) shows three flood zones, A, B and C. Zone C is based on the NRW's extreme (1 in 1000 year) flood outline and is subdivided into C1, indicating areas that are served by significant infrastructure, including flood defences, and C2.

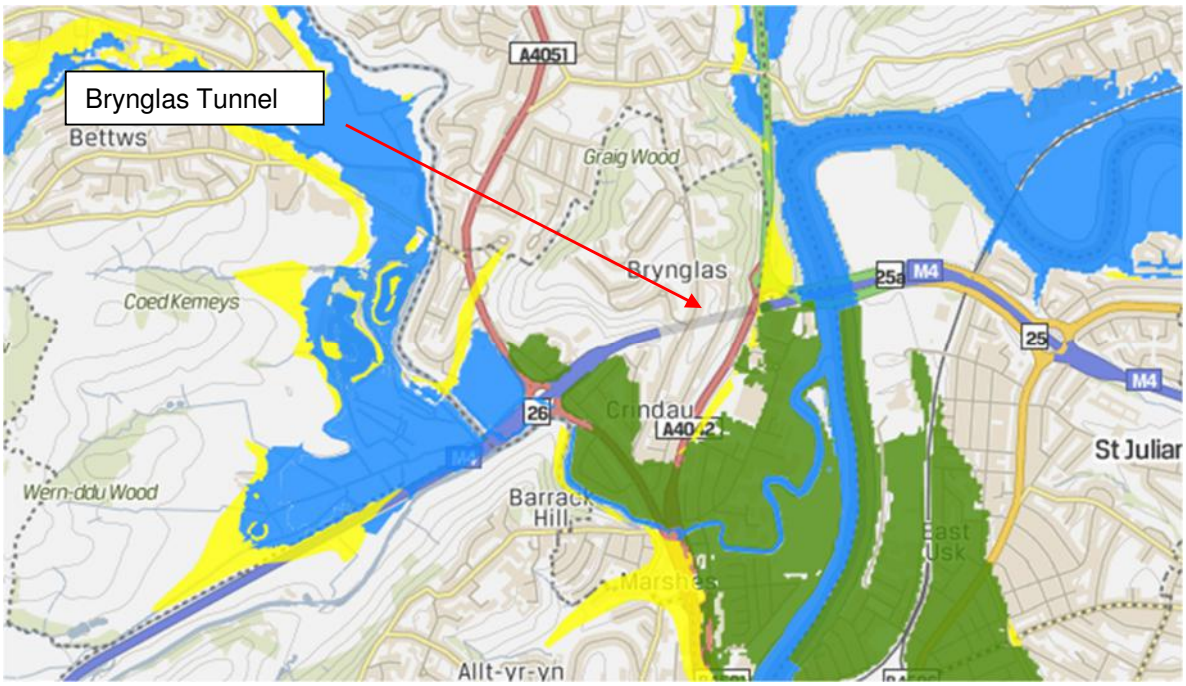


Figure 11-2 TAN15 development advice map (Zone C1 – green, C2 – blue, B – yellow)

As illustrated in Figure 12-2 the DAM flood zone categorisation varies across the length of the Scheme, with areas adjacent to the north side of the Malpas viaduct located in C2, the Brynglas tunnel located in flood zone A, defined as 'areas at little are no risk of fluvial or coastal/tidal flooding', and areas local to the Usk bridge in flood zones C1 and C2.

Further detail is provided in the NRW flood map in Figure 12-3, a licenced copy of which was supplied as part of a Product 4 flood data pack.

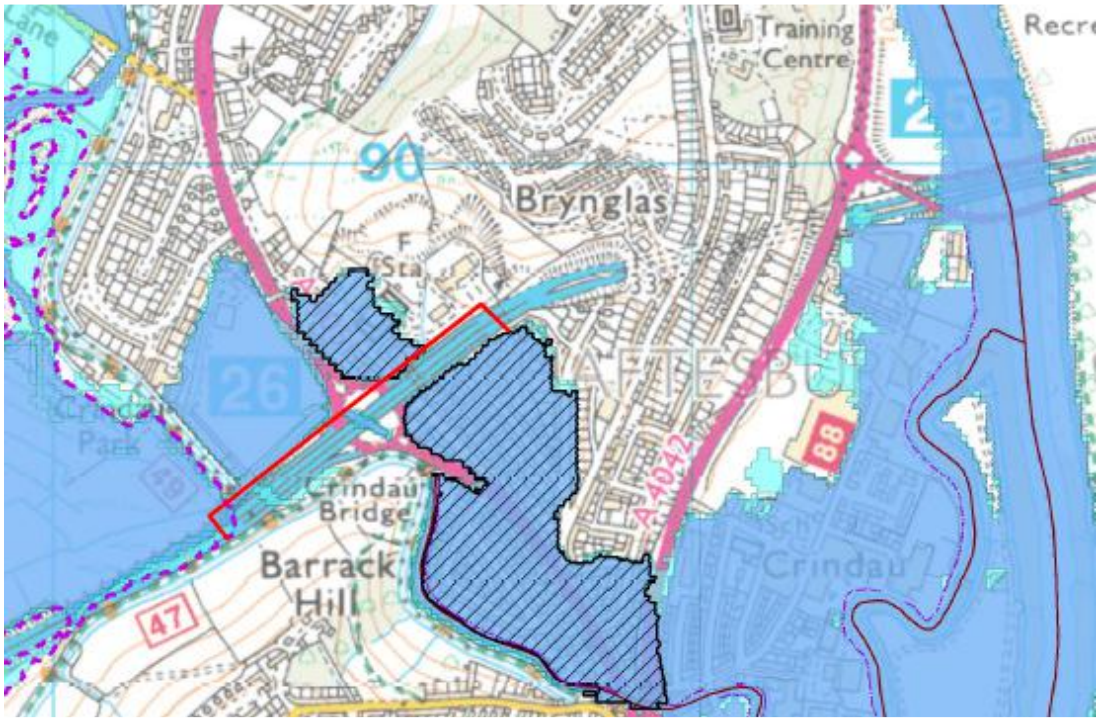


Figure 12-3 NRW Flood map for planning (blue – flood zone 3, light blue – flood zone 2, areas of hatch benefitting from flood defences, pink dash – existing flood defences)

Whilst areas in the vicinity of the Malpas viaduct and Usk bridge parts of the Scheme are therefore potentially at risk of flooding from the tidally dominated River Usk and its interactions with the Malpas Brook the risk is low due to the presence of flood defences. In addition, both of these structures are elevated above ground and as the proposed repair and refurbishment works focus on the underside of these structures, the temporary works will be carried out above ground level.

Given the high degree of protection provided by existing flood defences, the temporary nature of the proposed works and that works areas are largely above ground level, baseline flood risk from rivers and the sea is concluded to be low. The potential for the Scheme to influence the flooding regime of the River Usk and Malpas Brook is discussed in Section 12.6.

12.4.5 Discharges and Abstractions

Records supplied by NRW confirm that there are seven active consents to discharge to surface waters within the study area. Six of these consents are held by DCWW with one linked to a single domestic dwelling. Discharges are received by the River Usk as well as the Malpas Brook.

There are two licenced abstractions within the study area, supported by the Malpas Brook and an unnamed tributary of this watercourse. The abstractions supply top up water to a fishing lake in Bettws and to the M&BC.

12.4.6 Summary

Table 12-4 provides a summary of the values / sensitivities assigned to the individual water receptors within the study area.

Table 12-4 Summary of water receptor value

Receptor	Value (Sensitivity)	Rationale
River Usk	Very High	Designated Special Area of Conservation (SAC) and achieves WFD Good status for chemical water quality. The river has a wide floodplain downstream of the study area that accommodates residential/commercial and industrial receptors, the majority of which are afforded protection by existing flood defences.
Malpas Brook	Medium	Achieves WFD Moderate status. Has a relatively narrow floodplain which is prevented from regular inundation by existing flood defences
Monmouthshire & Brecon Canal	High	Achieves WFD Good status and is an important recreational resource used by walkers and cyclists.
Unnamed ditches	Medium	Common place local features but serve a land drainage function
SE Valleys Eastern Devonian Old Red Sandstone aquifer	High	Achieves WFD Good status for quality and quantity, Secondary A aquifer capable of supporting water supplies at a local rather than strategic scale

12.5 Design, Mitigation & Enhancement Measures

A Construction Environmental Management Plan (CEMP) will be implemented prior to commencement of the construction works to ensure that good practice is employed and the environment is safeguarded. The contractor will prepare detailed method statements and appropriate controls implemented. The plan will cover activities such as storage of fuels, chemicals and oils, pollution control, and emergency contingency.

The water quality of the River Usk, Malpas Brook and other surface waters will be protected during the construction period by following good practice pollution control techniques, as documented in the following publications:

- Relevant NRW (formerly Environment Agency Wales) Pollution Prevention Guidance has recently been withdrawn. Any new guidance published during the construction-phase will be reviewed and implemented where appropriate (Ref 12-4);
- C650 – Environmental Good Practice on Site (Ref 12-5); and

- C532 - Control of Water Pollution from Construction Sites (Ref 12-6).

A fully enclosed system of working over the River Usk channel is proposed to prevent materials or discharges of water entering the river, however, an emergency spillage response plan will also be produced, documenting the actions to be taken by construction site personnel in the event of an emergency spillage and setting out clear lines of communication with NRW, in order to contain and reduce the environmental impact of any such event.

The construction site compound area will be bunded for the storage of fuels, chemicals and refuelling areas, to prevent leakage and will be located as far away as possible from surface water bodies. Any refuelling will only take place within a designated fuel transfer area. Any drainage from this area will incorporate an isolation facility such that the outlet could be sealed in the event of a spillage.

To mitigate for the potential for flood risk impacts the contractor would sign up to the NRW flood warning service. The Usk Bridge and surrounding area lie within the NRW Usk Estuary Flood Warning Area. Flood warning lead times at this location for both fluvial and tidal flooding are expected to be long, with significant advance warning of large floods providing adequate time to evacuate workers from the temporary platform that is required beneath the River Usk Bridge.

This platform will ideally span the full width of the channel and will be in place for approximately 18 months. Its level has been set following an assessment of extreme flooding frequency, using flood level data supplied by NRW, to ensure an acceptable level of flood risk to the platform and that the presence of the platform will not exacerbate flood risk upstream and downstream of the bridge. A minimum soffit level of 8.60 mAOD is proposed on the basis that this level represents a conservative, precautionary, estimate of the 1 in 100 year design flood level at the Usk Bridge and the likelihood of a 1 in 100 year flood occurring during the 20 months' works duration is very low, at only 1.5%.

12.6 Assessment of Impacts

The following section assesses the potential effects on the individual receptors identified in Table 12-4, considering the measures outlined in Section 12.5.

12.6.1 Groundwater Resources

As discussed in Section 3, it is considered that the Scheme would not result in any effect on the baseline quality or quantitative status of groundwater resources within the SE Valleys Eastern Devonian Old Red Sandstone aquifer (**high** value/sensitivity). The magnitude of impact is classified as **negligible** in accordance with Table 12-2 and the overall impact has **neutral** significance.

12.6.2 Surface Water Quality

With regard to effects on the water quality of surface waterbodies, during the maintenance/repair stage impacts are considered to relate to the potential for accidental spillage of fuels, lubricants and hydraulic fluids from plant and equipment, leading to subsequent contamination of the water environment. There is also risk of stored materials within the construction compound, such as soil, being washed into the adjacent River Usk, leading to sedimentation or contamination. However, these risks will be significantly reduced by implementing appropriate working practices and pollution prevention techniques. In addition, regular visual monitoring of the River Usk for any indication of sedimentation will be undertaken by the appointed contractor, particularly during periods of heavy rainfall and should any visual indicators of pollution be observed emergency pollution control measures would be put into action. No works are anticipated to the wet channel of the River Usk and the nature of the maintenance works and stringent control and monitoring measures put in place by the contractor will ensure no impacts will be sustained to the watercourse.

The River Usk is assigned **very high** value/sensitivity, however the magnitude of impact is classified as **negligible** in accordance with Table 12-2 and the overall impact has **neutral** significance. The risks of pollution of the Malpas Brook (**medium** value) and M&BC (**high** value) are similarly low, with a **negligible** magnitude and overall **neutral** significance.

Following completion of the repair and maintenance works, a new pollution control system at the Usk Bridge, where no facility currently exists, will become operational, resulting in improved treatment of highway drainage prior to discharge to the river. This is assessed as having a **low minor beneficial** magnitude of impact, with an overall effect of **moderate beneficial** significance.

12.6.3 Flood Risk Impacts

The creation of permanent areas of new impermeable surface is not anticipated hence there would be no long term effect on existing rainfall runoff rates or volumes. The proposed works are to be carried out to elevated structures so flooding of the works areas is considered highly unlikely and no loss of floodplain storage is anticipated. Prior written consent will be secured from NRW for any works, in, under, over or within 8 metres of the top of the bank of the River Usk, a designated 'Main River'.

The potential for flood risk impacts is therefore limited to restriction of flow in the River Usk, causing increased water levels, due to construction of a temporary working platform spanning the channel beneath the bridge. However, the proposed level of the platform at the 1 in 100 year design flood level (8.6mAOD) coupled with the short duration of the works and receipt of NRW flood warnings, will substantially mitigate this risk.

A **negligible** magnitude of effect on baseline flood risk is therefore concluded, having an overall **neutral** significance.

12.6.4 Abstractions and Discharges

The proposed maintenance and repair works are considered to have no potential to affect the integrity of existing abstractions and discharges to surface waters within the study area.

12.7 Conclusions & Recommended Further Works

It is concluded that, given the design and mitigation measures proposed, during the repair and maintenance phase the overall impact on water environment receptors would be **neutral**. When repair and maintenance works are complete a new pollution control system at the Usk Bridge, would operate where no facility currently exists. This has the potential to result in a **moderate beneficial** effect on localised water quality in the River Usk.

12.8 References

Ref 12- 1	The DMRB relevant to your chapter – DMRB Volume 11, Section 3, Part 10 Road Drainage and the Water Environment (HD 45/09) (2009)
Ref 12-2	Practical Methodology for determining the significance of impacts on the Water Environment (Mustow et al, 2005) Mustow, S.E., Burgess, R.F., and Walker, N., 2005. Practical methodology for determining the significance of impacts on the water environment. Water and Environment Journal, 19 (2), 100–108.
Ref 12-3	River Basin Management Plan Severn River Basin District (EA, 2009)
Ref 12-4	NRW pollution prevention guidance – available via https://www.gov.uk/government/collections/pollution-prevention-guidance-ppg
Ref 12-5	Publication 741 – Environmental Good Practice on Site (4th Edition, 2015) CIRIA
Ref 12-6	C532 - Control of Water Pollution from Construction Sites (CIRIA, 2001)

13 CUMULATIVE EFFECTS

13.1 Introduction

Cumulative effects are the result of multiple actions on environmental receptors or resources. There are principally two types of cumulative effect to be assessed:

- Type 1 - where different environmental impacts are acting on a given receptor, but are the result of one project; or
- Type 2 - where environmental impacts are the result of multiple projects in combination (including the project being assessed).

13.2 Methodology

The cumulative environmental effects during construction and operation are considered against the significance criteria set out in DMRB Volume 11, Section 2, Part 5, as shown in Table 13.1. These criteria could reflect beneficial or adverse effects.

Table 13.1 Significance Criteria – Cumulative Effects

Significance	Effect
Severe	Effects that the decision-maker must take into account as the receptor/resource is irretrievably compromised.
Major	Effects that may become a key decision-making issue.
Moderate	Effects that are unlikely to become issues on whether the project design should be selected, but where future work may be needed to improve on current performance.
Minor	Effects that are locally significant.
Not Significant	Effects that are beyond the current forecasting ability or are within the ability of the resource to absorb such change.

13.3 Cumulative Effects of the Project (Type 1)

13.3.1 Construction

Chapter 5: Air Quality concludes that impacts to air quality receptors are considered to be not significant.

Chapter 6: Nature Conservation concludes that impacts to ecological receptors are considered to be not significant.

Chapter 7: Materials concludes that temporary slight adverse impacts are anticipated during the construction phase with permanent slight adverse impacts also being identified as a result of some site waste materials being disposed of to landfill.

Chapter 8: Noise and Vibration- significant effects have been identified at Pant Road, Waterside Court and Aston Crescent during the proposed night time working. However, these works will be temporary in nature and intermittent during the construction phase. The effects are considered to be locally significant but will not result in any long-term impacts.

Chapter 9: Effects in all Travellers concludes that although there will be an increase of traffic on the diversion route during the night time closures these are only temporary and therefore impacts to all travellers are considered to be not significant.

Chapter 10: Community and Private Assets concludes that impacts to social receptors are considered to be not significant.

Chapter 11: Road Drainage and the Water Environment concludes that impacts to hydrological receptors are considered to be not significant.

13.3.2 Construction

Receptor Group	Air Quality	Ecology and Nature Conservation	Materials	Noise and Vibration	Effects on All Travellers	Community and Private Assets	Road Drainage and Water	
Properties above Brynglas Tunnel (Redland Street & Brynglas Road)	Not Sig	NA	NA	NA	NA	Not Sig	NA	Minor
Properties In Malpas- Pant Road, Malpas Road, Aston Crescent, Bryn Bevan	Not Sig	NA	NA	Significant	NA	Not Sig	NA	Minor
Properties in Glebelands- Bank Street	Not Sig	NA	Slight adverse	Not Sig	NA	Not Sig	NA	Minor
Properties adjacent to Network Rail Depot- Albany Street/ Glassworks Cottages	Not Sig	NA	Slight adverse	Significant	NA	Not Sig	NA	Minor
Public Rights of Way- Brecon & Monmouthshire Canal	Not Sig	NA	NA	NA	NA	Not Sig	NA	Minor
Public Rights of Way- River Usk footpath	Not Sig	NA	NA	NA	NA	Not Sig	NA	Minor
A48/ Southern Distributor Road	Not Sig	NA	Slight adverse	NA	Slight Adverse	Not Sig	NA	Minor
River Usk SAC/ SSSI	NA	Not Sig	NA	NA	NA	NA	Not Sig	Minor
Malpas Brook	NA	Not Sig	NA	NA	NA	NA	Not Sig	Minor
Brecon & Monmouthshire Canal	NA	Not Sig	NA	NA	NA	Not Sig	NA	Minor
Glebelands SINC	NA	Not Sig	NA	NA	NA	Not Sig	NA	Minor
Protected Species	NA	Not Sig	NA	NA	NA	NA	NA	Minor

Plants and Habitats	NA	Not Sig	NA	NA	NA	NA	NA	Minor
Devonian Old Red Sandstone Aquifer	NA	NA	NA	NA	NA	NA	Not Sign	Minor
Landfill Capacity (Newport)	NA	NA	Slight Adverse	NA	NA	NA	NA	Minor

13.4 Cumulative Effects of Multiple Projects (Type 2)

Cumulative effects may occur due to the various planned transportation and land development Schemes in the vicinity of the Scheme.

13.4.1 M4 Junction 28 Improvements

The M4 Junction 28 Improvements will be carried out at the western extent of the A48/ Southern Distributor Road in order to provide better transport infrastructure/ reduce journey times and to ease congestion.

The Junction 28 Improvements will commence in the summer of 2016. These works will coincide with the Brynglas Tunnel Refurbishments. The Contracting teams will work collaboratively throughout the construction-phase particularly in relation to night time closure schedules. Given the nature of the works proposed at Junction 28 and providing successful consultation between contracting parties takes place, it is not anticipated that there will be any in-combination effects to the Improvements upon any of the receptors identified in Table 13-1 above.

13.4.2 Magor Brewery Southern Distributor Road Closures

It will be essential that during the planning of the night time closures for the refurbishment works that consideration given to the activities of Magor Brewery.

Magor Brewery have recently obtained permissions from Newport City Council and Monmouthshire County Council to carry out closures of part of the A48/ SDR, Queensway Meadows and the Eastern Distributor Road to allow large pieces of brewery equipment to be transported to the brewery site from Newport Docks. The transportation of equipment will result in the closure of particular sections of the A48/SDR for up to 10 hours overnight on arranged dates for a 21 month duration. It is therefore essential that discussions are held with Newport City Council on a regular basis to ensure all dates of the Brewery transportation activities are known and that these works do not coincide with the Brynglas Tunnel Refurbishment night time closures as the Brewery activities will impact the availability of the diversion route.

13.4.3 Glebelands Residential Housing Development

The planned housing development to the south of the Glebelands will provide 153 houses, 102 of which will be built within the timeframe of the Brynglas Tunnel Refurbishments.

The developers have confirmed that the primary entrance route for this development will be via Turner Street with East Usk Road being used as an alternative for abnormal loads. As a result it is not anticipated that there will be any interaction with the construction traffic for the Brynglas Tunnel Refurbishments or impacts to the Glebelands development and construction activities.

13.4.4 Former Sainsbury's Housing Development

The planned housing development to the south of Shaftesbury Park will provide 140 houses, 135 of which will be built within the timeframe of the Brynglas Tunnel Refurbishments.

Given its location it is not anticipated that the Brynglas Tunnel Refurbishments will affect the construction traffic to this site, and given the nature of the development it is unlikely that the proposed night time closures will have any impact.

13.4.5 Former Bettws Comprehensive Housing Development

The ongoing housing development project on the site of the former Bettws Comprehensive school will provide 215 houses, 35 of which will be built within the timeframe of the Brynglas Tunnel Refurbishments.

Given its location it is not anticipated that the Brynglas Tunnel Refurbishments will affect the construction traffic to this site, and given the nature of the development it is unlikely that the proposed night time closures will have any impact.

13.4.6 Bank Street

Planning permission has been granted for the construction of two new dwellings on land to the east of 14a Glen Coed Bungalow, Bank Street. It is assumed that works will commence in early 2016. These works will coincide with the Brynglas Tunnel Refurbishments and therefore it will be essential for the Contractor to liaise and work collaboratively throughout the construction-phase particularly in relation to large deliveries. Bank Street is a residential road which is the main access route to Glebelands Recreational Ground and the location of the main site compound. Given the nature of the works proposed and providing successful consultation between contracting parties takes place, it is not anticipated that there will be any in-combination effects to the Improvements upon any of the receptors identified in Table 13-1 above.

13.4.7 Natural Resources Wales Flood Defence Scheme

During the construction-phase of the Brynglas Tunnel Refurbishments, on the south western bank of the River Usk, NRW will be carrying out works to the banks of the watercourse as part of their flood defence strategy. The flood defence works will be carried out immediately downstream of the Brynglas Tunnel Refurbishments and the River Usk Viaduct. Although the site compound and main points of entry of works for the Refurbishments will be from Glebelands Recreational Ground, there may be the need to (at times) access the eastern bank of the River Usk via Albany Street and the Public Right of Way which passes beneath the River Usk Viaduct. At this stage interface between working parties is considered to be limited given the main access points to the River Usk Viaduct and the interceptor working area will be gained from Glebelands Recreational Ground or the M4 hard shoulder.

14 SUMMARY AND ENVIRONMENTAL MANAGEMENT PLAN

This section summarises the issues and mitigation measures identified within each Chapter before and after mitigation assessment. In addition, the plan also identifies who is responsible for addressing these matters. The Environmental Management Plan presented below includes requirements for all topics including those which have been scoped out.

14.1.1 Environmental Management Plan

TOPIC CHAPTER	ISSUES	MITIGATION & ENHANCEMENT	RESPONSIBILITY
Chapter 5- Air Quality: Emissions to air	Impact of construction dust to receptors to properties at Malpas, Glebelands and properties positioned on top of the Tunnel.	The Institute of Air Quality Management (IAQM) Guidance on the Assessment of Dust from Demolition and Construction should be applied.	Contractor
		Mitigation measures in relation to controlling the construction impacts would be included in the Construction Environmental Management Plan (CEMP).	Contractor
		The SDR is the only traffic diversion route to be used during the course of the works to ensure the AQMAs currently in place with NCC remain unaffected.	Contractor/ NCC
		Contained working areas to be provided to minimise any dust/ impacts to air quality (such as when working beneath the River Usk Viaduct, inside the Tunnel and within close proximity to any other receptor)	Contractor
Landscape	To avoid the spread of invasive plant species. Landscape impacts resulting from temporary vegetation loss.	The Contractor shall demarcate all areas of Japanese Knotweed within the working area. This will need to be carried out immediately upon appointment before it completely dies back for the winter. The areas will be treated in accordance with best practice guidelines and under a method statement as agreed with NCC.	Contractor

TOPIC CHAPTER	ISSUES	MITIGATION & ENHANCEMENT	RESPONSIBILITY
		The Contractor will be responsible for agreeing a landscape design for the footprints of the Improvement works. These are to be agreed with the Employer, NCC and SWTRA.	Contractor
		The Improvement locations within the scheme footprint will be subject to an after-care period and maintenance.	Contractor
		The Contractor will draft a method statement in relation to working within areas infested with Japanese Knotweed. The Contractor will submit the method statement to the Employer and NCC for approval. The Contractor will also provide a copy of the method statement to the EHO for review and comment too.	Contractor
		The area behind Pant Road will be subject to aftercare and Japanese Knotweed will be treated. Upon completion of the aftercare period or as soon as Japanese Knotweed has been eradicated from the area (whichever happens first), the Contractor will liaise with SWTRA and NCC and review an appropriate planting and/or seeding mix for the area and management approach.	Contractor/SWTRA/NCC
Chapter 6: Ecology & Nature Conservation	▪ Disturbance to, permanent and temporary loss of habitats along the road verge,	The Contractor will undertake pre-construction surveys for otters along the River Usk, Malpas Brook and the Brecon and Monmouthshire Canal prior to works commencing adjacent to the canal.	Contractor

TOPIC CHAPTER	ISSUES	MITIGATION & ENHANCEMENT	RESPONSIBILITY
	▪ Permanent and temporary loss of reptile habitat. ▪ Potential disturbance to nesting birds. ▪ Potential disturbance to hibernating/ roosting bats. ▪ Disturbance to otters as a result of construction. ▪ Impacts to the River Usk SAC and SSSI.	Any requirements in relation to bats will be provided to the Contractor by the Employer upon appointment as surveys are currently underway.	Contractor
		The Contractor will be responsible for ensuring a robust Pollution Control Plan is in place particularly in relation to the River Usk.	Contractor
		SSSI Assent will be required to work above the River Usk. This will be incorporated into the Flood Defence which the Contractor will submit upon appointment to NRW.	Contractor
		The Contract will be responsible for ensuring that no site lighting (including compound security lighting) is directed at the River Usk or along its banks.	Contractor
		All works above the River Usk and in the surrounding area must remain outside with wetted channel and must also remain >1m away from the top of bank. The Contractor will be responsible for assessing construction-phase activities to ensure this is the case at all times unless the Contractor has obtained prior agreement/ assent from NRW.	Contractor
		The Contractor will be responsible for ensuring safe passage for otters along the banks of the River Usk and beneath the Malpas Viaduct at all times.	Contractor

TOPIC CHAPTER	ISSUES	MITIGATION & ENHANCEMENT	RESPONSIBILITY
		The contractor will ensure that the compound is placed outside of the boundary of the River Usk SAC/SSSI (usually 1m either side of the river bank). The exact location will be agreed with NCC and NRW	Contractor/NCC/NRW
		Where any site clearance is undertaken, materials should be used to create brash piles outside of the working area to provide refuges for reptiles, amphibians and small mammals.	Contractor
Geology & Soils	▪ Possibility of encountering contamination during construction activities.	The Contractor will be responsible for undertaking soil sampling at the pre-construction phase in accordance with best practice. The Contractor will need to confirm existing ground conditions at the temporary site compound location.	Contractor
		Soil sampling will be carried out by the Contractor upon removal of the temporary site compound to confirm ground conditions have not changed.	Contractor
		The Contractor will be responsible for the undertaking of soil sampling and testing at any proposed excavation location to confirm soil condition.	Contractor

TOPIC CHAPTER	ISSUES	MITIGATION & ENHANCEMENT	RESPONSIBILITY
Chapter 7: Materials	▪ Transportation of CD& E materials and waste. ▪ Utilisation of waste infrastructure sites. ▪ Depletion of finite natural resources e.g. aggregate for construction. ▪ Decreased landfill capacity. ▪ Material damage or wasting.	Where practicable, specification and procurement of material resources will utilise those that are: locally sourced; use local skilled labour to install; are low in carbon, environmental and user health impact; durable; include recycled materials; and are responsibly sourced.	Contractor
		The Contractor will adopt the BES 6001 Responsible Sourcing of Construction Products Standard	Contractor
		Adoption and implementation of the CEMP to ensure that consideration is given to material requirements throughout the maintenance and improvements and that vehicle movements are kept to a practicable minimum.	Contractor
		Adoption of 'Just in time delivery' to alleviate space constraints for storage, site congestion and provision of safe, secure and protected material storage areas.	Contractor
		Adoption of the waste hierarchy.	Contractor
		Careful quality control during the maintenance and improvement works.	Contractor
		The Contractor will complete the SWMP and ensure its implementation during the works.	Contractor/NRW
		Representative noise survey locations have been agreed with Newport City Council by the Employer. The	NCC/Contractor

TOPIC CHAPTER	ISSUES	MITIGATION & ENHANCEMENT	RESPONSIBILITY
Chapter 8: Noise & Vibration	Noise and Vibration levels exceeding the acceptable levels during construction work – especially at residential receptors.	Contractor will be responsible for any subsequent monitoring during the construction-phase.	
		The Contractor will be responsible for reviewing works methods and techniques and ensuring mitigation in line with best practice and requirements set out by the EHO are implemented.	Contractor
		The Contractor will review the approaches to works and mitigation will need to be discussed with the Environmental Health Officer at Newport City Council. Works may need to be phased to minimise disturbance.	Contractor
		BS 5228 2009 +A1:2014 *"Code of practice for noise and vibration control on construction and open sites"*- Part 1 will be adhered to.	Contractor
		BS 5228 2009 +A1 2014, *Code of practice for noise and vibration control on construction and open sites*' - Part 2: will be adhered to.	Contractor
		The possibility of submitting a Section 61 Consent Application in terms of the Control of Pollution Act 1974 (Ref 8-5) could be considered. This would allow for consideration of a detailed construction programme and method statement that would allow for selection of the most appropriate mitigation measures. Only essential work will take place over weekends and night-time. These are works that are only possible to carry out during closure of the M4.	Contractor

TOPIC CHAPTER	ISSUES	MITIGATION & ENHANCEMENT	RESPONSIBILITY
		Careful selection of plant and construction methods. Only plant conforming to relevant national, EU or international standards, directives and recommendations on noise and vibration emissions would be used.	Contractor
		Reversing alarms incorporating one of more of the features listed below or any other comparable system would be used where reasonably practicable: Highly directional sounders; Use of broad band signals; Self-adjusting output sounders; and Flashing warning lights.	Contractor
		All generators and compressors would be 'sound reduced' models fitted with acoustic lining/sealed acoustic covers where appropriate. All ancillary pneumatic percussive tools would be fitted with mufflers or silencers as recommended by the manufacturer.	Contractor
		Where reasonably practicable, fixed items of construction plant would be electrically powered in preference to diesel or petrol driven.	Contractor

TOPIC CHAPTER	ISSUES	MITIGATION & ENHANCEMENT	RESPONSIBILITY
		Plant and equipment liable to create noise and/or vibration whilst in operation would, as far as reasonably practicable, be located away from sensitive receptors and away from walls reflecting towards sensitive receptors.	Contractor
		Percussive piling would only be used where no other suitable system is available.	Contractor
		All machines in intermittent use shall be shut down in the intervening periods between works or throttled down to a minimum. Lorry engines would be switched off when vehicles are stationary. Noise emitting equipment which is required to run continuously shall be housed in a suitable acoustic enclosure.	Contractor
		All compressors and generators shall be "sound reduced" models fitted with properly lined and sealed acoustic covers which shall be kept closed whenever the machines are in use, and all pneumatic percussive tools shall be fitted with mufflers or silencers of the type recommended by the manufacturers.	Contractor
		All vehicles and mechanical plant used for the purpose of the work shall be fitted with effective exhaust silencers and shall be maintained in good and efficient working order and operated to minimise noise emissions.	Contractor

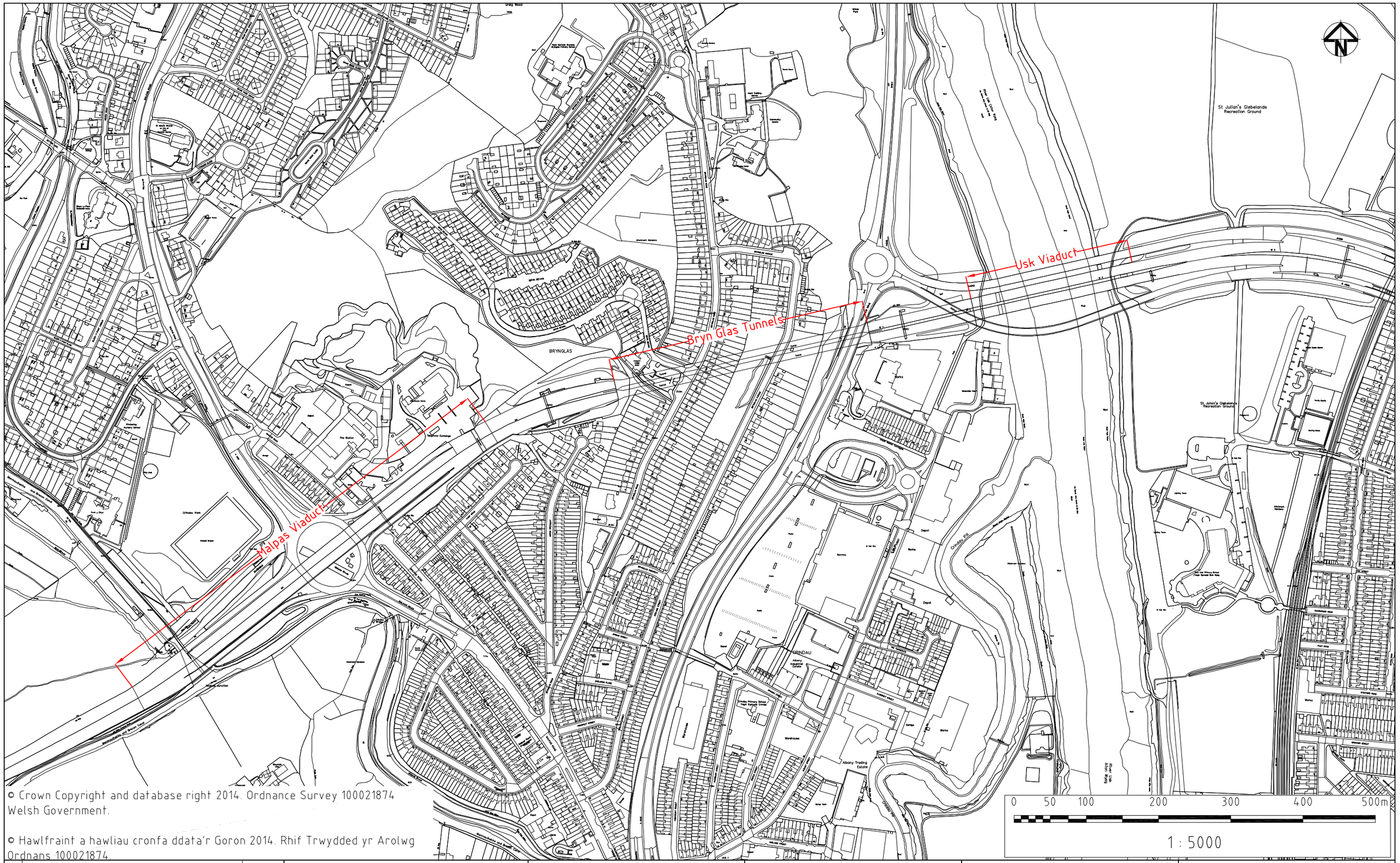
TOPIC CHAPTER	ISSUES	MITIGATION & ENHANCEMENT	RESPONSIBILITY
		Temporary noise barriers would be used to reduce noise levels where appropriate and practicable. Such measures can be particularly appropriate for stationary or near-stationary plant such as pneumatic breakers, piling rigs and compressors. Barriers would be located as close to the plant as possible and, in order to provide adequate attenuation, would have a mass per unit area of at least 7 kg/m2.	Contractor
Chapter 9: Effects On All Travellers		Continued liaison with ABP and mariners to be carried out over the course of the works.	Contractor
		Notice to all mariners to be served.	Contractor
		The SDR is the only route to be used by diverted traffic during the night closures. Other diversion routes are not to be signed or made widely available for M4 traffic.	Contractor/NCC
		Sufficient notice to be given regarding any closures and public information made available.	Contractor

TOPIC CHAPTER	ISSUES	MITIGATION & ENHANCEMENT	RESPONSIBILITY
		Continued liaison with NCC.	Contractor
Chapter 10: Community & Private Assets	Minimise disturbance and impacts to location residents and other social receptors.	Local residents will be kept informed and notified of working programme by the Contractor.	Contractor
		A list of key local events such as football and rugby matches will be drafted and the works should be time to ensure any road closures avoid these dates.	NCC/Contractor
		All main contractors will be required to sign up and adhere to the Considerate Construction Scheme which promotes good practice on construction sites.	Contractor
		The area of Glebeland Park to be used to house the construction compound will be reinstated to its current condition following the works	Contractor
		The CEMP will include appropriate information concerning works and possible traffic diversion measures	Contractor
		The CEMP will include appropriate information relating to the temporary use of the Glebelands Park area to locate the construction compound.	Contractor

TOPIC CHAPTER	ISSUES	MITIGATION & ENHANCEMENT	RESPONSIBILITY
Chapter 11: Road Drainage & the Water Environment	▪ Risk of mobilising suspended solids in runoff from works areas. ▪ Spillage of fuels, lubricants and hydraulic fluids from construction plant and subsequent contamination of the water environment. ▪ Scheme discharges of runoff from the highway pose a risk of acute pollution of receiving watercourses in an accidental spill scenario. ▪ Ensuring full awareness of flood risk during construction-phase.	The Contractor will ensure pollution control measures are in place at any works location adjacent to any controlled waters.	Contractor
		The Contractor will ensure that the identified aquifer within the scheme boundary does not receive highway runoff.	Contractor
		All potential pollution pathways will be identified by the Contractor prior to start of works on site commencing.	Contractor
		Emergency response plan to be provided to NRW by the Contractor detailing approaches to be adopted in relation to high tides and strong storm events.	Contractor
		Contractor to sign up to NRW flood warning and high tide alerts.	Contractor
		The scaffolding beneath the Usk viaduct should not cover the entire bridge at any one time.	Contractor
		Marine Licence to cover any works above the River Usk or within the wetted channel.	Contractor
		Notice to all Mariners.	Contractor

TOPIC CHAPTER	ISSUES	MITIGATION & ENHANCEMENT	RESPONSIBILITY
Licenses, Consents & Permits		Flood Defence Consent to cover temporary works and potentially the site compound if within 7m of the top of bank.	Contractor
		SSSI Assent (detailed and covered by FDC but do check this is still the case).	Contractor
		AIES screening report to be submitted and content agreed by the Contractor.	Contractor
		Ordinary water consent if any works to be undertaken to the Malpas Brook (from NCC).	Contractor
		Environmental Permit if excavated materials are to be resued and a permit is required.	Contractor

Figures



Issue	Description	Date
01	PRELIMINARY DESIGN	27/03/15

Client: Llywodraeth Cymru Welsh Government

Status: PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION

Scales	1:5000	Current Issue Signatures	
		Author N.CLEMENTS	
Original Size	A3	Checker C.BURGHAM-MALIN	
Height Datum	DATUM	Approver J. PHILLIPS	
Grid	GRID	© Copyright reserved	
Filename:	007-UA007844-01.DWG		

Project: M4 BRYN GLAS TUNNELS

Title: OVERALL LOCATION PLAN

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Drawing No.	Project No.	Issue
007	— UA007844 —	01

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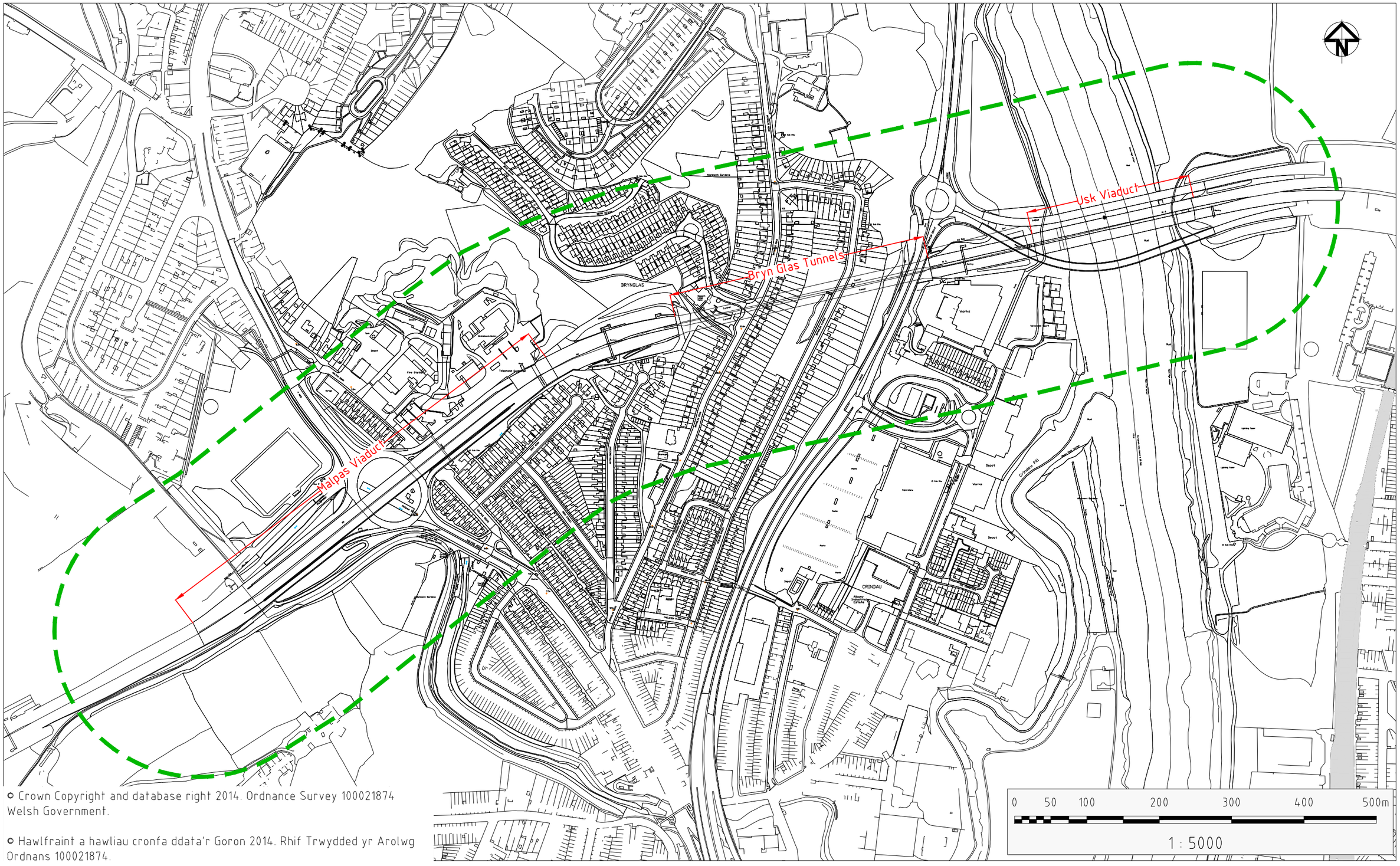

Rev	Date	Description	Drawn	Check	Approv
01	22.10.15	FIRST ISSUE	JN	AE	APP

NOTES:

KEY

APPROXIMATE 200m BUFFER

Client

Llywodraeth Cymru
Welsh Government

Site

Address
City

WELSH GOVERNMENT

Client

Company name 1
Company name 2
Address
City and postcode
Phone: +44 (0)0 000 00 00
Fax +44 (0)0 000 00 00
client@internet.com
www.client.com

Suitability Description:

Suitability description

Suitability description comment

Designed	X. XXXXX	Date XXJANXX	Signed
Drawn	J.NORMAN	Date XXJANXX	Signed
Checked	A.ELLIS	Date XXJANXX	Signed
Approved	X. XXXXX	Date XXJANXX	Signed
Scale:	1:5000	Datum:	AOD
Original Size:	A3	Grid:	OS
Suitability Code:	Sx	Project Number:	UA007844

PROJECT:

M4
BRYN GLAS
TUNNELS

TITLE:

Air Quality

ARCADIS Design & Consultancy for natural and built assets

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Revision: 01

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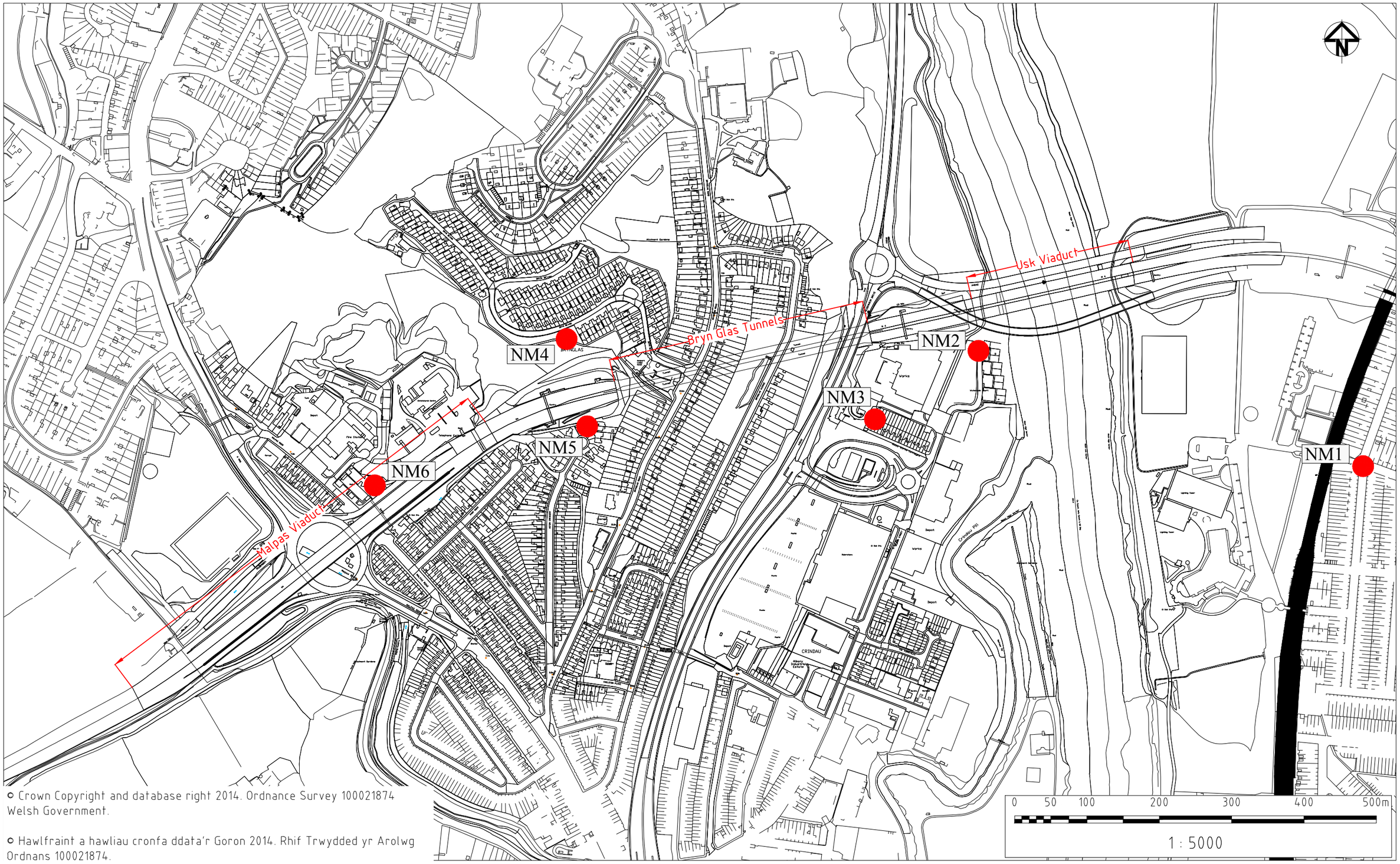

Rev	Date	Description	Drawn	Check	Approv
01	22.10.15	FIRST ISSUE	JN	AE	APP

NOTES:

KEY

PROPOSED MONITORING LOCATIONS

NM1 - BANK STREET
NM2 - WATERSIDE COURT
NM3 - GLASSWORKS COTTAGES
NM4 - BRYN BEVAN
NM5 - ASTON CRESCENT
NM6 - IBIS HOTEL/ MALPAS ROAD

Client

Llywodraeth Cymru
Welsh Government

Site

Address
City

WELSH GOVERNMENT

Client

Company name 1
Company name 2
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City and postcode
Phone +44 (0)0 000 00 00
Fax +44 (0)0 000 00 00
client@internet.com
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Suitability Description:

Suitability description

Suitability description comment

Designed	X. XXXXX	Date XXJANXX	Signed
Drawn	J.NORMAN	Date XXJANXX	Signed
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PROJECT:

M4
BRYN GLAS
TUNNELS

TITLE:

Noise and Vibration
Monitoring Plan

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APPENDIX A

Ecological extended Phase 1 habitat survey report

Brynglas Tunnels Refurbishments

Preliminary Ecological Assessment

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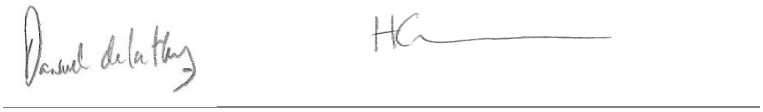
Brynglas Tunnels Refurbishments

Preliminary Ecological Assessment

Author	Daniel de la Hey/ Hannah Corcoran	
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Approver	Jon Davies	

Report No 007-UA007844-UE21-R-01

Date April 2015

CONTENTS

SUMMARY

Hyder Consulting (UK) Ltd were commissioned by the Welsh Government to undertake a preliminary ecological assessment, comprising an extended Phase 1 Habitat Survey and desk study, of the Brynglas Tunnels Refurbishment Project, Newport. The aims of the survey were to:

- Identify any notable habitats or species that could pose potential constraints to the scheme;
- Identify potential impacts of the scheme on ecological receptors;
- Outline any recommendations for avoiding, minimising or offsetting any predicted adverse effects on ecological receptors.

The survey confirmed the presence of a range of habitat types potentially suitable for supporting a number of protected species including bats, badgers (*Meles meles*), great crested newts *(Triturus cristatus),* reptiles and breeding birds.

Given the nature of the scheme (repairs and maintenance) to the existing M4 carriageway and structures, there is anticipated to be limited impact upon the surrounding area and ecological receptors. However, a number of further surveys are recommended in the Conclusions and Recommendations section of this document.

1 Introduction

Hyder Consulting (UK) Plc were appointed by the Welsh Government to undertake an Extended Phase 1 Habitat Survey of the Brynglas Tunnels, Malpas and River Usk Viaducts and immediate surrounding areas. The site is located to the north of Newport, South Wales, grid reference ST 31485 89963 (refer to Figures 1 and 2). The scheme area and site boundary (including the three structures) are shown inside the redline boundary as indicated on Figure 2. The scheme carries the existing M4 between Junctions 25a to 26.

The proposed works involve a range of targeted activities such as resurfacing of the existing carriageway and strengthening of the River Usk Viaduct, as well as the installation of a fire main, petrol interceptor and pollution containment tank. The water supply to the tunnel portals and the installation of drainage attenuation are intended to be carried out as small scale advanced works at the end of 2015.

The purpose of the Extended Phase 1 Habitat Survey was to identify the presence or likely presence of protected species and habitats across the site, in order to inform the environmental assessment process and to identify whether any further targeted ecological surveys are required.

2 Methodology

The study comprised a desk-based exercise and an Extended Phase 1 Habitat Survey which was undertaken in March 2015.

2.1 Desk Study

The desk based study involved a combination of a web-based search and a data request consultation with the South East Wales Biological Records Centre (SEWBReC).

The online mapping resource provided by the Countryside Council for Wales (CCW, now Natural Resources Wales (NRW)) was used to search for any statutory designated sites of nature conservation importance within a specific radius of the site boundaries, as follows:

- Special Protection Areas (SPAs) and Ramsar Sites designated for their bird interests within a 30km radius);
- Special Areas of Conservation (SACs) within a 30km radius; and
- Sites of Special Scientific Interest (SSSIs) and all other statutory designated sites within a 2km radius.

Records of protected or otherwise notable species of conservation concern within 2km of the proposed development site boundary were obtained from SEWBReC. In addition, citations of any non-statutory designated sites within a 2km radius of the site, including County Wildlife Sites (CWS), were also obtained. Local Wildlife Sites (LWSs) are identified and selected for their local nature conservation value. They protect threatened species and habitats acting as buffers, stepping stones and corridors between nationally-designated wildlife sites.

2.2 Field Survey

An Extended Phase 1 Habitat Survey was undertaken in March 2015. Where access permitted, the survey area comprised all areas within the site boundary and the immediate surrounds. Refer to Figures 1 and 2. The main areas of focus were along the banks of the River Usk, to the south of the existing M4 at Malpas, and beneath the Malpas Viaduct at the western extent of the scheme corridor.

2.2.1 Phase 1 Habitat Survey

The habitat survey involved identifying and mapping the dominant habitat types following the NRW-approved Joint Nature Conservation Committee (JNCC) Phase 1 habitat survey methodology (JNCC, 2010). The outputs of this include a habitat map and a set of target notes (TNs) (which are provided in Figure 1 and Appendix A to this report). Dominant plant species were noted, as were any uncommon species or species indicative of particular habitat types. However, no attempt was made to compile exhaustive species lists.

Botanical names follow Stace (1997). Particular attention was paid to any hedgerows and trees within the survey area, and the status of each hedgerow with regard to the Hedgerows Regulations (1997) was also assessed using the Wildlife and Landscape Criteria.

2.2.2 Protected Species Survey

The Phase 1 Habitat survey was 'extended' to include an assessment of the potential for the habitats on site to support protected species, as follows:

- The likely value of any aquatic and/or terrestrial habitat on site for use by foraging and hibernating amphibians, particularly with regard to protected species such as great crested newt (*Triturus cristatus*). A Habitat Suitability Index (HSI) assessment was undertaken for each pond/waterbody identified within the proposed development site that contained water at the time of survey, to assess its suitability for supporting a population of breeding great crested newts. The likely value of any terrestrial habitat on site for use by foraging and hibernating reptiles was also assessed.

- The likely value of the site, and its immediate surroundings, in relation to suitability for use by roosting and/or foraging bats. Mature trees, buildings and other potentially suitable roosting opportunities within and adjacent to the site were reviewed (where possible) for their likely occupancy by roosting and/or hibernating bats.

- The likely value and suitability of hedgerows and scrub vegetation for supporting a population of dormice *(Muscardinus avellanarius).*

- The likely value and suitability of watercourses on and adjacent to the site to support fish and aquatic invertebrates, including white-clawed crayfish (*Austro-potamobius pallipes);*

- The likely value of the site for otter (*Lutra lutra*) in terms of foraging habitat and potential resting places, including a check for otter signs (to include holts, couches, footprints and spraints).

- The presence of any characteristic signs of badger (*Meles meles*) activity, including setts, latrines, paths, footprints, hairs and feeding signs.
- The likely value of the site for other protected or otherwise notable species or groups, including invertebrates.

3 Results

The results of the desk study and walkover survey are described below, with sites or features of particular nature conservation interest detailed as appropriate.

The Phase 1 habitat survey map is presented in Figure1, whilst the TNs are included in Appendix A. The results of the hedgerow assessment are presented in Appendices B and C.

3.1 Statutory Designated Sites

Four statutory designated sites were identified during the desk study.

The Scheme passes over the River Usk (Lower Usk) (at ST 314 899) which is designated as a Site of Scientific Interest (SSSI) and Special Area of Conservation (SAC).

The River Usk (Lower Usk) SSSI is a large mesotrophic lowland river, which has developed an extensive floodplain with a complex and active system of meanders, cut-offs and back channels. The river acts as an important wildlife corridor, migration route and breeding area for numerous species.

Other notable features of the SSSI include: diverse aquatic and riparian plant communities; an internationally important assemblage of fish species; a wide range of riverside breeding birds; notable mammal species including otter (*Lutra lutra*) and bat species such as Daubenton's bat (*Myotis daubentonii*); and important assemblages of craneflies (including rare and scarce species) and localised populations of white-clawed crayfish (*Austropotamobius pallipes*).

The River Usk/ Afon Wysg is also designated as a SAC for supporting the Annex I habitat 'watercourses of plain to montane levels with *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation', as well as the following Annex II species:

- Sea lamprey (*Petromyzon marinus*)
- Brook lamprey (*Lampetra planeri*)
- River lamprey (*Lampetra fluviatilis*)
- Twaite shad (*Alosa fallax*)
- Atlantic salmon (*Salmo salar*)
- Bullhead (*Cottus gobio*)
- Otter (*Lutra lutra*)

In addition, there are two bat SACs in the wider area. The Usk Bat Sites SAC, is located approximately 30km north of the Scheme, whilst the Wye Valley and Forest of Dean Bat Sites SAC is located approximately 22km to the north-east. The Wye Valley Woodlands SAC is located approximately 22km to the east of the Scheme.

The Usk Bat Sites SAC is primarily designated for supporting a large lesser horseshoe bat (*Rhinolophus hipposideros*) maternity roost and several hibernation sites located within caves. The SAC is believed to contain at least 5% of the UK's lesser horseshoe bat population. The Wye Valley and Forest of Dean Bat Sites SAC is designated for supporting the greatest concentration of lesser horseshoe bats in the UK (totalling 26% of the national population) and approximately 6% of the UK's greater horseshoe bat (*Rhinolophus ferrumequinum*) population. The SAC is considered to support an exceptional breeding population of lesser horseshoe bat, and also includes several hibernation sites, located within disused mines, used by both lesser and greater horseshoe bats. Lesser horseshoe bats are also a qualifying feature of the Wye Valley Woodlands SAC.

3.2 Non-Statutory Designated Sites

Eighteen non-statutory designated Sites of Importance for Nature Conservation (SINCs) were identified within 1km of the Scheme, and are detailed in Table 1. One SINC (Glebelands) spans the Scheme, and five are located immediately adjacent to, or in very close proximity to, the Scheme (namely Brynglas Wood, Crindau Field, Gwastad Mawr and the Monmouthshire & Brecon Canal (Crumlin Arm and Main Arm)).

Table 1: Non-statutory SINCs located within 1km of the Scheme.

SINC	**Approx. distance from Scheme**	**Reason for designation**
Allt-yr-yn (part of the SINC is also designated as a Local Nature Reserve (LNR) and a Gwent Wildlife Trust Nature Reserve).	50m south	Mosaic of ancient semi-natural woodland, regenerating woodland, ponds and semi-and unimproved neutral grasslands.
Barrack Hill	400m south	A large mosaic site with semi improved wet and dry neutral grassland, scrub and bracken with small stream and drains.
Barrack Hill Woodland	100m south	Mixed Beech (*Fagus sylvatica*), oak (*Quercus* sp.) and Ash (*Fraxinus excelsior*) woodland.
Bettws Angling	400m north	Mosaic habitat including scrub, waterbodies and grassland.
Bettws Empoundment	700m north	Mosaic of marshy grassland and known otter (*Lutra lutra*) holt recorded on the site. Malpas Brook flows through the SINC.
Brynglas Wood	10m north	Semi-natural recent woodland with rich ground flora including abundant Bluebell (*Hyacinthoides*

SINC	Approx. distance from Scheme	Reason for designation
		non-scripta) and Wood Anemone (*Anemone nemorosa*).
Canal Fields	900m north	Mosaic of unimproved, marshy and semi improved grassland adjacent to the Monmouthshire & Brecon Canal and the Malpas Brook/ Bettws Brook.
Coed Kemeys	900m north	Ancient semi-natural woodland.
Crindau Field	10m north	Mosaic habitat including scrub.
Crindau Pill	200m south	Fresh waterstream used by otters.
Glebelands	Spans Scheme	Large site on a former landfill comprised of amenity grassland, and to the north of the site, woodland and scrub. SINC forms part of the River Usk Corridor.
Graig Wood	350m north	Ancient semi-natural woodland.
Gwastad Mawr	0m north	Marshy grasslands and improved grassland mosaic within wet ditches and ponds. Diverse invertebrate fauna recorded on site.
Malpas Brook/ Bettws Brook	300m north	Freshwater brook.
Monmouthshire & Brecon Canal (Crumlin Arm)	10m south	Site is a disused linear waterway supporting standing open water habitat, a variety of adjacent habitats and associated species including otters.
Monmouthshire & Brecon Canal (Main Arm)	0m north	Freshwater canal.
Moorings	550m north	Site supports fen and reedbed habitats and includes a breeding population of Cetti's warbler (*Cettia cetti*).
Pilton Vale Brook	700m north	Freshwater linear brook and tributaries supporting swamp and semi-improved neutral grassland habitats. Otter recorded on site.

3.3 Plants and Habitats

SEWBReC held records of a number of protected plant species/species of principal importance listed under Section 42 of the NERC Act (2006) located within 1km of the Scheme, including Bluebell (*Hyacinthoides non-scripta*), Red-tipped Cudweed (*Filago lutescens*) and Red Hemp-nettle (*Galeopsis angustifolia*). The majority of these records

were associated with Gwasted Mawr SINC and Allt-yr-yn SINC/ LNR/ Gwent Wildlife Trust Nature Reserve.

SEWBReC also held a number of records of 'notable' plants (including species regarded as 'Locally Important', LBAP species and UK Red Data Book-listed species) located within or in close proximity to the Scheme. These again related to the Gwasted Mawr SINC, Allt-yr-yn SINC/ LNR/ Gwent Wildlife Trust Nature Reserve, and also the Glebelands SINC, and included Compact Brome (*Anisantha madritensis*), Chives (*Allium schoenoprasum*), Hog's Fennel (*Peucedanum officinale*), Good-King-Henry (*Chenopodium bonus-henricus*) and Charlock (*Sinapis arvensis*).

During the survey, a range of habitat conditions were found to be present within the scheme boundary. Such habitats included mudflats within the channel of the River Usk, which is crossed by the River Usk Viaduct and currently carries the M4 motorway. The mudflats are exposed at times of low tide. Mudflats are characterised by high biological productivity and abundance of organisms, but low diversity, with few rare species. Intertidal mudflats are considered a Priority Habitat for Conservation of Biological Importance in Wales (NERC Act 2006).

Areas of neutral semi-improved grassland were also found during the survey (see Figure 1). These grassland areas were dominated by species such as Couch species (*Elymus spp.*) and Creeping Bent *(Agrostis stoli*), and Sea Beet (*Beta vulgaris* subsp. *Maritima*) was also identified, as well as areas supporting Common Reed (*Phragmites australis*). Amenity grassland areas at both the eastern and western extents of the scheme were found to be species-poor, intensively managed and supported Perennial Rye-grass (*Lolium perenne*), Creeping Buttercup (*Ranunculus repens*) and White Clover (*Trifolium repens*).

Particularly at the eastern extent of the scheme corridor, but at locations throughout, patches of dense Bramble and scrub were also identified.

Along the southern extent of the M4, forming part of the Monmouthshire & Brecon Canal corridor, sections of broad-leaved woodland were also identified. Species present included mature Ash (*Fraxinus*) trees, semi-mature Alder (*Alnus glutinosa*), Pedunculate Oak (*Quercus robur)* and Hazel (*Corylus avellana*). Canals are considered a Priority Habitat for Conservation of Biological Importance in Wales (NERC Act, 2006)

The Monmouthshire & Brecon Canal at Malpas (TN 7) supports marginal and aquatic vegetation including Common Reed (*Phragmites australis*), Common Water Star-wort (*Callitriche marginata*), Yellow Flag Iris (*Iris pseudacorus***)** and Marsh Marigold *(Caltha palustris).*

Passing beneath the Monmouthshire & Brecon Canal is the Malpas Brook (TN 6), which flows through the centre of Junction 26. At the far western extent of the scheme, the Malpas Brook comprises a stone substrate with a wooded riparian zone. However, Japanese Knotweed (*Fallopia japonica)* was identified on both banks of the watercourse (refer to Section 3.3.1 below). Where the Malpas Brook flows through Junction 26, the channel becomes canalised, and has been previously subject to heavy engineering. Rivers are considered a Priority Habitat for Conservation of Biological Importance in Wales (NERC Act, 2006).

No rare or uncommon plant species were observed during the survey.

3.3.1 Invasive Plant Species

SEWBReC held a number of records for invasive plant species, listed under Schedule 9 of the Wildlife and Countryside Act 1981 (as amended), located within or in close proximity to the Scheme. These records originated from the M4, the A4042 Usk River Bridge, Gwasted Mawr SINC, Allt-yr-yn SINC/ LNR/ Gwent Wildlife Trust Nature Reserve, the Monmouthshire & Brecon Canal and the Glebelands SINC and included:

- Japanese Knotweed (*Fallopia japonica*)
- Sea-buckthorn (*Hippophae rhamnoides*)
- Indian Balsam (*Impatiens glandulifera*)
- Japanese Rose (*Rosa rugosa*)
- Rhododendron (*Rhododendron ponticum*)

Japanese knotweed was recorded in most areas within the scheme boundary during the Phase 1 survey (see Figure 1). Key locations included: both the east and west banks of the River Usk; significant, dense stands of Knotweed at the rear of the properties on Pant Road (immediately to the south of the Malpas Viaduct); and along the banks of Malpas Brook and immediately adjacent to the Malpas Viaduct to the south of the existing M4 along the woodland edge. Stands of Japanese Knotweed were also identified infrequently on the existing M4 soft estate.

No other invasive plant species were identified during the survey. However, the site visit was undertaken in late winter when some species may not have been visible.

3.4 Terrestrial and Aquatic Invertebrates

SEWBReC held a number of records of protected invertebrate species/species of principal importance listed under Section 42 of the NERC Act (2006) located within 1km of the Scheme. This included one white-clawed crayfish record (from 1999) originating from Gwasted Mawr SINC. In addition, web-based searches also revealed records of white-clawed crayfish in the Malpas Brook.

The majority of invertebrate records represented large wainscot (*Rhizedra lutosa*) records originating at Haisbro Avenue, Newport. SEWBReC also held a number of records of 'notable' invertebrate species (including LBAP and UK Red Data Book listed species) located within or in close proximity to the Scheme. These records originated from the Gwasted Mawr SINC, Allt-yr-yn SINC/ LNR/ Gwent Wildlife Trust Nature Reserve and the Glebelands SINC, and included variable damselfly (*Coenagrion pulchellum*) and moth species such as orange footman (*Eilema sororcula*) tansy plume (*Platyptilia ochrodactyla*) and scarlet tiger (*Callimorpha dominula*).

During the survey, no species of interest were identified. However, a range of habitat conditions were found to be present in areas adjacent to the existing M4, although outside of the anticipated working area (e.g. along the Brecon and Monmouthshire Canal).

3.5 Amphibians

The SEWBReC desk study search revealed one great crested newt (*Triturus cristatus*) record (from 2002), located approximately 0.8km north from the Scheme (at ST 305905). The desk study also revealed a number of records for common frog (*Rana temporaria*), common toad (*Bufo bufo*), smooth newt (*Lissotriton vulgaris*) and palmate newt (*Lissotriton helveticus*) (from 1999-2014) located within 1km of the Scheme. The majority of these records were associated with Gwastad Mawr SINC, Kimberly Park, the Brecon and Monmouthshire Canal and Allt-yr-yn SINC/ LNR/ Gwent Wildlife Trust Nature Reserve.

The eastern extent of the scheme corridor in the vicinity of the River Usk Viaduct did not comprise suitable habitat for use by great crested newts, particularly given the high tidal range of the River Usk. However, the survey did identify three waterbodies with the potential for use by breeding great crested newts. In addition, suitable surrounding terrestrial habitat was also identified.

At the rear of Pant Road immediately to the west of the Brynglas Tunnels, a shallow small ditch was identified with aquatic vegetation present, such as Duckweed and Common Water Starwort (TN 9). In addition, disused sections of the Brecon and Monmouthshire Canal were also identified as providing potentially suitable habitat conditions for use by breeding great crested newts. The disused canal sections comprised large areas of Common Reed and other aquatic plant species (these could not be effectively identified as they were located on the opposite side of the Canal along a section which was not accessible).

In addition, to the north of the Malpas Viaduct and adjacent to the canal, there were large areas of marshy grassland comprising suitable foraging habitat for great crested newts, and to the south of the Malpas Viaduct, a small pond area was also identified (TN 4). However, this was heavily shaded and was considered likely to dry out at certain times of year; it also contained limited amounts of aquatic vegetation.

Overall, the HSI assessment of all waterbodies did not identify any ponds/ ditches of a good or excellent condition. The Brecon and Monmouthshire Canal was assessed as being of an Average quality (scoring 0.65), with the other two waterbodies being assessed as Poor quality (ponds 1 and 2 scored 0.37 and 0.41 respectively). For details of the HSI assessment, refer to Appendix B.

3.6 Reptiles

The SEWBReC records search revealed a number of slow-worm (*Anguis fragilis*), grass snake (*Natrix natrix*) and adder (*Vipera berus*) records (from 1999-2013), located within 1km of the Scheme. The majority of these records were associated with Gwastad Mawr SINC, Kimberly Park, the Monmouthshire & Brecon Canal, Allt-yr-yn SINC/ LNR/ Gwent Wildlife Trust Nature Reserve and Herbert Road, Newport.

Along the edges of the dense Bramble scrub on the western bank of the River Usk, grassland areas provided some limited suitable habitat for use by reptiles. However, given the proximity to the River Usk and its high tidal range, it was considered unlikely to support a stable reptile population.

Due to the residential gardens present along Pant Road (TN 8), the compost heaps and the unmanaged vegetative strip (which is now dense with Japanese Knotweed), it is considered possible that a small number of common reptile species, such as slow worms, could be present. However, given the isolated heavily urban surrounds, it is considered unlikely that reptiles would be present in large numbers.

The riparian woodland along the Malpas Brook and along the Brecon and Monmouthshire Canal would provide suitable foraging opportunities for Grass Snake (*Natrix natrix*).

Overall, the potential for reptiles to be present within the scheme corridor has been assessed as low, and they are very unlikely to be present within the working area.

3.7 Birds

The SEWBReC data review identified a large number of bird records located within 2km of the Scheme, the majority of which were associated with the River Usk, the Brecon and Monmouthshire Canal, Allt-yr-yn SINC/ LNR/ Gwent Wildlife Trust Nature Reserve and various locations within Newport, including the Ynys-y-fro Reservoir and Glebelands SINC. Fifteen species afforded full protection under Schedule 1 of the Wildlife and Countryside Act 1981 (as amended) have been recorded within 2km of the site, namely:

- black-tailed godwit (*Limosa limosa*)
- fieldfare (*Turdus pilaris*)
- Cetti's warbler (*Cettia cetti*)
- bearded tit (*Panurus biarmicus*)
- barn owl (*Tyto alba*)
- pied avocet (*Recurvirostra avosetta*)
- kingfisher (*Alcedo atthis*)
- hen harrier (*Circus cyaneus*)
- merlin (*Falco columbarius*)
- Eurasian Hobby (*Falco subbuteo*)
- red kite (*Milvus milvus*)
- peregrine falcon (*Falco peregrinus*)
- black-necked grebe (*Podiceps nigricollis*)
- redwing (*Turdus iliacus*)
- Mediterranean gull (*Larus melanocephalus*)

Nineteen species of principal importance listed under Section 42 of the NERC Act (2006), have been recorded within 2km of the Scheme, namely:

- yellow wagtail (*Motacilla flava*)
- song thrush (*Turdus philomelos*)
- dunnock (*Prunella modularis*)
- northern lapwing (Vanellus vanellus)
- Cetti's warbler
- bearded tit (*Panurus biarmicus*)
- barn owl (*Tyto alba*)
- linnet (*Linaria cannabina*)
- kestrel (*Falco tinnunculus*)
- black-tailed godwit (*Limosa limosa*)
- fieldfare
- lesser spotted woodpecker (*Dendrocopos minor*)
- black-headed gull (*Chroicocephalus ridibundus*)
- reed bunting (*Emberiza schoeniclus*)
- hen harrier
- merlin (*Falco columbarius*)
- Eurasian hobby
- Red kite
- Tree pipit (*Anthus trivialis*)

SEWBReC held a number of notable bird records (including LBAP and RSPB Welsh Red and Amber listed birds) located within or in close proximity to the Scheme. These records originated from the Gwasted Mawr SINC, Allt-yr-yn SINC/ LNR/ Gwent Wildlife Trust Nature Reserve, the Glebelands SINC and the Brecon and Monmouthshire Canal, and included Eurasian teal (*Anas crecca*), water rail (*Rallus aquaticus*), long-tailed tit (*Aegithalos caudatus*) and house martin (*Delichon urbicum*).

The viaduct structures provide a number of suitable ledges and fissures that could provide potential nesting opportunities for birds. However, given the volumes of traffic, disturbance and associated updraft, the tunnels are not considered suitable for use by breeding birds.

Areas within the soft estate and immediately adjacent to and beneath the structures (for example, areas of scrub) provide suitable nesting opportunities for breeding birds. However, heavy traffic and high levels of disturbance again reduce the suitability of some

of these areas. Common bird species were observed along the Brecon and Monmouthshire Canal during the survey. However, no species of conservation concern were identified. In addition, no waders or waterfowl were identified along the section of the River Usk crossed by the existing M4/ River Usk Viaduct.

3.8 Mammals

3.8.1 Bats

The SEWBReC desk study records revealed a number of common pipistrelle (*Pipistrellus pipistrellus*), soprano pipistrelle (*Pipistrellus pygmaeus*), noctule bat (*Nyctalus noctula*), whiskered/Brandt's bat (*Myotis mystacinus/ brandtii*), lesser horseshoe bat (*Rhinolophus hipposideros*), brown log-eared bat (*Plecotus auritus*) and Daubenton's bat (*Myotis daubentonii*) records located within 2km of the Scheme. The majority of these records were associated with Barack Hill/the Brecon and Monmouthshire Canal, and various locations in Newport, including the conurbations of Malpas, Caerleon and Bettws.

These records included: one brown long-eared bat and one unidentified bat roost record associated with residential properties located in the Newport conurbations of Bettws and Caeleon; one noctule bat roost record from the section of the Brecon and Monmouthshire Canal referred to as 'Fourteen Locks'; and a lesser horseshoe roost located at Llantarnum Abbey, Cwmbran.

Although there are several SACs located within 30km of the scheme which are designated for their bat populations, the structures on-site are mostly unsuitable for use by the qualifying interest species.

Both the Malpas and the River Usk Viaduct were identified as being potentially suitable for use by roosting bats (TNs 2 and 3). Although the structures form part of the existing M4, and are thus subject to high volumes of traffic, noise and vibration, access points appeared to be present into the main cavity of the structures. In addition, roosting bats may utilise areas of the structures where mortar is missing between sections of brickwork, particularly beneath the structures and along the parapets. Features of most interest include the River Usk Viaduct abutments on both the east and west banks. Although these structures do get inundated with tidal waters, the grilled entrance points provided access positions for bats.

During the survey, no attempts were made to demarcate all potential features as it is recommended that a licensed bat worker undertakes a site visit to inspect the structures further and to carry out more detailed inspections.

Bat foraging habitat was also identified along the scheme corridor, along the banks of the River Usk, along the Brecon and Monmouthshire Canal, and to the north of the Malpas Viaduct. There was a mature Ash tree (TN5), which supported features (such as rot holes, lifting bark and dead wood within the upper canopy of the tree) which were considered suitable to support roosting/hibernating bats. The Brecon and Monmouthshire Canal also provides a potential commuting route which could be utilised by bats.

3.8.2 Hazel Dormouse

No records of dormice were identified during the desk study, and no evidence of their presence was discovered during the survey. The woodland corridor along the Brecon

and Monmouthshire Canal was considered potentially suitable for use by dormice, with the presence of Hazel.

3.8.3 Badger

SEWBReC held no records of badger (*Meles meles*) within 2km of the Scheme.

No sign of badgers were recorded during the survey. However, beneath the eastern abutment of the River Usk Viaduct (TN 1), fresh signs of digging and a high level of activity was observed. It was not possible to access beneath the toe of the eastern abutment at the time of the survey, and therefore presence of badgers could not be confirmed.

3.8.4 Otter and Water Vole

SEWBReC held a number species of otter (*Lutra lutra*) records (from 1984-2014) and three water vole (*Arvicola amphibious*) records (from 1984-2012) located within 1km of the Scheme. The majority of these records were associated with the Monmouthshire & Brecon Canal (including where it passes under the M4), Malpas Brook (part of which is designated as a SINC), Gwastad Mawr SINC and various locations along the A4042 and the M4.

The River Usk provides suitable foraging habitat for otters, the Usk is designated as a SAC, in part, due to its otter population. The mudflats and grassland immediately adjacent to the River Usk have limited lying up and resting sites, particularly given the tidal regime of the River Usk. The areas of dense scrub may provide areas of temporary shelter for otters. However, the eastern bank in particularly is frequently used by dog walkers.

The Malpas Brook and the Brecon and Monmouthshire Canal both provide suitable habitat for water voles and otters. During the survey, no field signs confirming presence/ absence were identified. However, the surveys were undertaken in March 2015 where water vole surveys in particular would be carried out later in the year.

No potential otter holts were identified during the survey.

3.8.5 Other Mammals

SEWBReC held two records for hedgehog (*Erinaceus europaeus*), listed as a species of principal importance under Section 42 of the NERC Act (2006), originating from Lambert Street and Herbert Road, Newport.

As stated in Section 3.8.3 above, extensive digging and foraging activity was observed beneath the eastern abutment of the River Usk Viaduct. It is possible that this could be a result of other mammal activity.

3.9 Limitations

The survey comprised the proposed scheme corridor and areas to be directly impacted by the works which included the soft estate and immediately adjacent habitat areas.

Survey limitations included restricted access to the full northern side of the Malpas Viaduct due to restrictions associated with the canal crossing point and locked gates.

In addition, it was not possible to access beneath the eastern abutment of the River Usk Viaduct, where high levels of digging and ground disturbance, presumably by mammals, was observed. The limited access to this area was due to the high level fencing and the need to undertake hard shoulder stops to reach this location. In order to access this area (for any subsequent surveys) it will be necessary to liaise with South Wales Trunk Road Agency (SWTRA).

Access to the inside of the Brynglas Tunnels had been obtained during a night time closure in December 2014.

4 Conclusions and Recommendations

Although the River Usk is designated as a SAC and SSSI, the watercourse and qualifying features are not anticipated to be impacted by the proposed repair works.

No rare or uncommon plants or habitats were identified during the survey, and areas where mudflats have been identified will not be impacted by the works.

Japanese Knotweed has been identified in numerous locations along the scheme corridor, with a particularly dense area identified at the rear of the properties on Pant Road. It is proposed for a water main to be installed at this location, which would result in working in a contaminated area (refer to Figure 1). No other invasive species were identified during the survey, but the site visit was carried out in March 2015, and a review of the extent of invasive plant species is recommended for later in the year.

Desk study records revealed the presence of white-clawed crayfish in Malpas Brook. The watercourse will not be impacted by the works, and therefore no targeted further surveys recommended.

None of the water bodies identified will be impacted by the works being undertaken, although potential terrestrial habitat for amphibians will be impacted at the rear of Pant Road. However, the ditch was assessed in line with the Habitat Suitability Index (HSI) methodology, and scored 0.39, indicating low suitability. Given the isolated location of this ditch and the obvious presence of hydro-carbons, combined with the low HSI score, no further surveys of this waterbody are considered necessary.

In addition, as works at the western extent of the scheme are to be focused upon the carriageway, and no works are proposed to the underside of the structure, therefore no impacts are anticipated to the terrestrial habitat areas immediately adjacent to the Malpas Viaduct. In addition, no targeted great crested newt surveys are considered necessary for the Brecon and Monmouthshire Canal or Pond 2 either.

As identified in Section 3.6 above, the area behind Pant Road, given the presence of gardens and compost heaps, may provide suitable habitat for common species of reptiles (such as slow worms) although any population likely to be present is considered to be small. Consequently, further targeted reptile surveys in this area may be of benefit. However, it would be appropriate to review the extent of Japanese Knotweed later in the year, and whether this area has been subject to extensive treatment; if it hasn't it may remain dense, thereby reducing suitability for reptiles.

No further bird surveys are recommended. However, when the works are undertaken, nesting bird inspections should be considered and undertaken where appropriate.

Inspections to confirm the presence/absence of roosting bats from the River Usk Viaduct and Malpas Viaducts are recommended. The River Usk abutments also provide potentially suitable roosting opportunities. Although a section of the Malpas Viaduct is used for Traffic Management material storage, it does have entry points between the Viaduct walls and bridge deck which could be utilised by bats to access the area. In addition, inspections should also be carried out using a licensed bat worker to confirm presence/absence of roosting bats from any identified features on each of the structures. Where absence cannot be confirmed, further surveys, such as dusk emergence/dawn re-entry surveys, should be undertaken. The Brynglas Tunnels are not considered suitable for use by roosting bats due to the confined space, high volumes of fast moving traffic and disturbance.

It is recommended that access is obtained from SWTRA, and the area directly beneath the River Usk Viaduct is surveyed to confirm presence/absence of badgers.

Otters are one of the qualifying features of the River Usk SAC. Although no field signs were observed during the surveys, nor were any potential otter holts identified, the presence of otters using the banks of the River Usk should be assumed.

The Brecon and Monmouthshire Canal and the Malpas Brook are to remain unaffected by the proposed repair works to the Malpas Viaduct; therefore, further surveys to confirm the presence/absence of water voles are not considered necessary.

In summary, a number of further surveys are recommended based upon the scheme proposals drafted to date, particularly in relation to bats. However, it is important to note that the works proposed to be carried out are considered to be repairs and maintenance works, and therefore confined to the existing M4 structures.

5 References

Department for Environment, Food and Rural Affairs (DEFRA) http://jncc.defra.gov.uk/page-5706. Accessed in March 2015

Multi-Agency Geographical Information for the Countryside (MAGIC) website (www.magic.gov.uk). Accessed in December 2013.

JNCC (2010). Handbook for Phase 1 habitat survey. JNCC.

Stace, C. (1997). New Flora of the British Isles Second Edition. Cambridge University Press.

Appendix A
Phase 1 Habitat Survey Target Notes

Target Notes

Number	Description
1	Beneath the M4 motorway, River Usk Viaduct; which has areas of disturbed earth and foraging signs. Mammal activity, potentially badgers. No access to this area at the time of the survey.
2	Bridge abutments with barred gates through which bats could gain access to the structure. This structure was the east of the River Usk.
3	Bridge abutments with barred gates through which bats could gain access to the structure. This structure was the west of the River Usk.
4	Pond within a woodland strip which supported some emergent plant species such as Yellow-flag, the pond was shallow and filled with leaf litter. The pond was considered likely to dry up frequently and was adjudged to be 'poor' in respect to its ability to support great crested newts.
5	There was a mature Ash tree (TN5), which supported features (such as rot holes, lifting bark and dead wood within the upper canopy of the tree) which are considered suitable features to support roosting/hibernating bats
6	Malpas Brook is a stone-bottomed river bed, with a wooded riparian zone. However, Japanese Knotweed (*Fallopia japonica*) is present on both banks of the watercourse
7	The Monmouthshire & Brecon Canal at Malpas supports marginal and aquatic vegetation, including Common Reed, Common Water Star-wort, Yellow Flag Iris and Marsh Marigold. The canal was considered to be 'average' in respect to its ability to support great crested newts
8	The area behind the properties on Pant Road contains compost heaps and unmanaged vegetative strip (which is now dense with Japanese Knotweed); it is considered possible that a small number of common reptile, such as slow worms, could be present.
9	A shallow small ditch was identified with aquatic vegetation present, such as Duckweed and Common Water Starwort. The ditch was considered likely to dry up frequently, and was adjudged to be 'poor' in respect to its ability to support great crested newts

Appendix B

HSI Assessment

GREAT CRESTED NEWT SURVEY WATERBODY RECORD FORM

Contract no. UA007842	Contract name: Brynglas Tunnels

GENERAL DETAILS

Pond name/number: One	Grid reference:
Surveyors: DdlH & HC	Site status:
Date (dd/mm/yy): March 2015	Photograph number:

SKETCH OF WATERBODY
(annotate with dimensions and other relevant information)

DESCRIPTION OF WATERBODY

Approximate area (m^2): $5m^2$	Estimated maximum depth (m): 10cm
Approximate circumference (m): 21m	No. of 2m sections (for population estimates): 5

Water quality (good/moderate/poor/bad):

Poor due to presence of hydro-carbons (rainbow sheen on the surface).

(NB. **Good** = water normally clear with abundant and diverse invertebrate community including relatively sensitive groups *e.g.* mayfly larvae, water shrimps, amphibians (smooth newts and frog tadpoles) and fish; **Moderate** = moderate invertebrate diversity; **Poor** = low invertebrate diversity, species characteristic of low O_2 tension *e.g.* midge and mosquito larvae; **Bad** = clearly polluted, pollution tolerant invertebrates present (*e.g.* rat-tailed maggots), usually turbid, no submerged plants).

Pond permanence (provide indication of pond age and permanence):

Likely to dry up.

Perimeter shade (%): 0	Macrophyte cover (% of surface area):20%
Fish presence (species and estimated number): No	Waterfowl presence (species and estimated number): Absent

Description of marginal and aquatic vegetation present (note the presence of invasive exotic plant species *e.g.* Australian swamp stonecrop and water ferns). Also note access to pond by livestock, evidence of poaching and signs of bank erosion.

Common water starwort.

FURTHER INFORMATION

Description of surrounding area (include details of habitat types and extent, habitat connectivity, presence of adjacent waterbodies, suitable foraging and hibernating habitat, management of aquatic and terrestrial habitat and likely use of pesticides and fertiliser):

Grass path or extensive stands of Japanese knotweed, moderate terrestrial habitat. Given dense and extensive Japanese Knotweed present (subject to intensive spraying regime according to SWTRA) and isolated urban location- consider terrestrial habitat to be poor.

Other relevant details (include details of any other amphibian species observed):

Details of survey methods appropriate for waterbody (include details such as access, suitability for torch, bottle-trap and netting surveys, number of bottle traps required *etc.* The presence of invasive exotic plant species may exclude the use of certain survey techniques *e.g.* netting).

Torch, net and egg search possible of a section of ditch.

HAZARDS

Identify the presence of any potential hazards (*e.g.* deep silt, deep water, giant hogweed, fly-tipping *etc*).

In residential area, next to footpath, Japanese Knotweed. Isolated.

GREAT CRESTED NEWT SURVEY WATERBODY RECORD FORM

Contract no. UA007842	Contract name Brynglas Tunnels Refurbishments	
GENERAL DETAILS		
Pond name/number: 2	Grid reference:	HSI (1): A / B / C
Surveyors: DdlH & HC	Site status:	
Date (dd/mm/yy): March 2015	Photograph number:	

SKETCH OF WATERBODY
(annotate with dimensions and other relevant information)

DESCRIPTION OF WATERBODY

Approximate area (m^2) [HSI (2)]:- 10m^2	Estimated maximum depth (m):8cm
Approximate circumference (m): -14m	No. of 2m sections (for population estimates):7

Water quality (good/moderate/poor/bad) [HSI (4)]:

Moderate

(NB. **Good** = water normally clear with abundant and diverse invertebrate community including relatively sensitive groups *e.g.* mayfly larvae, water shrimps, amphibians (smooth newts and frog tadpoles) and fish; **Moderate** = moderate invertebrate diversity; **Poor** = low invertebrate diversity, species characteristic of low O_2 tension *e.g.* midge and mosquito larvae, low diversity of plants; **Bad** = clearly polluted, pollution tolerant invertebrates present (*e.g.* rat-tailed maggots), usually turbid, few or no submerged plants).

Pond permanence (provide indication of pond age and permanence). HSI (3) Estimate the number of years in ten during which the pond is likely to dry up; never / two years in ten or less / between 3 and 9 years in ten /annually.]

Likely to dry up.

Perimeter shade to at least 1m from shore (%) [HSI 5]	Macrophyte cover (% of surface area) [HSI (10) includes emergents, floating plants (not duckweed), & submerged plants reaching surface]:
100	<5
Fish presence (species and estimated number) [HSI (7) = either Absent/possible/minor/major]: No	Waterfowl presence (species, estimated number, severity of impact upon pond) [HSI (6) absent/minor impact/major impact]: May use the waterbody as present in the canal. Potential minor impact.

Description of marginal and aquatic vegetation present (note the presence of invasive exotic plant species *e.g.* Australian swamp stonecrop and water ferns). Also note access to pond by livestock, evidence of poaching and signs of bank erosion.

Yellow flag Iris.

FURTHER INFORMATION

Description of surrounding area (include details of habitat types and extent, habitat connectivity, presence of adjacent waterbodies, suitable foraging and hibernating habitat, management of aquatic and terrestrial habitat and likely use of pesticides and fertiliser), in accordance with **Habitat Suitability Index**
[HSI (8) – no. of ponds within 1km not separated by major barrier [use map] & HSI (9) terrestrial habitat = good/moderate/poor/none]

- Ash woodland with mature trees, hazel and ground flora
- Approximately six ponds within 1km.
- Terrestrial habitat- good.

Other relevant details (include details of any other amphibian species observed):

None

Details of survey methods appropriate for waterbody (include details such as access, suitability for torch, bottle-trap and netting surveys, number of bottle traps required *etc*. The presence of invasive exotic plant species may exclude the use of certain survey techniques *e.g.* netting).

Torch, net and egg search.

HAZARDS

Identify the presence of any potential health and safety/environmental hazards (*e.g.* deep silt, deep water, giant hogweed, fly-tipping *etc*).

Japanese knotweed present, adjacent to the tow path.

GREAT CRESTED NEWT SURVEY WATERBODY RECORD FORM

Contract no. UA007842	Contract name: Brynglas Tunnels Refurbishments

GENERAL DETAILS

Pond name/number: 3	Grid reference:
Surveyors: DdlH & HC	Site status:
Date (dd/mm/yy): March 2015	Photograph number:

SKETCH OF WATERBODY
(annotate with dimensions and other relevant information)

DESCRIPTION OF WATERBODY

Approximate area (m^2): 2500m^2 (approx. area, immediately adjacent to the working area).	Estimated maximum depth (m): approx. 1.5m
Approximate circumference (m):1010m (approx. circumference immediately adjacent to the working area).	No. of 2m sections (for population estimates): 505 (approx.).

Water quality (good/moderate/poor/bad):

Moderate.

(NB. **Good** = water normally clear with abundant and diverse invertebrate community including relatively sensitive groups *e.g.* mayfly larvae, water shrimps, amphibians (smooth newts and frog tadpoles) and fish; **Moderate** = moderate invertebrate diversity; **Poor** = low invertebrate diversity, species characteristic of low O_2 tension *e.g.* midge and mosquito larvae; **Bad** = clearly polluted, pollution tolerant invertebrates present (*e.g.* rat-tailed maggots), usually turbid, no submerged plants).

Pond permanence (provide indication of pond age and permanence):

Permanent.

Perimeter shade (%): 50%	Macrophyte cover (% of surface area): <5
Fish presence (species and estimated number): Yes	Waterfowl presence (species and estimated number): Minor impact

Description of marginal and aquatic vegetation present (note the presence of invasive exotic plant species *e.g.* Australian swamp stonecrop and water ferns). Also note access to pond by livestock, evidence of poaching and signs of bank erosion.

Yellow Flag Iris and Common Reed.

FURTHER INFORMATION

Description of surrounding area (include details of habitat types and extent, habitat connectivity, presence of adjacent waterbodies, suitable foraging and hibernating habitat, management of aquatic and terrestrial habitat and likely use of pesticides and fertiliser):

Canal passes beneath the existing M4. Suitable terrestrial habitat present to the north of the existing M4. Limited suitable terrestrial habitat adjacent to the canal and tow path to the south of the existing M4.

Other relevant details (include details of any other amphibian species observed):

Details of survey methods appropriate for waterbody (include details such as access, suitability for torch, bottle-trap and netting surveys, number of bottle traps required *etc.* The presence of invasive exotic plant species may exclude the use of certain survey techniques *e.g.* netting).

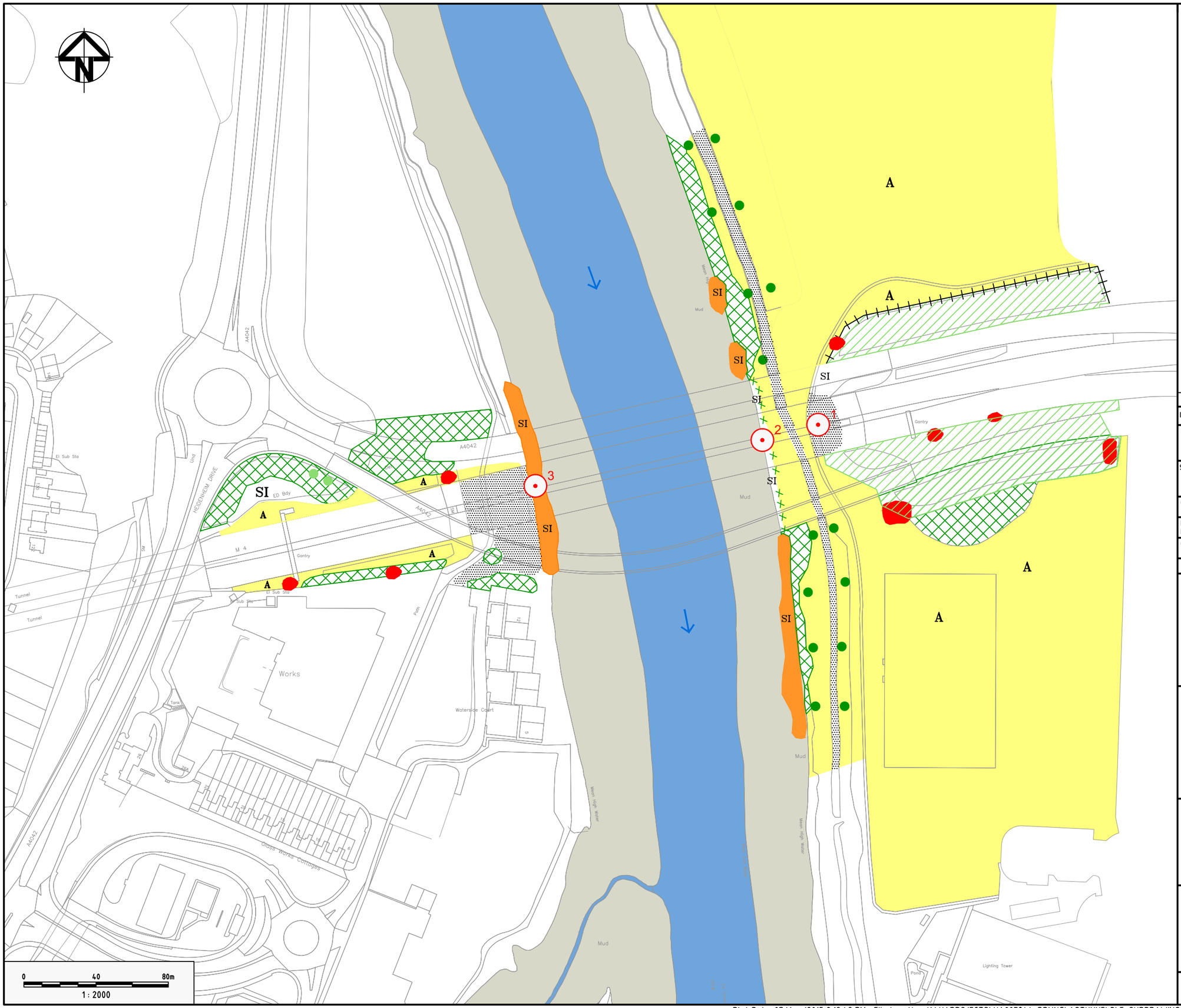
Torch, net and egg search. Given high usage of the tow path, bottle trapping not recommended.

HAZARDS

Identify the presence of any potential hazards (*e.g.* deep silt, deep water, giant hogweed, fly-tipping *etc*).

Next to a footpath, deep water - remote at night.

Figure 1
Phase 1 Habitat Survey Plan



Legend:

- BROAD-LEAVED SEMI-NATURAL WOODLAND
- BROAD-LEAVED PLANTATION WOODLAND
- CONIFEROUS PLANTATION WOODLAND
- DENSE/CONTINUOUS SCRUB
- SCATTERED SCRUB
- BROAD-LEAVED SCATTERED TREES
- CONIFEROUS SCATTERED TREES
- SI — SPECIES-RICH SEMI-IMPROVED NEUTRAL GRASSLAND
- MARSH/MARSHY GRASSLAND
- A — AMENITY GRASSLAND
- SI — SPECIES-POOR SEMI-IMPROVED GRASSLAND
- MUD
- OPEN STANDING WATER
- RUNNING WATER
- JAPENESE KNOTWEED
- BARE GROUND
- HARDSTANDING
- FENCE

Issue	Description	Date
01	FIRST ISSUE	07 APR 15

Status: PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION

Scales	1:2000	Current Issue Signatures
Original Size	A3	Author: P.SHEPHARD
Height Datum	NEWLYN	Checker: D.DE LA HEY
Grid	O.S	Approver:
		© Copyright reserved

Filename: V001-UA007844-UE21D-00_PH1.DWG

Client: WELSH GOVERNMENT

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Bristol, England
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Tel: +44 (0)117 372 1200
Fax: +44 (0)117 372 1508

Project: BRYNGLASS TUNNELS

Title: PHASE 1 MAP SHEET 1

Drawing No.	Project No.	Issue
V001	– UA007844 –	01

50mm on Original

Legend:

- BROAD-LEAVED SEMI-NATURAL WOODLAND
- BROAD-LEAVED PLANTATION WOODLAND
- CONIFEROUS PLANTATION WOODLAND
- DENSE/CONTINUOUS SCRUB
- SCATTERED SCRUB
- BROAD-LEAVED SCATTERED TREES
- CONIFEROUS SCATTERED TREES
- SI — SPECIES-RICH SEMI-IMPROVED NEUTRAL GRASSLAND
- MARSH/MARSHY GRASSLAND
- A — AMENITY GRASSLAND
- SI — SPECIES-POOR SEMI-IMPROVED GRASSLAND
- MUD
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- FENCE

Issue	Description	Date
01	FIRST ISSUE	07 APR 15

Status: PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION

Scales	1:2000	Current Issue Signatures	
		Author	P.SHEPHARD
Original Size	A3	Checker	D.DE LA HEY
Height Datum	NEWLYN	Approver	
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Filename: V001-UA007844-UE21D-00_PH1.DWG

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Project: BRYNGLAS TUNNELS

Title: PHASE 1 MAP SHEET 2

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V001	UA007844	01

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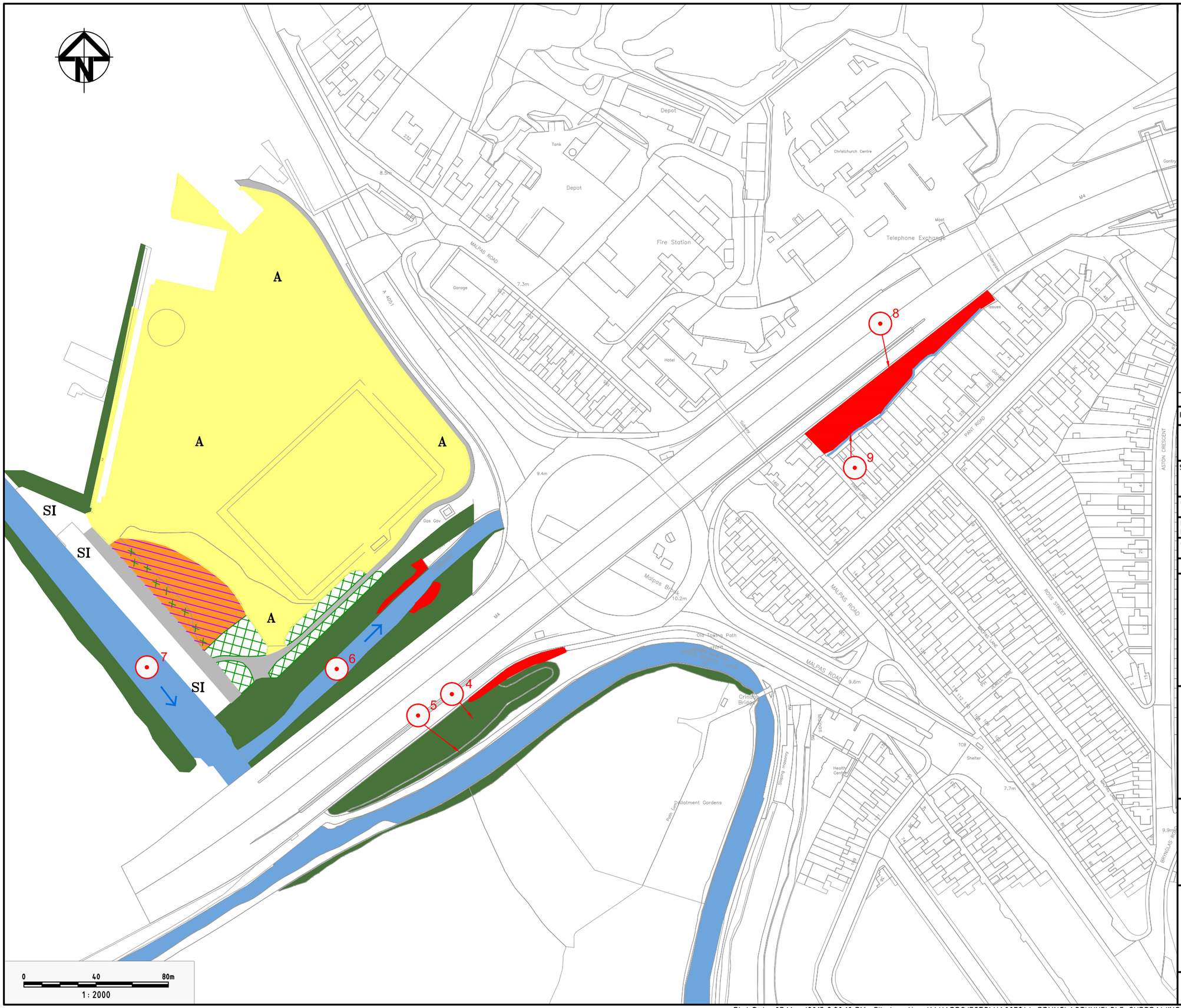

Legend:

- BROAD-LEAVED SEMI-NATURAL WOODLAND
- BROAD-LEAVED PLANTATION WOODLAND
- CONIFEROUS PLANTATION WOODLAND
- DENSE/CONTINUOUS SCRUB
- SCATTERED SCRUB
- BROAD-LEAVED SCATTERED TREES
- CONIFEROUS SCATTERED TREES
- SI — SPECIES-RICH SEMI-IMPROVED NEUTRAL GRASSLAND
- MARSH/MARSHY GRASSLAND
- A — AMENITY GRASSLAND
- SI — SPECIES-POOR SEMI-IMPROVED GRASSLAND
- MUD
- OPEN STANDING WATER
- RUNNING WATER
- JAPENESE KNOTWEED
- BARE GROUND
- HARDSTANDING
- FENCE

Issue	Description	Date
01	FIRST ISSUE	07 APR 15

Status: PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION

Scales	1:2000	Current Issue Signatures
		Author P.SHEPHARD
Original Size	A3	Checker D.DE LA HEY
Height Datum	NEWLYN	Approver
Grid	O.S	© Copyright reserved

Filename: V001-UA007844-UE21D-00_PH1.DWG

Client: WELSH GOVERNMENT

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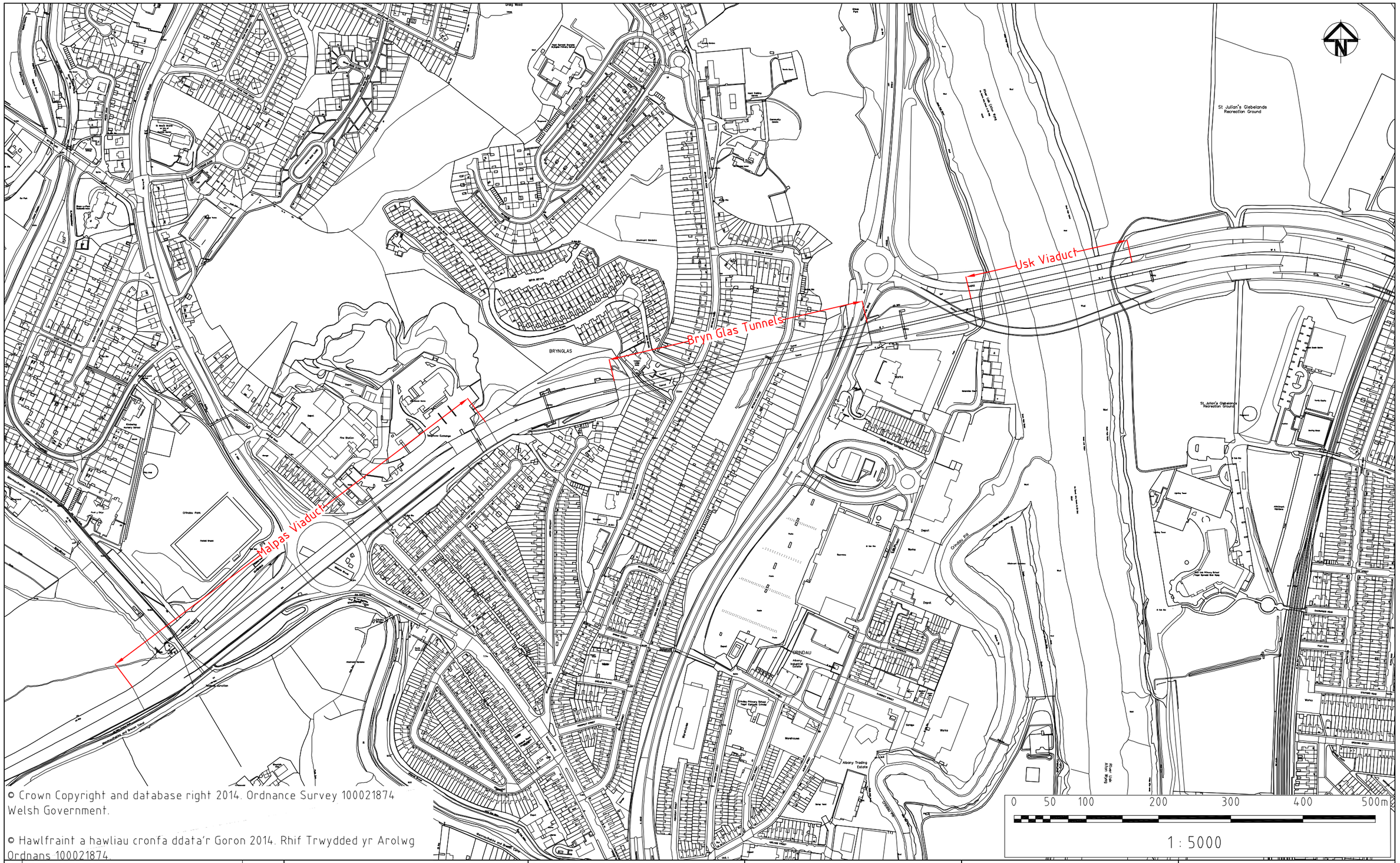
Project: BRYNGLASS TUNNELS

Title: PHASE 1 MAP SHEET 2

Drawing No.	Project No.	Issue
V001	UA007844	01

Figure 2

Site Layout Plan



Issue	Description	Date
01	PRELIMINARY DESIGN	27/03/15

Client: Llywodraeth Cymru Welsh Government

Status: PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION

Scales	1:5000	Current Issue Signatures	
		Author N.CLEMENTS	
Original Size	A3	Checker C.BURGHAM-MALIN	
Height Datum	DATUM	Approver J. PHILLIPS	
Grid	GRID	© Copyright reserved	
Filename:	007-UA007844-01.DWG		

Project: M4 BRYN GLAS TUNNELS

Title: OVERALL LOCATION PLAN

Hyder Consulting (UK) Limited
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CF3 0EY
Tel: +44 029 20926700
Fax: +44 029 20925222

Drawing No.	Project No.	Issue
007	— UA007844 —	01

50mm on Original

30/Mar/2015 K:\UA006729 - M4 Corridor\T-Tunnels\E Our Drawings\007-UA007844-01.dwg V1

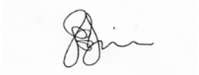
APPENDIX B

Targeted species-specific survey information

Llywodraeth Cymru
Welsh Government

Hyder

Technical Note

Document Information		Total number of pages: 3	
Project		M4 Brynglas Tunnel Refurbishments	
Title		Badger Survey Update	
File No-Project Ref-Office-Rev-File Loc			
Author	Print Name	Signature	Date
	Alex Ellis		09/09/2015
Checker	Hannah Corcoran		09/09/2015
Approver	Jon Davies		17/09/15

1 Introduction

1.1.1 This Technical Note presents the results of a badger survey of an area on the eastern bank beneath the Usk viaduct which forms part of the M4 motorway. The area could not be accessed during the original extended Phase 1 habiat survey. This technical note has been produced to follow on from an inspection of the area. It is intended that this addendum report should be read in conjunction with the 2015 Ecological Appraisal Report.

1.1.2 The aims of the study were to confirm the presence/ absence of badger setts on a large embankment of exposed earth beneath the viaduct. This area could not be accessed earlier in the year due to the presence of a security fence, which meant that access at that time would have been required from the hard shoulder.

2 Methodology

2.1.1 Inspections of the area were carried out to confirm the presence/absence of badgers. The area was searched for any characteristic signs of badger activity including setts, latrines, paths, footprints, hairs and feeding signs. Where access permitted, the survey boundary was extended (up to 100 m) in order to search adjacent areas for active badger setts.

3 Results

3.1.1 The habitats within the area on the eastern bank beneath the Usk Viaduct were suitable for foraging badgers, but no definitive signs were observed and no setts were identified on or immediately adjacent to the site. The surveys confirmed the absence of badgers from this location.

4 Conclusions

4.1.1 The proposed works comprise the re-surfacing of the carriageways and repair works to the supporting structures. No definitive signs of badger have been recorded along the entire works footprint (Malpas and Usk Viaducts), therefore no mitigation is required.

4.1.2 A pre-construction check will, however, be undertaken in order to confirm that the status of badgers in the working has not changed prior to works on site commencing.

Appendix A

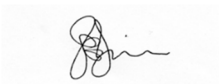
Figure 1

(Google maps).

Llywodraeth Cymru
Welsh Government

Hyder

Technical Note

Document Information		Total number of pages: 3	
Project		M4 Brynglas Tunnel Refurbishments	
Title		Great crested newt eDNA sampling	
File No-Project Ref-Office-Rev-File Loc			
Author	Print Name	Signature	Date
	Alex Ellis		09/09/2015
Checker	Hannah Corcoran		09/09/2015
Approver	Jon Davies		17/09/2015

1 Introduction

1.1.1 This Technical Note presents the results of the eDNA water sampling that was undertaken as part of the Brynglas Tunnel Refurbishments in order to confirm the presence/ absence of great crested newts within the Scheme corridor. At the time of undertaking the works, the scope of the construction phase activities had not been determined, and given the seasonal limitations associated with the undertaking of great crested newt surveys, eDNA sampling was advised. At the time of the eDNA sampling, potential impacts to adjacent waterbodies and suitable terrestrial habitat were anticipated. It is recommended that this Technical Note is read in conjunction with the Preliminary Ecological Assessment Report (2015).

1.1.2 The aims of the study were to confirm the presence/ absence of great crested newts within the Scheme corridor and anticipated working area, to identify any potential constraints to the proposals for the maintenance activities.

2 Methodology

2.1.1 Water samples were taken from each of the waterbodies and sent to Fera Laboratories for analysis. Pond 1 (see Figure 1) was completely surveyed with no limitations experienced. Pond 2 had completely dried up, so samples could not be taken. In addition, although water samples were taken from the two disused canal sites, it was not possible to access both sides of the canal due to gated maintenance structures.

2.1.2 At the time of the sampling, Pond 2 had dried out, making it less favourable for great crested newts (and not possible to take a water sample for eDNA analysis). In addition, it was noted that the presence of macrophytes in the canal had increased. In addition,

a larger population of water fowl was also observed, thereby further reducing the suitability of the waterbodies for use by great crested newts.

3 Results

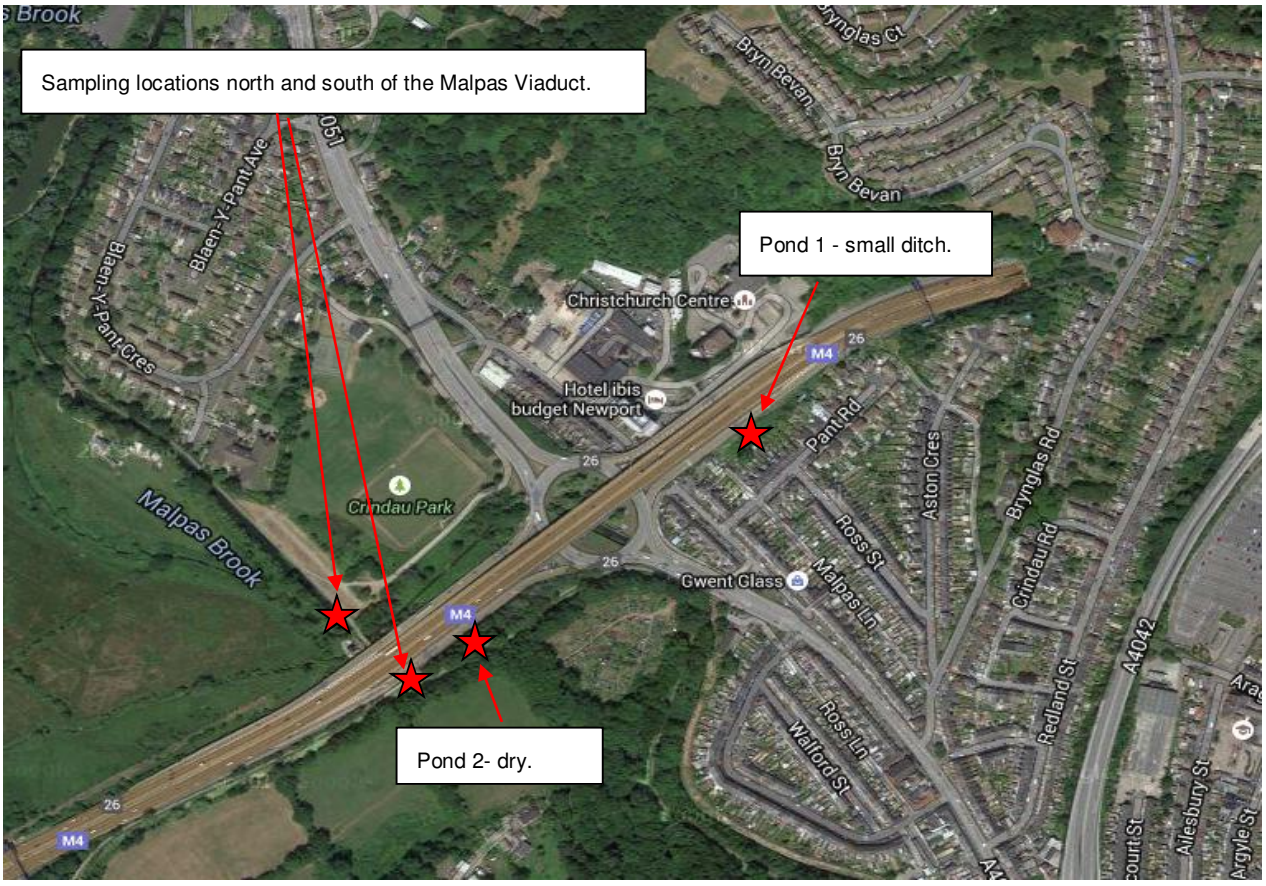
3.1.1 The results for all of the waterbodies confirmed the absence of great crested newts for the sampled locations.

4 Conclusions

4.1.1 Although the eDNA sampling results provided a negative result, there were some limitations to the sampling, as identified in Section 2 above. Notwithstanding the fact that the absence of newts was confirmed, upon completion of the sampling works it was established that none of the waterbodies or suitable adjacent terrestrial habitat identified in early 2015 will be impacted by the works. The proposed works comprise the re-surfacing of the carriageways and repair works to the supporting structures. Therefore, these activities will be limited to the existing M4 soft estate, and there would be no effects on newts even if they were present.

Appendix A

Figure 1



(Google maps).

Llywodraeth Cymru
Welsh Government

Hyder

Welsh Government

Brynglas Tunnel Refurbishments

Bat Inspection Survey

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Brynglas Tunnel Refurbishment

Bat Inspection Survey

Author	Alex Ellis	
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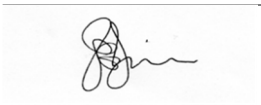
Approver	Jon Davies	
Report No		
Date	10th September 2015	

This report has been prepared for Welsh Government in accordance with the terms and conditions of appointment for Bat Survey August 2015. Hyder Consulting (UK) Limited (2212959) cannot accept any responsibility for any use of or reliance on the contents of this report by any third party.

CONTENTS

1 SUMMARY

This report present the findings of an inspection survey associated with the proposed works to the Malpas and Usk viaducts of the M4 motorway, undertaken by Hyder Consulting (UK) Ltd on behalf of the Welsh Assembly Government in July 2015. This report has been prepared as an addendum to the Preliminary Ecological Appraisal, also prepared by Hyder Consulting, which contains further details regarding the proposed works and an assessment of effects arising from the works.

The purpose of the July 2015 survey was to assess the viaducts on their suitability to support roosting bats throughout the year.

Both the Malpas and Usk viaducts were assessed as offering low potential to support roosting bats throughout the summer. The Malpas viaduct was also assessed as offering potential to support hibernating bats.

Further surveys are recommended in order to properly assess the impacts of the proposed works on bats and their roosts. One evening emergence and/or dawn re-entry survey should be carried out in summer on both viaducts and static detector surveys should be undertaken over winter within the internal spaces of the Malpas viaduct.

2 Introduction

This report presents the results of an inspection survey of the Malpas and Usk viaducts which form part of the M4 motorway. It is intended that this addendum report should be read in conjunction with the 2015 Ecological Appraisal Report.

The aims of the study were to investigate the suitability of the structures to support roosting bats throughout the year, in order to identify any potential constraints to the proposals for the re-surfacing and repair works.

The survey was undertaken during July 2015.

3 Methodology

A daytime internal and external inspection of the Malpas and Usk viaducts was carried out by Nancy Davies (Natural Resources Wales (NRW) bat licence ref 66118:OTH:CSAB:2015) and Alex Ellis (NRW bat licence ref: 63427:OTH:CSAB:2015), to assess the suitability of the structures to support roosting bats. The inspection followed methods outlined in the Bat Conservation Trust's (BCT) Bat Surveys: Good Practice Guidelines 2nd Edition (Hundt, 2012).

The carriageways and the exterior of the abutments and supports were inspected using binoculars for any features that could potentially provide opportunities for roosting bats or ingress/egress points to the interior spaces. In addition, the interior spaces of both viaducts were inspected and assessed for their potential to support summer and/or winter roosting (hibernating) bats. Any definitive signs of their presence (droppings, urine staining or feeding remains) was noted.

4 Results

The carriageway areas of both the Malpas and Usk viaducts are constructed from concrete with pebble-dashed fascias. The Usk viaduct is supported on concrete pillars whereas the Malpas

viaduct is supported by a combination of concrete pillars (at either end) and brick, breezeblock and concrete structures (in the centre).

The carriageway section of the Malpas viaduct contained only one feature (Plate 1 + 2) with low potential to support summer roosting bats, namely the gaps within the expansion joints above the subway (beneath the carriageway). The remainder of the structure was well sealed. In addition to the carriageway, there are four large internal storage spaces (Plate 3) within the structures concrete support pillars (accessed from Malpas roundabout), which were identified as offering some potential to support roosting bats (in particular over winter hibernating bats) due to the presence of a wall cavity between the brick and breezeblock layers.

The Usk viaduct contained a number of features (Plate 4) identified as offering low potential to support roosting bats, namely the gaps where the carriageway meets the four support structures across the river. Furthermore, within this viaduct there are internal spaces within each abutment (four in total). These were assessed as offering little or no potential to support roosting bats due to their smooth concrete construction (lack of obvious crevices) and the fact that they frequently flood.

5 Conclusions

The survey has confirmed the presence of features within the structures which offer some potential to support roosting bats, both in summer and winter.

The proposed works comprise the re-surfacing of the carriageways and repair works to the supporting structures. These areas provide potential habitat for bats, although no definitive signs of the species have been observed on the proposed works site to date.

Based on the low potential of the structures to support summer roosting bats, it is recommended that an evening emergence and/or dawn re-entry survey is undertaken on both of the viaducts. These surveys should be carried out when bats are active between May and September (but optimally by August). In addition, static detectors should be placed within the four internal spaces of the Malpas viaduct over winter (November to February) to passively monitor if there is any activity associated with hibernating bats.

Appendix 1: Photographs

Plate 1: Malpas Viaduct

Plate 2: Malpas Viaduct – Expansion Joint

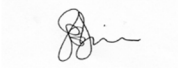
Plate 3: Malpas Viaduct – The central Internal Spaces (Circled in green)

Plate 4: Usk Viaduct (Bat features marked in red)

Llywodraeth Cymru
Welsh Government

Hyder

Technical Note

Document Information		Total number of pages: 4	
Project		M4 Brynglas Tunnel Refurbishments	
Title		Bat Survey Update	
File No-Project Ref-Office-Rev-File Loc			
Author	Print Name	Signature	Date
	Alex Ellis		10/09/2015
Checker	Hannah Corcoran		11/09/15
Approver	Jon Davies		17/09/15

1 Introduction

1.1.1 This Technical Note presents the results of a dusk emergence bat survey of the features of interest identified within the Malpas and Usk Viaducts which form parts of the M4 motorway. This technical note has been produced to follow on from an inspection of the structures. It is intended that this addendum report should be read in conjunction with the 2015 Bat Inspection Survey Report, and Preliminary Ecological Appraisal.

1.1.2 The aims of the study were to confirm the presence/ absence of roosting bats within the Malpas and Usk Viaducts.

2 Methodology

2.1.1 A dusk emergence survey of the identified features of interest within the Malpas and Usk viaducts was undertaken on 25th August 2015. These surveys were undertaken by experienced surveyors using broadband (time expansion and frequency division) bat detectors, allowing bat calls to be recorded for subsequent identification.

The surveys methods are in accordance with the guidance provided by the Bat Conservation Trust. For the dusk survey, the surveyors were in place half an hour before sunset and continued for up to an hour and a half, or until it was too dark to determine whether or not bats were emerging from the tree (by this time, any bats present are likely to have emerged).

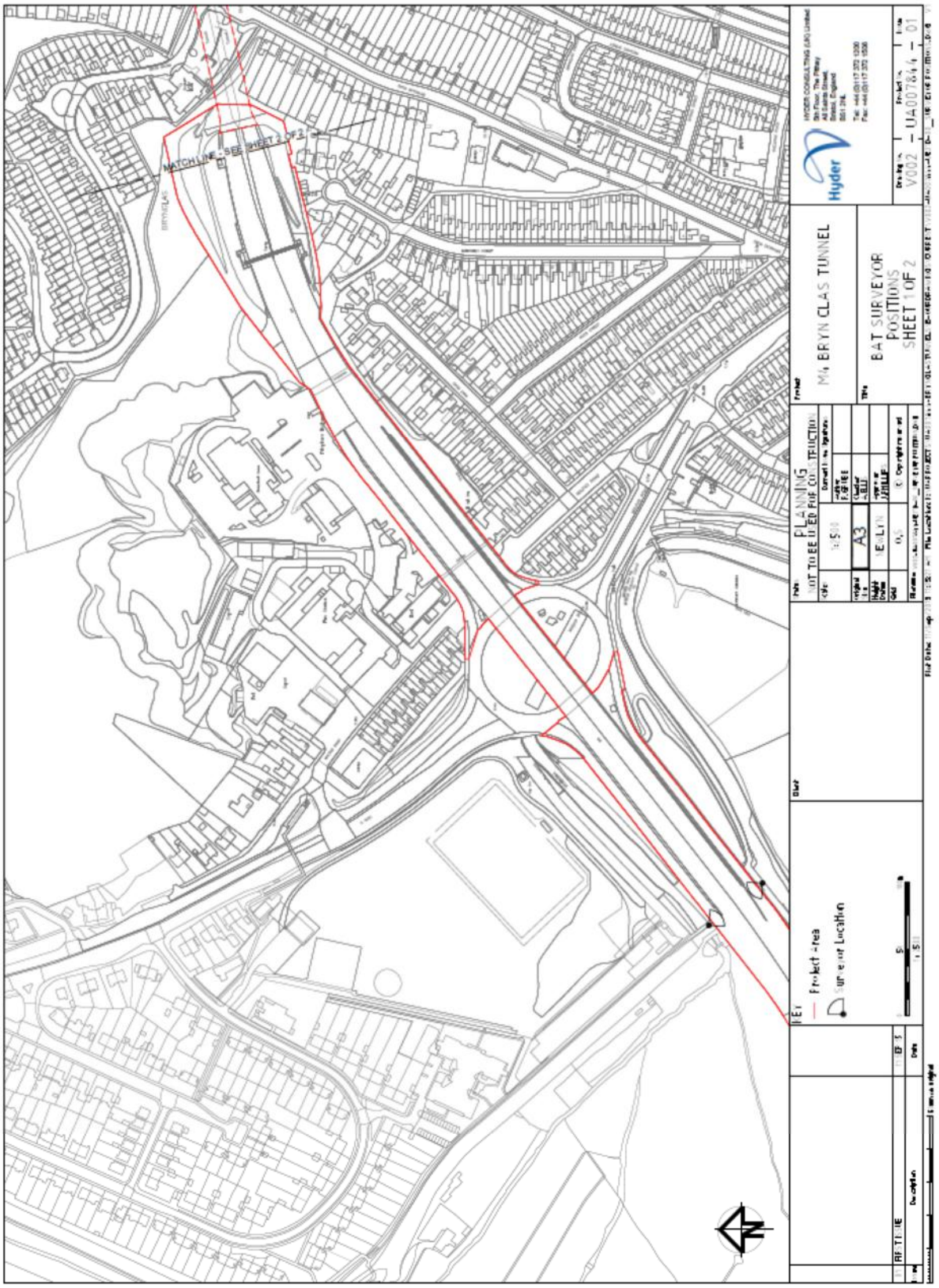
3 Results

3.1.1 The surveys confirmed the absence of roosting bats within both viaducts. The surveys did, however, identify suitable foraging and commuting areas within close proximity to the structures, namely Glebelands Park and the Malpas Canal.

4 Conclusions

4.1.1 The proposed works comprise the re-surfacing of the carriageways and repair works to the supporting structures. However, no definitive signs of roosting bats have been recorded in either structure (Malpas and Usk Viaducts), therefore no mitigation is required.

4.1.2 A pre-construction check will be undertaken in order to confirm that the status of bats in the working has not changed prior to works on site commencing.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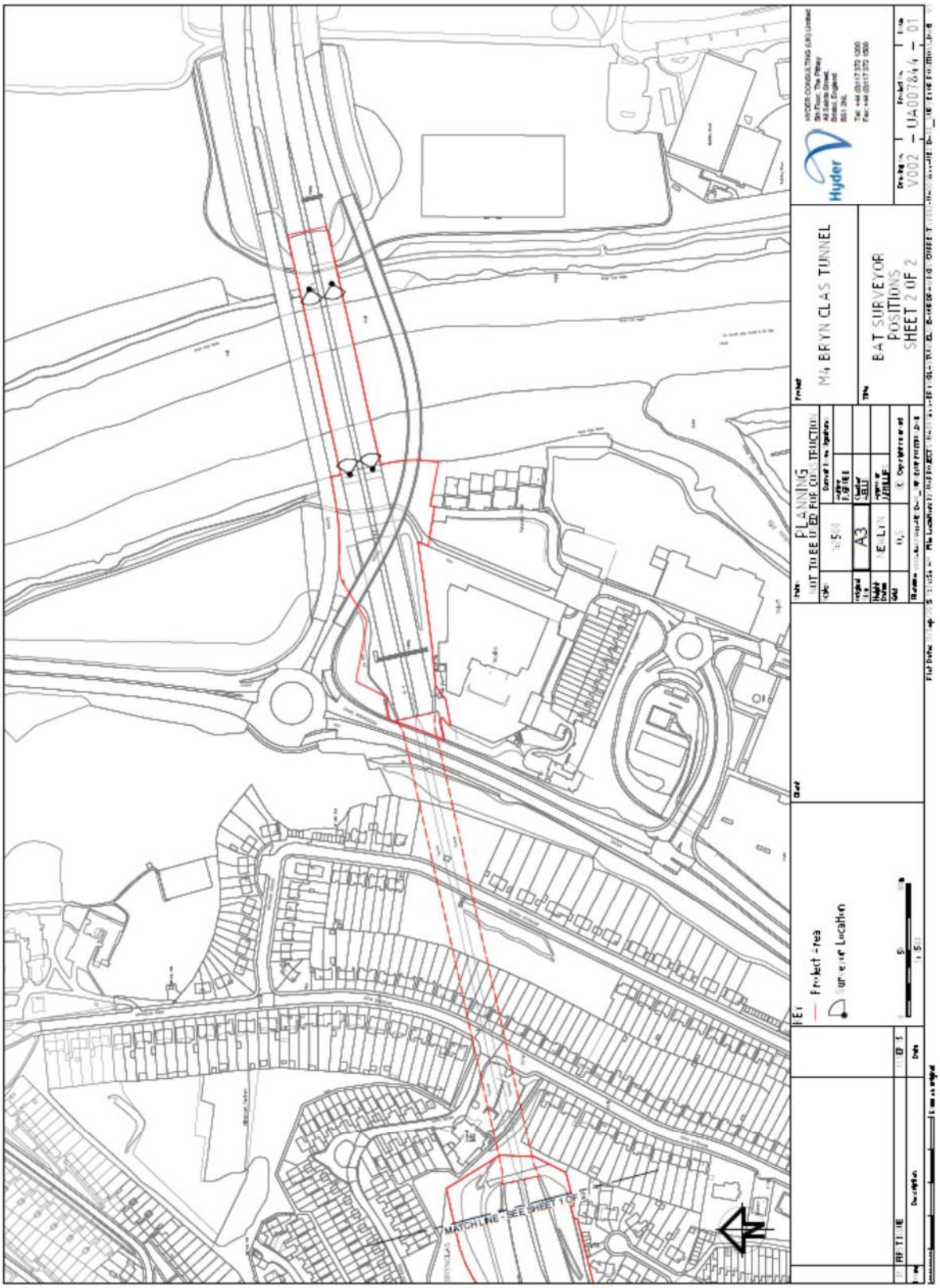
M4 BRYN GLAS TUNNEL
BAT SURVEYOR POSITIONS SHEET 1 OF 2
A3
Project Area
Survey Location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PLANNING
NOT TO BE USED FOR CONSTRUCTION
M4 BRYN GLAS TUNNEL
BAT SURVEYOR POSITIONS
SHEET 2 OF 2
A3
Project Area
Surveyor Location

APPENDIX C

Preliminary Site Waste Management Plan

Introduction

Arcadis was instructed by Welsh Government, 'the Client', to undertake an Outline Site Waste Management Plan (SWMP) for Brynglas Tunnel Refurbishments, 'the Scheme'.

On 1st December 2013, the Site Waste Management Plans Regulations 2008 were repealed. However, the implementation of a SWMP remains industry best practice and a requirement of Welsh Government in the delivery of schemes. This report has been prepared for the Client in accordance with the repealed SWMP Regulations 2008.

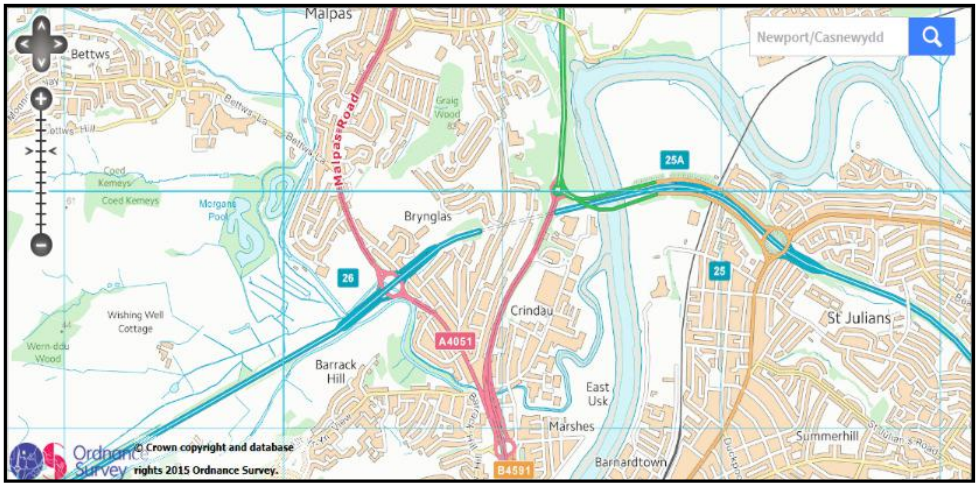
The Preliminary SWMP, is a live document that will evolve into a SWMP prior commencement of works on site. This will be updated regularly during the course of the maintenance and improvement works of the Scheme. Preparing a Preliminary SWMP at an early stage of design facilitates the identification and implementation of waste minimisation opportunities at the design stage and reuse and recycling opportunities during onsite operations, reducing the quantities of CD&E waste sent to landfill. Preparing a Preliminary SWMP also encourages the review of current waste reduction and recovery practice levels, highlighting areas where good and best practice can be achieved.

The main purpose of the SWMP will be to assess and record how waste is reduced, reused, recycled and disposed of by the Scheme's project team. This effectively means:

1. Recording decisions taken to prevent waste through concept and design.
2. Forecasting waste produced onsite.
3. Planning how to reduce, reuse and then recover the forecast waste.
4. Implementing and monitoring the planned waste related activity.
5. Reviewing the SWMP and recording lessons learnt.
6. Description of the works

Description of the works

The project is located on the M4 between junctions 25A and 26, to the north of Newport.



The primary purpose of the Scheme is to improve conditions for health and safety purposes and to also ensure the structures continue to carry the levels of traffic which use the M4 on a daily basis. At present, the maintenance and improvement works are currently scheduled to commence on site in March 2016 and will continue for a 21 month duration. The works will cost approximately £40 million.

Brynglas Tunnel Refurbishment

- Replacement of carriageways (maintenance);
- Refurbishment of drainage system (maintenance);
- Replacement of Concrete Dado panels (maintenance);
- Replacement/repair of secondary lining panels & supports (maintenance);
- Repair of cracks to primary lining (maintenance);
- Add secondary cladding system to control seepage (maintenance);
- Repair/repointing of masonry wing walls (maintenance);
- Repairs to Cross-passageways – re-lining/waterproofing (maintenance);
- Provide a water supply to tunnel portals for fire-fighting (improvements);
- Drainage attenuation & treatment prior to outfall to the Usk (improvements).
- Installation of Video Accident Incident Detection (VAID) system, including cameras, control systems and power (improvements);
- Replacement of emergency telephones and other life safety systems (maintenance);
- Replace tunnel control system (maintenance);
- Replace tunnel signals (maintenance).
- Replacement of tunnel lighting (maintenance);
- Replace electrical supply cabling (maintenance);
- Provision of new control building (improvement/maintenance).

River Usk Bridge

- Joint replacement including localised re-waterproofing and resurfacing (maintenance);
- Concrete repairs (including breaking out defective concrete) to the underside of the bridge deck (maintenance);
- Reinforcement repairs to the underside of the bridge deck (maintenance);
- Surface water drainage replacement (including the outfall to the Usk) (maintenance);
- Parapet/verge repairs (maintenance):
- Localised concrete repairs to substructure and parapets (maintenance).

Malpas Viaduct

- Joint replacement including localised re-waterproofing and resurfacing (maintenance);
- Localised concrete repairs to substructure and parapets (maintenance).

Preliminary SWMP Template

Introduction

Preparing the Preliminary SWMP Template at planning encourages the review of current waste reduction and recovery practice levels, highlighting areas where good and best practice in waste minimisation and management can be achieved. The Preliminary SWMP Template also facilitates the identification and implementation of waste minimisation and reuse and recycling opportunities during at all stages of the project, reducing the quantities of construction, demolition and excavation waste sent to landfill. The Scheme's Preliminary SWMP Template is presented in a series of 6 Stages that cover the Scheme's process from policy and setup to repairs, completion and use:

Stage	Description
Stage 1	Policy and setup: the Pre-repairs Team records the administration details and set targets
Stage 2	Preparation and concept design: the Pre-repairs Team prepare the initial concept and undertake design decisions to reduce waste
Stage 3	Detailed design: the Pre-repairs Team forecast the waste and record the waste reduction/minimisation actions
Stage 4	Pre-repairs: the Pre-repairs Team record the waste carriers, waste destinations and waste management and recovery actions
Stage 5	Construction: the Repairs Team record the actual waste movements
Stage 6	Post completion and use: the Repairs Team review KPIs, report, compare actual quantities with estimates and sign the declaration

The Preliminary SWMP can be used in conjunction with existing waste management tools and systems, such as the Waste & Resources Action Programme (WRAP) Net Waste Tool, WRAP Waste to Landfill Reporting Portal, WRAP SWMP Tracker, SmartWaste Plus or the WRAP Site-specific Waste Analysis Tool (SSWAT).

The SWMP provides options for planning and processing waste during the maintenance and improvement works on the site. It also demonstrates that Welsh Government is a considerate client who is interested in maximising opportunities for reuse and recycling and in diverting waste from landfill.

Limitations

Material resources and waste targets have not yet been set and initial quantifications of the material resources use and waste arisings forecast from the Scheme are not available at this stage. As development of the design continues, the accuracy and extent of the figures for material resources use and waste quantifications will improve, supporting the effective planning and management of any wastes likely to arise from the Scheme.

Forecast data for waste arisings from the proposed Scheme has been estimated based upon the cost of the proposed maintenance and improvement works, wastes likely to arise given the nature of the Scheme and SmartWaste KPIs since actual waste arisings data is not available. These are considered to provide a reliable basis for assessment of the conditions.

In the absence of complete and consistent data from Wales, the identification of potential waste infrastructure sites (that could receive wastes being produced by the Scheme) has been carried out through the interrogation of the Environment Agency (EA) Environmental Permitting Regulations (EPR) database. Potential waste carriers that could utilised by the Scheme have been identified through interrogation of the EA's Public Register.

Preliminary SWMP Implementation

This report includes an Excel based workbook that provides a focal point to collect waste data from repairs-related activities onsite.

The key roles and associated responsibilities for implementation of the SWMP are summarised below. These roles and responsibilities are based on those required by the now repealed SWMP Regulations 2008:

Team member	Key role
Client and developer	• Promote waste minimisation • Insist on good practice from all other team members • Ensure that all hazardous wastes have been identified prior to construction • Review strategy over time and identify waste reduction opportunities
Designer	• Consider design options and reduce bespoke elements • Promote reuse / retention of existing elements • Specify the use of recycled content materials • Identify waste prevention and reduction opportunities
Principal Contractor – Site Manager	• Develop a site specific waste strategy, implement and communicate to all parties • Assist in design process to reduce waste and monitor implementation • Drive segregation of waste arisings and designation of areas for waste activities • Facilitate onsite storage compounds and treatment of segregated materials • Reduce waste being brought onto site as packaging, etc. • Ensure appropriate waste storage containers onsite • Identify and confirm all destinations for waste leaving the site, including for hazardous waste • Ensure appropriate offsite transport in line with local regulatory requirements • Keep proper records of all wastes produced, reused and sent offsite
Subcontractor	• Develop method statements for activities onsite • Liaise with Main Contractor and agree way forward • Assist in ensuring onsite practices are safe and will not impact the environment • Ensure that wastes are properly segregated
Site worker	• Question unsatisfactory practices onsite and follow instructions as provided • Assist in ensuring onsite practices are safe and will not impact the environment • Ensure that wastes are properly segregated

Non-exhaustive list of waste infrastructure sites within the study area that have the potential to take CD&E waste

Infrastructure Site Type	Site Name	Capacity (tonnes)	Postcode	Licence number
Caerphilly		**455,995**		
Special Waste Transfer Station	Amber Engineering Ltd	74,999	CF82 7RJ	EA/EPR/XP3295FK/V004
	Full Moon Waste Transfer Station	74,999	NP11 7BD	EA/EPR/WP3490VW/V002
Household, Commercial & Industrial Waste Transfer Station	Berth Gron Quarry Transfer Station	24,999	CF46 6PH	EA/EPR/UP3695FZ/A001
	Gellia'r-gwellt Uchaf Transfer & Composting Station	150,000	CF82 8FY	EA/EPR/TP3695FC/V006
	Gibbon Equipment Hire Ltd	1,000	CF82 7QZ	EA/EPR/FP3195FC/A001
	Olivers Sales & Rentals	30,000	CF82 8AU	EA/EPR/WP3799FB/V004
	Pen Y Fan Processing And Recycling Ltd	74,999	NP12 0HY	EA/EPR/GP3692LQ/A001
Metal Recycling Site (mixed MRS's)	Evans Logistics Ltd	24,999	NP22 5PT	EA/EPR/WP3295FG/A001
Glamorgan		**3,129,115**		
Special Waste Transfer Station	Acorn Environmental Special Waste Transfer Station	4,999	CF3 2ES	EA/EPR/BP3095FX/A001
	Atlantic Recycling Limited	280,000	CF3 2EJ	EA/EPR/PP3993VS/V004
	Building 209 Hazardous Waste Compound	168	CF62 4AD	EA/EPR/GP3396EA/A001
	City Special Waste Ltd	12,000	CF24 5SD	EA/EPR/YP3399FR/V002
	Curran Embankment Transfer Station	4,999	CF10 5FX	EA/EPR/CP3899FG/V002

Brynglas Tunnel Refurbishments

Infrastructure Site Type	Site Name	Capacity (tonnes)	Postcode	Licence number
	M E M Group Plc	4,999	CF24 5TW	EA/EPR/SP3595FT/V002
	Merthyr Industrial Services Ltd Transfer Stn	48,116	CF48 2TA	EA/EPR/FP3695FJ/A001
	Safety Kleen S E Wales	4,999	CF3 2ES	EA/EPR/DP3399FJ/V003
Household, Commercial & Industrial Waste Transfer Station	A & T Waste Disposal Company	24,999	CF10 5DF	EA/EPR/KP3695FL/A001
	Bessemer Close Transfer Station	150,000	CF11 8DL	EA/EPR/VP3199FC/A001
	Biffa Viking Place Waste Transfer Stn	74,999	CF10 4TS	EA/EPR/SP3795FZ/A001
	Brindley Road	24,999	CF11 8TX	EA/EPR/CP3498ED/A001
	Cardiff Recycling Ltd	24,999	CF10 4LU	EA/EPR/MP3998EV/A001
	Jwb Recycling Ltd	4,999	CF71 7PB	EA/EPR/RP3998FJ/A001
	Lamby Way M R F & Household Waste Site	50,075	CF3 2HP	EA/EPR/MP3195FR/A001
	Merthyr Borough Recycling Centre Ltd-transfer Station	120,000	CF48 2TA	EA/EPR/ZP3899FX/V002
	R G F Haulage Ltd	74,999	CF24 5SD	EA/EPR/UP3295FU/V004
	Simply- Fill Ltd	24,999	CF5 6AB	EA/EPR/TP3095FP/V002
	Step Up Skips	4,900	CF46 6TB	EA/EPR/WP3499FR/A001
	Unit 2, Sea View Bungalow	4,999	CF3 2TN	EA/EPR/WP3495EH/A001
Transfer Station taking Non-Biodegradable Wastes	British Gas Plc Transfer Station	30,000	CF11 0XR	EA/EPR/HP3399FS/S002

Infrastructure Site Type	Site Name	Capacity (tonnes)	Postcode	Licence number
Material Recycling Treatment Facility	Dow Corning Waste Transfer Station	4,999	CF63 2YL	EA/EPR/AP3495FZ/A001
Metal Recycling Site (mixed MRS's)	122/128 East Moors Road	4,999	CF24 5EE	EA/EPR/RP3392EY/V002
	Abba Scrap	24,999	CF48 2TA	EA/EPR/DP3299FD/V002
	Heads Of The Valley Salvage	5,876	CF48 2YG	EA/EPR/DP3899FK/V002
	J Pesci & Sons Ltd	24,999	CF83 3DA	EA/EPR/NP3599FC/V002
Gwent		**1,459,139**		
Special Waste Transfer Station	Eco Oil Ltd	4,999	NP19 4PL	EA/EPR/PP3295FP/V004
	Hafod Garage Waste Transfer Station	74,999	NP23 4GU	EA/EPR/AP3399FR/V003
	New Inn Transfer Station	74,999	NP4 0LS	EA/EPR/YP3599FQ/V005
	Sims Group U K Ltd	859,600	NP20 2WE	EA/EPR/CP3795FY/V005
	Tafarnaubach Waste Facility	24,999	NP22 5AA	EA/EPR/GP3337KD/V002
Household, Commercial & Industrial Waste Transfer Station	Able Skip Hire Limited	24,999	NP19 4SU	EA/EPR/EP3895FB/A001
	D S Smith Recycling U K Ltd	74,999	NP26 5PW	EA/EPR/BB3237AQ/V002
	Fred Lloyd & Sons Ltd	24,999	NP4 0TW	EA/EPR/UP3495FT/V006
	G D Environmental Services Ltd	74,999	NP19 4PP	EA/EPR/RP3295FS/V003
	Volehurst Ltd	15,500	NP20 2BU	EA/EPR/KP3595FB/A001
	Woodstock Waste Transfer Stn	4,050	NP26 5PR	EA/EPR/KP3095FE/V002
Material Recycling Treatment Facility	Olleco Cymru Wales	25,000	NP19 4PL	EA/EPR/BP3296EF/V005

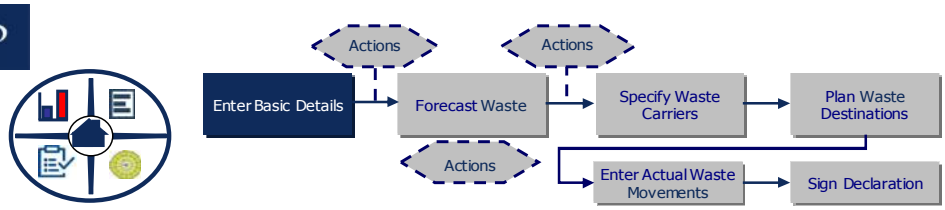
Brynglas Tunnel Refurbishments

Infrastructure Site Type	Site Name	Capacity (tonnes)	Postcode	Licence number
Metal Recycling Site (mixed MRS's)	Fred Lloyd & Sons Ltd	74,999	NP4 0TW	EA/EPR/UP3495FT/V006
	Newport Weee Facility (weee)	74,999	NP20 2WE	EA/EPR/BP3992SG/V002
	North Quay	24,999	NP20 2WE	EA/EPR/TP3495FK/V004
Mid Glamorgan		**632,498**		
Household, Commercial & Industrial Waste Transfer Station	The Granary	22,500	CF83 3QS	EA/EPR/EP3994LG/V002
Transfer Station taking Non-Biodegradable Wastes	Hendy Recycling	99,999	CF72 8PG	EA/EPR/FB3336RD/V002
Material Recycling Treatment Facility	Egan Waste Services Recycling Centre	485,000	CF37 5TA	EA/EPR/KP3636HB/V002
Metal Recycling Site (mixed MRS's)	Old Barry Sidings	24,999	CF37 2PE	EA/EPR/MP3894VQ/V003
Monmouthshire		**139,998**		
Special Waste Transfer Station	Five Lanes Transfer Station And H W R C	74,999	NP26 3AY	EA/EPR/WP3599FY/V004
Household, Commercial & Industrial Waste Transfer Station	Llanfoist Waste Transfer Station	40,000	NP7 9AQ	EA/EPR/AP3499FY/V006
	R B Skip Hire Ltd	24,999	NP16 5QD	EA/EPR/TP3995FA/V002
Newport		**109,499**		
Household, Commercial & Industrial Waste Transfer Station	Alexandra Docks	90,000	NP20 2NP	EA/EPR/PB3333DH/A001
Metal Recycling Site (mixed MRS's)	Newport Waste Facility	14,500	NP19 4ST	EA/EPR/YP3135TE/V003
	S J Bull Scrapyard	4,999	NP20 5NQ	EA/EPR/RP3699FA/V002
Vale Of Glam		**4,999**		
Material Recycling Treatment Facility	Rob Morris Environmental	4,999	CF71 7PB	EA/EPR/FP3092SW/A001

Infrastructure Site Type	Site Name	Capacity (tonnes)	Postcode	Licence number
Rhondda Cynon Taff		**327,539**		
Special Waste Transfer Station	Weighbridge Yard	4,999	CF44 0PN	EA/EPR/EB3531RZ/A001
Household, Commercial & Industrial Waste Transfer Station	Creigiau Tyres	24,999	CF38 2EE	EA/EPR/FP3295LD/A001
	L C C Wales Ltd	24,999	CF44 9UN	EA/EPR/CB3135AA/A001
	Stephen Parle Transfer Station (bevans) (liquidation)	24,999	CF44 0BX	EA/EPR/PP3995FN/V003
	Veolia Es Cleanaway (uk) Limited	24,950	CF37 5YL	EA/EPR/HP3795FS/V002
	Waste Transfer Station Tir Ergyd Yard	74,999	CF44 0BX	EA/EPR/NP3198VA/V002
	Ystrad Barwig Recycling Centre	24,999	CF38 1BL	EA/EPR/FP3390VJ/V003
Transfer Station taking Non-Biodegradable Wastes	Tynewydd Farm Transfer Station	4,999	CF72 8NE	EA/EPR/UP3895FW/V002
Material Recycling Treatment Facility	Bryn Pica Waste Operations	74,999	CF44 0BX	EA/EPR/AP3199FE/S010
	Harp International Ltd	2,600	CF37 5SX	EA/EPR/NP3099FS/V008
Metal Recycling Site (mixed MRS's)	Gene Metals	4,000	CF37 1RX	EA/EPR/SP3895FE/A001
	Llantrisant Autos	1,000	CF72 8LN	EA/EPR/BP3695FA/A001
	M & E Bin Hire	24,999	CF37 4BW	EA/EPR/SP3495FG/V002
	Pantile Autos	4,999	CF40 1SB	EA/EPR/SP3395FU/A001
	Wastetechnique Ltd	4,999	CF39 8YN	EA/EPR/CP3895FQ/A001

APPENDIX C1

Example Site Waste Management Plan



? Tell me about this sheet

What to enter? Enter details of the project client, principal contractor, location and value . Select the metrics for the project (e.g. floor area) and record any project targets (e.g. waste to landfill, waste arisings, etc).

When? The basic details, metrics, project targets and the schedule sections of this sheet should be completed at the onset of a project. The sign off, explanation of deviation from the plan and lesson learnt sections should be completed at the end of the project.

Why? To provide project details and identify the person(s) responsible for the project SWMP.

Basic Details

Client name :	Welsh Government
Principal contractor :	TBC
Owner of document :	Arcadis
Project title :	Brynglas Tunnel Refurbishments
Project Reference :	TBC
Project location :	Wales
Project postcode :	Various
Construction value :	£40,000,000.00
Type of construction :	Tunnels
Activity :	Refurbishment and Maintenance

Metrics

Please select metrics applicable to your project. These metrics are then used in the KPI sheet to track your progress.

Metric	Amount	Unit

Project targets

Please select project targets applicable to your project

KPI	Phase	Target	Unit
Waste recovery	All	70	%

Schedule

Start date :	01-Jan-16	dd/mm/yy
Completion date :	01-May-17	dd/mm/yy

Brynglas Tunnel Refurbishments

Waste Actions

Enter actions in the next available row below

Number	Type of Waste Action	Action Taken	Action owner	Reference to project document /	Waste stream	Material type	Estimated Cost Saving	Waste reduced		Date for completion (dd/mm/yyyy)	Status
								(m^3)	(tonnes		
1	Waste Management and Recovery Action	Investigate reuse of site won material as backfill	Design Consultant		Inert - Soil & stones	soil and stones other than those mentioned in 17 05 03					Incomplete
2	Waste Prevention Action	Prefabricated elememts to be used e.g. secondary lining panels	Design Consultant		Mixed C&D waste (17 09 04)	mixed construction and demolition wastes other than those mentioned in 17 09 01, 17 09 02 and 17 09 03					Incomplete
3	Waste Reduction Action	Reuse packaging by returning to supplier/manufacturer or using it for other purposes	Principal Contractor		Packaging	mixed packaging					Incomplete
4	Waste Management and Recovery Action	Setup area for segregated skips and use the national colour -coding scheme for waste containers to ensure waste is separated efficiently	Principal Contractor		Mixed C&D waste (17 09 04)	mixed construction and demolition wastes other than those mentioned in 17 09 01, 17 09 02 and 17 09 03					Incomplete
5	Waste Management and Recovery Action	Order materials in bulk where appropriate with minimal / reusable packaging where possible	Principal Contractor		Mixed C&D waste (17 09 04)	mixed construction and demolition wastes other than those mentioned in 17 09 01, 17 09 02 and 17 09 03					Incomplete
6	Waste Reduction Action	When incorporating requirements for waste reduction in procurement documents, refer to WRAP guidance on model wording	Principal Contractor								Incomplete
7	Waste Reduction Action	Put in place Materials Logistic Plan looking at supply routes, handling, storage and security for main construciton phase of the project	Principal Contractor								Incomplete
8	Waste Reduction Action	Avoid disposal of reusable materials	Principal Contractor		Packaging	mixed packaging					Incomplete
9	Waste Prevention Action	Use recycled aggregates (either onsite or off site) in concrete mix, as fill, etc.	Principal Contractor		Inert - mixture of concrete, bricks, tiles etc.	mixtures of concrete, bricks, tiles and ceramics other than those mentioned in 17 01 06					Incomplete

Forecast Waste

C, D or E Activity	Waste Stream	Material Type	Further description of waste - optional	Suggested LOW Code	Waste or Re-Use	Forecast Quantities (m^3)	Forecast Quantities (tonnes)	Calculated Quantities (Converting between m^3 and t) (m^3)	Calculated Quantities (tonnes)	Forecast provided by
Excavation	*Packaging*	*plastic packaging*	*plastic packaging*	*15 02 02*	*Off-site destination*	*###*	*###*	*###*	*###*	*A.N Other*
Demolition	Mixed Hazardous - C&D waste (17 09 03*)	other construction and demolition wastes containing dangerous substances		17 09 03*	Off-site segregated	29.48		29.48	7.96	
Demolition	Other C&D segregated waste	Furniture and bulky items		20 03 07	Off-site segregated	0.28		0.28	0.05	
Demolition	Other C&D segregated waste	discarded electrical and electronic equipment other than those mentioned in 20 01 21, 20 01 23 and 20 01 35		20 01 36	Off-site segregated	1.72		1.72	0.43	
Construction	Packaging	mixed packaging		15 01 06	Off-site mixed		7.41	35.29	7.41	SmartWaste KPIs
Construction	Other C&D segregated waste	mixed municipal waste	Liquids	20 03 01	Off-site mixed		18.07	86.05	18.07	SmartWaste KPIs
Construction	Inert - mixture of concrete, bricks, tiles etc.	concrete		17 01 01	On-site recycled		431.78	339.98	431.78	SmartWaste KPIs
Construction	Inert - mixture of concrete, bricks, tiles etc.	bricks		17 01 02	On-site recycled		3.76	3.13	3.76	SmartWaste KPIs
Construction	Inert - mixture of concrete, bricks, tiles etc.	mixtures of concrete, bricks, tiles and ceramics other than those mentioned in 17 01 06		17 01 07	On-site recycled		255.51	206.06	255.51	SmartWaste KPIs
Construction	Wood	wood		17 02 01	Off-site segregated		82.19	241.74	82.19	SmartWaste KPIs
Construction	Metals	mixed metals		17 04 07	Off-site segregated		12.14	28.90	12.14	SmartWaste KPIs
Excavation	Inert - Soil & stones	soil and stones other than those mentioned in 17 05 03		#N/A	Off-site segregated		172.01	#N/A	172.01	SmartWaste KPIs
Construction	Mixed Hazardous - C&D waste (17 09 03*)	other construction and demolition wastes containing dangerous substances		17 09 03*	Off-site segregated		1.69	6.26	1.69	SmartWaste KPIs
Construction	Mixed C&D waste (17 09 04)	mixed construction and demolition wastes other than those mentioned in 17 09 01, 17 09 02 and 17 09 03		17 09 04	Off-site segregated		1,905.66	5955.19	1905.66	SmartWaste KPIs
Construction	Other C&D segregated waste	biodegradable kitchen and canteen waste		20 01 08	Off-site segregated		33.11	165.55	33.11	SmartWaste KPIs
Construction	Other C&D segregated waste	Furniture and bulky items		20 03 07	Off-site mixed		0.10	0.56	0.10	SmartWaste KPIs

Specify Waste Carriers

Name	Contact Details	Date checked with Environment Agency (dd/mm/yyyy)	Registration Number	Expiry Date (dd/mm/yyyy)
Universal Waste Recycling Ltd		21/09/2015	CB/FE5347GD	05/11/2017

Specify Waste Management Facilities

Name	Type of facility	% reused if known	% recycled if known	% energy recovery if known	% total all forms of recovery	Overall diverted from landfill /	Date checked with Environment Agency (dd/mm/yyyy)	Licence / Exemption Number	Location of relevant documentation, e.g. WTN	C, D or E Activity (Leave blank if same facility & recovery rate are used for different waste streams)	Waste Stream
Erecycler Limited	Segregated waste sent off site					80%	21/09/2015	DB3193HM/A001		Demolition	Other C&D segregated waste
G D Environmental Services Ltd	Segregated waste sent off site					80%	21 Sep 2015	RP3295FS/V003		Construction	Other C&D segregated waste
G L J Recycling Limited	Segregated waste sent off site					80%	21 Sep 2015	DB3097TJ/T001		Construction	Metals
Tradebe (Gwent) Ltd	Mixed waste sent off site					50%	21 Sep 2015	GP3298FY/T001		Construction	Mixed Hazardous - C&D waste (17 09 03*)

What to enter? Enter a waste management action for each different waste type. The template consolidates the material types into a pre-determined list of waste streams and allows you to select a waste management facility and disposal cost for each waste stream.

When? This sheet should be completed during the pre-construction phase.

Why? Plan Waste Destinations' performs one simple task – it allows you to match up your forecast waste streams with expected waste management facilities (entered in 'Specify Waste Carriers').

The Client and the Principal Contractor must take all reasonable steps to ensure that:

- they have a copy of, or reference to, the written description of the waste required by section 34 of the Environmental Protection Act 1990;
- all waste from the site is dealt with in accordance with the waste duty of care in section 34 of the Environmental Protection Act 1990(3) and the Environmental Protection (Duty of Care) Regulations 1991(4); and
- materials will be handled efficiently and waste managed appropriately.

Total estimated forecast waste	Total (m^3)	Total (t)
Total from Waste Streams	6551.01	2068.81
Total Reused on site	549.17	691.05

Plan Waste Destinations

Construction
Demolition
Excavation

Construction

Waste sent offsite	Forecast: Estimated Volume (m^3)	Forecast: Estimated Weight (t)	Proposed Destination	% Diverted from landfill	Cost of waste disposal: £/m^3	Cost of waste disposal: £/t	Cost Forecast	Comments
Metals	28.90	12.14	G L J Recycling Limited (Construction Metals)	80%			FALSE	
Wood	241.74	82.19	G D Environmental Services Ltd (Construction Other C&D segregated	80%			FALSE	
Packaging	35.29	7.41	G D Environmental Services Ltd (Construction Other C&D segregated	80%			FALSE	
			Multiple Destinations					
Mixed Hazardous - C&D waste	6.26	1.69	Tradebe (Gwent) Ltd (Construction Mixed Hazardous - C&D waste (17 09	50%			FALSE	
Mixed C&D waste	5955.19	1905.66	G D Environmental Services Ltd (Construction Other C&D segregated	80%			FALSE	
Other C&D segregated waste	252.15	51.28	Erecycler Limited (Demolition Other C&D segregated waste)	80%			FALSE	
	6519.53	**2060.37**					**£0.00**	

Retained on site	Forecast: Estimated Volume (m^3)	Forecast: Estimated Weight (t)
Recycled on site	549.17	691.05
	549.17	**691.05**

Demolition

Waste sent offsite	Forecast: Estimated Volume (m^3)	Forecast: Estimated Weight (t)	Proposed Destination	% Diverted from landfill	Cost of waste disposal: £/m^3	Cost of waste disposal: £/t	Cost of waste disposal: Cost Forecast	Comments
			Multiple Destinations					
			Multiple Destinations					
Mixed Hazardous - C&D waste	29.48	7.96	Tradebe (Gwent) Ltd (Construction Mix	50%			FALSE	
Other C&D segregated waste	2.00	0.48	Erecycler Limited (Demolition Other C&	80%			FALSE	
	31.48	**8.44**					**£0.00**	

Retained on site	Forecast: Estimated Volume (m^3)	Forecast: Estimated Weight (t)
	0.00	**0.00**

Excavation

Waste sent offsite	Forecast		Proposed Destination	% Diverted from landfill	Cost of waste disposal			Comments
	Estimated Volume (m^3)	Estimated Weight (t)			£/m^3	£/t	Cost Forecast	
			Multiple Destinations					
	0.00	0.00					£0.00	

Retained on site	Forecast	
	Estimated Volume (m^3)	Estimated Weight (t)
	0.00	0.00

What to enter? Enter the details of each waste movement (using the pre-determined list of wastes) and its destination for your project. Note - the template pulls through waste carrier and waste management facility data entered earlier in tab 4-Specify Waste Carriers (to avoid repetitive data input). Enter your data in the 'Actual Waste Movements' table starting at cell C30. The summary 'Waste totals' table will update accordingly.

When? Record your actual waste movements once the construction team has mobilised on site.

Waste Totals

Display summary as:

Tonnes

Waste Stream	Total waste arising (Tonnes)	Total material retained on site (Tonnes)	Total waste sent offsite (Tonnes)	Total waste to landfill (Tonnes)	Total waste recovered offsite (Tonnes)	Cost of waste disposal
Inert - Soil & stones						£0.00
Hazardous - Soil & stones						£0.00
Non Haz (Non Inert) - Dredgings						£0.00
Segregated Haz - Soil & stones						£0.00
Gypsum						£0.00
Metals						£0.00
Wood						£0.00
Packaging						£0.00
Inert - Building rubble						£0.00
Inert - Glass						£0.00
Mixed Hazardous - C&D waste						£0.00
Mixed C&D waste						£0.00
Segregated Haz Waste						£0.00
Other C&D segregated waste						£0.00
Total						**£0.00**

Brynglas Tunnel Refurbishments

Actual Waste Movements

Movement Number	C, D or E Activity	Waste Stream	Material Type	Further description of waste (optional)	LOW Code used	On or off site destination	Off site carrier	Off site destination	On site reuse explanation (optional)	Overide facility recovery rate for individual skip	Overall diversion from landfill / recovery (further detail on Sheet 4)	Date of Movement(s) (dd/mm/yyyy)	Waste Totals				
													(m^3)	(tonnes)	Actual Cost	£/m^3	£/t
1											100%						
2											100%						
3											100%						
4											100%						
5											100%						
6											100%						
7											100%						
8											100%						
9											100%						
10											100%						
11											100%						
12											100%						
13											100%						
14											100%						
15											100%						
16											100%						
17											100%						
18											100%						
19											100%						
20											100%						
21											100%						
22											100%						
23											100%						
24											100%						
25											100%						
26											100%						
27											100%						
28											100%						
29											100%						
30											100%						
31											100%						
32											100%						

Brynglas Tunnel Refurbishments

My targets

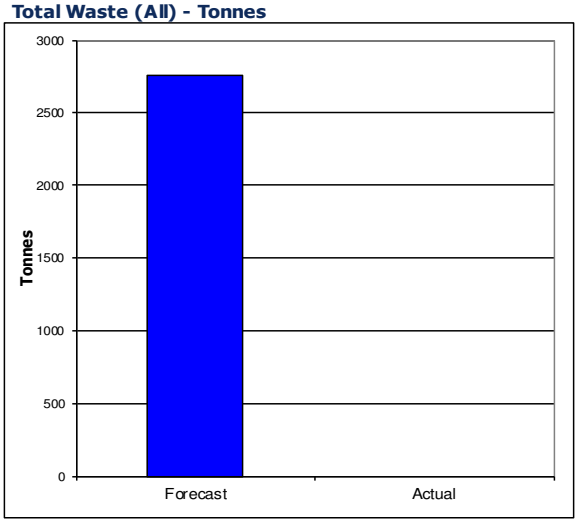
KPI	Target
Waste recovery (All)	70%

KPI Report

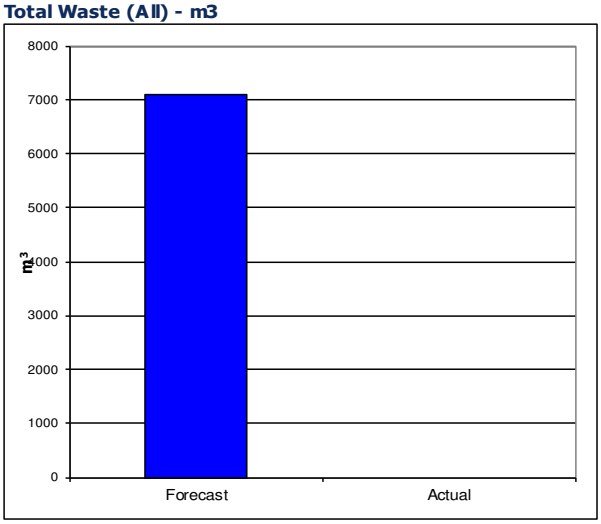
Select Metric :	Total
Select Phase :	All

	Forecast		Actual	
	m^3	Tonnes	m^3	Tonnes
Total Waste	7100.18	2759.86	0.00	0.00
Total Waste to landfill	1320.92	416.66	0.00	0.00
% Waste diverted from landfill	81%	85%	#DIV/0!	#DIV/0!
% Material reused on site	8%	25%	#DIV/0!	#DIV/0!

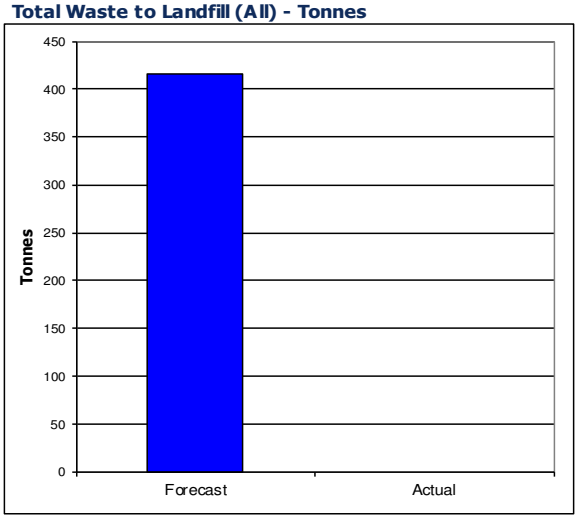
Total Waste (All) - Tonnes



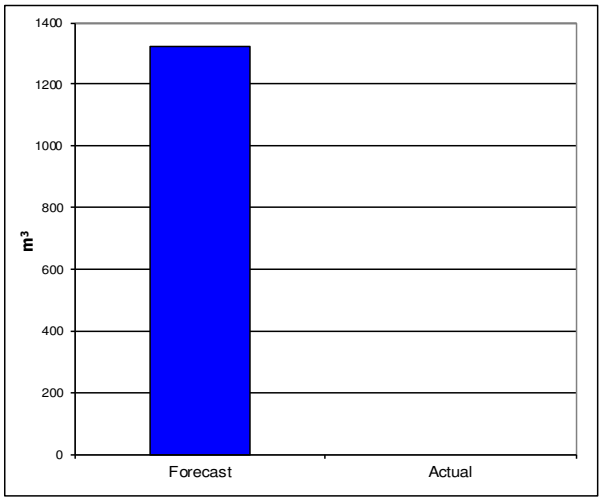
Total Waste (All) - m3



Total Waste to Landfill (All) - Tonnes



Total Waste to Landfill (All) - m3



View data in:	tonnes

	Forecast m³	Forecast Tonnes	Actual m³	Actual Tonnes
Total Waste	7,100	2,760	0.00	0.00
Total Waste to landfill	1,321	417	0.00	0.00
% Waste diverted from landfill	81%	85%	#DIV/0!	#DIV/0!
% Materials reused on site	8%	25%	#DIV/0!	#DIV/0!

Reporting

Combined stages C,D and E

Construction

Demolition

Excavation

Combined stages C, D and E

		Waste and material arisings		Waste sent offsite		Materials kept onsite		Sent to landfill		Diverted from landfill		Cost of waste disposal (offsite)	
Forecast/Actual		F	A	F	A	F	A	F	A	F	A	F	A
Unit		tonnes	tonnes	tonnes	tonnes	tonnes	tonnes	tonnes	tonnes	tonnes	tonnes	£	£
Total		2,759.86		2,068.81		691.05		416.66		1,652.15			
Class	Non Haz (Inert)	691.05				691.05							
	Haz	9.65		9.65				4.82		4.82			
	Non Haz (Non Inert)	2,059.16		2,059.16				411.83		1,647.33			
Assigned Waste Stream	Inert - Soil & stones												
	Non Haz (Non Inert) - Soil & stones												
	Non Haz (Non Inert) - Dredgings												
	Segregated Haz - Soil & stones												
	Gypsum												
	Metals	12.14		12.14				2.43		9.71			
	Wood	82.19		82.19				16.44		65.75			
	Packaging	7.41		7.41				1.48		5.93			
	Inert - Building rubble	691.05				691.05							
	Inert - Glass												
	Mixed Hazardous - C&D waste	9.65		9.65				4.82		4.82			
	Mixed C&D waste	1,905.66		1,905.66				381.13		1,524.53			
	Segregated Haz Waste												
	Other C&D segregated waste	51.76		51.76				10.35		41.41			
List of Waste (LOW) Code	08 01 11*												
	08 01 12												
	08 01 13*												
	08 01 14												
	edcf												
	08 03 18												
	13 01 12*												
	13 01 13*												
	13 05 01*												
	13 05 03*												
	13 05 06*												
	13 07 01*												
	14 06 01*												
	14 06 02*												
	14 06 03*												
	14 06 04*												
	14 06 05*												
	15 01 01												
	15 01 02												
	15 01 03												
	15 01 04												
	15 01 05												
	15 01 06	7.41		7.41									
	15 01 07												
	15 01 09												
	15 01 10*												
	15 01 11*												
	15 02 02*												
	15 02 03												
	16 01 03												
	16 01 07*												
	16 02 09*												
	16 06 01*												
	16 06 02*												
	16 06 03*												
	16 06 04												
	16 07 08*												
	16 10 01*												
	17 01 01	431.78				431.78							
	17 01 02	3.76				3.76							
	17 01 03												
	17 01 06*												
	17 01 07	255.51				255.51							
	17 02 01	82.19		82.19									
	17 02 02												
	17 02 03												
	17 02 04*												
	17 03 01*												
	17 03 02												
	17 03 03*												
	17 04 01												
	17 04 02												
	17 04 03												
	17 04 04												
	17 04 05												
	17 04 06												
	17 04 07	12.14		12.14									
	17 04 09*												
	17 04 10*												
	17 04 11												
	17 05 03*												
	17 05 04												
	17 05 05*												
	17 05 06												
	17 05 07*												
	17 05 08												
	17 06 01*												
	17 06 03*												
	17 06 04												
	17 06 05*												
	17 08 01*												
	17 08 02												
	17 09 01*												
	17 09 02*												
	17 09 03*	9.65		9.65									
	17 09 04	1,905.66		1,905.66									
	19 13 01*												
	20 01 01												
	20 01 08	33.11		33.11									
	20 01 11												
	20 01 21*												
	20 01 23*												
	20 01 25												
	20 01 35*												
	20 01 36	0.43		0.43									
	20 01 99												
	20 02 01												
	20 03 01	18.07		18.07									
	20 03 03												
	20 03 04												
	20 03 06												
	20 03 07	0.15		0.15									
	08 01 19												
	13 01 11*												
	13 02 08*												
	16 05 07*												
	10 11 03												
	20 01 02												
	20 01 39												

		Recovery of materials and wastes											
		Re-used				Recycled				Energy recovery			
		off-site		on-site		off-site		on-site		off-site		on-site	
Forecast/Actual		F	A	F	A	F	A	F	A	F	A	F	A
Unit		tonnes	tonnes	tonnes	tonnes	tonnes	tonnes	tonnes	tonnes	tonnes	tonnes	tonnes	tonnes
Total								691.05					
Class	Non Haz (Inert)							691.05					
	Haz												
	Non Haz (Non Inert)												
Assigned Waste Stream	Inert - Soil & stones												
	Non Haz (Non Inert) - Soil & stones												
	Non Haz (Non Inert) - Dredgings												
	Segregated Haz - Soil & stones												
	Gypsum												
	Metals												
	Wood												
	Packaging												
	Inert - Building rubble							691.05					
	Inert - Glass												
	Mixed Hazardous - C&D waste												
	Mixed C&D waste												
	Segregated Haz Waste												
	Other C&D segregated waste												
List of Waste (LOW) Code	08 01 11* to 16 10 01* (all rows)												
	17 01 01							431.78					
	17 01 02							3.76					
	17 01 07							255.51					
	all other LOW codes												

Brynglas Tunnel Refurbishments

Brynglas Tunnel Refurbishments

Excavation

		Waste and material arisings		Waste sent offsite		Materials kept onsite		Sent to landfill		Diverted from landfill		Cost of waste disposal (offsite)	
Forecast/Actual		F	A	F	A	F	A	F	A	F	A	F	A
Unit		tonnes	tonnes	tonnes	tonnes	tonnes	tonnes	tonnes	tonnes	tonnes	tonnes	£	£
Total													
Class	Non Haz (Inert)												
	Haz												
	Non Haz (Non Inert)												
Assigned Waste Stream	Inert - Soil & stones												
	Non Haz (Non Inert) - Soil & stones											FALSE	
	Non Haz (Non Inert) - Dredgings											FALSE	
	Segregated Haz - Soil & stones											FALSE	
	Gypsum											FALSE	
	Metals											FALSE	
	Wood											FALSE	
	Packaging											FALSE	
	Inert - Building rubble											FALSE	
	Inert - Glass											FALSE	
	Mixed Hazardous - C&D waste											FALSE	
	Mixed C&D waste											FALSE	
	Segregated Haz Waste											FALSE	
	Other C&D segregated waste											FALSE	
List of Waste (LOW) Code	08 01 11*												
	08 01 12												
	08 01 13*												
	08 01 14												
	08 01 18												
	08 03 18												
	13 01 12*												
	13 01 13*												
	13 05 01*												
	13 05 03*												
	13 05 06*												
	13 07 01*												
	14 06 01*												
	14 06 02*												
	14 06 03*												
	14 06 04*												
	14 06 05*												
	15 01 01												
	15 01 02												
	15 01 03												
	15 01 04												
	15 01 05												
	15 01 06												
	15 01 07												
	15 01 09												
	15 01 10*												
	15 01 11*												
	15 02 02*												
	15 02 03												
	16 01 03												
	16 01 07*												
	16 02 09*												
	16 06 01*												
	16 06 02*												
	16 06 03*												
	16 06 04												
	16 07 08*												
	16 10 01*												
	17 01 01												
	17 01 02												
	17 01 03												
	17 01 06*												
	17 01 07												
	17 02 01												
	17 02 02												
	17 02 03												
	17 02 04*												
	17 03 01*												
	17 03 02												
	17 03 03*												
	17 04 01												
	17 04 02												
	17 04 03												
	17 04 04												
	17 04 05												
	17 04 06												
	17 04 07												
	17 04 09*												
	17 04 10*												
	17 04 11												
	17 05 03*												
	17 05 04												
	17 05 05*												
	17 05 06												
	17 05 07*												
	17 05 08												
	17 06 01*												
	17 06 03*												
	17 06 04												
	17 06 05*												
	17 08 01*												
	17 08 02												
	17 09 01*												
	17 09 02*												
	17 09 03*												
	17 09 04												
	19 13 01*												
	20 01 01												
	20 01 08												
	20 01 11												
	20 01 21*												
	20 01 23*												
	20 01 25												
	20 01 35*												
	20 01 36												
	20 01 99												
	20 02 01												
	20 03 01												
	20 03 03												
	20 03 04												
	20 03 06												
	20 03 07												
	08 01 19												
	13 01 11*												
	13 02 08*												
	16 05 07*												
	10 11 03												
	20 01 02												
	20 01 39												

		Recovery of materials and wastes											
		Re-used				Recycled				Energy recovery			
		off-site		on-site		off-site		on-site		off-site		on-site	
Forecast/Actual		F	A	F	A	F	A	F	A	F	A	F	A
Unit		tonnes	tonnes	tonnes	tonnes	tonnes	tonnes	tonnes	tonnes	tonnes	tonnes	tonnes	tonnes
Total													
Class	Non Haz (Inert)												
	Haz												
	Non Haz (Non Inert)												
Assigned Waste Stream	Inert - Soil & stones												
	Non Haz (Non Inert) - Soil & stones												
	Non Haz (Non Inert) - Dredgings												
	Segregated Haz - Soil & stones												
	Gypsum												
	Metals												
	Wood												
	Packaging												
	Inert - Building rubble												
	Inert - Glass												
	Mixed Hazardous - C&D waste												
	Mixed C&D waste												
	Segregated Haz Waste												
	Other C&D segregated waste												
List of Waste (LOW) Code	08 01 11*												
	08 01 12												
	08 01 13*												
	08 01 14												
	08 01 18												
	08 03 18												
	13 01 12*												
	13 01 13*												
	13 05 01*												
	13 05 03*												
	13 05 06*												
	13 07 01*												
	14 06 01*												
	14 06 02*												
	14 06 03*												
	14 06 04*												
	14 06 05*												
	15 01 01												
	15 01 02												
	15 01 03												
	15 01 04												
	15 01 05												
	15 01 06												
	15 01 07												
	15 01 09												
	15 01 10*												
	15 01 11*												
	15 02 02*												
	15 02 03												
	16 01 03												
	16 01 07*												
	16 02 09*												
	16 06 01*												
	16 06 02*												
	16 06 03*												
	16 06 04												
	16 07 08*												
	16 10 01*												
	17 01 01												
	17 01 02												
	17 01 03												
	17 01 06*												
	17 01 07												
	17 02 01												
	17 02 02												
	17 02 03												
	17 02 04*												
	17 03 01*												
	17 03 02												
	17 03 03*												
	17 04 01												
	17 04 02												
	17 04 03												
	17 04 04												
	17 04 05												
	17 04 06												
	17 04 07												
	17 04 09*												
	17 04 10*												
	17 04 11												
	17 05 03*												
	17 05 04												
	17 05 05*												
	17 05 06												
	17 05 07*												
	17 05 08												
	17 06 01*												
	17 06 03*												
	17 06 04												
	17 06 05*												
	17 08 01*												
	17 08 02												
	17 09 01*												
	17 09 02*												
	17 09 03*												
	17 09 04												
	19 13 01*												
	20 01 01												
	20 01 08												
	20 01 11												
	20 01 21*												
	20 01 23*												
	20 01 25												
	20 01 35*												
	20 01 36												
	20 01 99												
	20 02 01												
	20 03 01												
	20 03 03												
	20 03 04												
	20 03 06												
	20 03 07												
	08 01 19												
	13 01 11*												
	13 02 08*												
	16 05 07*												
	10 11 03												
	20 01 02												
	20 01 39												

Environmental Assessment Methods

An advantage of using the SWMP template is to meet requirements for Environmental Assessment Methods such as BREEAM and CEEQUAL.

This page helps users who are striving towards achieving requirements of these Environmental Assessments to draw out the information they require.

It should be noted that:

- not all projects require an Environmental Assessment but those that do can use this sheet for guidance; and
- users should check the relevant assessment manuals (if) applicable to their project for compliance with waste management requirements.

Common Requirements for Environmental Assessment Methods (EAMs)

There are some requirements with regards to Site Waste Management Planning that are common to many EAMs. The following is a suggested list of good practice which may be required for compliance. Users should check the guidance for the relevant assessment method for exact requirements.

- Compliance with Environmental Protection Act 1990 and the Environmental Protection (Duty of Care) Regulations 1991(4).
- Regular updating of the SWMP and evidence of review and implementation.
- Determine and follow a formal waste minimisation plan.
- Set targets to reduce, re-use and / or recycle waste.
- Active monitoring of targets for the duration of the project.
- Report % of inert waste material that has been segregated (on or off-site) and diverted from landfill.
- Report % by volume of non-hazardous waste material that has been segregated (on or off site) and diverted from landfill.

BREEAM

A Site Waste Management Plan is required to achieve credits under the BREEAM issue relating to construction waste management. There are certain aspects that must be included in a SWMP. The checklist below summarises some of these.

It is important to note that either mass **or** volume can be recorded for BREEAM and users are advised to choose the unit that suits their project and targets most appropriately.

Users must refer to their BREEAM guidance to confirm compliance as the requirements can differ between BREEAM schemes.

Checklist

Does your SWMP include the following?	Completed?	Notes
Target benchmark for resource efficiency i.e. m^3 of waste per $100m^2$ or tonnes of waste per $100m^2$	No	
Procedures and commitments for minimising non-hazardous waste in line with the benchmark	No	
Procedures for minimising hazardous waste	No	
Procedures for monitoring, measuring and reporting hazardous and non-hazardous site waste	No	
Procedures for sorting, reusing and recycling construction waste into defined waste groups (see additional guidance section), either on site or through a licensed external contractor	No	
The name or job title of the individual responsible for implementing the above.	No	

	Forecast		Actual	
	Total (m^3)	**Total** (t)	**Total** (m^3)	**Total** (t)
Construction waste per $100m^2$ GIFA	No GIFAm2 entered	No GIFAm2 entered	No GIFAm2 entered	No GIFAm2 entered

Diversion of non-hazardous waste from landfill	**Volume** (%)	**Tonnage** (%)	**Volume** (%)	**Tonnage** (%)
Non-demolition %	73.78%	59.89%	No waste	No waste
Demolition %	80.00%	80.00%	No waste	No waste

APPENDIX D

Baseline Noise Survey Data

Location NML1

Address	Start Time	Measurement Time	Leq	LE	Lmax	Lmin	LN1	LN2	LN3	LN4	LN5
1	30/09/2015 19:00	00d 00:10:00.0	59.2	87	83.1	54	69.2	59.9	57.6	55.8	54.9
2	30/09/2015 19:10	00d 00:10:00.0	58.6	86.4	75.9	53.9	64.1	59.8	58	56.2	54.8
3	30/09/2015 19:20	00d 00:10:00.0	58.3	86.1	71.3	53.5	66.3	59.4	57.3	55.9	54.8
4	30/09/2015 19:30	00d 00:10:00.0	58.5	86.3	71	54.3	61.9	59.7	58.2	56.7	55.2
5	30/09/2015 19:40	00d 00:10:00.0	58.5	86.3	71	53.9	65.8	59.9	57.8	56.4	55.3
6	30/09/2015 19:50	00d 00:10:00.0	57.6	85.4	67.4	52.6	63.6	59.2	57	55.2	54
7	30/09/2015 20:00	00d 00:10:00.0	57.8	85.6	76.2	51.8	64.2	59.5	57.1	55	53
8	30/09/2015 20:10	00d 00:10:00.0	57.3	85.1	67.8	52.4	62.6	59.1	56.9	55.1	53.7
9	30/09/2015 20:20	00d 00:10:00.0	57.1	84.9	65.8	50.6	61.6	59	56.7	54.5	52.6
10	30/09/2015 20:30	00d 00:10:00.0	58.7	86.5	75.7	52.2	68.8	59.6	56.7	54.9	53.5
11	30/09/2015 20:40	00d 00:10:00.0	56.9	84.7	70.7	52	62.9	58.5	56.3	54.5	52.9
12	30/09/2015 20:50	00d 00:10:00.0	57	84.8	71.7	51	64.7	58.3	56.1	54	52.1
13	30/09/2015 21:00	00d 00:10:00.0	57.2	85	74.5	48.8	67.1	58.1	55.7	53.9	50.3
14	30/09/2015 21:10	00d 00:10:00.0	56.2	84	64.7	51.2	60	58.3	55.8	53.5	52.4
15	30/09/2015 21:20	00d 00:10:00.0	55.9	83.7	69.1	51.1	60.6	57.7	55.2	53.2	52.3
16	30/09/2015 21:30	00d 00:10:00.0	55.7	83.5	70.5	49.8	61.4	57.6	54.8	52.6	51.3
17	30/09/2015 21:40	00d 00:10:00.0	56.1	83.9	68.2	49.5	62.9	58.5	55.4	52.7	51.3
18	30/09/2015 21:50	00d 00:10:00.0	55.9	83.7	72.2	46	62.8	58	54.6	51.9	48.1
19	30/09/2015 22:00	00d 00:10:00.0	55	82.8	69.1	49.3	60.5	57.1	54.1	51.6	50.2
20	30/09/2015 22:10	00d 00:10:00.0	55.7	83.5	68.9	49	64.1	57.3	54.8	52.7	50.9
21	30/09/2015 22:20	00d 00:10:00.0	55.2	83	65.7	48.3	63.2	57.1	54.4	51.8	49.7
22	30/09/2015 22:30	00d 00:10:00.0	53.9	81.7	60.8	47	58.6	56.1	53.5	50.5	48.6
23	30/09/2015 22:40	00d 00:10:00.0	53.5	81.3	65.2	46.8	59.3	55.7	52.7	50.1	48.2

Address	Start Time	Measurement Time	Leq	LE	Lmax	Lmin	LN1	LN2	LN3	LN4	LN5
24	30/09/2015 22:50	00d 00:10:00.0	53.6	81.4	61.3	47.2	58.9	56.2	52.7	50	48.4
25	30/09/2015 23:00	00d 00:10:00.0	54.6	82.4	63.6	45.5	60.3	57.5	53.5	49.8	46.8
26	30/09/2015 23:10	00d 00:10:00.0	54.4	82.2	67.4	44.4	61.4	56.9	53.2	50.2	45.8
27	30/09/2015 23:20	00d 00:10:00.0	53	80.8	66.1	42.7	59	55.6	51.9	47.7	44.2
28	30/09/2015 23:30	00d 00:10:00.0	52.3	80.1	65.8	42.2	58.7	55.1	51.1	46.9	43.8
29	30/09/2015 23:40	00d 00:10:00.0	52.6	80.4	62.7	40.7	59.8	55.9	50.8	46.8	43.4
30	30/09/2015 23:50	00d 00:10:00.0	52.3	80.1	62.6	39.8	59.2	55.6	50.8	44.6	41.4
31	01/10/2015 00:00	00d 00:10:00.0	52.6	80.4	60.2	44.3	58.9	55.7	51.4	47.3	45.6
32	01/10/2015 00:10	00d 00:10:00.0	51.5	79.3	59.8	38.4	58.4	54.7	50.3	44.9	40.6
33	01/10/2015 00:20	00d 00:10:00.0	54	81.8	69.3	42.1	63.2	57.7	51.2	46.8	43.6
34	01/10/2015 00:30	00d 00:10:00.0	52.3	80.1	68.9	39.7	59.1	55.6	50.1	43.2	40.8
35	01/10/2015 00:40	00d 00:10:00.0	52	79.8	60.5	39.5	59.3	55.2	50.3	45.4	40.7
36	01/10/2015 00:50	00d 00:10:00.0	52.3	80.1	62.3	38.9	60.6	56	50.1	44.2	41.1
37	01/10/2015 01:00	00d 00:10:00.0	52.4	80.2	65.8	39.1	62.1	55.7	49.8	44.3	40.8
38	01/10/2015 01:10	00d 00:10:00.0	52.6	80.4	62.5	39.4	59.6	56.4	50.5	44.9	42.1
39	01/10/2015 01:20	00d 00:10:00.0	52.4	80.2	61.9	37.3	59.6	56.7	50	45	38.5
40	01/10/2015 01:30	00d 00:10:00.0	51.4	79.2	61.8	37.6	59.2	55.1	49.4	44.8	40.3
41	01/10/2015 01:40	00d 00:10:00.0	52.3	80.1	61.8	38.1	59.4	56.3	50.3	44.4	40.4
42	01/10/2015 01:50	00d 00:10:00.0	52.8	80.6	69	35.5	63.9	56.1	49.3	42	37.3
43	01/10/2015 02:00	00d 00:10:00.0	52.8	80.6	64.1	39.4	60.5	56.8	50.2	43.4	41.4
44	01/10/2015 02:10	00d 00:10:00.0	51.8	79.6	60.3	37.6	59.1	55.2	50	43.4	38.5
45	01/10/2015 02:20	00d 00:10:00.0	52	79.8	61.3	41.1	59.2	55.7	50.3	45.5	42
46	01/10/2015 02:30	00d 00:10:00.0	52.5	80.3	61.2	38.7	59.8	56.4	50.5	45.1	39.9
47	01/10/2015 02:40	00d 00:10:00.0	53	80.8	62.8	39.7	59.5	56.6	51.3	46.4	42.2
48	01/10/2015 02:50	00d 00:10:00.0	52.8	80.6	62.5	43.1	59.5	56.3	51.1	47.2	45.4
49	01/10/2015 03:00	00d 00:10:00.0	51.5	79.3	59.5	37.7	57.8	54.7	50.5	43.6	38.7
50	01/10/2015 03:10	00d 00:10:00.0	53.4	81.2	63.5	44.6	60.4	56.4	52.3	48	45.7
51	01/10/2015 03:20	00d 00:10:00.0	52.6	80.4	62.2	41.4	59.5	55.8	50.9	46.3	43.3

Brynglas Tunnel Refurbishments

Address	Start Time	Measurement Time	Leq	LE	Lmax	Lmin	LN1	LN2	LN3	LN4	LN5
52	01/10/2015 03:30	00d 00:10:00.0	52.5	80.3	61.9	40.8	60	56	50.6	45.2	42.3
53	01/10/2015 03:40	00d 00:10:00.0	51.8	79.6	61	39.9	59	55.4	50	45.9	41.8
54	01/10/2015 03:50	00d 00:10:00.0	53.2	81	61.8	41.2	59.3	56.7	51.7	46.6	42.9
55	01/10/2015 04:00	00d 00:10:00.0	53.7	81.5	64.2	41	60.1	57.3	52.3	47.2	43.8
56	01/10/2015 04:10	00d 00:10:00.0	53.6	81.4	62.9	37.6	60.6	57.3	52	44.3	39.2
57	01/10/2015 04:20	00d 00:10:00.0	54.1	81.9	62.6	45.3	59.8	56.8	53.2	49.5	46.9
58	01/10/2015 04:30	00d 00:10:00.0	55.3	83.1	72.6	45.5	66	57.8	52.9	49.5	47.3
59	01/10/2015 04:40	00d 00:10:00.0	55	82.8	62.9	43.5	61.1	57.9	54	50.2	45.6
60	01/10/2015 04:50	00d 00:10:00.0	56.4	84.2	62.9	48.4	61	59.2	55.6	52.3	50
61	01/10/2015 05:00	00d 00:10:00.0	57.6	85.4	64.5	49.4	62.3	60.3	57	53.5	51.4
62	01/10/2015 05:10	00d 00:10:00.0	59.3	87.1	75	47.9	67.6	61.3	58	54.9	52.2
63	01/10/2015 05:20	00d 00:10:00.0	60	87.8	78.7	52.4	64.8	61.8	59	56.3	54.6
64	01/10/2015 05:30	00d 00:10:00.0	58.9	86.7	66.2	52.8	63.2	60.9	58.6	56	53.8
65	01/10/2015 05:40	00d 00:10:00.0	59.1	86.9	71.6	50.6	66.8	61.7	57.8	54.8	52.4
66	01/10/2015 05:50	00d 00:10:00.0	58.6	86.4	64.1	52.8	62.5	60.7	58.1	55.9	53.8
67	01/10/2015 06:00	00d 00:10:00.0	59.4	87.2	65.1	53.6	63.6	61.3	58.9	56.7	55.1
68	01/10/2015 06:10	00d 00:10:00.0	60	87.8	69.7	54.3	63.8	61.7	59.8	57.4	56.1
69	01/10/2015 06:20	00d 00:10:00.0	60.8	88.6	65.8	54.9	63.9	62.5	60.5	58.7	56.9
70	01/10/2015 06:30	00d 00:10:00.0	62	89.8	70.5	56.8	65.8	63.9	61.7	59.4	58
71	01/10/2015 06:40	00d 00:10:00.0	62	89.8	68.2	57.5	65.8	63.6	61.7	60	58.7
72	01/10/2015 06:50	00d 00:10:00.0	63.7	91.5	85.9	56.6	71.6	63.4	61.4	60	58.9
73	01/10/2015 07:00	00d 00:10:00.0	62.7	90.5	73.1	57.2	67.3	63.9	62.5	60.5	59.1
74	01/10/2015 07:10	00d 00:10:00.0	62.4	90.2	69.6	58.9	65.3	63.5	62.2	60.8	59.9
75	01/10/2015 07:20	00d 00:10:00.0	63	90.8	74.1	58.6	67.9	64	62.7	61.3	60.1
76	01/10/2015 07:30	00d 00:10:00.0	62.2	90	72.9	58.2	65.7	63.6	62	60.3	59.3
77	01/10/2015 07:40	00d 00:10:00.0	61.4	89.2	68.7	55.9	65	63	61.3	58.5	57.1
78	01/10/2015 07:50	00d 00:10:00.0	61.3	89.1	71.4	57.5	66	62.6	60.9	59.5	58.5
79	01/10/2015 08:00	00d 00:10:00.0	60.9	88.7	69.1	56.5	64.1	62.3	60.7	59.3	57.4

Address	Start Time	Measurement Time	Leq	LE	Lmax	Lmin	LN1	LN2	LN3	LN4	LN5
80	01/10/2015 08:10	00d 00:10:00.0	60.2	88	71.4	56.2	63.2	61.6	60	58.1	57.4
81	01/10/2015 08:20	00d 00:10:00.0	59.5	87.3	71.6	55.2	63.4	60.6	59.1	57.7	56.3
82	01/10/2015 08:30	00d 00:10:00.0	60.9	88.7	79.9	54.9	70.1	61.3	59.5	57.6	55.8
83	01/10/2015 08:40	00d 00:10:00.0	60.9	88.7	74.4	56.5	67.6	62.3	60.3	58.7	57.7
84	01/10/2015 08:50	00d 00:10:00.0	61.5	89.3	75.7	56.4	68.2	62.9	60.8	58.9	57.4
85	01/10/2015 09:00	00d 00:10:00.0	61.3	89.1	72.5	55.8	66.6	62.4	61	59.4	58
86	01/10/2015 09:10	00d 00:10:00.0	60.2	88	68.2	56.2	63.2	61.6	60.2	58.2	57.1
87	01/10/2015 09:20	00d 00:10:00.0	62.3	90.1	75.3	58.1	68.7	63.3	61.7	60.4	59.6
88	01/10/2015 09:30	00d 00:10:00.0	61.9	89.7	70.6	57.9	65.2	63	61.7	60.3	59.1
89	01/10/2015 09:40	00d 00:10:00.0	62	89.8	73.1	57.6	68.3	63.5	61.5	59.6	58.8
90	01/10/2015 09:50	00d 00:10:00.0	61.8	89.6	73.1	56.8	67.8	63.2	61.2	59.4	58.5
91	01/10/2015 10:00	00d 00:10:00.0	63.5	91.3	90.7	55.3	68.3	63.1	60.9	59	57.4
92	01/10/2015 10:10	00d 00:10:00.0	63	90.8	88.1	56.5	69.3	64.1	61.3	59.5	58.2
93	01/10/2015 10:20	00d 00:10:00.0	63	90.8	76.9	56.7	74.2	63.5	61.5	59.4	58
94	01/10/2015 10:30	00d 00:10:00.0	61.1	88.9	71	56.3	64.7	62.8	60.7	58.9	57.3
95	01/10/2015 10:40	00d 00:10:00.0	60.4	88.2	69.6	55.1	64.7	62	60.2	58.4	57
96	01/10/2015 10:50	00d 00:10:00.0	60.5	88.3	82.7	55.1	65.7	62	60	57.7	56.1
97	01/10/2015 11:00	00d 00:10:00.0	60.7	88.5	76.1	55.6	68.8	61.6	59.5	57.9	56.8
98	01/10/2015 11:10	00d 00:10:00.0	60.3	88.1	76.9	54.4	67.1	61.7	59.9	57.6	56
99	01/10/2015 11:20	00d 00:10:00.0	60.6	88.4	74.4	54.7	67.1	61.9	60	57.8	56.4
100	01/10/2015 11:30	00d 00:10:00.0	59.8	87.6	71.4	54.5	66	61.4	59.4	57.4	56.1
101	01/10/2015 11:40	00d 00:10:00.0	60.6	88.4	75.1	54.5	68.7	61.6	60	57.7	55.8
102	01/10/2015 11:50	00d 00:10:00.0	60.3	88.1	72.4	55.1	65.7	62.1	59.6	57.8	56.4
103	01/10/2015 12:00	00d 00:10:00.0	59.7	87.5	74.8	53.9	66.3	60.8	59.1	56.9	55.5
104	01/10/2015 12:10	00d 00:10:00.0	71	98.8	99.1	54.7	78.6	62.4	59.7	57.4	55.9
105	01/10/2015 12:20	00d 00:10:00.0	60.4	88.2	71.6	54	66.5	62.2	59.8	57.4	55.3
106	01/10/2015 12:30	00d 00:10:00.0	60.9	88.7	74.3	55.7	68.2	62.5	60.2	57.9	56.9
107	01/10/2015 12:40	00d 00:10:00.0	59.6	87.4	66.1	54.8	62.7	61	59.4	57.7	56.1

Brynglas Tunnel Refurbishments

Address	Start Time	Measurement Time	Leq	LE	Lmax	Lmin	LN1	LN2	LN3	LN4	LN5
108	01/10/2015 12:50	00d 00:10:00.0	60	87.8	68.8	53.6	65.1	61.8	59.6	57.1	54.9
109	01/10/2015 13:00	00d 00:10:00.0	60	87.8	69.5	54.5	64.5	61.5	59.7	57.7	56.2
110	01/10/2015 13:10	00d 00:10:00.0	59.7	87.5	67.9	54.6	64.9	61.7	59.1	57.3	55.7
111	01/10/2015 13:20	00d 00:10:00.0	61	88.8	71	54.6	67.2	62.6	60.3	58.8	56.9
112	01/10/2015 13:30	00d 00:10:00.0	62	89.8	76.6	55.8	70.4	63.6	60.7	58.4	56.9
113	01/10/2015 13:40	00d 00:10:00.0	62	89.8	80.1	53.8	68.8	63.4	60.5	58.2	56.2
114	01/10/2015 13:50	00d 00:10:00.0	59.8	87.6	71	54.8	65.9	61.4	59.2	57.3	56.2
115	01/10/2015 14:00	00d 00:10:00.0	59.6	87.4	70.1	55.1	65.2	61.1	59.2	57.2	56.1
116	01/10/2015 14:10	00d 00:10:00.0	60.6	88.4	74.8	56.2	66.6	61.9	60	58.2	57.2
117	01/10/2015 14:20	00d 00:10:00.0	60.5	88.3	74.4	54.9	66.9	61.9	59.7	58.1	56.1
118	01/10/2015 14:30	00d 00:10:00.0	60.7	88.5	74.6	55.5	66.8	61.9	60.1	58.3	56.7
119	01/10/2015 14:40	00d 00:10:00.0	61.3	89.1	78.9	54.9	68.1	62.2	60.1	58.4	55.9
120	01/10/2015 14:50	00d 00:10:00.0	60.1	87.9	71.2	54.6	67.4	61.7	59.5	57.3	55.7
121	01/10/2015 15:00	00d 00:10:00.0	69.3	97.1	92.8	54.4	84.6	65.2	60.5	57.9	56.2
122	01/10/2015 15:10	00d 00:10:00.0	66.7	94.5	93.5	55.7	82.7	64.8	59.9	58.3	57.1
123	01/10/2015 15:20	00d 00:10:00.0	64.2	92	94.8	56.2	70.7	63	60.5	58.6	57.5
124	01/10/2015 15:30	00d 00:10:00.0	63.5	91.3	93.7	55.5	68.2	61.9	59.9	58.1	56.9
125	01/10/2015 15:40	00d 00:10:00.0	60.9	88.7	71.9	56.3	65.7	62.4	60.5	58.7	57.5
126	01/10/2015 15:50	00d 00:10:00.0	61.3	89.1	75.4	56.8	68.3	62.5	60.6	59.1	57.9
127	01/10/2015 16:00	00d 00:10:00.0	61.5	89.3	77	57	67.8	62.5	60.8	59.1	58.1
128	01/10/2015 16:10	00d 00:10:00.0	61.3	89.1	72.9	56.3	69.1	62.5	60.7	58.8	57.5
129	01/10/2015 16:20	00d 00:10:00.0	61.7	89.5	80.9	57.7	68	62.5	60.8	59.3	58.6
130	01/10/2015 16:30	00d 00:10:00.0	60.9	88.7	70.6	57	65.8	62	60.5	59.1	58
131	01/10/2015 16:40	00d 00:10:00.0	60.3	88.1	69.3	56.3	65.9	61.7	59.8	58.3	57.3
132	01/10/2015 16:50	00d 00:10:00.0	62.4	90.2	82.5	56.6	72.7	63.2	60.8	59.3	57.7
133	01/10/2015 17:00	00d 00:10:00.0	60.9	88.7	71.4	56.4	67.8	62	60.5	58.8	57.6
134	01/10/2015 17:10	00d 00:10:00.0	60.1	87.9	68.7	55.6	63.2	61.4	59.9	58.3	56.7
135	01/10/2015 17:20	00d 00:10:00.0	60.5	88.3	70.9	56.1	64.2	61.9	60.1	58.7	57

Address	Start Time	Measurement Time	Leq	LE	Lmax	Lmin	LN1	LN2	LN3	LN4	LN5
136	01/10/2015 17:30	00d 00:10:00.0	61.4	89.2	77.2	56.5	67.9	62.4	60.6	59.2	58.3
137	01/10/2015 17:40	00d 00:10:00.0	61	88.8	69.8	55.4	65.4	63.2	60.6	58.3	56.7
138	01/10/2015 17:50	00d 00:10:00.0	59.5	87.3	75.3	54.9	66	60.7	58.8	57.1	56
139	01/10/2015 18:00	00d 00:10:00.0	59.1	86.9	71.9	54.9	63.7	60.3	58.8	57.4	56.2
140	01/10/2015 18:10	00d 00:10:00.0	58.7	86.5	69.7	54.1	64.1	60	58.4	56.4	54.9
141	01/10/2015 18:20	00d 00:10:00.0	60.1	87.9	68.1	55.3	64	61.6	59.8	58	56.7
142	01/10/2015 18:30	00d 00:10:00.0	60.1	87.9	82.5	55.2	66.5	61.2	59.5	57.9	56.4
143	01/10/2015 18:40	00d 00:10:00.0	60.6	88.4	80.8	55.5	66.4	61.9	59.8	58.3	57
144	01/10/2015 18:50	00d 00:10:00.0	60.1	87.9	77.9	56.3	64.7	61.1	59.7	58.1	57.3
145	01/10/2015 19:00	00d 00:01:14.2	61.8	80.5	85.3	55.5	77	60.4	58.8	57.3	56.1

Location NML2

Address	Time	Measurement Time	LAeq	LAE	LAmax	LAmin	LA01	LA10	LA50	LA90	LA99
1	30/09/2015 14:26	0:10:00	65.9	93.7	82.8	60.3	70.1	67.6	65.4	63.3	61.8
2	30/09/2015 14:36	0:10:00	66.3	94.1	72.3	61.8	69.6	67.9	66.1	64.1	62.8
3	30/09/2015 14:46	0:10:00	66.1	93.9	73.9	59.2	69.2	67.9	65.9	63.2	60.4
4	30/09/2015 14:56	0:10:00	65.7	93.5	71.6	59.6	69.6	67.8	65.2	62.8	61.1
5	30/09/2015 15:06	0:10:00	65.8	93.6	73.2	58.9	69.7	67.9	65.4	62.6	60.5
6	30/09/2015 15:16	0:10:00	65.5	93.3	70.8	59	69.2	67.5	65.2	62.1	60.6
7	30/09/2015 15:26	0:10:00	65.8	93.6	72.8	57	69.4	67.9	65.4	63	58.8
8	30/09/2015 15:36	0:10:00	65.4	93.2	72.7	57.9	69.4	67.6	65	61.6	59.3
9	30/09/2015 15:46	0:10:00	65.2	93	72.9	57.8	69	67.3	64.9	62	59.9
10	30/09/2015 15:56	0:10:00	65.5	93.3	72.6	58.2	69.3	67.7	65.2	62.1	60.2
11	30/09/2015 16:06	0:10:00	64.7	92.5	71	57.2	68.6	66.8	64.3	61.6	58.8
12	30/09/2015 16:16	0:10:00	64.5	92.3	73.3	56.3	68.7	66.8	64.1	60.9	58

13	30/09/2015 16:26	0:10:00	64.8	92.6	79.3	57.1	68.9	67	64.3	61.1	58.3
14	30/09/2015 16:36	0:10:00	64.2	92	70.8	54.7	68.7	66.8	63.6	59.8	56.6
15	30/09/2015 16:46	0:10:00	64.2	92	74.8	54.6	70.3	66.6	63.4	60	56.1
16	30/09/2015 16:56	0:10:00	64.4	92.2	73	54.5	69.5	66.9	63.7	59.7	56.7
17	30/09/2015 17:06	0:10:00	63.4	91.2	70.6	49.2	68	66.2	62.8	58.6	50.9
18	30/09/2015 17:16	0:10:00	63.7	91.5	69.8	55.2	68.2	66.1	63.1	59.8	57.6
19	30/09/2015 17:26	0:10:00	63.3	91.1	69.5	54.5	67.9	65.9	62.7	58.9	56
20	30/09/2015 17:36	0:10:00	63	90.8	71.8	52.8	68	65.6	62.2	58.5	54.9
21	30/09/2015 17:46	0:10:00	62.2	90	70	51.6	67.4	65.2	61.4	56.6	53.1
22	30/09/2015 17:56	0:10:00	62.4	90.2	69.8	51.4	67.8	65.3	61.4	57.4	52.6
23	30/09/2015 18:06	0:10:00	62	89.8	69.9	52.3	67.3	65	61.1	56.8	53.7
24	30/09/2015 18:16	0:10:00	62.9	90.7	74.3	51.4	68.4	66.2	61.9	56.7	53.2
25	30/09/2015 18:26	0:10:00	62.3	90.1	71.2	52.5	68	65.5	61.2	57	54.1
26	30/09/2015 18:36	0:10:00	60.9	88.7	70	42.9	67.4	64.8	59	51.2	44.3
27	30/09/2015 18:46	0:10:00	60.9	88.7	69.4	47	67.7	64.5	59	53.7	49.6
28	30/09/2015 18:56	0:10:00	61.1	88.9	70.2	44.3	67.6	64.7	59.4	53.4	46.3
29	30/09/2015 19:06	0:10:00	61.2	89	70.8	46.3	68	64.9	59.5	52.3	48.4
30	30/09/2015 19:16	0:10:00	61.8	89.6	69.7	47.1	67.7	65.5	60.3	53.2	48.4
31	30/09/2015 19:26	0:10:00	60.6	88.4	69.3	44.3	67.2	64.3	58.9	52.3	46.8
32	30/09/2015 19:36	0:10:00	61	88.8	72.6	40	68.1	64.9	58.5	49.7	42
33	30/09/2015 19:46	0:10:00	61	88.8	71.3	45.3	68.3	65	58.8	51.8	47.1
34	30/09/2015 19:56	0:10:00	61	88.8	72.7	44.8	67.7	64.9	58.9	52.4	47.1
35	30/09/2015 20:06	0:10:00	59.9	87.7	70.4	41.3	68	64.1	57.3	49.2	43.4
36	30/09/2015 20:16	0:10:00	61.2	89	71.3	44.9	67.6	64.9	59.5	51.5	46.1
37	30/09/2015 20:26	0:10:00	60.6	88.4	70.1	45.2	68	64.7	57.9	50.8	46.2
38	30/09/2015 20:36	0:10:00	60	87.8	69.8	42.8	67.1	63.9	57.6	50.1	44.8
39	30/09/2015 20:46	0:10:00	61.2	89	71.1	49.8	67.9	64.9	59.3	54.3	51
40	30/09/2015 20:56	0:10:00	60.3	88.1	70.7	42.4	67.5	64.4	58	50	44.1
41	30/09/2015 21:06	0:10:00	58.7	86.5	71.5	39.8	67.4	63	55.5	48.1	42.1
42	30/09/2015 21:16	0:10:00	61.2	89	70.2	44.4	67.7	64.9	59.3	52.2	45.7
43	30/09/2015 21:26	0:10:00	60.6	88.4	69.7	40.7	67.7	64.8	57.8	49.5	42.6

44	30/09/2015 21:36	0:10:00	60.5	88.3	70.4	36.4	67.7	64.4	58.3	48.6	37.8
45	30/09/2015 21:46	0:10:00	61.3	89.1	70.3	44.7	67.9	65.6	59	52.2	47
46	30/09/2015 21:56	0:10:00	61.4	89.2	70.6	45.5	67.9	65	59.6	52.7	46.6
47	30/09/2015 22:06	0:10:00	60.6	88.4	68.7	46.1	67.1	64.2	59.1	51.9	47.4
48	30/09/2015 22:16	0:10:00	61.7	89.5	70.1	44.6	67.8	65.4	60.1	53.2	46.6
49	30/09/2015 22:26	0:10:00	62.7	90.5	70.7	45.3	68.1	66.1	61.6	55.3	47.3
50	30/09/2015 22:36	0:10:00	60.6	88.4	69.8	37.3	67.6	64.5	58.4	50.2	39.3
51	30/09/2015 22:46	0:10:00	60.1	87.9	70.7	45.1	67.2	64.1	57.9	49.3	46.4
52	30/09/2015 22:56	0:10:00	61.3	89.1	69.5	43.4	67.7	65	59.7	51	44.7
53	30/09/2015 23:06	0:10:00	61.9	89.7	70.8	43.7	68.2	65.4	60.3	53.9	46.1
54	30/09/2015 23:16	0:10:00	62.1	89.9	70.7	45.6	68.3	65.8	60.5	54.3	48.6
55	30/09/2015 23:26	0:10:00	62.2	90	69.7	45.2	68.1	65.9	60.9	52.6	46.9
56	30/09/2015 23:36	0:10:00	63.3	91.1	77.4	48.9	69.8	66.5	61.8	55.5	50.2
57	30/09/2015 23:46	0:10:00	62.5	90.3	71.4	44.4	68.7	65.9	61.2	53.5	46.6
58	30/09/2015 23:56	0:10:00	64.4	92.2	70.7	53.8	69.5	67.5	63.4	58.9	55.5
59	01/10/2015 00:06	0:10:00	64.5	92.3	71.1	52.1	69.3	67.4	63.5	59.1	54.7
60	01/10/2015 00:16	0:10:00	65.1	92.9	72.3	54.9	70.1	67.9	64.2	60.3	56.8
61	01/10/2015 00:26	0:10:00	65.9	93.7	72.8	55.6	70.6	68.5	65.3	61	57.3
62	01/10/2015 00:36	0:10:00	65.7	93.5	72	56.7	69.9	68.2	65.3	61.5	58.4
63	01/10/2015 00:46	0:10:00	66.1	93.9	71.8	55.5	70.5	68.7	65.6	61.3	57.9
64	01/10/2015 00:56	0:10:00	66	93.8	72.9	57.5	70.6	68.4	65.6	61.9	59.5
65	01/10/2015 01:06	0:10:00	66.4	94.2	72.3	56.8	70.8	69	66	61.9	59.2
66	01/10/2015 01:16	0:10:00	67	94.8	72.4	58.7	70.9	69.1	66.8	63.9	60.3
67	01/10/2015 01:26	0:10:00	67.6	95.4	71.7	61.9	70.7	69.3	67.4	65.2	63.4
68	01/10/2015 01:36	0:10:00	67.9	95.7	74.9	62.3	70.6	69.5	67.6	65.9	64.2
69	01/10/2015 01:46	0:10:00	68.4	96.2	73.1	62.9	71.5	70	68.1	66.3	64.7
70	01/10/2015 01:56	0:10:00	68.2	96	75	62.8	71	69.8	67.9	65.9	64.3
71	01/10/2015 02:06	0:10:00	68.3	96.1	77.5	61.5	70.9	69.6	68.2	66.4	63.3
72	01/10/2015 02:16	0:10:00	68.5	96.3	75.1	63.9	70.9	69.7	68.4	66.9	65.6
73	01/10/2015 02:26	0:10:00	68.2	96	74.2	63.2	70.6	69.4	68.1	66.7	65.5
74	01/10/2015 02:36	0:10:00	68.4	96.2	75.3	62.7	70.9	69.7	68.4	66.7	65.2

75	01/10/2015 02:46	0:10:00	67.2	95	72.2	62.3	70.1	69	66.9	65.2	63.7
76	01/10/2015 02:56	0:10:00	67.1	94.9	77	61.1	70	68.6	66.9	65.3	62.5
77	01/10/2015 03:06	0:10:00	67.4	95.2	77.9	62.1	70.1	68.6	67.3	65.8	63.9
78	01/10/2015 03:16	0:10:00	67.1	94.9	71.4	62.8	69.4	68.4	67	65.4	63.8
79	01/10/2015 03:26	0:10:00	67	94.8	74.7	61.4	69.8	68.5	66.8	65.2	62.8
80	01/10/2015 03:36	0:10:00	66.6	94.4	70.7	62.6	68.9	67.9	66.4	65	63.7
81	01/10/2015 03:46	0:10:00	66.8	94.6	73.9	63.1	69.4	68.2	66.7	65.2	64.2
82	01/10/2015 03:56	0:10:00	67.2	95	83.5	62.1	70	68.6	66.8	65.3	63.5
83	01/10/2015 04:06	0:10:00	66.4	94.2	73	61.6	69.3	67.8	66.3	64.5	62.8
84	01/10/2015 04:16	0:10:00	67	94.8	88.7	62.9	69.8	68.2	66.7	65	63.7
85	01/10/2015 04:26	0:10:00	67.5	95.3	72.5	62.1	70.6	69.3	67.3	64.9	63.6
86	01/10/2015 04:36	0:10:00	68	95.8	72.3	62.7	70.6	69.5	67.8	66	64.6
87	01/10/2015 04:46	0:10:00	68.1	95.9	72	63	70.5	69.5	68	66.2	64.6
88	01/10/2015 04:56	0:10:00	67.8	95.6	72.4	62.2	70.9	69.6	67.5	65.4	63.8
89	01/10/2015 05:06	0:10:00	67.9	95.7	72.7	61	70.5	69.4	67.9	66	63.2
90	01/10/2015 05:16	0:10:00	67.2	95	79.5	60.1	70.5	68.8	67	64.8	62.7
91	01/10/2015 05:26	0:10:00	67.7	95.5	76	62.8	70.9	69.2	67.4	65.6	64.3
92	01/10/2015 05:36	0:10:00	67.6	95.4	72.9	62.9	70.5	69.3	67.4	65.5	64
93	01/10/2015 05:46	0:10:00	67.2	95	73	62.9	70.7	69	66.9	64.9	63.8
94	01/10/2015 05:56	0:10:00	66.5	94.3	73.2	61.3	69.7	68.1	66.4	63.9	62.3
95	01/10/2015 06:06	0:10:00	66.6	94.4	73.4	61	69.7	68.1	66.4	64.5	62.7
96	01/10/2015 06:16	0:10:00	66.2	94	71.3	60.4	69.2	67.9	66	64.1	61.6
97	01/10/2015 06:26	0:10:00	66.7	94.5	71.9	62.2	69.5	68.3	66.5	65	63.9
98	01/10/2015 06:36	0:10:00	66.5	94.3	72.3	61.8	69.2	68.1	66.3	64.6	62.8
99	01/10/2015 06:46	0:10:00	67.2	95	85.1	62.7	70	68.5	66.8	64.9	63.6
100	01/10/2015 06:56	0:10:00	66.4	94.2	71	61.8	69.1	67.9	66.3	64.4	62.9
101	01/10/2015 07:06	0:10:00	66	93.8	70.5	61.2	69.2	67.7	65.8	63.6	62.1
102	01/10/2015 07:16	0:10:00	66.3	94.1	72.9	60.6	69.8	67.9	66.1	63.9	62
103	01/10/2015 07:26	0:10:00	66.7	94.5	72.2	62.1	69.6	68.3	66.5	64.6	63.2
104	01/10/2015 07:36	0:10:00	66.6	94.4	72.7	62.6	69.8	68.1	66.3	64.5	63.6
105	01/10/2015 07:46	0:10:00	66.5	94.3	73.6	61.3	69.5	68	66.4	64.6	62.9

106	01/10/2015 07:56	0:10:00	66.3	94.1	70.5	60.6	68.9	67.8	66.1	64.3	62.4
107	01/10/2015 08:06	0:10:00	66.1	93.9	80.5	61	69.5	67.7	65.8	63.7	62.4
108	01/10/2015 08:16	0:10:00	66.5	94.3	71.3	61.6	69.7	68.2	66.3	64.3	63
109	01/10/2015 08:26	0:10:00	66.5	94.3	76.3	62.1	69.3	68	66.3	64.6	63.2
110	01/10/2015 08:36	0:10:00	66.8	94.6	73.6	61.5	69.5	68.3	66.6	65	63.6
111	01/10/2015 08:46	0:10:00	66.6	94.4	74.8	60.9	69.7	68.3	66.5	64.5	62.6
112	01/10/2015 08:56	0:10:00	65.7	93.5	69.7	60	68.5	67.4	65.6	63.2	61.5
113	01/10/2015 09:06	0:10:00	66.4	94.2	76.1	62	69.7	68.1	66.1	64.2	62.9
114	01/10/2015 09:16	0:10:00	66.6	94.4	78.9	60.6	71.5	68	66.1	64.2	62.8
115	01/10/2015 09:26	0:10:00	66.7	94.5	71.8	61.6	69.7	68.3	66.5	64.6	63
116	01/10/2015 09:36	0:10:00	65.9	93.7	70.4	61.1	68.7	67.5	65.8	63.8	62.2
117	01/10/2015 09:46	0:10:00	66.5	94.3	71.2	61.7	69.2	68.1	66.3	64.3	63
118	01/10/2015 09:56	0:10:00	66.9	94.7	84.2	61.4	72.6	67.9	66.1	64.3	62.7
119	01/10/2015 10:06	0:10:00	66.1	93.9	78.5	61.9	69.7	67.5	65.8	64.3	63
120	01/10/2015 10:16	0:10:00	66.6	94.4	75.4	61.9	69.6	68	66.4	64.9	63.3
121	01/10/2015 10:26	0:10:00	66.3	94.1	77.4	61.2	69.4	67.8	66.2	64.1	62.5
122	01/10/2015 10:36	0:10:00	66.2	94	71.3	62.3	68.7	67.4	66.1	64.8	63.8
123	01/10/2015 10:46	0:10:00	67.2	95	81.5	63.7	70.6	68.4	66.8	65.7	64.6
124	01/10/2015 10:56	0:10:00	66.8	94.6	82	62.7	69.8	68	66.5	64.9	63.9
125	01/10/2015 11:06	0:10:00	66.7	94.5	71.8	62.5	69.5	68.1	66.6	64.9	63.4
126	01/10/2015 11:16	0:10:00	67	94.8	74.6	63.5	69.9	68.4	66.8	65.4	64.3
127	01/10/2015 11:26	0:10:00	66.8	94.6	73.7	62	69.6	68.2	66.6	65.3	64
128	01/10/2015 11:36	0:10:00	66.9	94.7	74.4	61.8	69.9	68.2	66.7	65.3	64.1
129	01/10/2015 11:46	0:10:00	66.8	94.6	84.9	62.4	69.9	67.9	66.6	65.4	64.1
130	01/10/2015 11:56	0:10:00	66.8	94.6	83.6	63.1	69.2	67.9	66.6	65.2	64.2
131	01/10/2015 12:06	0:10:00	68.1	95.9	85.3	62.9	73.3	69.1	67.5	65.9	64.7
132	01/10/2015 12:16	0:10:00	67.2	95	76.8	62.9	69.4	68.3	67	65.9	64.5
133	01/10/2015 12:26	0:10:00	66.9	94.7	74.1	62.9	69.4	68.1	66.7	65.4	64
134	01/10/2015 12:36	0:10:00	67.7	95.5	77.4	62.9	72.7	69.3	67.3	65.5	64.1
135	01/10/2015 12:46	0:10:00	67.8	95.6	81.1	63	71.4	69.1	67.5	65.7	64.3
136	01/10/2015 12:56	0:10:00	67.6	95.4	76.8	63.7	70.4	69	67.4	65.9	64.7

137	01/10/2015 13:06	0:10:00	67.7	95.5	77.3	63.8	70.4	68.9	67.5	66	65.1
138	01/10/2015 13:16	0:10:00	67.5	95.3	72.4	63.7	70.1	69	67.4	65.8	64.8
139	01/10/2015 13:26	0:10:00	67.7	95.5	78.8	63.5	72	69	67.3	65.8	64.5
140	01/10/2015 13:36	0:10:00	67.6	95.4	71.7	61.2	70.6	69.2	67.4	65.4	63.3
141	01/10/2015 13:46	0:10:00	67.6	95.4	72.8	61.3	70.5	69.2	67.4	65.5	63.7
142	01/10/2015 13:56	0:10:00	67.5	95.3	72.9	62.6	70.3	69	67.3	65.5	63.7
143	01/10/2015 14:06	0:10:00	67.3	95.1	72.8	62.3	70	68.9	67.1	65.2	63.7
144	01/10/2015 14:16	0:10:00	68	95.8	71.6	63.7	70.7	69.4	67.8	66.1	64.6
145	01/10/2015 14:26	0:02:08	67.9	89	74.5	62.4	71.5	69.8	67.5	65.3	63.5

Location NML3

Address	Start Time	Measurement Time	Leq	LE	Lmax	Lmin	LN1	LN2	LN3	LN4	LN5
1	30/09/2015 19:26	00d 00:10:00.0	60	87.8	83.6	54.9	62.7	60.5	59	57.7	56.4
2	30/09/2015 19:36	00d 00:10:00.0	59.2	87	73.3	55.1	62.9	60.3	58.6	57.2	56
3	30/09/2015 19:46	00d 00:10:00.0	58.6	86.4	71.9	53.1	62.4	60	58.2	56.2	54.6
4	30/09/2015 19:56	00d 00:10:00.0	58.4	86.2	75.7	54.4	63.2	59.6	57.8	56.2	55.2
5	30/09/2015 20:06	00d 00:10:00.0	58.2	86	62.2	53.9	60.9	59.6	58	56.5	55.2
6	30/09/2015 20:16	00d 00:10:00.0	60.1	87.9	77.3	54.4	66.8	62.1	58.8	56.8	55.5
7	30/09/2015 20:26	00d 00:10:00.0	59.4	87.2	64.5	55	63.2	61.1	59	57.2	56
8	30/09/2015 20:36	00d 00:10:00.0	58.4	86.2	62.5	54.2	60.7	59.6	58.3	56.7	55.7
9	30/09/2015 20:46	00d 00:10:00.0	58.8	86.6	63.9	53.6	61.8	60.6	58.6	56.5	54.8
10	30/09/2015 20:56	00d 00:10:00.0	59.5	87.3	70	54.8	65.6	61	58.9	57.2	56
11	30/09/2015 21:06	00d 00:10:00.0	58.5	86.3	63.7	54.5	61.6	60.2	58.3	56.4	55.1
12	30/09/2015 21:16	00d 00:10:00.0	58.4	86.2	69.1	53.4	62	60	58.1	56.1	54.4
13	30/09/2015 21:26	00d 00:10:00.0	58.4	86.2	63.8	53.5	61.8	60.2	58.1	56.1	54.8
14	30/09/2015 21:36	00d 00:10:00.0	57.1	84.9	73.2	52	61.2	58.6	56.6	54.4	52.9
15	30/09/2015 21:46	00d 00:10:00.0	57.2	85	70.6	51.1	62.8	59.1	56.2	54.4	52.8
16	30/09/2015 21:56	00d 00:10:00.0	60.4	88.2	83.8	50.8	69.5	59.4	56.5	54	52.2
17	30/09/2015 22:06	00d 00:10:00.0	56.3	84.1	61.5	49.3	59.6	57.9	56.1	53.7	51.2
18	30/09/2015 22:16	00d 00:10:00.0	56.7	84.5	61.4	50.8	60	58.4	56.4	54.4	52.7

19	30/09/2015 22:26	00d 00:10:00.0	55.6	83.4	65.5	51.1	59	57.3	55.5	53.2	51.9
20	30/09/2015 22:36	00d 00:10:00.0	54.4	82.2	60.4	49.3	58.7	56.6	53.8	51.5	50.3
21	30/09/2015 22:46	00d 00:10:00.0	54.8	82.6	62.8	48.8	58.9	56.7	54.4	52.2	50
22	30/09/2015 22:56	00d 00:10:00.0	54.2	82	61.1	48.5	58.7	56.5	53.5	51.2	49.4
23	30/09/2015 23:06	00d 00:10:00.0	55.9	83.7	63.7	49.3	61.2	58.3	55.3	52.4	50.7
24	30/09/2015 23:16	00d 00:10:00.0	55.4	83.2	65.5	49	60.4	58	54.4	52.2	50.6
25	30/09/2015 23:26	00d 00:10:00.0	53.6	81.4	63.2	44.9	60.1	56.3	52.6	49	46.6
26	30/09/2015 23:36	00d 00:10:00.0	53.8	81.6	62.1	45.1	59.9	56.5	52.9	49.7	46.7
27	30/09/2015 23:46	00d 00:10:00.0	54.1	81.9	63.2	44.5	60.1	56.9	53	49.4	46.9
28	30/09/2015 23:56	00d 00:10:00.0	54.9	82.7	66.7	43.4	61.5	58	53.6	49.3	45.2
29	01/10/2015 00:06	00d 00:10:00.0	56.3	84.1	65.7	44.9	62.6	59.5	55	50.6	46.4
30	01/10/2015 00:16	00d 00:10:00.0	55.4	83.2	66.7	43.3	62.5	58.3	53.9	49.6	45.5
31	01/10/2015 00:26	00d 00:10:00.0	55.7	83.5	65.9	38	62.8	59.3	54	48.3	39.8
32	01/10/2015 00:36	00d 00:10:00.0	54.1	81.9	63.6	43	60.5	57.4	52.5	48.7	44.5
33	01/10/2015 00:46	00d 00:10:00.0	54	81.8	63.2	43.4	60.2	57.2	52.2	48.6	45.5
34	01/10/2015 00:56	00d 00:10:00.0	53.8	81.6	63	43.1	61.4	56.9	52.2	47.3	44.6
35	01/10/2015 01:06	00d 00:10:00.0	53.8	81.6	63.1	41.5	60.7	56.8	52.4	48.4	43.6
36	01/10/2015 01:16	00d 00:10:00.0	53	80.8	62.8	44.8	59.2	56.1	51.5	48.4	46.9
37	01/10/2015 01:26	00d 00:10:00.0	54.8	82.6	83.3	41.3	62.3	55.9	51.1	46.8	42.8
38	01/10/2015 01:36	00d 00:10:00.0	52.3	80.1	65.4	42.6	58.1	55.3	51.1	47.5	44.4
39	01/10/2015 01:46	00d 00:10:00.0	52	79.8	60.5	42.8	57.9	55	50.7	47	44
40	01/10/2015 01:56	00d 00:10:00.0	51	78.8	62.6	40.7	57.8	53.9	49.8	45.2	41.8
41	01/10/2015 02:06	00d 00:10:00.0	53.9	81.7	60.7	42	59.2	56.9	53	48.3	44.5
42	01/10/2015 02:16	00d 00:10:00.0	53.1	80.9	61	39.9	59.2	56.5	51.7	47.3	41.8
43	01/10/2015 02:26	00d 00:10:00.0	53.7	81.5	63.9	36.5	59.7	56.7	52.8	48.2	37.8
44	01/10/2015 02:36	00d 00:10:00.0	54	81.8	61.3	44.9	59.1	56.7	53.3	49.3	46.3
45	01/10/2015 02:46	00d 00:10:00.0	54	81.8	62.3	42.9	59.4	56.8	53	49.2	45.2
46	01/10/2015 02:56	00d 00:10:00.0	53.3	81.1	60.8	43.6	59	56.2	52.6	47.9	44.8
47	01/10/2015 03:06	00d 00:10:00.0	55.2	83	65.1	43.4	61.4	58.4	54	50.1	46.1
48	01/10/2015 03:16	00d 00:10:00.0	55.1	82.9	62.7	44	60.5	57.7	54.2	50.3	45.4
49	01/10/2015 03:26	00d 00:10:00.0	53.3	81.1	60.7	42.5	58.8	56.2	52.5	47.6	43.7

50	01/10/2015 03:36	00d 00:10:00.0	53.2	81	61.6	43.2	59.1	56	52.3	48.4	46
51	01/10/2015 03:46	00d 00:10:00.0	53.8	81.6	61.2	45.3	59.2	56.6	53.1	49.4	46.6
52	01/10/2015 03:56	00d 00:10:00.0	55	82.8	64.5	46.2	60.7	57.7	54.1	50.5	47.7
53	01/10/2015 04:06	00d 00:10:00.0	56	83.8	64.1	45.2	61.2	59	55	50.7	46.7
54	01/10/2015 04:16	00d 00:10:00.0	55.9	83.7	64.7	47.4	61.2	58.9	54.8	50.9	49.3
55	01/10/2015 04:26	00d 00:10:00.0	57.6	85.4	75.2	46.8	65.5	59.7	56.3	52.3	48.8
56	01/10/2015 04:36	00d 00:10:00.0	56.8	84.6	66.1	45.6	62.6	59.8	55.8	52.5	48.7
57	01/10/2015 04:46	00d 00:10:00.0	58.5	86.3	66.8	49.8	63	61	57.9	55.1	51.9
58	01/10/2015 04:56	00d 00:10:00.0	58.7	86.5	65.9	51.5	63.2	61.1	58.1	55.1	53.1
59	01/10/2015 05:06	00d 00:10:00.0	60.6	88.4	68.2	54.2	65.5	62.9	60	57.5	55.9
60	01/10/2015 05:16	00d 00:10:00.0	61.5	89.3	71.9	54.5	66.6	63.5	60.9	58.6	56.8
61	01/10/2015 05:26	00d 00:10:00.0	61.4	89.2	68	52.9	65.8	63.3	61.1	58.5	55.4
62	01/10/2015 05:36	00d 00:10:00.0	61.2	89	71	54.7	66.4	63.3	60.5	58.2	56.4
63	01/10/2015 05:46	00d 00:10:00.0	60.4	88.2	68.6	54.6	63.8	62.3	60.2	57.7	56.4
64	01/10/2015 05:56	00d 00:10:00.0	61	88.8	70.4	55.9	65.2	63	60.6	58.4	57.1
65	01/10/2015 06:06	00d 00:10:00.0	61.5	89.3	70.2	56.7	64.8	63.1	61.2	59.1	57.6
66	01/10/2015 06:16	00d 00:10:00.0	61.9	89.7	67.3	57.9	65.6	63.4	61.6	59.9	58.7
67	01/10/2015 06:26	00d 00:10:00.0	62.6	90.4	68.4	57.4	65.7	64.2	62.5	60.2	58.8
68	01/10/2015 06:36	00d 00:10:00.0	63.8	91.6	69.1	59.4	66.4	65.2	63.6	61.9	61
69	01/10/2015 06:46	00d 00:10:00.0	63.3	91.1	75.5	58.7	66.6	64.8	63	61.2	60
70	01/10/2015 06:56	00d 00:10:00.0	63.9	91.7	72	59.8	66.6	65.2	63.7	62.3	60.9
71	01/10/2015 07:06	00d 00:10:00.0	64.6	92.4	77.2	59.9	69	66	64.3	62.5	61.2
72	01/10/2015 07:16	00d 00:10:00.0	63.3	91.1	69.3	59.8	66.2	64.7	63.1	61.7	60.6
73	01/10/2015 07:26	00d 00:10:00.0	63.9	91.7	75.8	59.8	72	64.8	63.1	61.7	60.5
74	01/10/2015 07:36	00d 00:10:00.0	63.3	91.1	71.5	58.7	67.3	64.8	63	61	59.8
75	01/10/2015 07:46	00d 00:10:00.0	61.8	89.6	77	57.6	65.1	62.8	61.4	60	58.7
76	01/10/2015 07:56	00d 00:10:00.0	62.2	90	73.1	58.9	66.2	63.6	61.8	60.4	59.7
77	01/10/2015 08:06	00d 00:10:00.0	61.6	89.4	74.2	57.6	66.8	63	60.9	59.5	58.5
78	01/10/2015 08:16	00d 00:10:00.0	61.6	89.4	70.8	57.8	66.4	62.9	61.1	59.6	58.7
79	01/10/2015 08:26	00d 00:10:00.0	62.3	90.1	75.7	56.8	72.2	63	60.7	59.3	57.9
80	01/10/2015 08:36	00d 00:10:00.0	63.8	91.6	77.7	57.5	73	66.4	61.3	59.3	58.4

81	01/10/2015 08:46	00d 00:10:00.0	62.6	90.4	76.3	58.5	71	63.2	61.4	60.1	59.3
82	01/10/2015 08:56	00d 00:10:00.0	61	88.8	81.2	57.6	65.5	61.9	60.2	59	58.4
83	01/10/2015 09:06	00d 00:10:00.0	60.9	88.7	66.3	57	63.5	62.1	60.8	59.3	57.8
84	01/10/2015 09:16	00d 00:10:00.0	61.2	89	70.1	57.2	66.1	62.8	60.7	58.8	57.9
85	01/10/2015 09:26	00d 00:10:00.0	63.1	90.9	73.3	58.1	70.7	64.8	62.1	60.2	59.2
86	01/10/2015 09:36	00d 00:10:00.0	61.9	89.7	74	57.7	66.2	63.4	61.3	59.8	58.5
87	01/10/2015 09:46	00d 00:10:00.0	61.7	89.5	76.3	57.2	67.2	63.6	60.8	59.4	58.1
88	01/10/2015 09:56	00d 00:10:00.0	60.9	88.7	72	56.2	66.4	63	60.2	58.3	57
89	01/10/2015 10:06	00d 00:10:00.0	61	88.8	72.8	56.1	65.3	62.8	60.6	58.9	57.6
90	01/10/2015 10:16	00d 00:10:00.0	60.6	88.4	67.7	57	63.2	61.8	60.5	59.3	58.2
91	01/10/2015 10:26	00d 00:10:00.0	61.8	89.6	69.1	58	64.7	63.1	61.5	60	59
92	01/10/2015 10:36	00d 00:10:00.0	61.5	89.3	66.5	56.8	64.8	63.2	61.3	59.6	58
93	01/10/2015 10:46	00d 00:10:00.0	61.2	89	67.5	57.7	64.8	62.6	60.8	59.6	58.6
94	01/10/2015 10:56	00d 00:10:00.0	61	88.8	70.4	56.7	65.6	62.5	60.6	58.9	57.8
95	01/10/2015 11:06	00d 00:10:00.0	60.1	87.9	70.1	56.2	63.6	61.6	59.8	58.1	57.1
96	01/10/2015 11:16	00d 00:10:00.0	60.8	88.6	68.8	56.1	64.7	62.4	60.5	58.8	57.2
97	01/10/2015 11:26	00d 00:10:00.0	60.6	88.4	65.7	56.1	63.8	62	60.4	58.9	57.4
98	01/10/2015 11:36	00d 00:10:00.0	60.2	88	71.8	54.7	64.4	62.1	59.7	57.9	56.2
99	01/10/2015 11:46	00d 00:10:00.0	60.4	88.2	66.7	56.8	63.4	61.9	60.1	58.6	57.7
100	01/10/2015 11:56	00d 00:10:00.0	60.1	87.9	71.1	56.9	63.8	61.5	59.8	58.4	57.7
101	01/10/2015 12:06	00d 00:10:00.0	60.5	88.3	70.3	55.7	66.8	61.8	59.7	58.3	57.1
102	01/10/2015 12:16	00d 00:10:00.0	62.7	90.5	68.1	58.4	67	64.8	62	60.3	59.3
103	01/10/2015 12:26	00d 00:10:00.0	62.3	90.1	75.4	56	68.8	64.4	61.2	59	57.3
104	01/10/2015 12:36	00d 00:10:00.0	61.5	89.3	70.1	57.3	64.7	63.2	61.1	59.3	58
105	01/10/2015 12:46	00d 00:10:00.0	60.4	88.2	68.8	55.1	64	62.3	60	58.1	56.5
106	01/10/2015 12:56	00d 00:10:00.0	60.6	88.4	67	55.6	64	62.1	60.4	58.8	57
107	01/10/2015 13:06	00d 00:10:00.0	62.2	90	84.3	57.3	66.4	63.7	61.3	59.3	58.3
108	01/10/2015 13:16	00d 00:10:00.0	63.4	91.2	81.9	57.4	71.6	64.9	61.5	59.6	58.5
109	01/10/2015 13:26	00d 00:10:00.0	62	89.8	79.1	57.5	67.6	63.3	61.3	59.4	58.2
110	01/10/2015 13:36	00d 00:10:00.0	62.1	89.9	76.7	57.1	72.4	63.4	60.8	59.1	57.9
111	01/10/2015 13:46	00d 00:10:00.0	61.7	89.5	72.7	57.1	67.5	63.1	61.1	58.8	57.8

112	01/10/2015 13:56	00d 00:10:00.0	63.7	91.5	84.4	55.6	73.3	63.6	60.5	58.4	56.4
113	01/10/2015 14:06	00d 00:10:00.0	62.7	90.5	82.8	57.6	70.8	62.9	61	59.4	58.4
114	01/10/2015 14:16	00d 00:10:00.0	61.6	89.4	74.8	57.6	65.8	63.1	61	59.3	58.3
115	01/10/2015 14:26	00d 00:10:00.0	60.8	88.6	67.1	56.5	63.8	62.4	60.6	58.9	57.6
116	01/10/2015 14:36	00d 00:10:00.0	61.1	88.9	67.8	57.5	64.1	62.6	60.9	59.3	58.2
117	01/10/2015 14:46	00d 00:10:00.0	62.1	89.9	69.9	58.2	66	63.7	61.7	60	58.9
118	01/10/2015 14:56	00d 00:10:00.0	60.4	88.2	70	57.2	64.8	61.7	60	58.7	57.8
119	01/10/2015 15:06	00d 00:10:00.0	61.3	89.1	67.4	57.5	64.5	63	60.9	59.4	58.5
120	01/10/2015 15:16	00d 00:10:00.0	60.7	88.5	66	56.5	63.6	62.1	60.4	59	57.6
121	01/10/2015 15:26	00d 00:10:00.0	60.9	88.7	68.2	56.9	64.4	62.2	60.7	59.2	57.9
122	01/10/2015 15:36	00d 00:10:00.0	62.5	90.3	78	57.9	68.7	63.7	61.5	60.1	58.8
123	01/10/2015 15:46	00d 00:10:00.0	61.5	89.3	72.5	56.5	66.1	62.8	61.2	59.7	58.3
124	01/10/2015 15:56	00d 00:10:00.0	62.3	90.1	70.4	57.6	65.7	63.9	62	60.2	58.6
125	01/10/2015 16:06	00d 00:10:00.0	64.1	91.9	82.9	58.9	70.2	64.6	62.6	61	59.9
126	01/10/2015 16:16	00d 00:10:00.0	61.2	89	69.2	56.6	64.8	62.7	61	59	57.8
127	01/10/2015 16:26	00d 00:10:00.0	62.9	90.7	76.3	59.1	69.6	64.3	62.1	60.5	59.8
128	01/10/2015 16:36	00d 00:10:00.0	61.8	89.6	77.3	57.3	67.8	63.3	61.1	59.5	58.3
129	01/10/2015 16:46	00d 00:10:00.0	61.4	89.2	66.3	57.3	64.8	62.8	61.3	59.4	58.3
130	01/10/2015 16:56	00d 00:10:00.0	62.6	90.4	71.5	57.5	66.5	64.2	62.3	60.5	58.6
131	01/10/2015 17:06	00d 00:10:00.0	62.9	90.7	68.7	59.6	65.9	64.1	62.7	61.5	60.6
132	01/10/2015 17:16	00d 00:10:00.0	61.5	89.3	66.4	57.6	64.3	62.6	61.4	60.2	58.8
133	01/10/2015 17:26	00d 00:10:00.0	62.6	90.4	71.1	57.2	66.8	64.1	62.2	60.4	58.8
134	01/10/2015 17:36	00d 00:10:00.0	63	90.8	71.4	58.7	65.8	64.3	62.7	61.3	59.9
135	01/10/2015 17:46	00d 00:10:00.0	61.9	89.7	72.7	58.6	66.5	62.9	61.5	60.3	59.4
136	01/10/2015 17:56	00d 00:10:00.0	62.3	90.1	76.3	57.9	68.3	63.5	61.6	60.3	59.2
137	01/10/2015 18:06	00d 00:10:00.0	61	88.8	66.7	57.1	63.7	62.3	60.7	59.3	58.2
138	01/10/2015 18:16	00d 00:10:00.0	60.8	88.6	73.8	57.1	66.5	61.9	60.3	58.9	58.1
139	01/10/2015 18:26	00d 00:10:00.0	60.4	88.2	73.6	56.6	63.9	61.7	59.9	58.5	57.6
140	01/10/2015 18:36	00d 00:10:00.0	59.9	87.7	74.7	56.3	62.9	61.1	59.6	58.2	57.3
141	01/10/2015 18:46	00d 00:10:00.0	61.7	89.5	76.9	56.2	67.7	63.4	60.7	58.6	57.4
142	01/10/2015 18:56	00d 00:10:00.0	61.8	89.6	82	55.9	67.6	62.7	60.9	59.2	57.8

143	01/10/2015 19:06	00d 00:10:00.0	61.7	89.5	74.9	57.7	66.7	63	61.3	59.7	58.7
144	01/10/2015 19:16	00d 00:10:00.0	61.9	89.7	79.5	57.8	65.1	63.2	61.4	60.1	58.6
145	01/10/2015 19:26	00d 00:01:07.9	62	80.3	77.4	56.2	69.2	63.5	60.9	57.6	56.7

Location NML4

Address	Start Time	Measurement Time	Leq	LE	Lmax	Lmin	LN1	LN2	LN3	LN4	LN5
1	30/09/2015 19:42	00d 00:10:00.0	64.9	82.7	83.8	50.7	77.9	66.9	54.5	52	51.4
2	30/09/2015 19:52	00d 00:10:00.0	51.8	69.6	53.6	50.1	53.2	52.4	51.8	50.9	50.5
3	30/09/2015 20:02	00d 00:10:00.0	63.1	80.9	75.7	50.8	74.6	68.2	54.2	51.8	51.1
4	30/09/2015 20:12	00d 00:10:00.0	57.9	75.7	71.9	50.5	71	59.4	51.9	51.2	50.8
5	30/09/2015 20:22	00d 00:10:00.0	52.1	69.9	58.4	50.2	54.1	53.3	51.7	50.9	50.6
6	30/09/2015 20:32	00d 00:10:00.0	70.7	88.5	86.3	50.2	84.5	72.5	52.7	51.1	50.6
7	30/09/2015 20:42	00d 00:10:00.0	58.8	76.6	74.7	49.8	73.3	58.1	51.4	50.4	50.1
8	30/09/2015 20:52	00d 00:10:00.0	61.8	79.6	74.4	51.6	73.2	65.3	53.8	52.3	51.9
9	30/09/2015 21:02	00d 00:10:00.0	57.8	75.6	71.4	50.1	70.6	56.4	51.5	50.9	50.5
10	30/09/2015 21:12	00d 00:10:00.0	61.7	79.5	78.3	51.4	77.1	59.4	53.1	52.1	51.7
11	30/09/2015 21:22	00d 00:10:00.0	53.4	71.2	55.5	51.7	54.9	54.2	53.2	52.6	52.1
12	30/09/2015 21:32	00d 00:10:00.0	59	76.8	74.5	50.3	73.1	58.1	51.9	51	50.7
13	30/09/2015 21:42	00d 00:10:00.0	55.5	73.3	70	50.4	69	53.3	51.8	51	50.6
14	30/09/2015 21:52	00d 00:10:00.0	51.4	69.2	53.3	49.8	52.9	52.2	51.3	50.6	50.2
15	30/09/2015 22:02	00d 00:10:00.0	56.4	74.2	66.1	50.1	62.8	60.3	54.6	51	50.5
16	30/09/2015 22:12	00d 00:10:00.0	57	74.8	71.6	49.2	70.5	56.6	50.9	50	49.6
17	30/09/2015 22:22	00d 00:10:00.0	56.8	74.6	70.1	48.4	69.7	58.5	50.2	49	48.7
18	30/09/2015 22:32	00d 00:10:00.0	56.5	74.3	70.7	48.6	69.7	57.2	50.4	49.4	49
19	30/09/2015 22:42	00d 00:10:00.0	50.4	68.2	52.4	48.9	51.9	51.3	50.1	49.5	49.1
20	30/09/2015 22:52	00d 00:10:00.0	50.1	67.9	52.7	48.5	52.3	50.9	49.9	49.2	48.8
21	30/09/2015 23:02	00d 00:10:00.0	49.5	67.3	52.2	47.5	51.9	50.5	49.4	48.5	48.1
22	30/09/2015 23:12	00d 00:10:00.0	51.3	69.1	54.9	48.5	54.2	52.5	51.2	49.4	48.9

23	30/09/2015 23:22	00d 00:10:00.0	50.7	68.5	53	48.9	52.1	51.5	50.6	49.9	49.3
24	30/09/2015 23:32	00d 00:10:00.0	48.8	66.6	51.6	47.4	50.9	49.4	48.7	48.1	47.8
25	30/09/2015 23:42	00d 00:10:00.0	49.5	67.3	51.4	47.5	51	50.3	49.4	48.5	48
26	30/09/2015 23:52	00d 00:10:00.0	49.8	67.6	53.5	47.3	52.5	51.1	49.4	48.5	47.9
27	01/10/2015 00:02	00d 00:10:00.0	52.9	70.7	72.7	47.3	65.7	50.8	49	48.3	47.8
28	01/10/2015 00:12	00d 00:10:00.0	49.2	67	51.9	46.8	50.8	50.2	49.1	48.1	47.5
29	01/10/2015 00:22	00d 00:10:00.0	48.6	66.4	51.8	46.7	51	49.7	48.4	47.4	46.9
30	01/10/2015 00:32	00d 00:10:00.0	48.6	66.4	50.1	46.8	49.7	49.4	48.6	47.9	47.2
31	01/10/2015 00:42	00d 00:10:00.0	50.1	67.9	52.7	48.4	51.7	50.8	50	49.3	48.8
32	01/10/2015 00:52	00d 00:10:00.0	48.8	66.6	51.4	46.7	50.9	50.1	48.5	47.6	47.3
33	01/10/2015 01:02	00d 00:10:00.0	48.4	66.2	51.4	46.2	50.8	49.6	48.2	47	46.6
34	01/10/2015 01:12	00d 00:10:00.0	48.2	66	50.4	46.6	49.9	49.1	48.2	47.3	46.8
35	01/10/2015 01:22	00d 00:10:00.0	48.9	66.7	53.7	46.8	52.1	50.4	48.4	47.4	47.1
36	01/10/2015 01:32	00d 00:10:00.0	47.5	65.3	49.9	46.1	48.9	48.2	47.4	46.8	46.4
37	01/10/2015 01:42	00d 00:10:00.0	48.3	66.1	50.3	47	49.4	48.9	48.3	47.8	47.5
38	01/10/2015 01:52	00d 00:10:00.0	47.6	65.4	49.2	45.8	48.7	48.3	47.6	46.9	46.1
39	01/10/2015 02:02	00d 00:10:00.0	48.4	66.2	51.1	46	50.6	49.7	48.2	46.8	46.4
40	01/10/2015 02:12	00d 00:10:00.0	49.2	67	50.7	47.5	50.3	49.9	49.2	48.4	47.9
41	01/10/2015 02:22	00d 00:10:00.0	47.6	65.4	49.2	46	48.8	48.4	47.6	46.9	46.5
42	01/10/2015 02:32	00d 00:10:00.0	47.9	65.7	49.6	46.4	49.2	48.6	47.9	47.3	46.8
43	01/10/2015 02:42	00d 00:10:00.0	49.2	67	50.9	46.3	50.6	50.2	49.3	48.1	47.2
44	01/10/2015 02:52	00d 00:10:00.0	48.2	66	50.1	46.8	49.6	49.1	48.2	47.5	47.2
45	01/10/2015 03:02	00d 00:10:00.0	48.6	66.4	50.4	47.1	50.1	49.5	48.5	47.7	47.4
46	01/10/2015 03:12	00d 00:10:00.0	48.3	66.1	50	46.6	49.5	48.9	48.2	47.5	47
47	01/10/2015 03:22	00d 00:10:00.0	49.6	67.4	53.3	47.6	52.3	50.6	49.5	48.5	48
48	01/10/2015 03:32	00d 00:10:00.0	49.1	66.9	50.4	47.1	50.2	49.8	49.2	48.3	47.5
49	01/10/2015 03:42	00d 00:10:00.0	48.9	66.7	51.9	46.7	50.8	49.7	48.8	47.8	47.1
50	01/10/2015 03:52	00d 00:10:00.0	48.3	66.1	50.7	46.4	49.8	49.2	48.4	47.3	46.8
51	01/10/2015 04:02	00d 00:10:00.0	49.4	67.2	52.6	47.5	52	50.3	49.2	48.4	48
52	01/10/2015 04:12	00d 00:10:00.0	48.3	66.1	50.3	46.3	49.9	49.1	48.3	47.4	46.8
53	01/10/2015 04:22	00d 00:10:00.0	49.2	67	51.1	47.4	50.8	50.2	49	48.2	47.7

54	01/10/2015 04:32	00d 00:10:00.0	50.1	67.9	58.6	48	53.5	51.2	49.7	48.9	48.4
55	01/10/2015 04:42	00d 00:10:00.0	49.6	67.4	52.4	47.6	51.7	50.6	49.5	48.6	48.1
56	01/10/2015 04:52	00d 00:10:00.0	50.4	68.2	52.7	48.8	52.4	51.1	50.2	49.6	49.2
57	01/10/2015 05:02	00d 00:10:00.0	50.4	68.2	53.1	47.5	52.5	51.3	50.4	48.7	47.8
58	01/10/2015 05:12	00d 00:10:00.0	50.8	68.6	53.2	48.4	52.9	52.2	50.6	49.3	48.7
59	01/10/2015 05:22	00d 00:10:00.0	51.8	69.6	54.1	49.7	53.5	52.6	51.9	50.7	50
60	01/10/2015 05:32	00d 00:10:00.0	52.4	70.2	55.8	49.4	55.2	53.6	52.3	50.5	49.8
61	01/10/2015 05:42	00d 00:10:00.0	52.1	69.9	54.2	49.8	53.7	53	52.1	51.1	50.4
62	01/10/2015 05:52	00d 00:10:00.0	51.8	69.6	54.1	49.6	53.5	52.5	51.8	50.9	50.2
63	01/10/2015 06:02	00d 00:10:00.0	57.4	75.2	70.4	49.9	69.8	58.8	51.8	50.8	50.4
64	01/10/2015 06:12	00d 00:10:00.0	52.8	70.6	60.7	50.4	57	53.8	52.5	51.8	51.3
65	01/10/2015 06:22	00d 00:10:00.0	53.3	71.1	58.1	51.4	56.7	54	53.1	52.3	52
66	01/10/2015 06:32	00d 00:10:00.0	58.8	76.6	73.4	51.4	71.9	58.4	53	52.3	51.9
67	01/10/2015 06:42	00d 00:10:00.0	54.1	71.9	59.9	51.7	57.7	55.6	53.7	52.7	52.2
68	01/10/2015 06:52	00d 00:10:00.0	53.9	71.7	56.5	52.2	55.8	54.6	53.8	53.1	52.6
69	01/10/2015 07:02	00d 00:10:00.0	58.6	76.4	71.2	52.6	70.1	60.8	54.5	53.4	53
70	01/10/2015 07:12	00d 00:10:00.0	56.8	74.6	70.8	51.9	66.6	58.6	54.1	53	52.3
71	01/10/2015 07:22	00d 00:10:00.0	59	76.8	71.7	51.8	70.7	60.7	54.6	52.6	52.2
72	01/10/2015 07:32	00d 00:10:00.0	59.9	77.7	72.7	52.1	72.1	62.3	54.3	53.3	52.6
73	01/10/2015 07:42	00d 00:10:00.0	59.7	77.5	73.5	51.8	72.6	60.9	53.6	52.8	52.4
74	01/10/2015 07:52	00d 00:10:00.0	62.3	80.1	78.5	52	77.2	56.6	53.7	53	52.6
75	01/10/2015 08:02	00d 00:10:00.0	60.7	78.5	73.9	51.5	73.4	62.2	53.3	52.6	52.1
76	01/10/2015 08:12	00d 00:10:00.0	59.4	77.2	75	52.2	74.1	55.7	54.2	53.2	52.7
77	01/10/2015 08:22	00d 00:10:00.0	56.1	73.9	75.4	51.4	66.5	54	53.1	52.3	51.9
78	01/10/2015 08:32	00d 00:10:00.0	61.3	79.1	74.8	52.6	73.6	59.4	53.9	53.3	52.9
79	01/10/2015 08:42	00d 00:10:00.0	59.1	76.9	72.6	51.6	71.6	60.4	53.9	52.7	52.1
80	01/10/2015 08:52	00d 00:10:00.0	59	76.8	71.6	51	70.8	61.6	52.7	51.8	51.4
81	01/10/2015 09:02	00d 00:10:00.0	60.1	77.9	74	51.9	73.2	56.6	53.3	52.6	52.2
82	01/10/2015 09:12	00d 00:10:00.0	54.9	72.7	67.4	51.1	63.9	55.8	53.2	52	51.5
83	01/10/2015 09:22	00d 00:10:00.0	62.5	80.3	80.3	51.8	75.5	63.4	53.6	52.6	52.2
84	01/10/2015 09:32	00d 00:10:00.0	59.5	77.3	72.7	50.6	72.1	61.2	52.6	51.7	51.2

85	01/10/2015 09:42	00d 00:10:00.0	57.2	75	70.7	50.6	70	57.3	52.1	51.5	51
86	01/10/2015 09:52	00d 00:10:00.0	62.1	79.9	74.8	50.5	73.4	66.1	53.7	51.5	51
87	01/10/2015 10:02	00d 00:10:00.0	62.6	80.4	75.1	50.9	74.2	67.1	52.8	51.8	51.3
88	01/10/2015 10:12	00d 00:10:00.0	57.7	75.5	73.3	51.1	72.4	54.5	53.1	52	51.6
89	01/10/2015 10:22	00d 00:10:00.0	52.3	70.1	64.4	49.8	58.1	52.9	51.9	51.3	50.2
90	01/10/2015 10:32	00d 00:10:00.0	60.2	78	73	50.5	72.3	63	52.6	51.4	50.9
91	01/10/2015 10:42	00d 00:10:00.0	57.6	75.4	71.1	50.5	70.7	58.3	52.3	51.2	50.8
92	01/10/2015 10:52	00d 00:10:00.0	58.6	76.4	72.9	50.6	71.8	58.9	52.6	51.9	51.2
93	01/10/2015 11:02	00d 00:10:00.0	58.4	76.2	72.8	50.6	71.6	57.1	52	51.4	51
94	01/10/2015 11:12	00d 00:10:00.0	63.5	81.3	79.2	50.7	77.7	62.3	52	51.4	51
95	01/10/2015 11:22	00d 00:10:00.0	61.4	79.2	78.1	50.2	76.9	57.9	51.6	51	50.6
96	01/10/2015 11:32	00d 00:10:00.0	57.4	75.2	71	49.5	70.5	58.7	51.3	50.3	49.9
97	01/10/2015 11:42	00d 00:10:00.0	57.1	74.9	68.4	50.6	67.7	60.7	52.8	51.6	51
98	01/10/2015 11:52	00d 00:10:00.0	60.1	77.9	74.8	49.5	73.3	60.8	51.2	50.5	50.1
99	01/10/2015 12:02	00d 00:10:00.0	59.2	77	74.3	49.5	73.4	58.2	51.1	50.4	49.9
100	01/10/2015 12:12	00d 00:10:00.0	55.5	73.3	71.3	49.5	67	57.2	51	50.2	49.9
101	01/10/2015 12:22	00d 00:10:00.0	50.3	68.1	52.4	48.5	52.1	51.2	50.3	49.4	48.9
102	01/10/2015 12:32	00d 00:10:00.0	60.8	78.6	76.5	48.8	75.2	61.8	52	49.9	49.3
103	01/10/2015 12:42	00d 00:10:00.0	62.2	80	78.3	50	77	60.7	51.8	50.7	50.3
104	01/10/2015 12:52	00d 00:10:00.0	57.4	75.2	70	48.9	69.1	59.5	51.5	50	49.2
105	01/10/2015 13:02	00d 00:10:00.0	56.2	74	71.6	49.7	68.7	56.6	51.9	50.4	50
106	01/10/2015 13:12	00d 00:10:00.0	59.4	77.2	73.8	49.6	73.2	60.2	51.4	50.7	50.2
107	01/10/2015 13:22	00d 00:10:00.0	59.9	77.7	75.3	49.8	74.4	60	51.7	51	50.6
108	01/10/2015 13:32	00d 00:10:00.0	58.4	76.2	70.3	50.4	69.7	62.7	52.6	51.2	50.8
109	01/10/2015 13:42	00d 00:10:00.0	58.9	76.7	74.4	49.8	73.5	57.1	51.4	50.5	50.1
110	01/10/2015 13:52	00d 00:10:00.0	60.7	78.5	74.5	49.8	73.4	62.8	52.1	51.3	50.2
111	01/10/2015 14:02	00d 00:10:00.0	57.6	75.4	70.8	50.3	69.8	59.9	52.3	51	50.6
112	01/10/2015 14:12	00d 00:10:00.0	59.3	77.1	75.3	50.4	73.4	58	51.9	51.1	50.8
113	01/10/2015 14:22	00d 00:10:00.0	57.9	75.7	72.4	50.3	71.1	58	51.6	51	50.6
114	01/10/2015 14:32	00d 00:10:00.0	59.7	77.5	74.7	50.3	72	62.3	52.9	51.2	50.6
116	01/10/2015 14:52	00d 00:10:00.0	57.4	75.2	72.3	49.8	71.3	57.3	51.6	50.6	50.1

117	01/10/2015 15:02	00d 00:10:00.0	56.7	74.5	69.6	48.1	68.8	58.2	51.4	49.9	48.9
118	01/10/2015 15:12	00d 00:10:00.0	57.6	75.4	70.4	50.6	69.5	59.9	52.3	51.3	50.9
119	01/10/2015 15:22	00d 00:10:00.0	53	70.8	61.8	50.1	56.1	54.1	52.8	51.2	50.5
120	01/10/2015 15:32	00d 00:10:00.0	52.3	70.1	54.6	50.9	54.1	53.1	52.1	51.6	51.2
121	01/10/2015 15:42	00d 00:10:00.0	51.7	69.5	53.4	50.2	53	52.4	51.7	51.1	50.5
122	01/10/2015 15:52	00d 00:10:00.0	58.3	76.1	72.6	50	71.7	59.3	51.7	50.8	50.4
123	01/10/2015 16:02	00d 00:10:00.0	56.3	74.1	69	49.8	67.9	59.6	51.9	50.8	50.3
124	01/10/2015 16:12	00d 00:10:00.0	52.4	70.2	54.9	50.5	54.4	53.4	52.3	51.3	50.8
125	01/10/2015 16:22	00d 00:10:00.0	58.5	76.3	72.4	49	71.7	59.6	51.1	50.1	49.6
126	01/10/2015 16:32	00d 00:10:00.0	57.7	75.5	71	50.2	69.6	59.3	52.3	51.1	50.6
127	01/10/2015 16:42	00d 00:10:00.0	52.1	69.9	58.5	50	55.5	53.2	51.7	50.9	50.6
128	01/10/2015 16:52	00d 00:10:00.0	51.1	68.9	57.3	49.3	54.4	51.8	50.9	50.2	49.8
129	01/10/2015 17:02	00d 00:10:00.0	59.1	76.9	74.2	50.3	73.1	59.7	51.8	51.1	50.8
130	01/10/2015 17:12	00d 00:10:00.0	57.9	75.7	71.9	50.3	70.6	58.8	52.1	51.1	50.6
131	01/10/2015 17:22	00d 00:10:00.0	61.7	79.5	73.1	50.8	72.3	66.1	53	51.8	51.5
132	01/10/2015 17:32	00d 00:10:00.0	54	71.8	65.1	51	60.7	55	53.6	52.2	51.2
133	01/10/2015 17:42	00d 00:10:00.0	59.1	76.9	75.5	51	70.3	61.4	53.3	52	51.5
134	01/10/2015 17:52	00d 00:10:00.0	58.3	76.1	71.6	51.4	70.4	60.4	53.3	52.1	51.6
135	01/10/2015 18:02	00d 00:10:00.0	53.3	71.1	54.9	51.4	54.5	54	53.3	52.3	51.8
136	01/10/2015 18:12	00d 00:10:00.0	59	76.8	75.2	51.4	73.2	55.4	53.1	52.4	51.7
137	01/10/2015 18:22	00d 00:10:00.0	57.8	75.6	73.2	50.5	70.7	58.5	52.5	51.6	51.1
138	01/10/2015 18:32	00d 00:10:00.0	54.6	72.4	69	51	63.7	56.6	52.5	51.8	51.4
139	01/10/2015 18:52	00d 00:10:00.0	57.3	75.1	71.5	50.7	70.8	55.4	52.1	51.4	51.1
140	01/10/2015 19:02	00d 00:10:00.0	61.8	79.6	77.9	51.7	76.1	60.7	53.4	52.6	52.1
141	01/10/2015 19:12	00d 00:10:00.0	56.4	74.2	68.9	50.8	67.8	57.8	52.6	51.7	51.2
142	01/10/2015 19:22	00d 00:10:00.0	58.5	76.3	74.1	49.9	73.1	54.9	51.8	51.1	50.3
143	01/10/2015 19:32	00d 00:10:00.0	59	76.8	72.8	50.5	71.7	60.5	53.7	51.7	50.9
144	01/10/2015 20:12	00d 00:10:00.0	58.8	76.6	74.7	50.6	73.2	57.4	52.2	51.5	51

Location NML 5

Address	Start Time	Measurement Time	Leq	LE	Lmax	Lmin	LN1	LN2	LN3	LN4	LN5
1	30/09/2015 19:53	00d 00:10:00.0	57.1	84.9	81.5	51.7	62.5	57.7	55.9	54	52.7
2	30/09/2015 20:03	00d 00:10:00.0	56.1	83.9	61.2	51.1	59.7	58	55.8	53.8	52.1
3	30/09/2015 20:13	00d 00:10:00.0	56.1	83.9	64.3	50.8	59.9	57.8	55.6	53.8	52.5
4	30/09/2015 20:23	00d 00:10:00.0	55.7	83.5	64.1	49.8	59.3	57.5	55.4	53	51.3
5	30/09/2015 20:33	00d 00:10:00.0	55.7	83.5	61.8	49.1	59.8	57.3	55.3	53.5	50.6
6	30/09/2015 20:43	00d 00:10:00.0	56.3	84.1	62.7	50.3	59.9	58	56.1	53.8	51.6
7	30/09/2015 20:53	00d 00:10:00.0	55.5	83.3	62.9	49.9	59	57.4	55	53.1	51.3
8	30/09/2015 21:03	00d 00:10:00.0	54.9	82.7	59.6	49.5	57.8	56.6	54.7	52.7	50.8
9	30/09/2015 21:13	00d 00:10:00.0	55.1	82.9	60.3	48.6	58.6	57.2	54.8	52.3	49.7
10	30/09/2015 21:23	00d 00:10:00.0	54	81.8	59.4	46.7	57.8	56	53.6	50.8	48.3
11	30/09/2015 21:33	00d 00:10:00.0	54.4	82.2	64.6	47.4	59	56.4	53.8	50.6	48.4
12	30/09/2015 21:43	00d 00:10:00.0	53.9	81.7	60.7	47.3	58	56.1	53.5	50.9	48.9
13	30/09/2015 21:53	00d 00:10:00.0	53.4	81.2	68.1	42.3	58.8	55.4	52.9	48.8	44.7
14	30/09/2015 22:03	00d 00:10:00.0	52.5	80.3	58.2	46	56	54.5	52.2	49.8	47.4
15	30/09/2015 22:13	00d 00:10:00.0	53.2	81	60.2	45.6	57.8	55.4	52.6	49.9	48.2
16	30/09/2015 22:23	00d 00:10:00.0	52.3	80.1	60.4	44	57.5	54.7	51.8	48.3	45.9
17	30/09/2015 22:33	00d 00:10:00.0	52	79.8	57.2	43.5	56	54.2	51.7	48.1	45.6
18	30/09/2015 22:43	00d 00:10:00.0	51.8	79.6	57.3	43	55.7	54	51.4	48.3	45.2
19	30/09/2015 22:53	00d 00:10:00.0	51.3	79.1	58.9	43.6	55.8	53.5	50.9	47.6	45.5
20	30/09/2015 23:03	00d 00:10:00.0	52.7	80.5	59.8	44.8	57.5	55.1	52.2	48.7	46
21	30/09/2015 23:13	00d 00:10:00.0	52.6	80.4	63.1	42.4	57.4	55	51.9	48.7	44.3
22	30/09/2015 23:23	00d 00:10:00.0	50.8	78.6	56.8	38	55	53.2	50.3	46.5	40.2
23	30/09/2015 23:33	00d 00:10:00.0	51	78.8	59.4	41.1	56.2	53.7	50.3	45.3	42.6
24	30/09/2015 23:43	00d 00:10:00.0	50.7	78.5	65.1	38.4	56.2	53.6	49.7	44.7	40.5
25	30/09/2015 23:53	00d 00:10:00.0	51	78.8	58.7	38.3	56	54.1	50.5	44.6	40.3
26	01/10/2015 00:03	00d 00:10:00.0	51.3	79.1	60.7	40.9	56.3	54	50.9	45.6	42.1
27	01/10/2015 00:13	00d 00:10:00.0	50.4	78.2	58.6	39.3	55.8	53.2	49.8	44.7	40.5

28	01/10/2015 00:23	00d 00:10:00.0	50.9	78.7	65.2	37.6	59	53.8	49.7	42.3	38.7
29	01/10/2015 00:33	00d 00:10:00.0	50.9	78.7	58.1	38.4	56.4	54.2	50.2	43.7	39.8
30	01/10/2015 00:43	00d 00:10:00.0	50.7	78.5	60.5	37.9	56.7	53.8	49.3	44.1	38.7
31	01/10/2015 00:53	00d 00:10:00.0	50.1	77.9	58.2	36.7	56.1	53.6	48.8	41.5	37.9
32	01/10/2015 01:03	00d 00:10:00.0	49.4	77.2	56.3	38.2	54.7	52.4	48.6	43.1	39.5
33	01/10/2015 01:13	00d 00:10:00.0	50.8	78.6	59.1	36.6	56.8	54	50.1	42.1	37.9
34	01/10/2015 01:23	00d 00:10:00.0	49.9	77.7	58	34.8	55.9	52.9	49	41.8	36
35	01/10/2015 01:33	00d 00:10:00.0	50.5	78.3	60.4	39.8	56	53	49.8	46.5	41.4
36	01/10/2015 01:43	00d 00:10:00.0	49.7	77.5	58.5	38	55.6	52.7	48.8	43.3	39.3
37	01/10/2015 01:53	00d 00:10:00.0	48.5	76.3	60	35.3	56.1	52.2	46.4	40.4	37.5
38	01/10/2015 02:03	00d 00:10:00.0	49.8	77.6	64.4	36.3	55.3	53.1	48.4	42	37.6
39	01/10/2015 02:13	00d 00:10:00.0	48.3	76.1	54.6	37.5	53.3	51.5	47.3	42.1	38.9
40	01/10/2015 02:23	00d 00:10:00.0	49.5	77.3	58.5	34.5	55.3	52.9	48.3	42	35.9
41	01/10/2015 02:33	00d 00:10:00.0	49.8	77.6	57	38.5	54.6	52.9	49.1	42.4	39.8
42	01/10/2015 02:43	00d 00:10:00.0	50.5	78.3	59.9	38.9	55.4	53.5	49.7	44.1	40.5
43	01/10/2015 02:53	00d 00:10:00.0	49.7	77.5	58.6	40.6	55.3	52.5	48.8	43.7	41.8
44	01/10/2015 03:03	00d 00:10:00.0	50.8	78.6	58.2	38.9	55.9	53.3	50.3	46.1	40.3
45	01/10/2015 03:13	00d 00:10:00.0	51.7	79.5	60.6	40.5	56.7	54.4	51.2	47.2	42.8
46	01/10/2015 03:23	00d 00:10:00.0	50	77.8	56.3	38.6	54.6	52.7	49.5	43.3	39.9
47	01/10/2015 03:33	00d 00:10:00.0	49.1	76.9	57.1	35.4	54.9	52.5	48	40.6	38.6
48	01/10/2015 03:43	00d 00:10:00.0	49.6	77.4	57.5	36.2	55.1	52.5	48.9	41.9	37.3
49	01/10/2015 03:53	00d 00:10:00.0	52.1	79.9	59.8	40.7	57.4	55	51.3	46.9	42.1
50	01/10/2015 04:03	00d 00:10:00.0	51	78.8	57.7	39.3	56.1	54.2	49.9	44.8	41.1
51	01/10/2015 04:13	00d 00:10:00.0	52	79.8	58.2	43.4	56.3	54.4	51.8	47.5	44.6
52	01/10/2015 04:23	00d 00:10:00.0	51.8	79.6	60.4	39.1	57.1	54.5	51.4	45.5	40.1
53	01/10/2015 04:33	00d 00:10:00.0	52.4	80.2	62.4	42.6	57	55	51.9	46.7	44.1
54	01/10/2015 04:43	00d 00:10:00.0	53.4	81.2	59.3	42.5	57.5	55.9	53	49	44.2
55	01/10/2015 04:53	00d 00:10:00.0	53.7	81.5	60.3	42.5	57.4	55.9	53.6	50	44
56	01/10/2015 05:03	00d 00:10:00.0	54	81.8	60.6	46.7	58.5	56.4	53.4	50.4	48.4
57	01/10/2015 05:13	00d 00:10:00.0	55	82.8	71.1	46.4	60.4	57	54.2	50.8	48.2
58	01/10/2015 05:23	00d 00:10:00.0	54.7	82.5	59.4	45.7	57.9	56.9	54.5	50.8	47.7

59	01/10/2015 05:33	00d 00:10:00.0	54.5	82.3	59	48.5	57.6	56.3	54.4	52.1	49.8
60	01/10/2015 05:43	00d 00:10:00.0	55	82.8	60.9	47.7	58.6	57.1	54.7	51.8	48.6
61	01/10/2015 05:53	00d 00:10:00.0	55.1	82.9	61.1	47.1	58.9	57.1	54.8	51.7	48.8
62	01/10/2015 06:03	00d 00:10:00.0	56	83.8	66.6	50.3	59	57.8	55.8	53.2	51.6
63	01/10/2015 06:13	00d 00:10:00.0	56.8	84.6	62.8	52.5	60.6	58.3	56.5	55	53.5
64	01/10/2015 06:23	00d 00:10:00.0	57.3	85.1	66.3	53.8	61.2	58.7	56.8	55.5	54.6
65	01/10/2015 06:33	00d 00:10:00.0	57.8	85.6	62.3	54.1	60.9	59.3	57.5	56	54.9
66	01/10/2015 06:43	00d 00:10:00.0	57.6	85.4	67.4	52.9	62.3	58.9	57.2	55.8	54
67	01/10/2015 06:53	00d 00:10:00.0	58	85.8	73.7	53.2	64.6	58.7	57.3	55.7	54.4
68	01/10/2015 07:03	00d 00:10:00.0	57.8	85.6	63.2	54.2	60.4	58.9	57.7	56.3	55
69	01/10/2015 07:13	00d 00:10:00.0	58.3	86.1	66.5	55.2	63.4	59.5	57.9	56.8	55.9
70	01/10/2015 07:23	00d 00:10:00.0	58.2	86	69.4	55.1	60.7	59.4	57.9	56.9	56.2
71	01/10/2015 07:33	00d 00:10:00.0	57.2	85	61	51.1	59.9	59	57.4	54	52.3
72	01/10/2015 07:43	00d 00:10:00.0	58.1	85.9	63.3	54.1	60.6	59.3	58	56.8	55.1
73	01/10/2015 07:53	00d 00:10:00.0	58.3	86.1	61.1	54.9	60.2	59.2	58.2	57.1	56.1
74	01/10/2015 08:03	00d 00:10:00.0	58.5	86.3	65.1	55.1	62.4	59.7	58.2	56.8	55.9
75	01/10/2015 08:13	00d 00:10:00.0	59.5	87.3	87.4	54.8	63.1	59.9	58.1	56.6	55.7
76	01/10/2015 08:23	00d 00:10:00.0	57.6	85.4	65.8	54.7	60.7	58.6	57.3	56.3	55.6
77	01/10/2015 08:33	00d 00:10:00.0	57.5	85.3	63	53.6	60.4	58.8	57.3	56.2	55.4
78	01/10/2015 08:43	00d 00:10:00.0	57.9	85.7	67.4	54.4	62.1	59	57.6	56.2	55.3
79	01/10/2015 08:53	00d 00:10:00.0	58	85.8	62.3	54.8	60.2	59.3	57.8	56.6	55.7
80	01/10/2015 09:03	00d 00:10:00.0	58.1	85.9	65.2	54.1	60.5	59.2	57.9	56.9	55.5
81	01/10/2015 09:13	00d 00:10:00.0	57.9	85.7	77	54.3	61	58.9	57.6	56.1	55.1
82	01/10/2015 09:23	00d 00:10:00.0	57.9	85.7	63	54.5	60.6	59.2	57.7	56.4	55.1
83	01/10/2015 09:33	00d 00:10:00.0	57.7	85.5	64	53.5	60.6	59	57.5	56.1	54.8
84	01/10/2015 09:43	00d 00:10:00.0	57.1	84.9	61.1	53	59.9	58.8	57	54.9	53.8
85	01/10/2015 09:53	00d 00:10:00.0	57.1	84.9	63.4	52.8	59.7	58.3	57.1	55.1	53.8
86	01/10/2015 10:03	00d 00:10:00.0	57.2	85	64.4	51.8	61.1	58.5	57	55.6	53.2
87	01/10/2015 10:13	00d 00:10:00.0	58.6	86.4	70.8	53.3	67.6	59.5	57.2	55.9	54.8
88	01/10/2015 10:23	00d 00:10:00.0	57.6	85.4	67.9	53.1	61.7	59.1	57.2	55.7	54
89	01/10/2015 10:33	00d 00:10:00.0	57.7	85.5	64.6	53.8	61.4	59.1	57.3	55.8	54.6

90	01/10/2015 10:43	00d 00:10:00.0	57.8	85.6	62.8	54.9	60.3	59.1	57.5	56.3	55.6
91	01/10/2015 10:53	00d 00:10:00.0	57.3	85.1	64.4	53.9	60.8	58.5	57.1	55.6	54.8
92	01/10/2015 11:03	00d 00:10:00.0	57.7	85.5	71.1	53.7	61.4	58.8	57.3	56.1	54.9
93	01/10/2015 11:13	00d 00:10:00.0	57.3	85.1	73.6	54.1	59.6	58.5	57.1	55.8	55
94	01/10/2015 11:23	00d 00:10:00.0	57.3	85.1	62.3	53.2	59.9	58.7	57.2	55.6	54.2
95	01/10/2015 11:33	00d 00:10:00.0	58.7	86.5	72	53.2	63	60.7	57.9	56	54.7
96	01/10/2015 11:43	00d 00:10:00.0	57.8	85.6	67.4	52.8	61.8	59.3	57.5	55.8	54.2
97	01/10/2015 11:53	00d 00:10:00.0	56.6	84.4	68	52.4	61.7	58	56.2	54.7	53.3
98	01/10/2015 12:03	00d 00:10:00.0	56.2	84	60.5	52.7	58.7	57.6	56.1	54.7	53.7
99	01/10/2015 12:13	00d 00:10:00.0	56.5	84.3	62.7	52.8	58.9	57.9	56.3	54.7	53.5
100	01/10/2015 12:23	00d 00:10:00.0	57	84.8	82.9	52.5	64	57.7	55.8	54.4	53.6
101	01/10/2015 12:33	00d 00:10:00.0	56.9	84.7	66	53.3	60.1	58.2	56.7	55.2	54.3
102	01/10/2015 12:43	00d 00:10:00.0	55.9	83.7	63.5	51.9	58.8	57.4	55.7	54.1	52.8
103	01/10/2015 12:53	00d 00:10:00.0	56.6	84.4	68.7	51.7	64.9	57.7	55.7	54.2	52.6
104	01/10/2015 13:03	00d 00:10:00.0	55.7	83.5	63.4	52.1	59	56.9	55.5	53.9	52.9
105	01/10/2015 13:13	00d 00:10:00.0	56.3	84.1	68	52.6	61.9	57.5	55.6	54.4	53.4
106	01/10/2015 13:23	00d 00:10:00.0	56.7	84.5	61	52	59.5	58.1	56.6	55.1	53.8
107	01/10/2015 13:33	00d 00:10:00.0	57	84.8	65.2	52.8	60.5	58.3	56.7	55.4	54.2
108	01/10/2015 13:43	00d 00:10:00.0	56.1	83.9	60.1	51.5	58.3	57.3	56	54.6	53.2
109	01/10/2015 13:53	00d 00:10:00.0	56.1	83.9	66.9	51.4	60.8	57.4	55.9	54	52.5
110	01/10/2015 14:03	00d 00:10:00.0	56.1	83.9	61.2	52.1	58.9	57.6	55.8	54.4	52.9
111	01/10/2015 14:13	00d 00:10:00.0	56.3	84.1	65.3	52.3	59.2	57.4	56	54.8	53.6
112	01/10/2015 14:23	00d 00:10:00.0	57.3	85.1	72.4	52	66.7	58	56	54.3	53.2
113	01/10/2015 14:33	00d 00:10:00.0	56.1	83.9	66.3	52.2	61	57.7	55.6	53.8	52.9
114	01/10/2015 14:43	00d 00:10:00.0	56.8	84.6	70.8	53.4	60.8	57.8	56.5	55.2	54.2
115	01/10/2015 14:53	00d 00:10:00.0	55.9	83.7	63.3	51.8	60	57.2	55.7	54.1	52.6
116	01/10/2015 15:03	00d 00:10:00.0	56.6	84.4	66.2	52.4	62.9	58.5	55.9	54.3	53.4
117	01/10/2015 15:13	00d 00:10:00.0	56.1	83.9	60.1	52.6	58.9	57.5	56	54.6	53.6
118	01/10/2015 15:23	00d 00:10:00.0	56.4	84.2	69.1	52.1	61.5	57.5	56	54.4	53.4
119	01/10/2015 15:33	00d 00:10:00.0	56.2	84	64.4	52.4	59.6	57.4	56	54.9	53.6
120	01/10/2015 15:43	00d 00:10:00.0	56	83.8	63	53.5	58.3	57.1	55.9	54.7	54

121	01/10/2015 15:53	00d 00:10:00.0	56.8	84.6	78.2	52.9	62.3	57.6	55.9	54.6	53.7
122	01/10/2015 16:03	00d 00:10:00.0	56.4	84.2	66.3	52.9	60.3	57.5	56.2	55	53.8
123	01/10/2015 16:13	00d 00:10:00.0	56.8	84.6	65.6	53.4	60	57.9	56.6	55.2	54.5
124	01/10/2015 16:23	00d 00:10:00.0	56.3	84.1	66.9	52.4	59.7	57.6	55.9	54.7	53.5
125	01/10/2015 16:33	00d 00:10:00.0	56.1	83.9	62.9	52.2	59.1	57.1	55.9	54.8	53.3
126	01/10/2015 16:43	00d 00:10:00.0	56.1	83.9	65.4	52.3	58.9	57.1	55.9	54.8	53.6
127	01/10/2015 16:53	00d 00:10:00.0	56.6	84.4	64	53.9	59.9	57.6	56.5	55.2	54.5
128	01/10/2015 17:03	00d 00:10:00.0	57	84.8	71.1	52.9	62.2	59.1	56.3	55.1	53.9
129	01/10/2015 17:13	00d 00:10:00.0	56.4	84.2	64.6	53.7	59.2	57.3	56.3	55.3	54.4
130	01/10/2015 17:23	00d 00:10:00.0	56	83.8	60.9	52.1	58.5	57.3	56	54.3	53.2
131	01/10/2015 17:33	00d 00:10:00.0	58.7	86.5	82	51.8	69.9	58	56.1	54.5	52.9
132	01/10/2015 17:43	00d 00:10:00.0	56.8	84.6	65.5	53.6	61	57.9	56.5	55.2	54.3
133	01/10/2015 17:53	00d 00:10:00.0	56.6	84.4	65.6	53.3	59.9	57.8	56.3	55	54.1
134	01/10/2015 18:03	00d 00:10:00.0	57	84.8	72.2	51.5	60.9	58.3	56.5	55.2	53.2
135	01/10/2015 18:13	00d 00:10:00.0	57.5	85.3	68.2	52.6	63.5	58.6	57.1	55.6	54.1
136	01/10/2015 18:23	00d 00:10:00.0	57	84.8	65.6	52.7	61.6	58.3	56.8	55	53.8
137	01/10/2015 18:33	00d 00:10:00.0	59.2	87	86.7	51.1	63	59.1	56.9	55.1	52.9
138	01/10/2015 18:43	00d 00:10:00.0	57.1	84.9	67.3	51	62.3	58.9	56.6	54.1	52.3
139	01/10/2015 18:53	00d 00:10:00.0	56.8	84.6	68.3	52.6	60.5	58	56.6	54.7	53.6
140	01/10/2015 19:03	00d 00:10:00.0	57.1	84.9	65.8	53	62.5	58.3	56.8	55.2	54.1
141	01/10/2015 19:13	00d 00:10:00.0	57.4	85.2	67.5	52.8	62.2	58.9	56.8	55.1	54
142	01/10/2015 19:23	00d 00:10:00.0	56.8	84.6	63.7	52.3	61.2	58.1	56.5	54.9	53.6
143	01/10/2015 19:33	00d 00:10:00.0	55.3	83.1	59.7	51.1	57.7	56.6	55.3	53.7	52.1
144	01/10/2015 19:43	00d 00:10:00.0	55.7	83.5	64.5	51.6	61.2	57.1	55.1	53.7	52.6
145	01/10/2015 19:53	00d 00:01:49.6	57.2	77.6	76.7	51.7	68.6	57.2	55	53.4	52.6

Location NML6

Address	Start Time	Measurement Time	Leq	LE	Lmax	Lmin	LN1	LN2	LN3	LN4	LN5
1	30/09/2015 20:11	00d 00:10:00.0	60.5	88.3	79.7	53.5	67.6	63	59.5	56.4	54.7
2	30/09/2015 20:21	00d 00:10:00.0	60.3	88.1	70.8	52.5	66.1	63.1	59.2	56.3	53.8
3	30/09/2015 20:31	00d 00:10:00.0	60.2	88	70.2	53.4	65.3	62.7	59.5	56.7	55
4	30/09/2015 20:41	00d 00:10:00.0	60.1	87.9	68.5	49.9	65.7	62.8	59.5	56	51.3
5	30/09/2015 20:51	00d 00:10:00.0	59.9	87.7	74.6	52.2	66	62.6	58.7	55.6	53.2
6	30/09/2015 21:01	00d 00:10:00.0	59.4	87.2	70.5	52.1	66	61.7	58.4	55.1	53.5
7	30/09/2015 21:11	00d 00:10:00.0	59.9	87.7	70.6	51	66.6	62.9	58.7	55.3	52.9
8	30/09/2015 21:21	00d 00:10:00.0	59	86.8	78.5	50.9	65.9	61.4	57.8	54.7	52.3
9	30/09/2015 21:31	00d 00:10:00.0	58.5	86.3	68.2	50.1	64.9	61.5	57.3	53.2	51.4
10	30/09/2015 21:41	00d 00:10:00.0	58.4	86.2	69.8	48.6	64.9	61.7	57	53.2	50.7
11	30/09/2015 21:51	00d 00:10:00.0	58.9	86.7	69.7	51.1	64.6	61.7	58	54.4	52.2
12	30/09/2015 22:01	00d 00:10:00.0	59	86.8	72.1	49.5	65.8	61.9	57.8	54.1	51.1
13	30/09/2015 22:11	00d 00:10:00.0	57.9	85.7	68.9	49.5	64.6	60.7	56.8	52.9	50.9
14	30/09/2015 22:21	00d 00:10:00.0	58.2	86	68.6	47.5	64.7	61.6	56.6	52.4	49.9
15	30/09/2015 22:31	00d 00:10:00.0	57.7	85.5	67	47.9	64.9	61.3	55.9	52	49.4
16	30/09/2015 22:41	00d 00:10:00.0	58.1	85.9	70.9	47.8	65.9	61.8	55.7	51.2	49.3
17	30/09/2015 22:51	00d 00:10:00.0	57.6	85.4	71.2	47.6	65.9	60.6	55.7	51.6	49.4
18	30/09/2015 23:01	00d 00:10:00.0	57.1	84.9	73.3	47.5	66.2	59.9	55.2	51.2	49.1
19	30/09/2015 23:11	00d 00:10:00.0	56.6	84.4	69.3	48.5	63	59.2	55.4	51.8	50.3
20	30/09/2015 23:21	00d 00:10:00.0	55.6	83.4	71	41.4	64.1	59.1	53.1	48.9	44
21	30/09/2015 23:31	00d 00:10:00.0	54.9	82.7	67.9	45	63.9	58.7	52.3	48.4	46.1
22	30/09/2015 23:41	00d 00:10:00.0	55.3	83.1	67	42.8	64.1	58.7	53.2	48.3	43.8
23	30/09/2015 23:51	00d 00:10:00.0	55.4	83.2	68.5	43.1	64.1	58.3	53.3	48.7	44.6
24	01/10/2015 00:01	00d 00:10:00.0	57.2	85	75.2	45.3	64.6	61.1	55	50.1	46.8
25	01/10/2015 00:11	00d 00:10:00.0	54	81.8	66	42.8	63.3	56.7	51.9	47	44.4
26	01/10/2015 00:21	00d 00:10:00.0	54	81.8	64.8	42.5	62.1	57.6	51.5	45.8	43.6
27	01/10/2015 00:31	00d 00:10:00.0	54.6	82.4	67.9	43.8	63.5	58.4	51.1	47.5	45.1

28	01/10/2015 00:41	00d 00:10:00.0	54.6	82.4	68.1	41.7	63.7	58.3	51.6	46	43.3
29	01/10/2015 00:51	00d 00:10:00.0	54.8	82.6	66.1	41.2	63.1	59.1	52.2	46.1	42.4
30	01/10/2015 01:01	00d 00:10:00.0	55.9	83.7	72.2	41.8	65.7	59.3	52.6	46.1	43.8
31	01/10/2015 01:11	00d 00:10:00.0	55.7	83.5	67.7	39.6	63.5	59.8	52.9	46.3	41.9
32	01/10/2015 01:21	00d 00:10:00.0	54.5	82.3	66.3	39.5	62.4	58.8	51.5	44	41.2
33	01/10/2015 01:31	00d 00:10:00.0	55.5	83.3	71	39.8	64.9	59.4	52	45.9	42.7
34	01/10/2015 01:41	00d 00:10:00.0	54	81.8	66.3	40.5	63.2	57.5	51.3	46.7	42.5
35	01/10/2015 01:51	00d 00:10:00.0	54.9	82.7	67.5	40.2	64.8	59	50.5	44	41.4
36	01/10/2015 02:01	00d 00:10:00.0	56.3	84.1	68	39.5	65.3	60.4	53	44.1	40.5
37	01/10/2015 02:11	00d 00:10:00.0	54.9	82.7	66.4	41.8	64.1	58.7	52.3	46.1	43.1
38	01/10/2015 02:21	00d 00:10:00.0	55.6	83.4	68.5	40.1	64.6	59.4	52.1	45.6	41.3
39	01/10/2015 02:31	00d 00:10:00.0	59.4	87.2	78	42.6	68.2	63.1	56.5	48.4	43.8
40	01/10/2015 02:41	00d 00:10:00.0	57.2	85	67.4	41.9	64.4	61.1	55.2	48.2	43.5
41	01/10/2015 02:51	00d 00:10:00.0	57.1	84.9	67.3	44	64.4	61.1	54.9	49.6	45.7
42	01/10/2015 03:01	00d 00:10:00.0	55.4	83.2	67.9	41.1	63.9	58.6	53.3	45.9	42.7
43	01/10/2015 03:11	00d 00:10:00.0	58.2	86	69.2	44.7	65.1	61.7	56.2	50.6	45.8
44	01/10/2015 03:21	00d 00:10:00.0	57.5	85.3	68.2	43.8	65	61	55.7	49.8	45.5
45	01/10/2015 03:31	00d 00:10:00.0	55.5	83.3	65.8	42.7	62.6	59.2	53.6	47.3	44.1
46	01/10/2015 03:41	00d 00:10:00.0	56.2	84	67.4	39.2	63.6	60.5	53.5	43.2	40.2
47	01/10/2015 03:51	00d 00:10:00.0	57.3	85.1	68	42.1	64.9	61.3	55	48.1	44.2
48	01/10/2015 04:01	00d 00:10:00.0	56.6	84.4	67.7	45.3	64.5	60	54.5	48.6	46.5
49	01/10/2015 04:11	00d 00:10:00.0	57.7	85.5	67.5	42.7	64.8	61.4	55.9	49.1	44.7
50	01/10/2015 04:21	00d 00:10:00.0	58.9	86.7	73.7	47.1	66.9	62.4	56.9	52	48.7
51	01/10/2015 04:31	00d 00:10:00.0	57.4	85.2	68.2	42.6	64.4	61.2	55.4	49.5	44.7
52	01/10/2015 04:41	00d 00:10:00.0	58.5	86.3	68.8	46.2	65.5	61.8	57.1	51.8	48.7
53	01/10/2015 04:51	00d 00:10:00.0	59.7	87.5	67.5	45.2	65	62.9	58.8	54.2	49.4
54	01/10/2015 05:01	00d 00:10:00.0	59.7	87.5	70.1	48.3	65.9	63	58.7	54.4	51.5
55	01/10/2015 05:11	00d 00:10:00.0	60.3	88.1	81.1	49.5	66.5	62.9	59.2	54.7	50.7
56	01/10/2015 05:21	00d 00:10:00.0	61.2	89	72.1	50.1	67.3	64	60.3	56.9	52.6
57	01/10/2015 05:31	00d 00:10:00.0	60.8	88.6	69.1	48.6	66.6	63.2	60.2	56	50.6
58	01/10/2015 05:41	00d 00:10:00.0	60.9	88.7	68.5	51.5	66.1	63.4	60	56.6	54.2

59	01/10/2015 05:51	00d 00:10:00.0	61.4	89.2	69.5	52.6	66.6	64.1	60.6	57	54.8
60	01/10/2015 06:01	00d 00:10:00.0	62.5	90.3	70.2	53.6	67.6	65.1	62	58.5	55.3
61	01/10/2015 06:11	00d 00:10:00.0	63	90.8	76.7	56.5	67.8	65	62.1	59.8	57.9
62	01/10/2015 06:21	00d 00:10:00.0	63.1	90.9	74.9	57.5	68.7	65.1	62.2	60.5	59.3
63	01/10/2015 06:31	00d 00:10:00.0	62.4	90.2	73.5	55.6	68.2	64	61.7	60.3	57.9
64	01/10/2015 06:41	00d 00:10:00.0	62.2	90	75.5	56.4	67.7	63.7	61.7	60.3	58.1
65	01/10/2015 06:51	00d 00:10:00.0	62.3	90.1	71.5	57.7	68.4	63.9	61.7	60.4	58.8
66	01/10/2015 07:01	00d 00:10:00.0	63.3	91.1	75.7	59	68.7	64.8	62.8	61.1	60.4
67	01/10/2015 07:11	00d 00:10:00.0	63.6	91.4	73.6	59.1	68.4	65.2	62.9	61.4	60.2
68	01/10/2015 07:21	00d 00:10:00.0	63.4	91.2	72.7	58.9	69.5	65.3	62.7	61	60.1
69	01/10/2015 07:31	00d 00:10:00.0	63.2	91	74.7	58.7	69.2	64.7	62.5	60.9	59.9
70	01/10/2015 07:41	00d 00:10:00.0	62.2	90	71.8	57.2	66.9	64.2	61.6	59.9	58
71	01/10/2015 07:51	00d 00:10:00.0	62.6	90.4	71.4	58.6	67	64.1	62.2	60.6	59.6
72	01/10/2015 08:01	00d 00:10:00.0	62.7	90.5	72.1	55.6	67.1	64.5	62.3	60.6	57.5
73	01/10/2015 08:11	00d 00:10:00.0	63.2	91	71.7	57.3	69.4	64.9	62.6	60.8	58.4
74	01/10/2015 08:21	00d 00:10:00.0	62.5	90.3	69.3	54.1	66.2	64.5	62	60.3	56.8
75	01/10/2015 08:31	00d 00:10:00.0	62.8	90.6	77.4	56.7	67.7	64.5	62.3	60.2	58.4
76	01/10/2015 08:41	00d 00:10:00.0	63.6	91.4	73.8	58.1	67.5	65.5	63.1	61.4	59.5
77	01/10/2015 08:51	00d 00:10:00.0	63.5	91.3	72.4	57.5	68.5	65.3	63	61.4	59.1
78	01/10/2015 09:01	00d 00:10:00.0	63.6	91.4	74.3	57.8	70.4	65.4	62.9	60.8	59
79	01/10/2015 09:11	00d 00:10:00.0	63.3	91.1	74	56.5	67.8	65.1	62.7	60.7	58.3
80	01/10/2015 09:21	00d 00:10:00.0	63.8	91.6	74.6	58.2	69.8	65.8	63.2	60.7	59.4
81	01/10/2015 09:31	00d 00:10:00.0	63.4	91.2	74.5	56.5	69.6	65.5	62.5	60.8	59
82	01/10/2015 09:41	00d 00:10:00.0	63.6	91.4	77.6	56.2	68.4	65.8	62.9	59.9	57.5
83	01/10/2015 09:51	00d 00:10:00.0	63.9	91.7	72.1	56.7	68.1	66.1	63.4	60.9	58.6
84	01/10/2015 10:01	00d 00:10:00.0	63.6	91.4	76.2	54.6	69.8	65.7	62.9	60	56.6
85	01/10/2015 10:11	00d 00:10:00.0	63.2	91	73	56.5	68.6	65.1	62.7	60.4	57.9
86	01/10/2015 10:21	00d 00:10:00.0	62.8	90.6	70.9	55.1	67.4	64.8	62.3	60.4	56.8
87	01/10/2015 10:31	00d 00:10:00.0	63.4	91.2	74.3	55.5	70.7	65.6	62.5	59.9	57.9
88	01/10/2015 10:41	00d 00:10:00.0	63.2	91	73.9	57.2	67.8	65.3	62.7	60.1	58.4
89	01/10/2015 10:51	00d 00:10:00.0	62.9	90.7	74.4	54.3	67.9	64.9	62.4	60.1	56.7

90	01/10/2015 11:01	00d 00:10:00.0	62.5	90.3	71	55.3	67	64.6	61.9	59.6	57.7
91	01/10/2015 11:11	00d 00:10:00.0	62.6	90.4	71.4	55.1	67.9	64.8	61.9	59.6	57.6
92	01/10/2015 11:21	00d 00:10:00.0	62.8	90.6	76.9	54.5	70.9	64.9	61.6	58.6	56
93	01/10/2015 11:31	00d 00:10:00.0	64	91.8	78	55.5	71.9	66.1	62.6	60	58.3
94	01/10/2015 11:41	00d 00:10:00.0	63	90.8	78.2	55.6	68.6	64.9	62.4	60	57.5
95	01/10/2015 11:51	00d 00:10:00.0	63.3	91.1	76	55.5	69.3	65.7	62.4	59.8	56.8
96	01/10/2015 12:01	00d 00:10:00.0	63	90.8	72.7	56.7	67.7	65	62.3	60.3	58.1
97	01/10/2015 12:11	00d 00:10:00.0	64.3	92.1	78.6	56.4	71.9	67	62.7	59.8	57.6
98	01/10/2015 12:21	00d 00:10:00.0	64.9	92.7	84.4	56	72.9	66.2	63	59.8	58.1
99	01/10/2015 12:31	00d 00:10:00.0	63.9	91.7	83.3	57.4	68.6	65.4	62.6	60.6	58.9
100	01/10/2015 12:41	00d 00:10:00.0	63.1	90.9	77.8	56.3	68.9	64.9	62.2	59.5	57.5
101	01/10/2015 12:51	00d 00:10:00.0	63.2	91	74.9	57.6	69.2	65.4	62.5	60.1	58.9
102	01/10/2015 13:01	00d 00:10:00.0	62.6	90.4	72.1	54.9	67.2	64.5	62.2	59.6	56.8
103	01/10/2015 13:11	00d 00:10:00.0	63	90.8	73	54.9	68	65	62.4	60.5	59
104	01/10/2015 13:21	00d 00:10:00.0	63	90.8	71.4	55.1	67	65.1	62.4	60.4	57.2
105	01/10/2015 13:31	00d 00:10:00.0	63.3	91.1	72.7	56.3	66.8	65.3	62.8	60.8	59.4
106	01/10/2015 13:41	00d 00:10:00.0	62.3	90.1	69	54.8	66.1	64.3	61.9	59.9	57.2
107	01/10/2015 13:51	00d 00:10:00.0	63.7	91.5	79.1	56.7	71.2	65.4	62.4	59.9	57.5
108	01/10/2015 14:01	00d 00:10:00.0	63.2	91	71.1	56.4	68.1	65.5	62.7	60.4	58.6
109	01/10/2015 14:11	00d 00:10:00.0	63.5	91.3	73.1	57.4	69.6	65.7	62.8	60.2	58.6
110	01/10/2015 14:21	00d 00:10:00.0	63.6	91.4	73.2	57	69.2	65.8	62.8	60.6	58.2
111	01/10/2015 14:31	00d 00:10:00.0	63.6	91.4	74	56	70.1	65.9	62.7	60.2	57.4
112	01/10/2015 14:41	00d 00:10:00.0	63.8	91.6	72.8	54.1	69.8	66.3	63	60	57.7
113	01/10/2015 14:51	00d 00:10:00.0	62.9	90.7	73.3	55.4	68.8	64.9	62.5	59.8	57.3
114	01/10/2015 15:01	00d 00:10:00.0	63.1	90.9	74.1	55.2	69.2	65.2	62.3	59.8	57
115	01/10/2015 15:11	00d 00:10:00.0	63.4	91.2	75	55.8	68.6	65.5	62.7	60.7	57.4
116	01/10/2015 15:21	00d 00:10:00.0	62.5	90.3	72	54.3	67.2	64.5	62	59.5	57.1
117	01/10/2015 15:31	00d 00:10:00.0	62.8	90.6	78.4	55.7	67.2	64.6	62.3	59.9	57.3
118	01/10/2015 15:41	00d 00:10:00.0	63.1	90.9	75	58.2	68.5	64.9	62.6	60.9	59.4
119	01/10/2015 15:51	00d 00:10:00.0	63	90.8	78.4	57.3	70.2	64.8	61.8	60	58.6
120	01/10/2015 16:01	00d 00:10:00.0	62.8	90.6	71	55.6	66.5	64.5	62.5	61	58.6

121	01/10/2015 16:11	00d 00:10:00.0	62.8	90.6	72.8	56.4	69.7	64.5	62	60.4	58.5
122	01/10/2015 16:21	00d 00:10:00.0	63.3	91.1	73.2	58.5	68.8	65.4	62.6	61	59.9
123	01/10/2015 16:31	00d 00:10:00.0	63	90.8	76.1	58.5	68.6	64.6	62.5	60.5	59.5
124	01/10/2015 16:41	00d 00:10:00.0	62	89.8	70.9	57.6	66.8	63.9	61.6	59.6	58.6
125	01/10/2015 16:51	00d 00:10:00.0	62.7	90.5	74.1	57.2	69.2	64.5	62	60.2	58.7
126	01/10/2015 17:01	00d 00:10:00.0	62.3	90.1	69.8	57	66.1	64.1	61.9	60.1	58.6
127	01/10/2015 17:11	00d 00:10:00.0	62.4	90.2	71	57.6	66.7	63.9	62.1	60.4	58.7
128	01/10/2015 17:21	00d 00:10:00.0	62.6	90.4	68.8	56.9	66.9	64.7	62.1	60.3	58.5
129	01/10/2015 17:31	00d 00:10:00.0	62.6	90.4	73.2	55.1	67.1	64.8	61.9	59.6	57.7
130	01/10/2015 17:41	00d 00:10:00.0	62.6	90.4	69.3	56	66.4	64.7	62.3	59.6	57.6
131	01/10/2015 17:51	00d 00:10:00.0	63.4	91.2	82.2	55.7	70	65.2	62.3	60.1	57.5
132	01/10/2015 18:01	00d 00:10:00.0	62.6	90.4	68.9	55.2	66.5	64.7	62.2	59.8	57.3
133	01/10/2015 18:11	00d 00:10:00.0	62.9	90.7	74.2	57.3	67.3	64.7	62.4	60.5	59
134	01/10/2015 18:21	00d 00:10:00.0	62.7	90.5	75.8	54.1	69.2	64.8	61.7	59.3	56.5
135	01/10/2015 18:31	00d 00:10:00.0	61.9	89.7	70.4	54.4	67.1	64.3	61.4	58.9	56
136	01/10/2015 18:41	00d 00:10:00.0	61.9	89.7	70.5	55	66.3	64.2	61.6	58.8	56.1
137	01/10/2015 18:51	00d 00:10:00.0	61.1	88.9	71.1	52	66.8	63.6	60.2	56.9	53.4
138	01/10/2015 19:01	00d 00:10:00.0	62.3	90.1	70	54.8	65.9	64.4	62.1	59.1	56.4
139	01/10/2015 19:11	00d 00:10:00.0	62.4	90.2	70.8	54.9	67.1	64.2	61.9	59.8	57
140	01/10/2015 19:21	00d 00:10:00.0	61.4	89.2	69.8	55.3	65.5	63.3	61	59.2	56.8
141	01/10/2015 19:31	00d 00:10:00.0	61.3	89.1	68.8	58.2	64.6	62.2	61.1	60.2	59.4
142	01/10/2015 19:41	00d 00:10:00.0	60.4	88.2	71	57	64.4	62.2	59.9	58.8	57.9
143	01/10/2015 19:51	00d 00:10:00.0	60.7	88.5	73.1	56.7	67.9	61.6	60.1	58.8	57.8
144	01/10/2015 20:01	00d 00:10:00.0	60.2	88	76.7	56.4	65.8	61.8	59.7	57.9	57.2
145	01/10/2015 20:11	00d 00:00:05.8	61.1	68.7	65.5	58.8	63.4	63.4	60.8	59.3	59.3

Construction Noise Calculations

List of Construction Plant and Associated Source Noise Levels

Work Item	Work Duration	Construction Plant	Number	Source Reference	% On Time	Plant SPL at 10m L_{Aeq} (dB)
Site Clearance	1 week	Hand-strimmer Stihl FS90	1	Manufacturer	40	76
		JCB3CX or similar	1	Table C.4.No 66	40	69
		5T dumper	1	Table C4 No.8	30	78
		Road lorry (for removal)	1	Table C6 No.21	30	80
Excavation & Installation of pipe in Malpas Road	1 week	Road-saw	1	Table C4 No.73	40	84
		Pneumatic breaker + generator	1	Table C5 No.3	40	82
		JCB3CX or similar	1	Table C.4.No 66	40	69
		5T dumper	1	Table C4 No.8	30	78
		Petrol Vibrating roller (0.5m wide)	1	Table C5. No 21	40	80
		Road lorry (for removal)	1	Table C6 No.21	30	80
Excavation & Installation of pipe in Pant Road	1 week	Road-saw	1	Table C4 No.73	40	84
		Pneumatic breaker + generator	1	Table C5 No.3	40	82
		JCB3CX or similar	1	Table C.4.No 66	40	69
		5T dumper	1	Table C4 No.8	30	78
		Petrol Vibrating roller (0.5m wide)	1	Table C5. No 21	40	80
		Road lorry (for removal)	1	Table C6 No.21	30	80

Excavation & Installation of pipe in Pant Lane	1 week	Pneumatic breaker + generator	1	Table C5 No.3	40	82
		JCB3CX or similar	1	Table C.4.No 66	40	69
		5T dumper	1	Table C4 No.8	30	78
		Petrol Vibrating roller (0.5m wide)	1	Table C5. No 21	40	80
		Road lorry (for removal)	1	Table C6 No.21	30	80
Excavation & Installation of pipe alongside motorway	3 weeks	JCB3CX or similar	1	Table C.4.No 66	40	69
		5T dumper	1	Table C4 No.8	30	78
		Petrol Vibrating roller (0.5m wide)	1	Table C5. No 21	40	80
		Road lorry (for removal)	1	Table C6 No.21	30	80
Excavation & Installation of pipe alongside motorway & in hard-shoulder (night-time working)	15 nights	Road-saw	1	Table C4 No.73	40	84
		Pneumatic breaker + generator	1	Table C5 No.3	40	82
		JCB3CX or similar	1	Table C.4.No 66	40	69
		5T dumper	1	Table C4 No.8	30	78
		Petrol Vibrating roller (0.5m wide)	1	Table C5. No 21	40	80
		Road lorry (for removal)	1	Table C6 No.21	30	80
Excavation & Installation of pipe across W/B M4	3 nights	Road-saw	1	Table C4 No.73	40	84
		Pneumatic breaker + generator	1	Table C5 No.3	40	82
		JCB3CX or similar	1	Table C.4.No 66	40	69
		5T dumper	1	Table C4 No.8	30	78
		Petrol Vibrating roller (0.5m wide)	1	Table C5. No 21	40	80
		Road lorry (for removal)	1	Table C6 No.21	30	80
Excavation & Installation of pipe across E/B M4	3 nights	Road-saw	1	Table C4 No.73	40	84
		Pneumatic breaker + generator	1	Table C5 No.3	40	82

		JCB3CX or similar	1	Table C.4.No 66	40	69
		5T dumper	1	Table C4 No.8	30	78
		Petrol Vibrating roller (0.5m wide)	1	Table C5. No 21	40	80
		Road lorry (for removal)	1	Table C6 No.21	30	80
Tunnel Works						
Removal of existing lighting gantry	5 nights	Mobile scissor platforms	1	Table C4 No. 57	40	67
		Angle-grinders	1	Table C4 No. 93	40	80
		Generator	1	Table C4 No. 87	90	65
		Road lorry	1	Table C6 No.21	30	80
Cleaning of primary lining	5 nights	Jet washer (silenced)	1	Manufacturer	30	76
Non-destructive testing of lining	10 nights	Mobile scissor platforms	1	Table C4 No. 57	40	67
Repair Lining	30 nights	Mobile scissor platforms	1	Table C4 No. 57	40	67
		Hand-held concrete drills	1	Table C4 No. 69	30	85
		Grout injection pump	1	Manufacturer	40	77
		Generator	1	Table C4 No. 87	90	65
		Grout mixer	1	Manufacturer	40	69
Re-render lining	30 nights	Mobile scissor platforms	1	Table C4 No. 57	40	67
		Concrete Mixer	1	Table C4 No. 22	40	76
		Generator	1	Table C4 No. 87	90	65
Remove existing secondary lining	30 nights	Mobile scissor platforms	1	Table C4 No. 57	40	67
		Angle-grinders	1	Table C4 No. 93	40	80
		Generator	1	Table C4 No. 87	90	65

		Road lorry	1	Table C6 No.21	30	80
Remove existing concrete panels	40 nights	Generator	1	Table C4 No. 87	90	65
		Pneumatic breakers	1	Table C5 No. 3	40	82
		Small mobile crane/Forklift	1	Table C4 No. 43	40	70
		JCB3CX	1	Table C.4.No 66	40	69
		Road lorry	1	Table C6 No.21	30	80
Install new Concrete panels	40 nights	Small mobile crane/Forklift	1	Table C3 No.28	40	67
		Road lorry	1	Table C6 No.21	30	80
		Ready mix concrete lorries	1	Table C4 No.27	30	77
Install secondary lining	40 nights	Mobile scissor platforms	1	Table C4 No. 57	40	67
		Hand-held concrete drills	1	Table C4 No. 69	30	85
		Road lorry	1	Table C6 No.21	30	80
Install new lighting	40 nights	Mobile scissor platforms	1	Table C4 No. 57	40	67
		Hand-held concrete drills	1	Table C4 No. 69	30	85
		Road lorry	1	Table C6 No.21	30	80
Remove existing cabling/install new cabling	60 nights	Mobile scissor platforms	1	Table C4 No. 57	40	67
		Hand-held tools	4	Hyder Database	30	79
		Generator	1	Table C4 No. 87	90	65
		Road lorry	1	Table C6 No.21	30	80
Cross passageway works	30 nights	Generator	1	Table C4 No. 87	90	65
		Hand-held tools	4	Hyder Database	30	79
		Road lorry	1	Table C6 No.21	30	80
	40 nights	Generator	1	Table C4 No. 87	90	65

Cabling, Communications work		Hand-held tools	4	Hyder Database	30	79
		Road lorry	1	Table C6 No.21	30	80
Carriageway Reconstruction	4 w/ends	Cold-mill planer	1	Table C5 No.7	40	82
Excavation		Road lorry	1	Table C6 No.21	30	80
		Face shovel loader	1	Table C9 No.8	40	86
		360 Excavator + breaker	1	Table C1 No.9	40	90
		Generator	1	Table C4 No. 87	90	65
		Pneumatic breakers	1	Table C5 No. 3	40	82
Carriageway Reconstruction	4 w/ends	Paving machine	1	Table C5 No. 31	40	77
Re-laying		Road roller	1	Table C5 No. 19	40	80
		Road lorry	1	Table C6 No.21	30	80
Tunnel Services Building	20 nights	360 Excavator	1	Table C4 No.12	40	77
		Road lorry	1	Table C6 No.21	30	80
		Ready mix concrete lorries	1	Table C4 No.27	30	77
		Concrete Vibrator	1	Table C4 No.33	40	78
		Generator	1	Table C4 No. 87	90	65
		Mobile Crane	1	Table C3 No. 29	40	70
		Hand-held tools	4	Hyder Database	30	79
Drainage Works						
Site Clearance (off line - during daytime)	1 week	Hand-strimmer	1	Manufacturer	40	76
		JCB3CX or similar	1	Table C.4.No 66	40	69
		5T dumper	1	Table C4 No.8	30	78

		Road lorry (for removal)	1	Table C6 No.21	30	80
Site Clearance (Verges, during o/night closures)	6 nights	Hand-strimmer	1	Manufacturer	40	76
		JCB3CX or similar	1	Table C.4.No 66	40	69
		5T dumper	1	Table C4 No.8	30	78
		Road lorry (for removal)	1	Table C6 No.21	30	80
Temporary Sheet piling to excavation (off line - during daytime)	3 weeks	Sheet Piling rig	1	Table C3 No.2	30	87
		360 Excavator	1	Table C1 No.9	40	90
Excavate for storage tanks & interceptor (off line -during daytime)	1 week	360 Excavator	1	Table C1 No.9	40	90
		2 x 5T dumpers	2	Table C4 No.8	30	78
		JCB3CX or similar	1	Table C.4.No 66	40	69
		Road lorry (for removal)	1	Table C6 No.21	30	80
Blind base slabs (off line - during daytime)	3 days	Ready mix lorry	1	Table C4 No.27	30	77
		Vibrators & Generator	1	Table C4 No.33	40	78
Install Storage Tanks & Interceptor	4 nights	Mobile Crane	1	Table C3 No. 29	40	70
Backfill & Remove piles (off line -during daytime)	2 weeks	360 Excavator	1	Table C1 No.9	40	90
		2 x 5T dumpers	2	Table C4 No.8	30	78
		Petrol DD Vibrating roller (1.2m wide)	1	Table C5 No 20	40	75
Jet clean existing pipes & Chambers	1 week	Jet Cleaner	1	Manufacturer	30	76
Excavate & install other drainage runs & Chambers (off line - during daytime)	4 weeks	360 Excavator	1	Table C1 No.9	40	90
		2 x 5T dumpers	2	Table C4 No.8	30	78
		Petrol DD Vibrating roller (1.2m wide)	1	Table C5 No 20	40	75
		Road lorry (for removal)	1	Table C6 No.21	30	80

Excavate & install new verge drainage (assume 15 nights per carriageway)	30 nights	JCB3CX or similar	1	Table C.4.No 66	40	69
		Petrol Vibrating roller (0.5m wide)	1	Table C5 No 20	40	75
		Road lorry (for removal)	1	Table C6 No.21	30	80
River Usk Viaduct						
Deck waterproofing @ hinge joint locations	Weekend (poss. overnight)	Planer	1	Table C5 No. 7	50	82
		Shot Blasting	1	NIOSH	50	87
		Breaker	1	Table C5 No. 3	50	82
		Stihl Saw	1	Manufacturer	50	87
		Hand Held Spray	1	HSL*	50	81
		Compressor	1	Table C5 No. 5	50	65
		Generator	1	Table C4 N0. 87	50	65
Deck resurfacing & highway joint replacement @ hinge joint locations		Paver	1	Table C5 No. 31	50	77
		Compressor	1	Table C5 No. 5	50	65
		Generator	1	Table C4 N0. 87	50	65
Replace expansion joints (saw tooth)	Weekend (poss. overnight)	Breaker	1	Table C5 No. 3	50	82
		Stihl Saw	1	Manufacturer	50	87
		Power Tools	1	Table C4 No. 93	50	80
		Compressor	1	Table C5 No. 5	50	65
		Generator	1	Table C4 N0. 87	50	65
Strengthening of the main span hinges - thrust blocks	Normal working hours	Breaker	1	Table C5 No. 3	50	82
		Concrete Pump	1	Table C3 No. 25	50	78
		Tensioning Jack	1	Manufacturer	50	76
		Hand Tools	1	Table C4 No. 93	50	80

		Compressor	1	Table C5 No. 5	50	65
		Generator	1	Table C4 N0. 87	50	65
Concrete repairs/protection to the hinge joints	Normal working hours	Hydrojet	1	HSL	50	81
		Hand Tools	1	Table C4 No. 93	50	80
		Concrete Pump	1	Table C3 No. 25	50	78
		Compressor	1	Table C5 No. 5	50	65
		Generator	1	Table C4 No. 87	50	65
Concrete repairs - substructure	Normal working hours (poss. some overnight)	Jack Hammer	1	Table C5 No. 3	50	82
		Compressor	1	Table C5 No. 5	50	65
		Generator	1	Table C4 N0. 87	50	65
Concrete repairs - parapets	Overnight &weekend	Jack hammer	1	Table C5 No. 3	50	82
		Compressor	1	Table C5 No. 5	50	65
		Generator	1	Table C4 N0. 87	50	65
Verges and deck drainage	Weekend (poss. overnight)	Jack hammer	1	Table C5 No. 3	50	82
		Hand Tools	1	Table C4 No. 93	50	80
		Concrete Pump	1	Table C3 No. 25	50	78
		Compressor	1	Table C5 No. 5	50	65
		Generator	1	Table C4 No. 87	50	65
Malpas Viaduct						
		Planer	1	Table C5 No. 7	50	82
		Excavator	1	Table C5 No. 18	50	80

Deck waterproofing @ half joint and expansion joint locations	Weekend (poss. overnight)	Hand tools	1	Table C4 No. 93	50	80
		Concrete Spray	1	HSL*	50	81
		Compressor	1	Table C5 No. 5	50	65
		Generator	1	Table C4 No. 87	50	65
Deck resurfacing & highway joint replacement @ half joint and expansion joint locations	Weekend (poss. overnight)	Paver	1	Table C5 No. 31	50	77
		Compressor	1	Table C5 No. 5	50	65
		Generator	1	Table C4 N0. 87	50	65
Concrete repairs/protection to the half joints	Weekend (poss. overnight)	Hydro jet	1	HSL*	50	81
		Hand tools	1	Table C4 No. 93	50	80
		Concrete pump	1	Table C3 No. 25	50	78
		Compressor	1	Table C5 No. 5	50	65
		Generator	1	Table C4 No. 87	50	65
Concrete repairs - substructure	Normal working hours (poss. some overnight)	Jack hammer	1	Table C5 No. 3	50	82
		Compressor	1	Table C5 No. 5	50	65
		Generator	1	Table C4 N0. 87	50	65
Concrete repairs - parapets	Overnight & weekend	Jack hammer	1	Table C5 No. 3	50	82
		Compressor	1	Table C5 No. 5	50	65
		Generator	1	Table C4 No. 87	50	65
Malpas Slip Roads						
		Planer	1	Table C5 No. 7	50	82
		Shot Blasting	1	NIOSH	50	87

Deck waterproofing @ half joint and expansion joint locations	Weekend (poss. overnight)	Hydro jet	1	HSL*	50	81
		Hand Held Spray	1	HSL*	50	81
		Hand Tools	1	Table C4 No. 93	50	80
		Compressor	1	Table C5 No. 5	50	65
		Generator	1	Table C4 N0. 87	50	65
Deck resurfacing & highway joint replacement @ half joint and expansion joint locations		Paver	1	Table C5 No. 31	50	77
		Compressor	1	Table C5 No. 5	50	65
		Generator	1	Table C4 N0. 87	50	65
Concrete repairs/protection to the half joints	Weekend (poss. overnight)	Hydro jet	1	HSL*	50	81
		Hand Tools	1	Table C4 No. 93	50	80
		Concrete Pump	1	Table C3 No. 25	50	78
		Compressor	1	Table C5 No. 5	50	65
		Generator	1	Table C4 N0. 87	50	65
Concrete repairs - substructure	Normal working hours (poss. some overnight)	Jack hammer	1	Table C5 No. 3	50	82
		Hydro jet	1	HSL*	50	81
		Compressor	1	Table C5 No. 5	50	65
		Generator	1	Table C4 N0. 87	50	65
Concrete repairs - parapets	Overnight & weekend	Jack hammer	1	Table C5 No. 3	50	82
		Compressor	1	Table C5 No. 5	50	65
		Generator	1	Table C4 N0. 87	50	65

Prediction of Noise Impacts for Provision of Water Supply

Receptor	Site Clearance	Excavation & Installation of pipe in Malpas Road	Excavation & Installation of pipe in Pant Road	Excavation & Installation of pipe in Pant Lane	Excavation & Installation of pipe alongside motorway	Excavation & Installation of pipe alongside motorway & in hard-shoulder (night-time working)	Excavation & Installation of pipe across W/B M4	Excavation & Installation of pipe across E/B M5
135 Malpas Road		79.0						
137 Malpas Road		79.0			62.1			
139 Malpas Road		79.0			63.0			
144 Malpas Road		84.1	84.1	75.9	63.5			
146 Malpas Road		84.1	84.1	75.9	64.1			
148 Malpas Road				75.9				
150 Malpas Road				75.9				
152 Malpas Road				75.9				
1 Pant Rd	65.1		84.1	81.9	66.4			
2 Pant Rd			84.1					

3 Pant Rd	65.1				66.4			
5 Pant Rd	65.1				66.4			
7 Pant Rd	65.1				66.4			
9 Pant Rd	65.1				66.4			
11 Pant Rd	65.1				66.4			
13 Pant Rd	65.1				66.4			
15 Pant Rd	65.1				66.4			
17 Pant Rd	65.1				66.4			
19 Pant Rd	65.1				66.4			
21 Pant Rd	65.1				66.4			
23 Pant Rd	65.1				66.4			
25 Pant Rd	66.1				67.4			
27 Pant Rd	66.1				67.4			
29 Pant Rd	66.7				68.0			
31 Pant Rd	66.7				68.0			
33 Pant Rd	67.2				68.5			
35 Pant Rd	67.2				68.5			
37 Pant Ln	70.0				71.3			
39 Pant Ln	70.0				71.3	75.8		
41 Pant Ln	69.4				70.7	75.1		
43 Pant Ln	72.3				73.6	78.1		
45 Pant Ln	72.3				73.6	78.1		
46 Pant Ln	66.3					76.5		

47 Pant Ln	68.0					73.7		
76 Aston Crescent	70.0					75.8	75.8	69.8
79 Aston Crescent	71.5					77.2	77.2	71.2
Newport Lodge Hotel	59.2					65.0	65.8	66.7

Prediction of Noise Impacts for Provision of Tunnel Works

Receptor	Removal of existing lighting gantry	Cleaning of primary lining	Non-destructive testing of lining	Repair lining	Re-render lining	Remove existing secondary lining
Newport Lodge Hotel	55.1	47.1	39.4	57.2	49.5	55.1
135 Bryn Bevan	55.6	47.6	39.9	57.8	50.1	55.6
136 Bryn Bevan	54.8	46.9	39.1	57.0	49.3	54.8
137 Bryn Bevan	54.1	46.2	38.4	56.3	48.6	54.1
138 Bryn Bevan	53.8	45.8	38.1	55.9	48.2	53.8
Aria Care Home Bryn Bevan	53.4	45.4	37.6	55.5	47.8	53.4
140 Bryn Bevan	51.4	43.4	35.7	53.6	45.8	51.4
141 Bryn Bevan	51.6	43.6	35.8	53.7	46.0	51.6
142 Bryn Bevan	51.8	43.9	36.1	54.0	46.3	51.8
143 Bryn Bevan	51.9	43.9	36.2	54.1	46.4	51.9
144 Bryn Bevan	52.1	44.1	36.4	54.3	46.5	52.1
145 Bryn Bevan	52.3	44.3	36.6	54.4	46.7	52.3

59 Aston Crescent	58.3	50.3	42.6	60.5	52.7	58.3
79 Aston Crescent	62.2	54.2	46.5	64.4	56.6	62.2
96 Aston Crescent	63.8	55.8	48.1	65.9	58.2	63.8
6 Glassworks Cottages	47.6	39.6	31.9	49.8	42.0	47.6
7 Glassworks Cottages	48.8	40.8	33.0	50.9	43.2	48.8
8 Glassworks Cottages	48.8	40.8	33.1	51.0	43.3	48.8
9 Glassworks Cottages	48.9	41.0	33.2	51.1	43.4	48.9
10 Glassworks Cottages	49.3	41.3	33.5	51.4	43.7	49.3
5 Waterside Court	46.1	38.1	30.4	48.2	40.5	46.1
6 Waterside Court	46.2	38.2	30.5	48.4	40.6	46.2
7 Waterside Court	46.4	38.5	30.7	48.6	40.9	46.4
8 Waterside Court	46.5	38.5	30.8	48.6	40.9	46.5
9 Waterside Court	46.9	39.0	31.2	49.1	41.4	46.9
10 Waterside Court	46.9	39.0	31.2	49.1	41.4	46.9
11 Waterside Court	47.2	39.2	31.5	49.3	41.6	47.2
12 Waterside Court	47.2	39.3	31.5	49.4	41.7	47.2

	Remove existing concrete panels	**Install new concrete panels**	**Install secondary lining**	**Install new lighting**	**Remove existing cabling/install new cabling**
Newport Lodge Hotel	56.5	53.1	57.4	57.4	57.5
135 Bryn Bevan	57.0	53.6	57.9	57.9	58.0
136 Bryn Bevan	56.2	52.8	57.1	57.1	57.2
137 Bryn Bevan	55.5	52.1	56.4	56.4	56.5

138 Bryn Bevan	55.2	51.8	56.1	56.1	56.2
Aria Care Home Bryn Bevan	54.8	51.3	55.7	55.7	55.8
140 Bryn Bevan	52.8	49.4	53.7	53.7	53.8
141 Bryn Bevan	53.0	49.6	53.9	53.9	54.0
142 Bryn Bevan	53.2	49.8	54.1	54.1	54.2
143 Bryn Bevan	53.3	49.9	54.2	54.2	54.3
144 Bryn Bevan	53.5	50.1	54.4	54.4	54.5
145 Bryn Bevan	53.7	50.3	54.6	54.6	54.7
59 Aston Crescent	59.7	56.3	60.6	60.6	60.7
79 Aston Crescent	63.6	60.2	64.5	64.5	64.6
96 Aston Crescent	65.2	61.8	66.1	66.1	66.2
6 Glassworks Cottages	49.0	45.6	49.9	49.9	50.0
7 Glassworks Cottages	50.2	46.7	51.0	51.0	51.2
8 Glassworks Cottages	50.2	46.8	51.1	51.1	51.2
9 Glassworks Cottages	50.3	46.9	51.2	51.2	51.3
10 Glassworks Cottages	50.7	47.2	51.6	51.6	51.7
5 Waterside Court	47.5	44.1	48.4	48.4	48.5
6 Waterside Court	47.6	44.2	48.5	48.5	48.6
7 Waterside Court	47.8	44.4	48.7	48.7	48.8
8 Waterside Court	47.9	44.5	48.8	48.8	48.9
9 Waterside Court	48.3	44.9	49.2	49.2	49.3
10 Waterside Court	48.3	44.9	49.2	49.2	49.3
11 Waterside Court	48.6	45.2	49.5	49.5	49.6

12 Waterside Court	48.6	45.2	49.5	49.5	49.6
	Cross Passageway works	**Cabling, Communications work**	**Carriageway Reconstruction/ Excavation**	**Carriageway Reconstruction/ Relaying**	**Tunnel Services Building**
Newport Lodge Hotel	57.4	57.4	64.9	55.9	59.2
135 Bryn Bevan	58.0	58.0	65.4	56.4	59.7
136 Bryn Bevan	57.2	57.2	64.7	55.6	58.9
137 Bryn Bevan	56.5	56.5	64.0	54.9	58.2
138 Bryn Bevan	56.1	56.1	63.6	54.6	57.9
Aria Care Home Bryn Bevan	55.7	55.7	63.2	54.2	57.5
140 Bryn Bevan	53.7	53.7	61.2	52.2	55.5
141 Bryn Bevan	53.9	53.9	61.4	52.4	55.7
142 Bryn Bevan	54.2	54.2	61.7	52.6	55.9
143 Bryn Bevan	54.3	54.3	61.7	52.7	56.0
144 Bryn Bevan	54.4	54.4	61.9	52.9	56.2
145 Bryn Bevan	54.6	54.6	62.1	53.1	56.4
59 Aston Crescent	60.6	60.6	68.1	59.1	62.4
79 Aston Crescent	64.5	64.5	72.0	63.0	66.3
96 Aston Crescent	66.1	66.1	73.6	64.6	67.9
6 Glassworks Cottages	49.9	49.9	57.4	48.4	51.7
7 Glassworks Cottages	51.1	51.1	58.6	49.6	52.9
8 Glassworks Cottages	51.2	51.2	58.6	49.6	52.9
9 Glassworks Cottages	51.3	51.3	58.8	49.7	53.0
10 Glassworks Cottages	51.6	51.6	59.1	50.1	53.4

5 Waterside Court	48.4	48.4	55.9	46.9	50.2
6 Waterside Court	48.5	48.5	56.0	47.0	50.3
7 Waterside Court	48.8	48.8	56.3	47.2	50.5
8 Waterside Court	48.8	48.8	56.3	47.3	50.6
9 Waterside Court	49.3	49.3	56.8	47.7	51.0
10 Waterside Court	49.3	49.3	56.8	47.7	51.0
11 Waterside Court	49.5	49.5	57.0	48.0	51.3
12 Waterside Court	49.6	49.6	57.1	48.0	51.3

Prediction of Noise Impacts for Provision of Drainage Works

Receptor	Site Clearance (off line -during daytime)	Site Clearance (Verges, during o/night closures)	Temporary Sheet piling to excavation (off line -during daytime)	Excavate for storage tanks & interceptor (off line -during daytime)	Blind base slabs (off line -during daytime)
6 Glassworks Cottages	52.2	52.2	61.3	60.6	49.9
7 Glassworks Cottages	52.1	52.1	61.2	60.5	49.9
8 Glassworks Cottages	51.8	51.8	60.9	60.2	49.5
9 Glassworks Cottages	51.7	51.7	60.8	60.1	49.4
10 Glassworks Cottages	51.6	51.6	60.7	60.0	49.4
11 Glassworks Cottages	51.4	51.4	60.5	59.8	49.2
12 Glassworks Cottages	51.3	51.3	60.4	59.7	49.0
5 Waterside Court	56.7	56.7	65.8	65.1	54.5
6 Waterside Court	57.4	57.4	66.5	65.8	55.1

7 Waterside Court	58.4	58.4	67.5	66.8	56.1
8 Waterside Court	58.9	58.9	67.9	67.3	56.6
9 Waterside Court	59.7	59.7	68.8	68.1	57.5
10 Waterside Court	60.9	60.9	70.0	69.3	58.7
11 Waterside Court	61.4	61.4	70.5	69.8	59.1
12 Waterside Court	64.0	64.0	73.1	72.4	61.7
153 Stockton Road	46.7	46.7	55.8	55.1	44.5
151 Stockton Road	46.7	46.7	55.8	55.1	44.4
Receptor	**Install Storage Tanks & Interceptor**	**Backfill & Remove piles (off line -during daytime)**	**Jet clean existing pipes & Chambers**	**Excavate & install other drainage runs & Chambers (off line -during daytime)**	**Excavate & install new verge drainage (30 nights)**
6 Glassworks Cottages	39.9	60.4	44.7	60.7	50.5
7 Glassworks Cottages	39.8	60.3	44.6	60.6	50.4
8 Glassworks Cottages	39.5	60.0	44.2	60.3	50.1
9 Glassworks Cottages	39.4	59.9	44.1	60.2	50.0
10 Glassworks Cottages	39.3	59.8	44.1	60.1	49.9
11 Glassworks Cottages	39.1	59.6	43.9	59.9	49.7
12 Glassworks Cottages	39.0	59.5	43.8	59.8	49.6
5 Waterside Court	44.4	65.0	49.2	65.2	55.0
6 Waterside Court	45.1	65.6	49.9	65.9	55.7
7 Waterside Court	46.1	66.6	50.9	66.9	56.7
8 Waterside Court	46.6	67.1	51.3	67.4	57.1

9 Waterside Court	47.4	67.9	52.2	68.2	58.0
10 Waterside Court	48.6	69.2	53.4	69.4	59.2
11 Waterside Court	49.1	69.6	53.9	69.9	59.7
12 Waterside Court	51.7	72.2	56.5	72.5	62.3
153 Stockton Road	34.4	54.9	39.2	55.2	45.0
151 Stockton Road	34.4	54.9	39.1	55.2	45.0

Predicted Noise Impacts for River Usk Bridge Works

Malpas Viaduct	**Deck waterproofing @ half joint and expansion joint locations**				**Deck resurfacing & highway joint replacement @ half joint and expansion joint locations**	
	1. Strip off existing surfacing and waterproofing	**2. Grit blast existing concrete bridge deck**	**3. Repair existing concrete deck (as required)**	**4. Install primer, waterproofing**	**1. Install new highway joints (buried)**	**2. Install new surfacing**
Pant Y Celin	53.9	51.9	51.9	53.1	48.9	39.9
15a Blane Y Pant Crescent	50.0	48.0	48.0	49.3	45.0	36.1
15a Blane Y Pant Crescent	50.3	48.3	48.3	49.5	45.3	36.3
Kimberley Nursery School	49.8	47.8	47.8	49.0	44.8	35.8
137 Malpas Road	61.5	59.5	59.5	60.7	56.5	47.5
139 Malpas Road	62.3	60.3	60.3	61.6	57.3	48.3
141 Malpas Road	63.1	61.1	61.1	62.4	58.1	49.2

142 Malpas Road	60.5	58.5	58.5	59.7	55.5	46.5
143 Malpas Road	64.3	62.3	62.3	63.6	59.3	50.4
144 Malpas Road	62.9	60.9	60.9	62.1	57.9	48.9
145 Malpas Road	65.7	63.7	63.7	64.9	60.7	51.7
146 Malpas Road	63.4	61.4	61.4	62.6	58.4	49.4
148 Malpas Road	64.2	62.2	62.2	63.4	59.2	50.2
150 Malpas Road	65.0	63.0	63.0	64.2	60.0	51.0
152 Malpas Road	66.1	64.1	64.1	65.3	61.1	52.1
153 Malpas Road	70.0	68.0	68.0	69.3	65.0	56.1
177 Malpas Road	68.1	66.1	66.1	67.3	63.1	54.1
179 Malpas Road	66.9	64.9	64.9	66.2	61.9	53.0
181 Malpas Road	66.1	64.1	64.1	65.3	61.1	52.1
183 Malpas Road	65.2	63.2	63.2	64.4	60.2	51.2
185 Malpas Road	64.5	62.5	62.5	63.7	59.5	50.5
187 Malpas Road	63.7	61.7	61.7	62.9	58.7	49.7
189 Malpas Road	62.9	60.9	60.9	62.1	57.9	48.9
Ibis Hotel	73.4	71.4	71.4	72.6	68.4	59.4
1 Pant Ln	65.7	63.7	63.7	64.9	60.7	51.7
3 Pant Ln	65.7	63.7	63.7	64.9	60.7	51.7
5 Pant Ln	65.7	63.7	63.7	64.9	60.7	51.7
7 Pant Ln	65.7	63.7	63.7	64.9	60.7	51.7
9 Pant Ln	65.7	63.7	63.7	64.9	60.7	51.7
11 Pant Ln	65.7	63.7	63.7	64.9	60.7	51.7

Brynglas Tunnel Refurbishments

13 Pant Ln	65.7	63.7	63.7	64.9	60.7	51.7
15 Pant Ln	65.7	63.7	63.7	64.9	60.7	51.7
17 Pant Ln	65.7	63.7	63.7	64.9	60.7	51.7
19 Pant Ln	65.7	63.7	63.7	64.9	60.7	51.7
21 Pant Ln	65.7	63.7	63.7	64.9	60.7	51.7
23 Pant Ln	65.7	63.7	63.7	64.9	60.7	51.7
25 Pant Ln	66.7	64.7	64.7	65.9	61.7	52.7
27 Pant Ln	66.7	64.7	64.7	65.9	61.7	52.7
29 Pant Ln	67.4	65.4	65.4	66.6	62.4	53.4
31 Pant Ln	67.4	65.4	65.4	66.6	62.4	53.4
33 Pant Ln	67.9	65.9	65.9	67.1	62.9	53.9
35 Pant Ln	67.9	65.9	65.9	67.1	62.9	53.9
37 Pant Ln	70.7	68.7	68.7	69.9	65.7	56.7
39 Pant Ln	70.7	68.7	68.7	69.9	65.7	56.7
41 Pant Ln	70.0	68.0	68.0	69.3	65.0	56.1
43 Pant Ln	73.0	71.0	71.0	72.2	68.0	59.0
45 Pant Ln	73.0	71.0	71.0	72.2	68.0	59.0
46 Pant Ln	66.9	64.9	64.9	66.2	61.9	53.0
47 Pant Ln	68.6	66.6	66.6	67.8	63.6	54.6
59 Aston Crescent	60.5	58.5	58.5	59.7	55.5	46.5
79 Aston Crescent	58.8	56.8	56.8	58.0	53.8	44.8
Newport Lodge Hotel	55.8	53.8	53.8	55.0	50.8	41.8

	Concrete repairs/protection to the half joints		Concrete repairs - substructure	Concrete repairs - parapets		
	1. Break out defective reinforced concrete	2. Concrete repairs (incl. installing cathodic protection)	1. Break out and repair delaminated concrete	1. Break out and repair delaminated concrete		
Pant Y Celin	52.9	54.2	54.1	54.1		
15a Blane Y Pant Crescent	49.0	50.3	50.2	50.2		
15a Blane Y Pant Crescent	49.3	50.6	50.5	50.5		
Kimberley Nursery School	48.8	50.1	49.9	49.9		
137 Malpas Road	60.5	61.8	61.7	61.7		
139 Malpas Road	61.3	62.6	62.5	62.5		
141 Malpas Road	62.1	63.4	63.3	63.3		
142 Malpas Road	59.5	60.8	60.7	60.7		
143 Malpas Road	63.3	64.6	64.5	64.5		
144 Malpas Road	61.9	63.2	63.0	63.0		
145 Malpas Road	64.7	66.0	65.9	65.9		
146 Malpas Road	62.4	63.7	63.6	63.6		
148 Malpas Road	63.2	64.5	64.4	64.4		
150 Malpas Road	64.0	65.3	65.2	65.2		
152 Malpas Road	65.1	66.4	66.3	66.3		
153 Malpas Road	69.0	70.3	70.2	70.2		
177 Malpas Road	67.1	68.4	68.3	68.3		
179 Malpas Road	65.9	67.2	67.1	67.1		

Brynglas Tunnel Refurbishments

181 Malpas Road	65.1	66.4	66.3	66.3		
183 Malpas Road	64.2	65.5	65.4	65.4		
185 Malpas Road	63.5	64.8	64.7	64.7		
187 Malpas Road	62.7	64.0	63.9	63.9		
189 Malpas Road	61.9	63.2	63.0	63.0		
Ibis Hotel	72.4	73.7	73.6	73.6		
1 Pant Ln	64.7	66.0	65.9	65.9		
3 Pant Ln	64.7	66.0	65.9	65.9		
5 Pant Ln	64.7	66.0	65.9	65.9		
7 Pant Ln	64.7	66.0	65.9	65.9		
9 Pant Ln	64.7	66.0	65.9	65.9		
11 Pant Ln	64.7	66.0	65.9	65.9		
13 Pant Ln	64.7	66.0	65.9	65.9		
15 Pant Ln	64.7	66.0	65.9	65.9		
17 Pant Ln	64.7	66.0	65.9	65.9		
19 Pant Ln	64.7	66.0	65.9	65.9		
21 Pant Ln	64.7	66.0	65.9	65.9		
23 Pant Ln	64.7	66.0	65.9	65.9		
25 Pant Ln	65.7	67.0	66.9	66.9		
27 Pant Ln	65.7	67.0	66.9	66.9		
29 Pant Ln	66.4	67.7	67.6	67.6		
31 Pant Ln	66.4	67.7	67.6	67.6		
33 Pant Ln	66.9	68.2	68.0	68.0		

35 Pant Ln	66.9	68.2	68.0	68.0		
37 Pant Ln	69.7	71.0	70.9	70.9		
39 Pant Ln	69.7	71.0	70.9	70.9		
41 Pant Ln	69.0	70.3	70.2	70.2		
43 Pant Ln	72.0	73.3	73.1	73.1		
45 Pant Ln	72.0	73.3	73.1	73.1		
46 Pant Ln	65.9	67.2	67.1	67.1		
47 Pant Ln	67.6	68.9	68.8	68.8		
59 Aston Crescent	59.5	60.8	60.7	60.7		
79 Aston Crescent	57.8	59.1	59.0	59.0		
Newport Lodge Hotel	54.8	56.1	56.0	56.0		

Predicted Noise Impacts for Malpas Viaduct

	Deck waterproofing @ half joint and expansion joint locations				Concrete repairs - substructure
Receptors	**1. Strip off existing surfacing and waterproofing**	**2. Grit blast existing concrete bridge deck**	**3. Repair existing concrete deck (as required)**	**4. Install primer, waterproofing**	**1. Break out and repair delaminated concrete**
Pant Y Celin	54.3	59.3	53.3	56.0	57.0
15a Blane Y Pant Crescent	50.4	55.4	49.4	52.1	53.0

15a Blane Y Pant Crescent	50.6	55.6	49.6	52.3	53.3
Kimberley Nursery School	50.1	55.1	49.1	51.8	52.7
137 Malpas Road	62.2	67.2	61.2	63.9	64.8
139 Malpas Road	63.1	68.1	62.1	64.8	65.8
141 Malpas Road	63.9	68.9	62.9	65.5	66.5
142 Malpas Road	61.1	66.1	60.1	62.8	63.8
143 Malpas Road	65.0	70.0	64.0	66.7	67.6
144 Malpas Road	63.6	68.6	62.6	65.2	66.2
145 Malpas Road	66.5	71.5	65.5	68.2	69.2
146 Malpas Road	64.5	69.5	63.5	66.2	67.1
148 Malpas Road	64.7	69.7	63.7	66.3	67.3
150 Malpas Road	65.7	70.7	64.7	67.4	68.4
152 Malpas Road	66.7	71.7	65.7	68.4	69.4
153 Malpas Road	71.0	76.0	70.0	72.7	73.7
177 Malpas Road	69.2	74.2	68.2	70.8	71.8
179 Malpas Road	67.9	72.9	66.9	69.5	70.5
181 Malpas Road	66.7	71.7	65.7	68.4	69.4
183 Malpas Road	65.7	70.7	64.7	67.4	68.4
185 Malpas Road	65.0	70.0	64.0	66.7	67.6
187 Malpas Road	64.3	69.3	63.3	66.0	67.0
189 Malpas Road	63.3	68.3	62.3	64.9	65.9
Ibis Hotel	74.4	79.4	73.4	76.0	77.0
1 Pant Ln	66.3	71.3	65.3	68.0	69.0

3 Pant Ln	66.5	71.5	65.5	68.2	69.2
5 Pant Ln	66.5	71.5	65.5	68.2	69.2
7 Pant Ln	66.5	71.5	65.5	68.2	69.2
9 Pant Ln	66.5	71.5	65.5	68.2	69.2
11 Pant Ln	66.5	71.5	65.5	68.2	69.2
13 Pant Ln	66.5	71.5	65.5	68.2	69.2
15 Pant Ln	66.5	71.5	65.5	68.2	69.2
17 Pant Ln	66.5	71.5	65.5	68.2	69.2
19 Pant Ln	66.5	71.5	65.5	68.2	69.2
21 Pant Ln	66.5	71.5	65.5	68.2	69.2
23 Pant Ln	66.5	71.5	65.5	68.2	69.2
25 Pant Ln	67.9	72.9	66.9	69.5	70.5
27 Pant Ln	67.9	72.9	66.9	69.5	70.5
29 Pant Ln	68.1	73.1	67.1	69.8	70.7
31 Pant Ln	68.1	73.1	67.1	69.8	70.7
33 Pant Ln	68.6	73.6	67.6	70.3	71.3
35 Pant Ln	68.6	73.6	67.6	70.3	71.3
37 Pant Ln	71.8	76.8	70.8	73.4	74.4
39 Pant Ln	71.8	76.8	70.8	73.4	74.4
41 Pant Ln	71.0	76.0	70.0	72.7	73.7
43 Pant Ln	74.4	79.4	73.4	76.0	77.0
45 Pant Ln	74.4	79.4	73.4	76.0	77.0
46 Pant Ln	67.6	72.6	66.6	69.3	70.3

47 Pant Ln	69.2	74.2	68.2	70.8	71.8
59 Aston Crescent	72.1	77.1	71.1	73.8	74.8
79 Aston Crescent	71.8	76.8	70.8	73.4	74.4
Newport Lodge Hotel	56.1	61.1	55.1	57.7	58.7
	Deck resurfacing & highway joint replacement @ half joint and expansion joint locations		Concrete repairs/protection to the half joints		Concrete repairs - parapets
Receptors	1. Install new highway joints (buried)	2. Install new surfacing	1. Break out defective reinforced concrete	2. Concrete repairs (incl. installing cathodic protection)	1. Break out and repair delaminated concrete
Pant Y Celin	49.6	37.3	53.3	54.6	54.5
15a Blane Y Pant Crescent	45.7	33.4	49.4	50.7	50.6
15a Blane Y Pant Crescent	45.9	33.6	49.6	50.9	50.8
Kimberley Nursery School	45.4	33.1	49.1	50.4	50.3
137 Malpas Road	57.5	45.2	61.2	62.5	62.4
139 Malpas Road	58.4	46.1	62.1	63.4	63.3
141 Malpas Road	59.1	46.9	62.9	64.2	64.0
142 Malpas Road	56.4	44.1	60.1	61.4	61.3
143 Malpas Road	60.3	48.0	64.0	65.3	65.2
144 Malpas Road	58.8	46.6	62.6	63.9	63.7
145 Malpas Road	61.8	49.5	65.5	66.8	66.7
146 Malpas Road	59.8	47.5	63.5	64.8	64.7
148 Malpas Road	59.9	47.7	63.7	65.0	64.8

150 Malpas Road	61.0	48.7	64.7	66.0	65.9
152 Malpas Road	62.0	49.7	65.7	67.0	66.9
153 Malpas Road	66.3	54.0	70.0	71.3	71.2
177 Malpas Road	64.4	52.2	68.2	69.5	69.3
179 Malpas Road	63.1	50.9	66.9	68.2	68.0
181 Malpas Road	62.0	49.7	65.7	67.0	66.9
183 Malpas Road	61.0	48.7	64.7	66.0	65.9
185 Malpas Road	60.3	48.0	64.0	65.3	65.2
187 Malpas Road	59.6	47.3	63.3	64.6	64.5
189 Malpas Road	58.5	46.3	62.3	63.6	63.5
Ibis Hotel	69.6	57.4	73.4	74.7	74.6
1 Pant Ln	61.6	49.3	65.3	66.6	66.5
3 Pant Ln	61.8	49.5	65.5	66.8	66.7
5 Pant Ln	61.8	49.5	65.5	66.8	66.7
7 Pant Ln	61.8	49.5	65.5	66.8	66.7
9 Pant Ln	61.8	49.5	65.5	66.8	66.7
11 Pant Ln	61.8	49.5	65.5	66.8	66.7
13 Pant Ln	61.8	49.5	65.5	66.8	66.7
15 Pant Ln	61.8	49.5	65.5	66.8	66.7
17 Pant Ln	61.8	49.5	65.5	66.8	66.7
19 Pant Ln	61.8	49.5	65.5	66.8	66.7
21 Pant Ln	61.8	49.5	65.5	66.8	66.7
23 Pant Ln	61.8	49.5	65.5	66.8	66.7

25 Pant Ln	63.1	50.9	66.9	68.2	68.0
27 Pant Ln	63.1	50.9	66.9	68.2	68.0
29 Pant Ln	63.4	51.1	67.1	68.4	68.3
31 Pant Ln	63.4	51.1	67.1	68.4	68.3
33 Pant Ln	63.9	51.6	67.6	68.9	68.8
35 Pant Ln	63.9	51.6	67.6	68.9	68.8
37 Pant Ln	67.0	54.8	70.8	72.0	71.9
39 Pant Ln	67.0	54.8	70.8	72.0	71.9
41 Pant Ln	66.3	54.0	70.0	71.3	71.2
43 Pant Ln	69.6	57.4	73.4	74.7	74.6
45 Pant Ln	69.6	57.4	73.4	74.7	74.6
46 Pant Ln	62.9	50.6	66.6	67.9	67.8
47 Pant Ln	64.4	52.2	68.2	69.5	69.3
59 Aston Crescent	67.4	55.1	71.1	72.4	72.3
79 Aston Crescent	67.0	54.8	70.8	72.0	71.9
Newport Lodge Hotel	51.3	39.1	55.1	56.4	56.2

Predicted Noise Impacts for Malpas Slip Roads

	Deck waterproofing at hinge joint locations				
	1. Strip off existing surfacing and waterproofing	**2. Grit blast existing concrete bridge deck**	**3. Repair existing concrete deck (as required)**	**4. Install primer, waterproofing**	
6 Glassworks Cottages	52.9	57.9	52.9	58.9	

7 Glassworks Cottages	52.8	57.8	52.8	58.8	
8 Glassworks Cottages	52.5	57.5	52.5	58.5	
9 Glassworks Cottages	52.3	57.3	52.3	58.4	
10 Glassworks Cottages	52.3	57.3	52.3	58.3	
11 Glassworks Cottages	52.1	57.1	52.1	58.1	
12 Glassworks Cottages	52.0	57.0	52.0	58.0	
5 Waterside Court	57.4	62.4	57.4	63.4	
6 Waterside Court	58.1	63.1	58.1	64.1	
7 Waterside Court	59.1	64.1	59.1	65.1	
8 Waterside Court	59.5	64.5	59.5	65.5	
9 Waterside Court	60.4	65.4	60.4	66.4	
10 Waterside Court	61.6	66.6	61.6	67.6	
11 Waterside Court	62.1	67.1	62.1	68.1	
12 Waterside Court	64.7	69.7	64.7	70.7	
153 Stockton Road	47.4	52.4	47.4	53.4	
151 Stockton Road	47.3	52.3	47.3	53.4	
	Deck resurfacing & highway joint Replacement		**Replace expansion joints (saw tooth)**		
	1. Install new highway joints (buried)	**2. Install new surfacing**	**1. Break out existing joints**	**2. Repair existing concrete deck (as required)**	**3. Install new saw tooth joints**
6 Glassworks Cottages	47.9	50.5	59.1	51.0	35.9
7 Glassworks Cottages	47.8	50.5	59.0	50.9	35.8
8 Glassworks Cottages	47.5	50.6	58.7	50.6	35.5

9 Glassworks Cottages	47.3	50.6	58.5	50.5	35.3
10 Glassworks Cottages	47.3	50.6	58.5	50.4	35.3
11 Glassworks Cottages	47.1	50.7	58.3	50.2	35.1
12 Glassworks Cottages	47.0	50.7	58.2	50.1	35.0
5 Waterside Court	52.4	49.8	63.6	55.5	40.4
6 Waterside Court	53.1	49.7	64.3	56.2	41.1
7 Waterside Court	54.1	49.6	65.3	57.2	42.1
8 Waterside Court	54.5	49.5	65.7	57.7	42.5
9 Waterside Court	55.4	49.4	66.6	58.5	43.4
10 Waterside Court	56.6	49.2	67.8	59.7	44.6
11 Waterside Court	57.1	49.1	68.3	60.2	45.1
12 Waterside Court	59.7	48.8	70.9	62.8	47.7
153 Stockton Road	42.4	51.5	53.6	45.5	30.4
151 Stockton Road	42.3	51.5	53.5	45.5	30.3
	Strengthening of the main span hinges			**Concrete repairs/protection to the hinge joints**	
	1. Break out/scabble edge of existing concrete beams	**2. Cast reinforced concrete thrust blocks**	**3. Install & grout post tensioning**	**1. Break out defective reinforced concrete**	**2. Concrete repairs (incl. installing cathodic protection)**
6 Glassworks Cottages	52.9	51.0	51.1	54.4	49.3
7 Glassworks Cottages	52.8	50.9	51.1	54.3	49.2

8 Glassworks Cottages	52.5	50.6	50.7	54.0	48.9
9 Glassworks Cottages	52.3	50.5	50.6	53.9	48.8
10 Glassworks Cottages	52.3	50.4	50.6	53.8	48.7
11 Glassworks Cottages	52.1	50.2	50.4	53.6	48.5
12 Glassworks Cottages	52.0	50.1	50.3	53.5	48.4
5 Waterside Court	57.4	55.5	55.7	58.9	53.8
6 Waterside Court	58.1	56.2	56.3	59.6	54.5
7 Waterside Court	59.1	57.2	57.3	60.6	55.5
8 Waterside Court	59.5	57.7	57.8	61.1	55.9
9 Waterside Court	60.4	58.5	58.7	61.9	56.8
10 Waterside Court	61.6	59.7	59.9	63.1	58.0
11 Waterside Court	62.1	60.2	60.4	63.6	58.5
12 Waterside Court	64.7	62.8	62.9	66.2	61.1
153 Stockton Road	47.4	45.5	45.7	48.9	43.8
151 Stockton Road	47.3	45.5	45.6	48.9	43.8
	Verges and deck drainage				
	1. Break out existing verges & drainage	**2. Cast new verges inc. new deck drainage**			
6 Glassworks Cottages	55.0	49.3			
7 Glassworks Cottages	54.9	49.2			
8 Glassworks Cottages	54.6	48.9			
9 Glassworks Cottages	54.5	48.8			
10 Glassworks Cottages	54.4	48.7			

Brynglas Tunnel Refurbishments

11 Glassworks Cottages	54.2	48.5			
12 Glassworks Cottages	54.1	48.4			
5 Waterside Court	59.5	53.8			
6 Waterside Court	60.2	54.5			
7 Waterside Court	61.2	55.5			
8 Waterside Court	61.7	55.9			
9 Waterside Court	62.5	56.8			
10 Waterside Court	63.7	58.0			
11 Waterside Court	64.2	58.5			
12 Waterside Court	66.8	61.1			
153 Stockton Road	49.5	43.8			
151 Stockton Road	49.5	43.8			

Brynglas Tunnel Refurbishments

APPENDIX E

Scoping note issued to Newport City Council

Brynglas Tunnel Environmental Report

Date	20th August 2015
From	Hyder Consulting
To	Janelle Hotter – Newport City Council
Subject	Brynglas Tunnel Environmental Report: Transport Assessment

1. Introduction

Purpose of the Scoping Note

This consultation note outlines the extent of the assessment proposed for the transport assessment section of the Brynglas Tunnel Environmental Report.

Background

The M4 operates as dual, two-lane motorway in both directions through the Brynglas Tunnel and across the viaducts on either side. Either side, the motorway returns to dual, 3 lane operation resulting in the Tunnels and associated viaducts being a major pinch point on the network. The Brynglas Tunnel first opened in, and have been in operation since, the late 1960s. They carry approximately 80,000 vehicles per day along the M4 motorway around Newport and are critical to the efficient mass movement of road traffic along the M4 route in South Wales.

The condition of the Brynglas Tunnel is poor; the Tunnel is frequently reported as having safety related defects and recent safety inspections have noted seepage of the sub-carriageway up through the surfacing. Almost all of the Mechanical and Electrical (M&E) systems, as well as the sub-carriageways, carriageways, drainage and Tunnel linings have exceeded their design lives and are at significant risk of failure, whilst also causing the Tunnel to be non-compliant with current UK design standards.

The condition of the Tunnel deteriorated during a HGV Tunnel fire in 2011, which caused significant damage to the westbound bore. The repairs undertaken were temporary, designed to allow swift reopening of the Tunnel and M4 route, but these remain and are in urgent need of replacement. Failure of a critical system or the structure itself would require the immediate closure of Brynglas Tunnel for essential repairs which would have a significant impact upon transport in the region and in turn on the Welsh Economy.

The Proposed Scheme

The scheme involves the maintenance and refurbishment of three structures along the existing M4 between Junctions 25A and 26 (inclusive). Maintenance and refurbishment works are proposed for the River Usk Viaduct, Brynglas Tunnel and Malpas Viaduct. The proposed works locations are illustrated on the accompanying site plan in Appendix A. The works are to be carried out as one scheme within the same time frame.

During the repair and refurbishment of the River Usk Bridge, Brynglas Tunnel and Malpas Viaduct along the M4 motorway between Junctions 25A and 26. The Tunnel has two bores – eastbound and westbound, only one of the tunnel bores will be closed at any one time. The closures will take place at night and limited weekends.

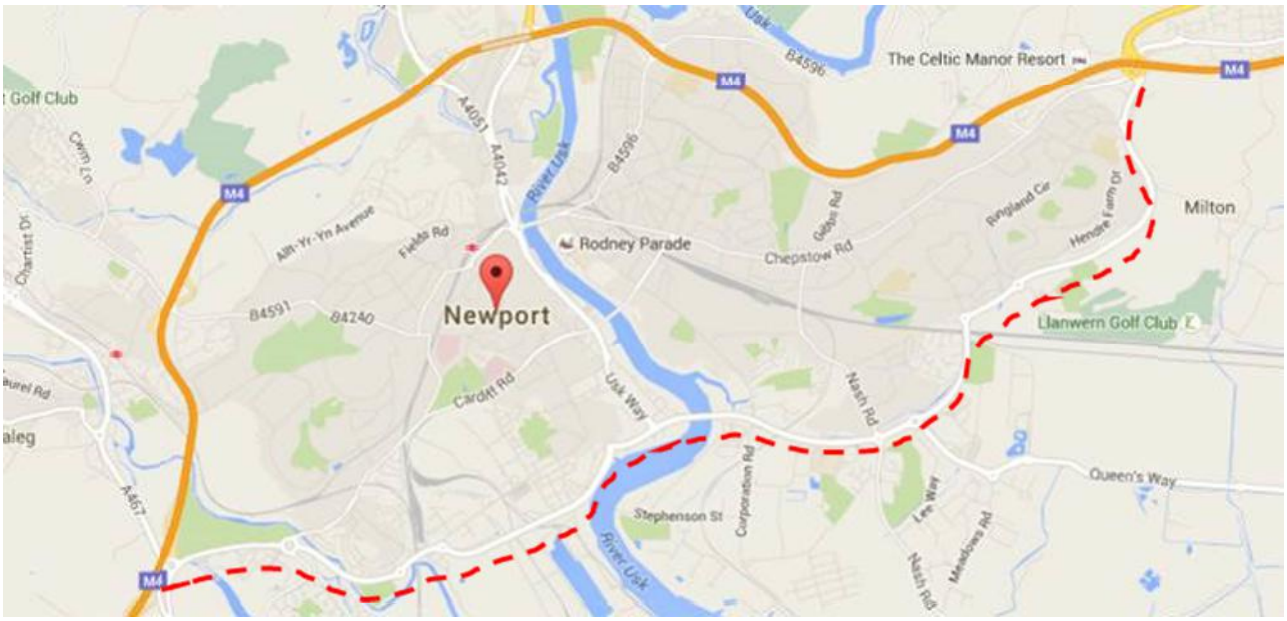
During the closure of either tunnel bore through both the night time and weekend closures the diversion route for traffic will be via the A48 Southern Distributor Road (SDR) to the south of Newport (as illustrated in Figure 1). All non-local (Newport) through traffic will be diverted onto the A48 SDR – westbound traffic will be directed to leave the motorway at Junction 24 and will re-join the motorway at Junction 28 and vice versa for eastbound traffic. For the purpose of the assessment it is assumed that all traffic that would otherwise travel through the Brynglas Tunnel during the permitted closure will divert onto the A48 SDR.

The closures will take place at night and at weekends. The night time closures are permitted a maximum of five nights of any one week. The night closures are permitted only during the following times:

- Monday – Thursday: 20:00 – 06:00
- Friday: 22:00 – 06:00
- Saturday: 20:00 – 06:00
- Sunday: 22:00 – 06:00

There will be a maximum of four weekend closures per bore (eight potential one-way weekend closures in total), which are permitted between 20:00 on Saturday through to 06:00 on Monday.

Figure 1: Proposed Diversion Route via the A48 Southern Distributor Route



The Assessment

The traffic and transport assessment will:

- Consider the potential impacts resulting from traffic movements associated with the diversion; and
- Consider the interaction between traffic movements related to the diversion and existing traffic flows on the surrounding highway network.

2. Proposed Methodology

This section sets out proposed approach that will be followed to determine the likely effects of the diversion.

Policy and Guidance

The methodology has been informed by the policy and guidance identified as relevant to this assessment:

- Planning Policy Wales Edition 7 (Welsh Government, July 2014);
- Technical Advice Note (TAN) 18: Transport (Welsh Government, March 2007);
- Environmental Impact Assessment: A Guide to Good Practice and Procedures (The Department for Communities and Local Government, 2006);
- Guidelines for the Environmental Assessment of Road Traffic (Institute of Environmental Management and Assessment (IEMA), 1993);
- Guidance on Transport Assessment (Department for Transport (DfT), 2007); and
- The Design Manual for Roads and Bridges (DMRB) (Highways Agency, 1993).

Assessment Methodology

The assessment of likely significant effect will follow the approach outlined below:

- Consultation;
- Consideration of best practice / guidance;
- Obtaining the baseline information including desktop studies, undertaking site visits and baseline data;
- Prediction of potential effects considering baseline information and diversion details;
- Identification of effects which, in particular, could be considered to be potentially significant;
- Identification of appropriate mitigation measures; and
- Prediction of residual effects.

3. Study Area

Criteria

The study area will be determined in accordance with The Guidelines for the Environmental Assessment of Road Traffic (Institute of Environmental Management and Assessment (IEMA), 1993), which suggests a number of rules to delimit the scale and extent of the assessment:

- Include highway links where traffic flows would increase by more than 30% (or the number of Heavy Goods Vehicles (HGVs) would increase by more than 30%); and
- Include any other specifically sensitive areas where traffic flows would increase by 10% or more.

Defined Study Area

The study area has been defined by the A48 SDR diversion route that will be in operation during the Brynglas Tunnel closures. It is proposed that the A48 SDR will be split into sections and where increases in total traffic flow or increases in HGV flow could be greater than 10% (for specifically sensitive areas) or 30% they will be included in the assessment.

4. Traffic and Transport Assessment

Overview

This section details the assessment that will be undertaken, namely:

- Baseline conditions;
- Identification of the potential effects during the diversion;
- Identification of appropriate mitigation measures; and
- Prediction of residual effects.

Baseline Conditions

The baseline conditions will be established:

- **Regulatory/Planning Policy Framework** – A review of the current legislation, national, regional and local policies would be undertaken.
- **Existing Highways** – An appraisal of the existing highway sections within the study area would be undertaken, together with a review of receptors.
- **Baseline Traffic Data** – Obtained to determine the existing total traffic and HGV traffic flows on the M4 and A48 SDR during the defined night time and weekend closures.
- **Traffic Growth** – It is expected that the diversion will commence late 2015. Where required the base year traffic flows will be factored to 2015 by applying a factor derived from the Trip End Model Presentation Program (TEMPRO) for the appropriate area and road type.

Potential Effects

The potential effects in the absence of mitigation measures will be undertaken during the diversion taking into account:

- **Diversion details** – Details on of the proposed diversion, routes and times will be presented, with details on the anticipated number of total vehicles and HGVs that will be diverted during the permitted closure times.
- **Significance of Effects** – The significance of effects of diversion traffic on each of the highway sections within the study area will be determined by taking into account:
  - **Route sensitivity** – Areas along the highway routes that could be sensitive to changes in traffic/HGV volumes will be identified. Sensitive areas are defined by the presence of sensitive receptors, such as hospitals, community centres, conservation areas, schools or colleges.

- **Magnitude of Change** – The expected traffic volumes during the diversion would be quantified and where appropriate assessed against anticipated background traffic flows to outline the anticipated percentage increases in total vehicles and HGVs.

A set of generic significance criteria are proposed in the 'Environmental Impact Assessment: A Guide to Good Practice and Procedures' (Department for Communities and Local Government, 2006) to describe the significance of effect, as detailed in **Table 1**.

Table 1: Transport and Access Assessment – Criteria for Determining Significance of Effects

Significance of Effect	Description
Major	These effects are likely to be important considerations at a regional or district scale
Moderate	These effects, if adverse, are likely to be important at the local scale. However, the cumulative effect of these may lead to an overall increase in the impact / effect of traffic
Minor	Generally related to local issues but the effects are relevant in the detailed design of the Development
Negligible	Effects are generally beneath levels of perception

The determination of the overall significance of the effect is a judgement as to whether the magnitude and duration of impacts, when combined with the characteristics of the highway network and the sensitivity of receptors will impact at a regional or district scale or are important at the local scale but cumulatively lead to an overall increase in the effects of traffic. If this is the case, then the effects are considered to be Significant. If the overall effect is likely to be only a local issue or beneath levels of perception, it is considered to be Not Significant.

Committed Development

We are not aware of any committed developments to be included as part of the assessment.

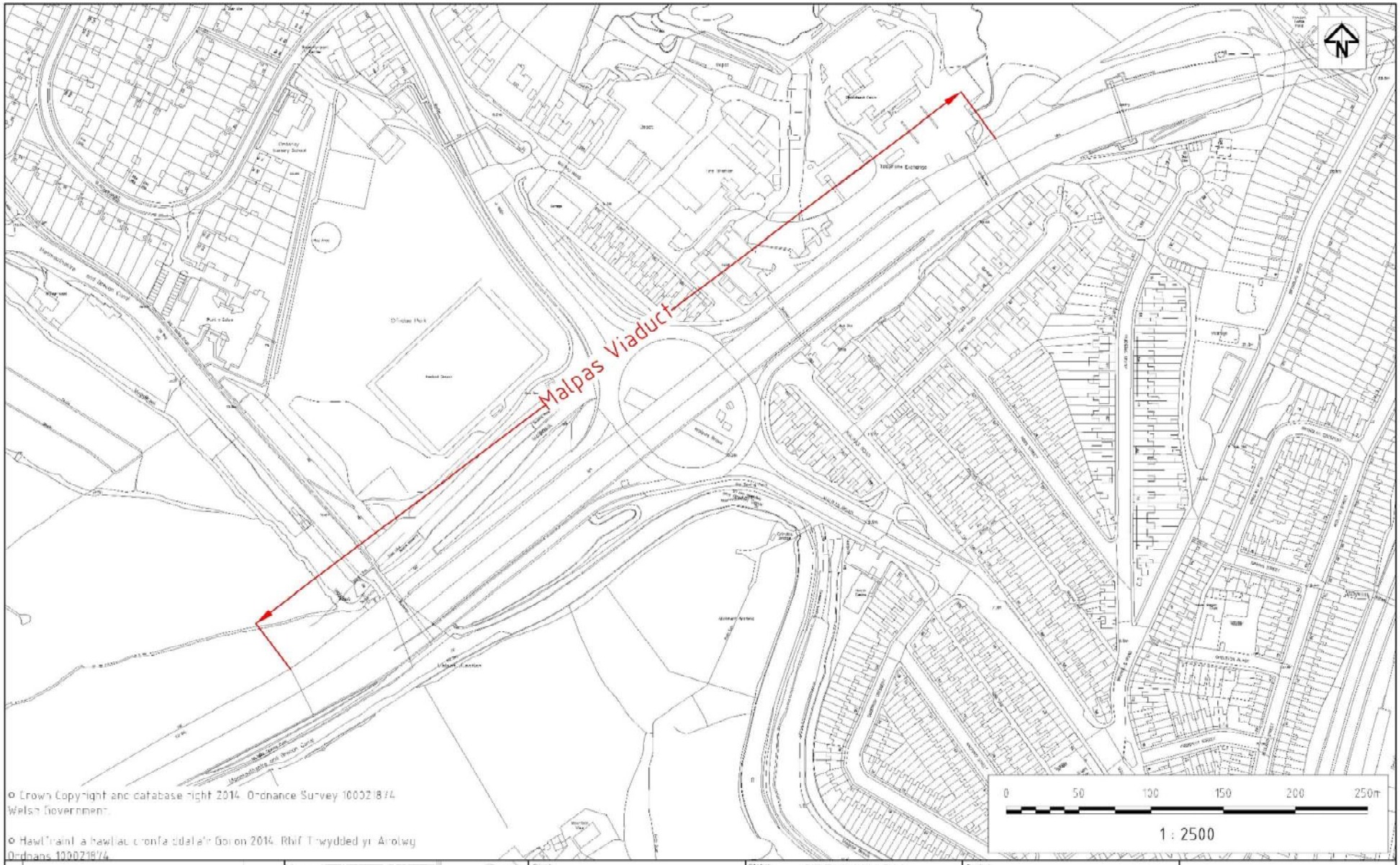
Mitigation Measures

Mitigation measures will be proposed to minimise the potential effects during the diversion.

Residual Effects

The potential residual effects on the individual receptors with the provision of the mitigation measures during the diversion will be presented.

Appendix A



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Status: PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION

Current Issue Signatories

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Original Size	A3
Height Datum	DATUM
Grid	GRID
Filename	004&005-UA007844-01.DWG
Author	N.CLEMENTS
Checked	C.BURGESS-MALIK
Approved	L.PHILLIPS

Project: M4 BRYN GLAS TUNNELS

Title: EXISTING STRUCTURES LOCATION PLAN SHEET 1 OF 2

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Drawing No.	Project No.	Issue
004	— UA007844 —	01

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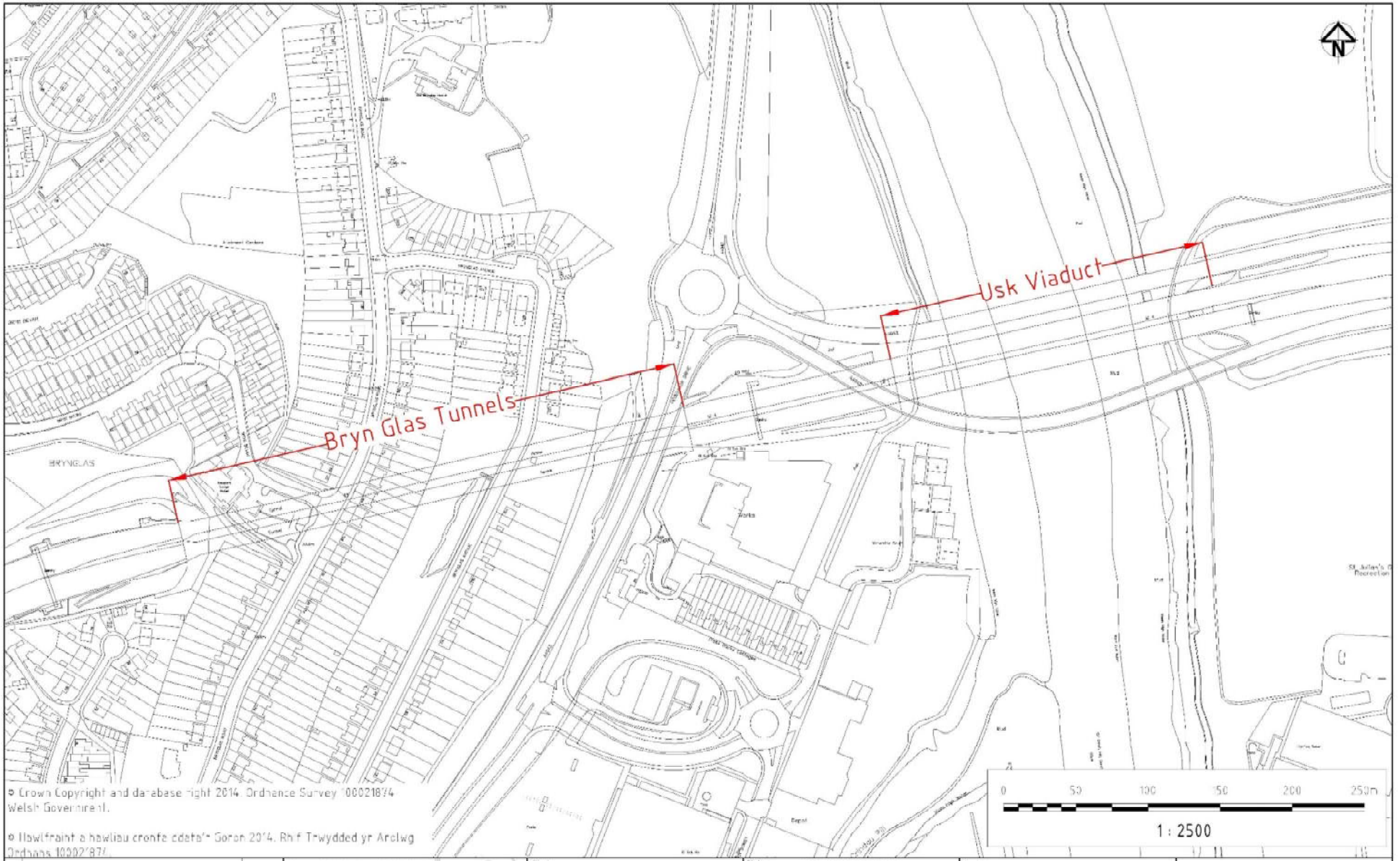

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Issue	Description	Date	

Client: Llywodraeth Cymru Welsh Government

Status: PRELIMINARY
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Current Issue Signatories

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Author	N.CLEMENTS
Checker	T.BRADSHAW-MARR
Approver	J.PHILLIPS
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Filename	0043005-UA007844-01.DWG

Project: M4 BRYN GLAS TUNNELS

Title: EXISTING STRUCTURES LOCATION PLAN SHEET 2 OF 2

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Drawing No.	Project No.	Issue
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