

IMPROVING STRATEGIC TRANSPORT ENCOMPASSING CORRIDORS FROM M4 JUNCTION 34 TO THE A48 | HIGHWAY LINK STUDY

WelTAG Stage Two Plus | Outline Business Case

MARCH 2021



Improving Strategic Transport Encompassing Corridors from M4 Junction 34 to the A48 | Highway Link Study

WelTAG Stage Two Plus | Outline Business Case

Author	MF
Checker	JH
Approver	JH
Report No	10028657-ARC-XX-XX-RP-TP-0001
Date	MARCH 2021

VERSION CONTROL

Version	Date	Author	Changes
P01	01/05/2020	MF	Confidential Draft WelTAG Stage Two Plus Commission
P02	25/09/2020	MF	Consultation Draft
P03	17/12/2020	MF	Consultation Draft Figure 2 update
P04	10/03/2021	MF	Final version

This report dated 10 March 2021 has been prepared for Vale of Glamorgan Council (the "Client") in accordance with the terms and conditions of appointment dated 18 December 2018 (the "Appointment") between the Client and **Arcadis Consulting (UK) Limited** ("Arcadis") for the purposes specified in the Appointment. For avoidance of doubt, no other person(s) may use or rely upon this report or its contents, and Arcadis accepts no responsibility for any such use or reliance thereon by any other third party.

CONTENTS

1	INTRODUCTION.....	1
1.1	Purpose of the Study.....	1
1.2	Context.....	1
1.3	WelTAG Stage Two Outline Business Case.....	3
1.4	Consultation.....	4
1.5	Appraisal Area Highway Link Study.....	6
1.6	Well-being of Future Generations (Wales) Act 2015.....	7
1.7	Welsh Government and Vale of Glamorgan Council Climate Emergency Declarations.....	8
1.8	COVID-19 Assessment Impact.....	9
1.9	Report Structure.....	10
2	STRATEGIC CASE.....	11
2.1	Overview.....	11
2.2	Scope.....	11
2.3	The Case for Change.....	11
2.4	Local Appraisal Area Issues and Opportunities.....	16
2.5	Summary of Problems and Opportunities.....	17
2.6	Involvement of Stakeholders.....	18
2.7	Objectives.....	19
2.8	WelTAG Stage Two Plus Option Development.....	22
2.9	Strategic Option Appraisal.....	32
2.10	Summary of Contribution to Problems, Objectives and Well-being Goals.....	48
3	TRANSPORT CASE.....	51
3.1	Overview.....	51
3.2	Approach to Impact Assessment.....	51
3.3	Impact Assessment Summary.....	53
3.4	Value for Money Assessment.....	54
3.5	Transport Case Summary.....	56
4	FINANCIAL CASE.....	58
4.1	Overview.....	58
4.2	Option Costs.....	58
4.3	Option Cost Summary.....	61
4.4	Funding and Accounting Implications.....	61
4.5	Financial Case Assessment.....	62

5	COMMERCIAL CASE	63
5.1	Overview	63
5.2	Procurement Strategy	63
5.3	Contract Type	64
5.4	Procurement Process	64
5.5	Suppliers	65
5.6	Contract Length	65
5.7	Allocation of Risk	65
5.8	Payment Mechanisms	65
5.9	Whole Life Costs	65
6	MANAGEMENT CASE	66
6.1	Overview	66
6.2	Project Plan	66
6.3	Legal Requirements	66
6.4	Governance	66
6.5	Project Reporting	67
6.6	Communications and Stakeholder Management	67
6.7	Risk Management	67
6.8	Monitoring and Evaluation	67
7	CONCLUSIONS AND RECOMMENDATIONS	68
7.1	Introduction	68
7.2	Preferred Transport Options	68
7.3	Consultation on Options	71
7.4	Recommendations Next Steps	71
7.5	WelTAG Stage Three	71
	GLOSSARY OF TERMS AND ACRONYMS	74

APPENDICES

APPENDIX A

Study Area

APPENDIX B

Drawings | Option A – Highway Route East of Pendoylan

APPENDIX C

Drawings | Option B – Highway Route West of Pendoylan

APPENDIX D

Drawings | Option C1 – Existing Infrastructure (Online) Enhancement

APPENDIX E

Drawings | Option C2 – Existing Infrastructure (Online) Enhancement

APPENDIX F

Transport Case | Impact Assessment Tables

APPENDIX G

Highway Option Costs | Summary Tables

FIGURES

Figure 1 WelTAG Stage One Strategic Appraisal Area.....	6
Figure 2 WelTAG Stage Two Plus Local Appraisal Area	7
Figure 3 Strategic Study Area (Case for Change Report).....	11
Figure 4 OJEU Process	64

TABLES

Table 1 WelTAG Seven-Point Assessment Scale.....	4
Table 2 Identified Problems.....	17
Table 3 Identified Opportunities.....	17
Table 4 Final Proposed Objectives.....	19
Table 5 Relationship of Objectives to Problems.....	20
Table 6 Relationship of Objectives to Well-being Goals	20
Table 7 Objectives Relating to the Wales Transport Strategy Outcomes	21

Table 8 Objectives Relating to the Strategic Priorities	21
Table 9 Objectives Relating to the Economic Action Plan Priorities	22
Table 10 Highway Option Descriptions	23
Table 11 Route Alignment Constraints and Potential Impacts	28
Table 12 Highway Design Risk Summary	30
Table 13 Highway Option Design Summary.....	31
Table 14 Strategic Option Appraisal Do-Minimum (2036 Scenario).....	32
Table 15 Strategic Option Appraisal Option A – Highway Route East of Pendoylan.....	34
Table 16 Strategic Option Appraisal Option B – Highway Route West of Pendoylan.....	38
Table 17 Strategic Option Appraisal Option C1 – Existing Infrastructure (Online) Enhancement	41
Table 18 Strategic Option Appraisal Option C2 – Existing Infrastructure (Online) Enhancement	45
Table 19 Strategic Option Appraisal Relationship of Well-being Goals to Options.....	49
Table 20 Strategic Option Appraisal Relationship of Objectives to Options	50
Table 21 Impact Assessment Summary	53
Table 22 Public Accounts (PVC £000's 2010 prices discounted to 2010)	55
Table 23 AMCB Summary Table for Sensitivity Test (prices in £000's, discounted to 2010)	55
Table 24 Option Cost Summary	61
Table 25 Financial Case Assessment	62

1 Introduction

1.1 Purpose of the Study

- 1.1.1 Arcadis Consulting (UK) Limited has been commissioned by the Vale of Glamorgan Council to develop and appraise potential options for improving the strategic transport network encompassing corridors from M4 Junction 34 to the A48 (Five Mile Lane), including the Pendoylan Corridor (or alternative). The appraisal of options has been undertaken in accordance with the Welsh Government's latest version of WelTAG (December 2017¹) including advice on the appraisal in relation to the Future Generations of Wales (2015) Act well-being goals². This WelTAG Stage Two Plus report subsequently presents the development and proportionate appraisal of highway route options between the M4 Junction 34 and A48.

1.2 Context

WelTAG Stage One Report | Improving Strategic Transport Encompassing Corridors from M4 Junction 34 to the A48 (November 2017)

- 1.2.1 The WelTAG Stage One report was prepared by Arcadis and considered the problems, opportunities and constraints, established objectives and appraised a long list of options and as a result three options were recommended to be taken forward for WelTAG Stage Two appraisal against the Do-Minimum, namely:

- Option B | M4 Junction 34 to A48 Highway Route East of Pendoylan
- Option C | M4 Junction 34 to A48 Highway Route West of Pendoylan
- Option G | Vale of Glamorgan Gateway Station (formerly Parkway Station) with Park and Ride facility and bus integration near to the M4 Junction 34

- 1.2.2 The WelTAG Stage One recommendations were considered by the project Review Group on 27th November 2017 and referred to the Vale of Glamorgan Council Environment and Regeneration Scrutiny Committee on 30th November 2017³, whereby the recommendations of the report were endorsed.

WelTAG Stage Two Report | Improving Strategic Transport Encompassing Corridors from M4 Junction 34 to the A48 (vD03 | October 2018)

- 1.2.3 A draft WelTAG Stage Two report (10013270-ARC-XX-XX-RP-TP-0001-D03) was prepared by Arcadis and was the subject of public consultation on three separate dates throughout April and May 2018, the output of which was included within the study's accompanying Consultation Report (10013270-ARC-XX-XX-RP-TP-0003).
- 1.2.4 The Final Report was presented to the project Review Group on 2nd October 2018. Following consideration of the report's output, several recommendations were agreed by the Review Group for undertaking in a Stage Two Plus study including a programme of early-stage environmental surveys and investigations, more detailed development of the highway link concept designs and completion of Vale of Glamorgan Gateway Station GRIP Stage 1 and GRIP Stage 2 studies. The purpose of the additional work in Stage Two was to consider the public consultation comments and provide additional information to inform a decision before proceeding to any options in a Stage Three study.

¹ <https://beta.gov.wales/sites/default/files/publications/2017-12/welsh-transport-appraisal-guidance.pdf>

² <https://beta.gov.wales/sites/default/files/publications/2017-12/WelTAG-2017-supplementary-guidance-the-well-being-of-future-generations-wales-act-2015.pdf>

³ http://www.valeofglamorgan.gov.uk/en/our_council/Council-Structure/minutes,_agendas_and_reports/minutes/Scrutiny-ER/2017/17-11-30.aspx

- 1.2.5 The proposals for additional Stage Two assessment (referred to as Stage Two Plus) were considered and agreed by the Vale of Glamorgan Council Environment and Regeneration Scrutiny Committee and Vale of Glamorgan Council Cabinet over several meetings.
- 1.2.6 The Vale of Glamorgan Council Cabinet meeting held on 4th April 2019 resolved:
- (1) T H A T the progress made on the WelTAG studies relating to improving the transport network corridor from the M4 Junction 34 to the A48 be noted.
 - (2) T H A T this matter be referred to Environment and Regeneration Scrutiny Committee for consideration.
 - (3) T H A T, subject to consideration by the Environment and Regeneration Scrutiny Committee the progression of the WelTAG studies for the M4 Junction 34 to the A48 to WelTAG Stage Three be endorsed, subject to the Welsh Government Capital Transport Grant funding applied for being made available.
- 1.2.7 The Vale of Glamorgan Council Environment and Regeneration Scrutiny Committee meeting held on 25th June 2019 recommended:
- (1) T H A T Cabinet give consideration to an additional option of improving the existing infrastructure without the need for a new road (*subsequently referred to as the 'Online Option'*).
 - (2) T H A T an additional report on the Stage Two Plus process should be reported back to the Committee.
 - (3) T H A T a letter be sent to the Welsh Government Minister in light of the Welsh Government declaration of a climate emergency, requesting the Welsh Government to outline its vision and how the impact on the environment would be minimised.
 - (4) T H A T Cabinet be requested to consider the impact on future generations and the environment should a new road be approved.
- 1.2.8 The Vale of Glamorgan Council Cabinet meeting held on 29th July 2019 resolved:
- (1) T H A T in relation to recommendation (1) of the Environment and Regeneration Scrutiny Committee meeting 25th June, it be noted that the Welsh Government has included an additional option of improving the existing infrastructure without the need for a new road on the Stage Two Plus process.
 - (2) T H A T in relation to recommendation (4) of Environment and Regeneration Scrutiny Committee meeting 25th June, it be noted that this will be covered in the Stage Two Plus process.

WelTAG Stage Two Plus Report | Highway Link Study

- 1.2.9 Following further consideration of the selected options, it was recognised that proposals for a Vale of Glamorgan Gateway Station present regional, strategic and sustainable transport opportunities that could be better recognised and scrutinised in isolation from the highways proposals, whilst also allowing a number of rail sub-options to be developed and independently WelTAG assessed. In addition, the rail and highway options under consideration retain separate management and control processes, which inherently influence next steps and programming for ongoing WelTAG assessment. In agreement with Welsh Government, a decision was therefore made by the Vale of Glamorgan Council to separate assessment of the Vale of Glamorgan Gateway Station option from the M4 Junction 34 to A48 highway link options.
- 1.2.10 This WelTAG Stage Two Plus report subsequently presents the development and proportionate appraisal of highway route options between the M4 Junction 34 and A48 and has been undertaken in conjunction with the Vale of Glamorgan Council. The detailed evidence, data and analysis underlying the statements made in this report are provided in the accompanying Impacts Assessment Report (10028657-ARC-XX-XX-RP-TP-0002) that supports this WelTAG Stage Two Plus Outline Business Case. For clarification and further to recommendations made by the Vale of Glamorgan Council Environment and Regeneration Committee and Cabinet, the study is considering

the following four highway options, in comparison to the Do-Minimum without a highway link improvement:

- M4 Junction 34 to A48 | Option A – Highway Route East of Pendoylan
- M4 Junction 34 to A48 | Option B – Highway Route West of Pendoylan
- M4 Junction 34 to A48 | Option C1 – Existing Infrastructure (Online) Enhancement
- M4 Junction 34 to A48 | Option C2 – Existing Infrastructure (Online) Enhancement

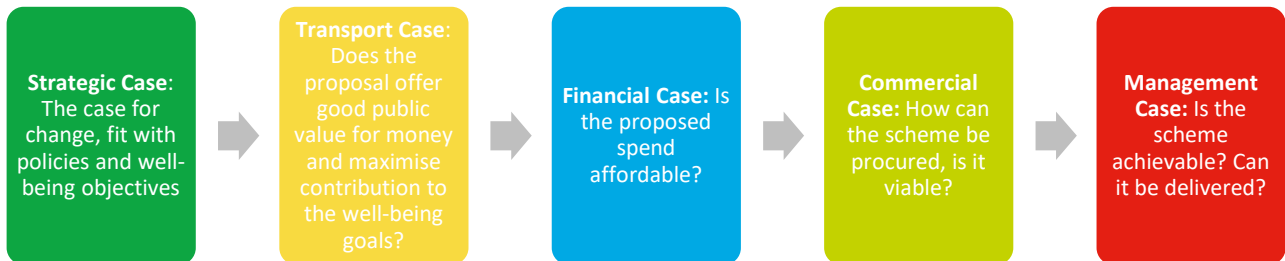
- 1.2.11 In undertaking the Stage Two Plus study, an iterative design process has been followed whereby further information on environmental considerations, together with comments received during the Stage Two consultation, has led to refinements to the concept design of options for appraisal. These refined options have in turn been appraised and further refinements made, notably with regards to the consideration of flood risk.
- 1.2.12 Included as part of the WelTAG Stage One study was the Welsh Government commissioned Peter Brett Associates (PBA) 'Case for Change' report addressing connectivity issues for strategic employment sites in the Vale of Glamorgan. This work was completed in December 2017. The purpose of this study was to clearly demonstrate and elaborate the case for change – that is, to provide a clear rationale for making an investment, its strategic fit, and how the investment would further the aims and objectives of Welsh Government and its partners. The key elements of the Case for Change report were extracted to inform the strategic case within the WelTAG Stage Two report (October 2018) and retained in the Stage Two Plus report. The full report is included as part of the Impacts Assessment Report.

1.3 WelTAG Stage Two | Outline Business Case

- 1.3.1 The WelTAG guidance states that the purpose of the Stage Two Outline Business Case is to *'examine in greater detail the short list of options for tackling the problem under consideration.'* During Stage Two, the appraisal team needs to consider how the proposed solution will lead to the desired outcomes, maximising contribution to objectives and well-being goals and use this understanding to refine the design of the options and identify key dependencies and constraints. At the end of the stage, the report should provide the Review Group with the evidence required to select a preferred option to take forward for Stage Three.
- 1.3.2 The guidance identifies that at the end of WelTAG Stage Two 'the strategic and transport cases must be virtually complete, and more information provided on the delivery, commercial and financial cases for the shortlisted options.' The assessment is required to provide stakeholders and decision makers with sufficient information and understanding of the problems and potential solutions to commit further resources to taking forward options to the next stage of appraisal. As such, this WelTAG Stage Two Plus Outline Business Case report:
- Sets out any changes that have occurred in the transport system and wider context since WelTAG Stage One (and in this case, since the Improving Strategic Transport Encompassing Corridors from M4 Junction 34 to the A48 WelTAG Stage Two study in October 2018).
 - Describes the process of developing the shortlisted options to a more developed solution for assessment.
 - Describes how each option would meet the objectives set out in WelTAG Stage One.
 - Presents a Five Case Assessment for each option with a separate presentation of the strategic, transport, management, financial and commercial case for each option and the contribution towards the well-being goals.
 - Determines whether there are any transport options that can address the issues identified, contributes positively to the well-being goals and objectives and can be delivered within technical and financial constraints.

- Selects a preferred option to be taken forward to Stage Three and establishes the methods to be used for further evidence and work to meet legislative requirements.
- Documents the decisions of the WelTAG Stage Two Review Group and the basis for these decisions.

1.3.3 This report follows the structure of the Five Case Model used by the Welsh Government:



1.3.4 For the key areas affecting decision making it provides a quantitative appraisal, and some areas of appraisal are largely qualitative. The guidance identifies that at the end of WelTAG Stage Two *‘the strategic and transport cases must be virtually complete, and more information provided on the delivery, commercial and financial cases for the shortlisted options.’* The report provides stakeholders and decision makers with sufficient information and understanding of the problems and potential solutions to commit further resources to taking forward options to Stage Three.

1.3.5 The additional work undertaken for the Stage Two Plus study provides more quantitative information for the appraisal than might normally be obtained for an Outline Business Case, recognising the importance of certain environmental factors in the decision-making process for this study. In accordance with the WelTAG guidance the significance and scale of the impacts throughout the assessment has been appraised using a seven-point scale, as presented in Table 1.

Table 1 WelTAG Seven-Point Assessment Scale

Large Beneficial	Moderate Beneficial	Slight Beneficial	Neutral	Slight Adverse	Moderate Adverse	Large Adverse
+++	++	+	0	-	---	----

1.4 Consultation

WelTAG Stage Two

1.4.1 Following the preparation of the original draft WelTAG Stage Two report (10013270-ARC-XX-XX-RP-TP-0001; Version D01; March 2018), consultation took place with stakeholders and the public on the two online options between April to July 2018, including three days of public exhibition where members of the study team and Vale of Glamorgan Council officers were available to discuss the study with attendees. The responses received to the consultation from the various sources (online, paper survey forms and written emails and letters) were provided to Arcadis.

These responses were analysed and a Consultation Report (10013270-ARC-XX-XX-RP-TP-0003; Version D01; September 2018) was prepared. In summary:

- The Consultation Report identified that there was significant engagement in the consultation process by stakeholders and the public, with 444 people attending events and a high number of responses received within the consultation period.

- There were significant objections to either highway option or the principle of a new road, with concerns centred on the lack of justification for the intervention; whether there are other options that would be more beneficial; and the impact on the communities and the environment.
- Support for the highways proposals was registered by a proportion of respondents, including some business responses.
- A range of specific issues were raised relating to the highway alignments, notably with concerns over the impact on access to Peterston-Super-Ely of suggested changes to the routing of traffic.
- The Western alignment was slightly preferred when compared to the Eastern alignment, mainly due to the concern over flooding issues for the Eastern alignment and visual impact on the existing communities (although the majority of respondents did not support either highway option).

1.4.2 In addition, there were concerns relating to the WelTAG process and the consultation that has taken place in Stage One and Stage Two. Where these have given rise to formal complaints, these have been responded to by the Vale of Glamorgan Council. It should be emphasised that WelTAG is a step-by-step process to aid decision making and the guidance asks that engagement takes place at each stage, as has occurred.

1.4.3 Whilst decisions have been made to proceed with further work on options, no commitment has been made on proceeding with any scheme at any stage. In preparing the WelTAG Stage Two Plus report, the consultation responses have been considered and have led to refinements to the highway alignments where possible, as well as consideration of the online option.

WelTAG Stage Two Plus

1.4.4 A further public consultation exercise has been completed to support consideration of the WelTAG Stage Two Plus options. In response to the COVID-19 pandemic, the consultation was completed virtually between 30th September 2020 and 23rd December 2020. In the absence of face-to-face consultation events, significant efforts were made to engage with local communities, including provision of:

- A dedicated public consultation webpage retained on the Vale of Glamorgan Council Transport Studies website inclusive of background information, supporting WelTAG documentation, drone footage of the proposed route alignments and access to an online questionnaire.
- An interactive consultation room allowing users to virtually engage with a series of bi-lingual consultation banners and access an online questionnaire.
- A bi-lingual consultation document and questionnaire issued to allow those potentially directly affected by the proposed route alignments.
- A letter advising of the proposed consultation issued to all those living within the scheme's study area.
- A series of presentations to local Community Councils, the Vale of Glamorgan Council Youth Cabinet and the Old Peoples Forum.
- Engagement with concerned residents including the provision of additional information where requested, and the completion of telephone and face-to-face 'Teams' calls.

1.4.5 Feedback stemming from the consultation has been captured as part of a standalone Consultation Report (Vale of Glamorgan Council Consultation Report; March 2021), which included consideration of several key themes following concerns and comments raised by members of the public. In summary:

- A total of 338 consultation survey responses were received with a summary of findings provided as follows:
 - The majority stated that they agreed or strongly agreed with the Do-Minimum scenario (no change, maintain the existing highway network). This was the most common response. At

least 70% of respondents were either disagreeing or strongly disagreeing with implementation of the Do-Something options (A, B, C1 and C2). Environmental impacts and impacts on property were the leading two reasons stated by respondents.

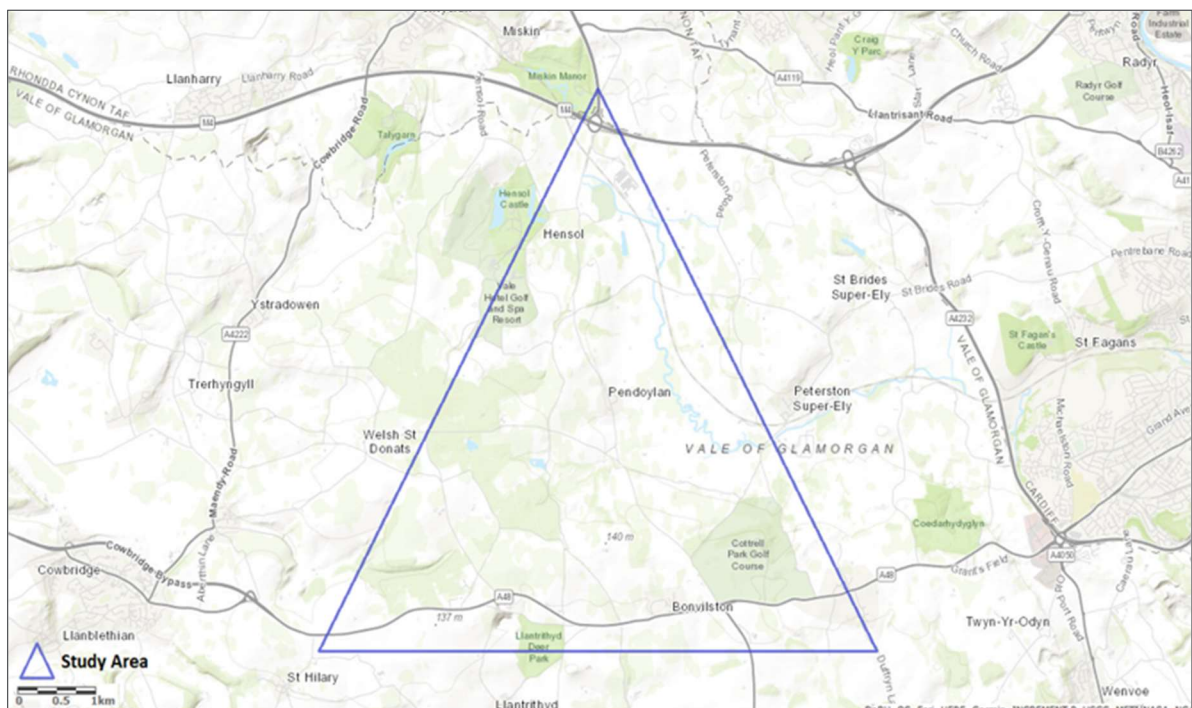
- Other key themes for opposing the interventions included support for alternative investment, the impact on safe cycling routes, opposition to the blocking of lanes [applicable to Option A and Option B], impacts on ancient woodland, concerns over increased traffic and the climate change emergency.
- Those who agreed or strongly agreed with the proposed interventions were as follows by option: Option C1 (16%), Option B (15%), Option A (14%) and Option C2 (13%).
- A further 1,847 individual pieces of communication were received. Correspondence received included emails, letters and petitions from local residents, businesses, charities, other local authorities, councillors, politicians, Community and Town Councils and local and nationwide organisations. Each piece of correspondence can be found in the Consultation Report.

1.4.6 There were concerns relating to the WelTAG process and the consultation that has taken place at Stage Two Plus. Where these have given rise to formal complaints, these have been responded to by the Vale of Glamorgan Council.

1.5 Appraisal Area | Highway Link Study

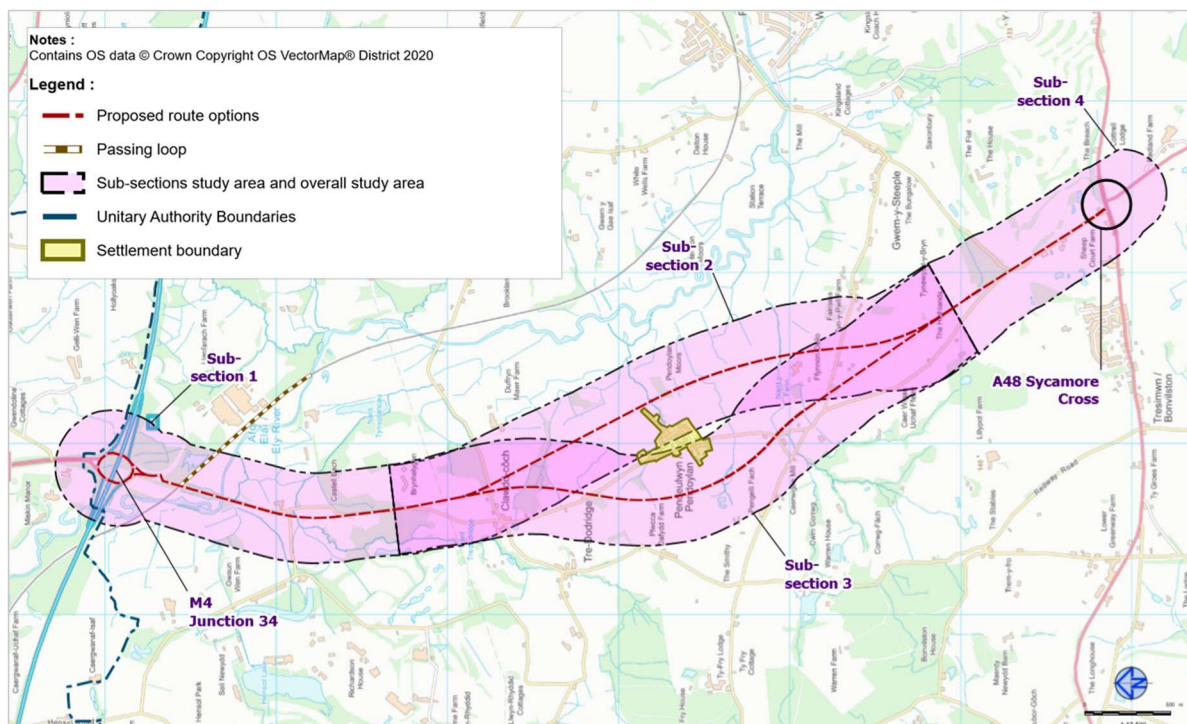
1.5.1 The WelTAG Stage One study originally focussed on a strategic appraisal area representing approximately 24 sq.km. defined by the M4 Junction 34 to the north and in a triangle approximately 7.3km from either side of the A48 Sycamore Cross junction. This is shown as Figure 1.

Figure 1 WelTAG Stage One Strategic Appraisal Area



1.5.2 The original study area remains the foundation from which the overarching WelTAG assessment has developed, with data analysis documented within the corresponding Impacts Assessment Report. However, the local appraisal area has continued to evolve in line with option development. The WelTAG Stage Two Plus Highway Link Study appraisal area is subsequently defined in Figure 2 with a 250m buffer either side of the offline alignments, whilst also encompassing the online options.

Figure 2 WelTAG Stage Two Plus | Local Appraisal Area



1.5.3 The extent of the buffer has effectively been determined by the requirements of environmental surveys required to support the study. For the purposes of the assessment, the study area has been separated into four distinct sub-sections. The full plan is presented in [Appendix A](#) with a summary provided as follows:

- **Sub-Section 1** | The route within the northernmost section southwards from the M4 Junction 34 for approximately 1.5km.
- **Sub-Section 2** | The proposed eastern route section around the settlement of Pendoylan. This is circa 3km in length and aligned north-northwest to south-southeast.
- **Sub-Section 3** | The proposed western route section around the settlement of Pendoylan. This is circa 3km in length and aligned north-northwest to south-southeast.
- **Sub-Section 4** | The southernmost segment of the route aligned north-northwest to south-southeast, approximately 1.2km in length and interconnects with the A48 Sycamore Cross junction.

1.6 Well-being of Future Generations (Wales) Act 2015

Five Ways of Working

1.6.1 This section provides an overview of how the approach and proposals set out in this report evidence the Five Ways of Working and support the seven well-being goals set out in the Future Generations of Wales Act 2015. As set out in detail in the Impacts Assessment Report, the latest WelTAG guidance has been developed in such a way to ensure that public funds are invested to maximise contribution to the well-being of Wales. The onus is specifically focused upon the delivery of sustainable development, of which will in turn contribute to the achievement of the well-being goals.

1.6.2 The WelTAG guidance states it is required *‘to ensure the needs of future generations are considered and understand how well they help public bodies to meet the well-being objectives and maximise their contribution to each of the seven goals.’* Consideration should be given to long-term challenges, trends, opportunities, as well as integration, collaboration, involvement and preventing problems from occurring or getting worse.

Long-term

- 1.6.3 The Impacts Assessment Report provides the evidence of both current and future problems, trends and opportunities to inform consideration of the long-term perspective and the development of options. Improvements are needed to address the congestion and connectivity issues associated with the M4 Junction 34 to A48 corridor and key connections, and the subsequent impacts on the economy, access to education, jobs and services, health and the environment (notably air quality and noise impacts).
- 1.6.4 Current traffic congestion and connectivity issues are anticipated to be exacerbated in the future with traffic growth as well as new developments. The options considered in the Outline Business Case offer long-term solutions to address the existing issues through implementation of a new highway link between the M4 Junction 34 and the A48. In addition, an option encompassing online improvements to the existing highway infrastructure has also been considered.

Prevention

- 1.6.5 The options under consideration offer the opportunity to prevent as far as possible the future problems and trends from occurring, through the enhancement of the local and strategic highway network. Moreover, the commercial, financial and management cases seek to identify costs and deliverability risks to aid decision making and prevent long-term liabilities for public money by considering all of the issues at the outset.

Integration

- 1.6.6 The options under consideration involve the integration of active travel as part of the local and strategic highway network, as well as supporting the potential for enhanced integration with public transport services and facilities as the highway network is enhanced. The WelTAG study has been undertaken in an integrated manner to consider and take account of other schemes and proposals through discussion with stakeholders, as well as integration with adjacent studies such as the M4 Junction 32 to Junction 35 WelTAG Stage Two Study and emerging proposals from the North West Cardiff Corridor Study (WelTAG Stage One).

Collaboration

- 1.6.7 In undertaking the WelTAG study, there has been collaboration between departments within the local authority and Welsh Government, as well as between stakeholders, Arcadis and other consultants working on adjacent projects influencing the study area issues and solutions.

Involvement

- 1.6.8 Stakeholder workshops and a full public consultation exercise was undertaken as part of the initial M4 Junction 34 to A48 WelTAG Stage Two Study. A further full public consultation exercise by virtual means on the highway options has since been completed to support consideration of the WelTAG Stage Two Plus study.

Well-being Goals

- 1.6.9 The objectives have been developed through consideration of the well-being goals and this is presented in the strategic case section. The strategic case also considers how each of the options meets the well-being goals. Together this seeks to ensure that achieving the well-being goals are at the centre of the setting of objectives for the study and the emerging interventions.

1.7 Welsh Government and Vale of Glamorgan Council Climate Emergency Declarations

- 1.7.1 An important development since completion of the first WelTAG Stage Two report in October 2018 has been Welsh Government's climate emergency declaration in 2019 stating its commitment towards '*achieving a carbon neutral public sector by 2030 and to coordinating action to help other areas of the economy to make a decisive shift away from fossil fuels, involving academia, industry and the third sector.*' Shortly before this declaration was announced, the Welsh Government

released *Prosperity for All: A Low Carbon Wales*, which sets out 100 policies and proposals to meet the 2020 carbon emissions targets.

- 1.7.2 In addition, the Welsh Government Minister for Environment, Energy and Rural Affairs made a Ministerial Statement in February 2021 that formally commits Wales to net zero carbon emissions by 2050 and sets an aspiration to achieve the target earlier than 2050. Expert viability advice from the independent Climate Change Committee to Welsh Government suggests that reaching the net zero carbon target in Wales is more affordable and achievable than previously thought.
- 1.7.3 As part of a collection of policies and proposals, the Transport Sector Emission Pathway sets out targets that carbon dioxide emissions from transport will be 43% lower than the baseline (2016) by 2030, and 79% lower by 2050. It was found that in the baseline, transport was the third largest carbon emitting sector in Wales.
- 1.7.4 Moreover, the Vale of Glamorgan Council also announced a climate emergency in 2019 outlining a commitment to deliver its well-being goals as set out in the Corporate Plan '*Strong Communities with a Bright Future*' and the well-being of Future Generations Act, and the progress of initiatives in support of the existing Carbon Management Plan. The Council further recognises that a reduction in carbon emissions can also deliver benefits in terms of new jobs, economic savings and market opportunities. The Council therefore resolves to:
- Join with Welsh Government and other councils across the UK in declaring a global climate emergency in response to the findings of the IPCC report.
 - Reduce its own carbon emissions to net zero before the Welsh Government target of 2030 and support the implementation of the Welsh Government's new Low Carbon Delivery Plan, to help achieve the Welsh Government's ambition for the public sector in Wales to be carbon neutral.
 - Make representations to the Welsh and UK Governments, as appropriate, to provide the necessary powers, resources and technical support to local authorities in Wales to help them successfully meet the 2030 target.
 - Continue to work with partners across the region to develop and implement best practice methods that can deliver carbon reductions and help limit global warming.
- 1.7.5 The climate emergency is a key influence on the direction of development and infrastructure provision for Wales, as well as an integral component towards shaping future transport schemes as the balance and inter-relationship between sustainable transport initiatives and highway network enhancement is carefully considered.
- 1.7.6 The WelTAG process and the framework provided by the well-being of Future Generations (Wales) Act 2015, enables the climate emergency considerations to be highlighted in the appraisal (as part of the strategic and transport case) and will subsequently provide an important context for this WelTAG appraisal, to be considered in the decision-making process. Further details regarding *Prosperity for All: A Low Carbon Wales* are included within the accompanying Impacts Assessment Report.

1.8 COVID-19 | Assessment Impact

- 1.8.1 As a result of the COVID-19 outbreak in early 2020, all key areas of the WelTAG assessment and appraisal including the case for change and socio-economic, cultural and environmental considerations are anticipated to be affected to a greater or lesser extent beyond expected conditions. At the time of this report, the future medium to longer-term implications of COVID-19 at a local, regional and national level remain extensively unknown and this study has not therefore made any assumptions as to the impacts on these scenarios.
- 1.8.2 However, it is anticipated that future work completed with regard to this appraisal and associated studies will increasingly need to consider the implications of the pandemic as information, trends and impacts become more widely known and accepted. This WelTAG Stage Two Plus assessment therefore remains an assessment based on pre-COVID-19 conditions and forecasts and for the purposes of the WelTAG appraisal should be viewed with this in mind.

1.9 Report Structure

1.9.1 In accordance with the WelTAG guidance the structure of this report is as follows:

- Chapter 2 | Strategic Case
- Chapter 3 | Transport Case
- Chapter 4 | Financial Case
- Chapter 5 | Commercial Case
- Chapter 6 | Management Case
- Chapter 7 | Conclusions and Recommendations

2 Strategic Case

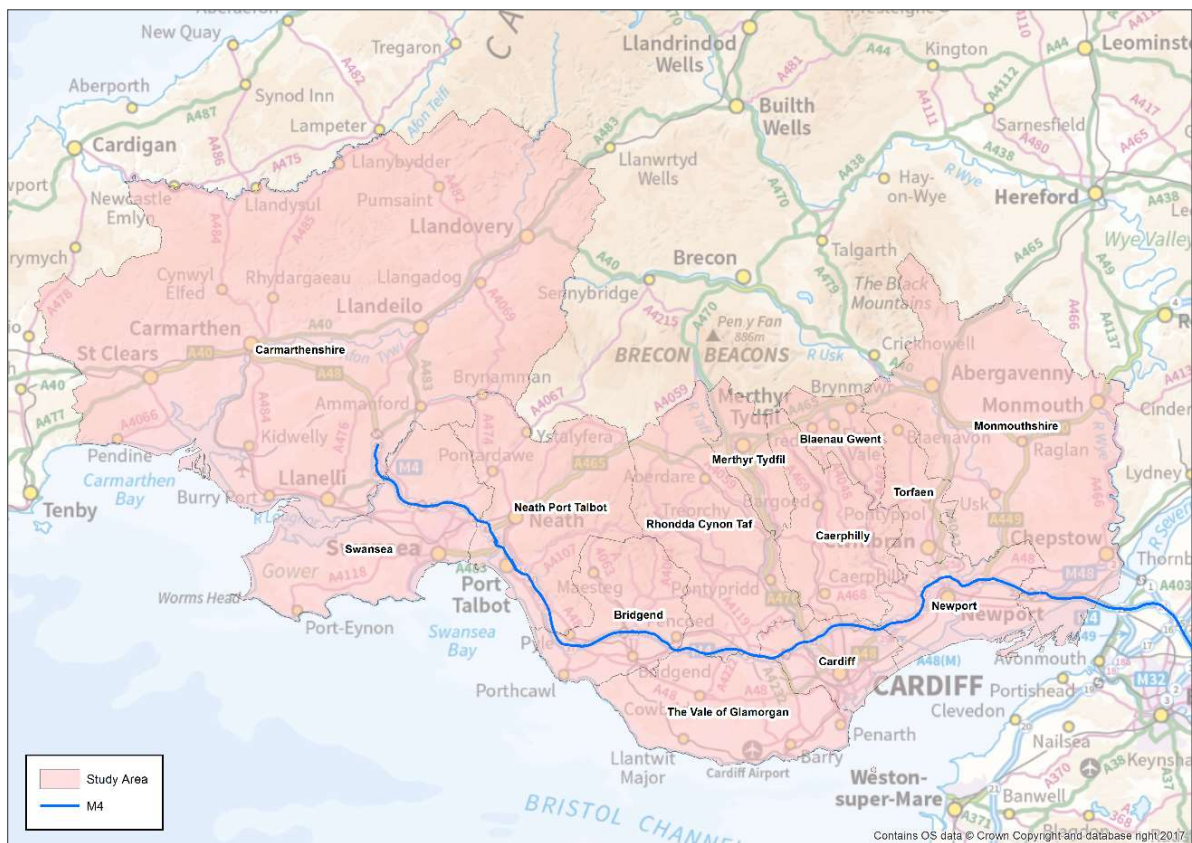
2.1 Overview

2.1.1 The strategic case addresses the need for change, providing an evidence-based description of the current situation, describes the likely situation if no action is taken and presents the reasons why an intervention is required. The strategic case includes analysis of the factors leading to the problem and the development of possible solutions, establishes objectives and provides a narrative as to how each of the solutions is intended to change the situation.

2.2 Scope

2.2.1 The scope of the study is to consider solutions to improve transport connectivity between the M4 Junction 34 and Five-Mile Lane, in order to improve strategic connectivity to strategic employment locations as well as to Cardiff Airport. The study firstly considers the strategic case, based on a strategic study area, as defined in the Case for Change report and shown in Figure 3. The study area includes the ten local authorities within the Cardiff Capital Region (Cardiff, Monmouthshire, Torfaen, Blaenau Gwent, Newport, Caerphilly, the Vale of Glamorgan, Merthyr Tydfil, Rhondda Cynon Taf and Bridgend), as well as three of the four members of the Swansea Bay City Region (Swansea, Neath Port Talbot and Carmarthenshire).

Figure 3 Strategic Study Area (Case for Change Report)



2.3 The Case for Change

Strategic Issues and Opportunities

2.3.1 The 'Case for Change' is set out in the Peter Brett Associates report contained in the accompanying Impacts Assessment Report. This forms a fundamental aspect of the strategic case, and thus the summary is included below.

Why is the case for improving connectivity to the Vale of Glamorgan being considered?

2.3.2 There are both regional, national and local drivers for improving connectivity to and from the Vale of Glamorgan. From a regional and national perspective:

- The emergence of the Cardiff Airport – St Athan Enterprise Zone (EZ) in the Vale of Glamorgan presents a strategically important economic development and employment opportunity for South Wales as a whole. **It is anticipated that this development will create 4,000 new jobs, with further indirect and induced employment across South Wales.**
- As part of the development of the Cardiff Capital Region and corresponding City Deal, there is a desire to improve transport connectivity across South East Wales, safeguarding and promoting employment and investment and attracting and retaining population. It is envisaged that judicious and targeted investment will ensure that the Capital Region remains attractive and competitive.
- Through an arms-length company, Welsh Government owns and operates Cardiff International Airport. Surface access to the airport has frequently been cited as a problem and there is a desire within Welsh Government to consider options for improving connectivity to and from the airport within the boundaries of European Union (EU) State Aid rules.

2.3.3 From a **local** perspective:

- In partnership with neighbouring Rhondda Cynon Taf County Borough Council, the Vale of Glamorgan Council is pursuing a sub-regional development strategy intended to ensure that the area offers an appropriate and future-proofed balance of employment, commercial and residential opportunities. The current transport infrastructure is considered to be a constraint in realising these aspirations.
- The transport links, across all modes, connecting the Vale of Glamorgan with Cardiff and the wider Capital Region experience significant congestion, which is considered by the Council to be acting as a major constraint on the area in terms of attracting investment and realising development planning opportunities, whilst it is also seen to detract from resident and visitor amenity.

What is the policy fit?

2.3.4 The key policies at the local, regional and national levels, highlighting the policies and proposed delivery programmes and schemes that are relevant to this study are presented in Section 2 of the Case for Change report and in more detail at the local level in the Impacts Assessment Report.

2.3.5 The Case for Change report identifies that the principle of improving connections to and from the Vale of Glamorgan aligns well with national, regional and local transport, planning and socio-economic policies. In particular, the EZ has been identified as a strategic opportunity area, with the overall policy framework providing guidance as to how the potential of such developments can be realised.

2.3.6 Of particular relevance is the clear alignment with the headline national and regional policies, as follows:

- Improvements to the connectivity of the Vale of Glamorgan would make an enabling contribution to the 'Themes' of **Prosperity for All – The National Strategy**. Enhancing access to a potentially major employment growth area and promoting development at the sub-regional level would support the emergence of regionally significant business and employment opportunities in the Vale of Glamorgan, which would be of benefit to communities across South Wales.
- **Prosperity for All** is underpinned by an **Economic Action Plan (EAP)**, which sets out a vision for 'inclusive growth, built on strong foundations, supercharged industries of the future and productive regions.' Within the EAP, there is a commitment to both:

- A new regionally focussed model of economic development, which will promote regional interests and issues in Welsh Government. In the context of this study, this can be thought of as the Cardiff Capital Region, of which the Vale of Glamorgan is part.
- A five-year programme of transport capital funding, linking to mandated regional land-use and planning decisions. Whilst this commitment remains at the strategic stage, it is possible that the EZ would be considered within the context of 'mandated regional land-use'.
- Investment in improved connectivity would also make a significant contribution to the outcomes and, by definition, the strategic priorities identified in the Wales Transport Strategy (which is currently being updated). As well as supporting access to employment, overall local and national connectivity would be improved, with resulting journey time, reliability and environmental benefits accruing.
- The regional employment opportunity presented by the EZ has the potential to contribute to the Our Valleys, Our Future priorities, particularly in terms of creating good quality jobs and furnishing residents with the skills to do them. However, facilitating this desired outcome will require both transport infrastructure and services which connect the Valleys labour market to employment opportunities in the Vale of Glamorgan.
- The emerging National Development Framework and Strategic Development Plans are likely to support the development of key sites within the Vale of Glamorgan, including the EZ. This would provide a firm policy basis for supporting accessibility improvements to these sites. The NDF Draft highlights Cardiff Airport as a key international connection.
- Powering the Welsh Economy, the document underpinning much of the Cardiff Capital Region City Deal, emphasises the need for investment in improved transport connectivity to both promote economic development and address existing transport problems.
- A Growth Strategy for the Swansea Bay City Region recognises the need for improved connectivity between the City Region, the rest of Wales, the UK more generally and internationally. Access to Cardiff Airport is specifically noted as a desired outcome.

Land-Use Development Baseline

- 2.3.7 The Peter Brett Associates report notes that the declaration of an EZ in the Vale of Glamorgan has facilitated a strategically important and high value economic development and employment site within the area. 78% of the total employment land allocation for the Vale of Glamorgan falls within the EZ and it is anticipated that the site will create 4,000 direct jobs. The EZ therefore represents a development of strategic importance for the Cardiff Capital Region and South Wales as a whole.
- 2.3.8 Whilst the report is focussed on the case for improving connectivity to the Vale of Glamorgan, there is also a specific case for considering infrastructure improvements which would support the development of the sub-regional economy, combining the development potential of the EZ and strategic opportunity sites in Rhondda Cynon Taf (the Rhondda Gateway and Llanilid on the M4). The realisation of these sites and the EZ would assist in addressing an identified market failure in respect of the provision of Grade A commercial property within the Capital Region and would assist in ensuring the Region as a whole is competitive against other areas of the UK.
- 2.3.9 Ensuring that the EZ and the wider Vale of Glamorgan maximises its development and regional economic potential (particularly in terms of the sub-region being developed in partnership with Rhondda Cynon Taf County Borough Council) will require the provision of a safe and efficient transport network capable of meeting the needs of employees, business visitors and freight. As the subsequent sections explain, the transport infrastructure and services in their current form are likely to act as a constraint on the anticipated development of the EZ and the wider sub-regional opportunity.
- 2.3.10 With regard to the strategic land-use development issue, it is worth noting that the Inspector's Report on the Vale of Glamorgan Local Development Plan (LDP) suggests that without intervention in the relatively short-term, transport infrastructure may start to place a longer-term constraint on land-use aspirations within the Vale of Glamorgan, negatively affecting the economy of the County.

Socio-Economic Baseline

- 2.3.11 A comprehensive socio-economic baselining exercise by Peter Brett Associates has identified two key points in relation to the socio-economic profile of the study area:
- There is strong evidence of the existence of a 'two-speed economy' with a broadly affluent rural hinterland and coastal zone encircling the Valleys, which suffer high levels of multiple deprivation (including high levels of economic inactivity and unemployment). The imbalance within the regional economy is negative for the study area as a whole.
 - There is an evidenced issue with productivity/ competitiveness within the study area as a whole and within constituent local authorities.
- 2.3.12 Participation (i.e., high levels of economic activity and employment) and productivity are considered to be the building blocks of a strong economy. Whilst there are variances across the study area, there is a clearly evidenced problem in respect of both of these growth factors when the area is considered as a single entity.
- 2.3.13 At the strategic level, the rationale for improving transport connections to and from the Vale of Glamorgan is based on supporting strategic economic and land-use development within the Vale of Glamorgan, most notably in the context of the EZ. It is anticipated that by improving connectivity (the outcome), there will be a positive impact in terms increased Gross Value Added (GVA), reduced unemployment, and higher household incomes, for example (the impacts).
- 2.3.14 It is also important to note the economic position of the study area is not static. Improvements to transport connectivity (e.g., improvements to the South Wales Mainline (SWML), removal of the tolls on the Severn Bridges) and other infrastructure investments within the study area could disadvantage both the Cardiff Capital Region and Swansea Bay City Region if other areas of the UK, and in particular the south west of England, are deemed to be more competitive. Whilst the Metro will greatly assist in supporting the economic competitiveness of South Wales, the threat of a loss of economic activity is a real one.
- 2.3.15 It is in this context that the EZ, and indeed the wider sub-regional opportunity, can be considered so important. The EZ, amongst other developments, presents a regionally significant economic growth opportunity, potentially generating a range of employment opportunities across different occupational categories, both directly and in terms of indirect and induced employment. Of critical importance is the potential creation of jobs in manufacturing (skilled and unskilled) which would be well suited to parts of the study area with high concentrations of residents in these occupational categories.
- 2.3.16 Effective transport connectivity between the Vale of Glamorgan and the rest of the study area is however likely to be essential in ensuring the EZ is competitive in matching jobs with the labour market and facilitating business-to-business interactions.

Transport Connectivity Baseline

- 2.3.17 The land-use development and socio-economic 'cases' set out above from the Peter Brett Associates report clearly highlight the scale of the EZ and its socio-economic importance to South Wales. However, the current transport connectivity of the Vale of Glamorgan is considered to be a constraint in the development of the EZ sites and thus the benefits associated with it. Specifically:
- Whilst the M4 provides high quality strategic access points to the Vale of Glamorgan, the local road network within the Vale is generally of a single carriageway standard and suffers significant congestion around the primary 'gateway' of Culverhouse Cross. Accessibility analysis shows that the need to route via Junction 33 of the M4 and the busy Culverhouse Cross does have a negative impact on both journey length and reliability.
 - The most direct route from the M4 to the EZ is via Junction 34 of the M4. However, the connecting road is of a poor quality with lengthy single-track sections and poor visibility. The Junction 34 option has become a rat run for those travelling to the Vale of Glamorgan from the west, with negative implications for communities along the route, including Pendoylan village.

- Whilst there is a reasonable public transport network connecting Cardiff City Centre with the Airport (and, to a much lesser extent, St Athan), connections from elsewhere in the Capital Region and areas to the west are limited, infrequent and generally require interchange. It is notable that those currently working in the EZ area generally travel to work by car.
- Public transport journey times to the Vale of Glamorgan generally and the EZ specifically are well in excess of those by car.
- Freight access to and from the Vale of Glamorgan is sub-optimal, with issues associated with journey time reliability, routeing through broadly residential areas and a circuitous route to West Wales. The area around Cardiff Airport has a high proportion of freight intensive industries, whilst the focus of the EZ on aerospace and manufacturing means that there is likely to be significant growth in freight movements from the Vale of Glamorgan in the medium-term. The provision of appropriate freight routes to the M4 is a key consideration of any future improvements to Vale of Glamorgan connectivity.

2.3.18 Whilst the EZ presents a regionally significant opportunity, the labour market catchment of the site is limited by the current transport infrastructure and services. If this issue is not resolved, it may have longer term implications for firms currently located in the Vale of Glamorgan and in terms of the business location decisions of prospective investors. The limited labour market catchment of the EZ currently is compounded by comparatively poor business-to-business accessibility. This may have an impact on business location/ investment decisions and would also weaken the agglomeration benefits associated with the development of an aerospace cluster in the Vale.

2.3.19 Moreover, the accessibility analysis undertaken found that relatively modest reductions in journey times to/ from the Vale of Glamorgan would significantly increase the labour market and business-to-business catchment of the EZ.

The Future of Cardiff International Airport

2.3.20 Whilst the aspiration to improve the connectivity of the Vale of Glamorgan is predominantly focussed on unlocking the land-use development and employment potential of the EZ, any such improvement would clearly be beneficial for Cardiff International Airport. Indeed, the desk-based analysis and consultation demonstrated that the current surface accessibility of the airport is acting as a key constraint on route development, frequency and ultimately passenger numbers.

2.3.21 It is noted that at the time of writing, significant challenges are faced in the aviation sector through the impact of COVID-19 including Cardiff Airport. However, surface accessibility is assumed to remain a concern in order for the airport to be competitive and serve its role in international connectivity for Wales.

Why invest in improved transport connectivity?

2.3.22 As explained above, improvements in transport connectivity to and from the Vale of Glamorgan would assist in improving the accessibility of the EZ and would better connect jobs to labour and businesses to other businesses within the study area. It is noted that the case for change report places the importance on the WelTAG study to generate a preferred option.

2.3.23 The extent to which each of the desirable outcomes and impacts, and their relative magnitude, will be realised through improving connectivity to the Vale of Glamorgan will be dependent on the preferred option pursued.

Conclusions | The Case for Change

2.3.24 A case for change has been made predominantly on the basis of realising the strategic development and employment opportunities associated with the Cardiff Airport – St Athan EZ, which will offer economic development benefits for South Wales as a whole.

2.3.25 Taken together, consultation and desk-based analysis has demonstrated that the current transport connectivity of the Vale of Glamorgan, in the context of the EZ and airport, is sub-optimal in terms of journey times, journey time reliability, public transport coverage and the routeing of strategic traffic.

If these issues are not addressed, there is a risk that the opportunities offered by the EZ may not be fully realised.

- 2.3.26 The socio-economic baselining of the study area has clearly highlighted the multitude of problems currently being experienced in the Cardiff Capital Region and Swansea Bay City Region. These include low levels of productivity and business competitiveness, limited inward investment, high rates of economic inactivity & unemployment and concentrated areas of multiple deprivation. The EZ is part of a package of measures across the respective City Regions which could begin to tackle these issues through creating (high value) direct, indirect and induced employment opportunities, as well as wider supply-chain opportunities for Welsh businesses across the region. However, its success is dependent on connecting the employment opportunities to the labour market and ensuring that business-to-business interactions are as seamless as possible.
- 2.3.27 Moreover, with a once in a generation programme of capital investment in transport infrastructure in the Capital Region and connecting Wales with England underway, there is an opportunity for the areas to the west of Cardiff to better access a wider range of employment and business opportunities. However, this improved connectivity also presents a risk, in that by failing to address the transport problems in the Vale of Glamorgan, the economic gravity of the area could shift to the east, with potential for economic leakage to England.
- 2.3.28 There are also a number of opportunities for Cardiff International Airport with the presence of a well-connected international airport generally seen to be positive in promoting economic development and inward investment. However, the current surface access to the airport has been widely cited as a constraint.
- 2.3.29 Finally, within the Vale of Glamorgan itself, the current transport infrastructure is considered to be having a negative impact on the area, particularly in terms of congestion and journey time reliability. The transport issues are considered to be having a negative impact on business performance, the attractiveness of the Vale of Glamorgan as a place to live, work and do business and, in the longer-term, land-use aspirations within the Vale of Glamorgan.
- 2.3.30 In short, improving the transport connectivity of the Vale of Glamorgan is considered necessary to support national, regional and local economic performance.

2.4 Local Appraisal Area Issues and Opportunities

- 2.4.1 Alongside the strategic case for change, the analysis for this WelTAG study report has focussed on the specific issues within the local appraisal area. This reiterates that the highway network through and near to the Pendoylan corridor between the M4 Junction 34 and the A48 is extensively poor, comprising narrow lanes with limited passing opportunities, restricted speed as a result of adverse route alignments, and is predominantly non-compliant to current Design Manual for Roads and Bridges (DMRB) standards.
- 2.4.2 Sustainable transport options are also restricted with no immediate access to local and regional rail services or robust provision for cycling, and although local bus services do operate through Pendoylan village, services are subject to the constraints of the road network and delay. There is a high reliance on car travel to access services and employment with limited public transport options.
- 2.4.3 Traffic congestion and resilience issues evident throughout the region are particularly affecting the M4 corridor and the A48/ A4232 at Culverhouse Cross during peak commuting hours. There is high car dependency within the local area with 92% of those living within the study area. As a result of congestion, and when there are incidents on the M4, the Pendoylan corridor also functions as a 'rat-run.'
- 2.4.4 'Five Mile Lane' from the A48 to the A4226 north west of Barry has been upgraded. This may be having the effect of altering trip patterns on the road network including through Pendoylan village. In addition, the resilience of the strategic network throughout this area is anticipated to deteriorate in the medium to long-term with committed development planned for the region.
- 2.4.5 There are subsequently opportunities to introduce and establish an enhanced and sustainable transport network by improving strategic connectivity southwards from M4 Junction 34 to the A48

and beyond. If no action is taken, it is anticipated that traffic congestion and resilience problems will continue to worsen on the strategic routes, leading to an increasing level of traffic routing through the Pendoylan area to avoid delays.

2.5 Summary of Problems and Opportunities

2.5.1 The identified issues that require addressing are summarised below, which were identified through the Case for Change report, reference to previous feasibility reports and policy, and consultation with stakeholders and members of the public as part of the Stage One WelTAG study. The identified problems are as presented in Table 2.

Table 2 Identified Problems

Reference	Heading
P01	Poor highway infrastructure between M4 Junction 34 and the A48 leading to poor access for local communities and businesses.
P02	Poor sustainable access to Cardiff Airport and strategic destinations.
P03	High use of the private car for local and regional trips (e.g., journeys to work).
P04	Existing congestion issues at M4 Junction 34 and on the A48 which are likely to worsen with the committed developments in the area.
P05	Poor infrastructure and local connectivity by walking and cycling.
P06	Environmental issues associated with high use of the car, including adverse greenhouse emissions and noise pollution.
P07	Accessibility for HGVs.
P08	Adverse road safety conditions along existing routes non-compliant to current DMRB highway standards.

2.5.2 The opportunities of the study area were also identified to assist in ensuring that the identified objectives and options are realistic as well as maximise opportunities and consider the context of the study area. Following feedback from the stakeholder workshop and public consultation in Stage One, the opportunities were identified, as illustrated in Table 3.

Table 3 Identified Opportunities

Reference	Opportunity
O1	Improved connections to link the airport to Strategic Opportunity Areas (SOAs) e.g., Llantrisant and other regional centres.
O2	National significance of Cardiff Airport.
O3	Growth of Cardiff Airport and investment in St. Athan EZ infrastructure.
O4	Five Mile Lane upgrade will significantly improve access between the A48 and Cardiff Airport.
O5	Potential to create connections between M4 Junction 34 and A48 to continue Five Mile Lane route.

Reference	Opportunity
O6	Northernmost 500m section of route near M4 Junction 34 of good standard with existing bridges over the River Ely which is a Site of Special Scientific Interest (SSSI) and mainline railway.
O7	Proposed improvement at Bonvilston end of route, connecting to Sycamore Cross.
O8	Potential for Park and Ride and bus and cycle connections.

2.6 Involvement of Stakeholders

2.6.1 There were a wide range of key stakeholders involved in the Review Group for the Stage Two report (finalised October 2018), who were in summary:

- The communities of Pendoylan, St Nicholas with Bonvilston and Peterston-Super-Ely who directly experience the existing issues of traffic through the lanes and will also be most affected by transport proposals.
- Businesses in the appraisal area and its vicinity, including Renishaw's, Vale Resort Hotel, Welsh Rugby Union as well as local agricultural, tourism, leisure, and other small businesses.
- The Vale of Glamorgan Council and the neighbouring authorities of Rhondda Cynon Taf and Cardiff.
- Transport network providers including Cardiff Airport, Network Rail, Welsh Government and Transport for Wales.
- Transport operators including Cardiff Bus and New Adventure Travel.
- Road haulage businesses represented by the Road Haulage Association.
- The wider business community of the affected local authorities.

2.6.2 This Stage Two Plus report has involved ongoing discussions with departments of the Vale of Glamorgan Council and with Natural Resources Wales (NRW) especially regarding hydrological modelling. These discussions have informed refinements to the concept design of options and the methodology for appraisal.

Stakeholder Engagement Process

2.6.3 The strategy has been to involve stakeholders throughout the WelTAG stages, with key stakeholders also represented on the project's assigned Review Group. The public have also been consulted at stages One, Two and Two Plus to gain feedback on issues, objectives and options. The WelTAG reports have been taken through the political process, involving presentation to Cabinet and the Environment and Regeneration Scrutiny Committee of the Vale of Glamorgan Council.

Review Group

2.6.4 Early development of the offline highway options has been subject to a series of Review Group meetings as part of the original WelTAG Stage One and Stage Two studies. These meetings are referenced as follows:

- WelTAG Stage One Strategic Outline Case (Improving Strategic Transport Encompassing Corridors from M4 Junction 34 to the A48) | Review Group Meeting 27th November 2017.
- WelTAG Stage Two Outline Business Case (Improving Strategic Transport Encompassing Corridors from M4 Junction 34 to the A48) | Review Group Meeting 16th January 2018.
- WelTAG Stage Two Outline Business Case (Improving Strategic Transport Encompassing Corridors from M4 Junction 34 to the A48) | Review Group Meeting 27th March 2018.

- WelTAG Stage Two Outline Business Case (Improving Strategic Transport Encompassing Corridors from M4 Junction 34 to the A48) | Review Group Meeting 2nd October 2018.

Collaboration with Neighbouring Authorities

2.6.5 During the WelTAG Stage One and Two studies, collaboration has taken place with the neighbouring authorities on their development and transport plans with Welsh Government and their consultants, with respect to an emerging Masterplan for Cardiff Airport and St Athan and the strategic case for improved connections and other consultants with respect to the WelTAG Stage Two study of the M4 Junctions 32-35 and the early stages of the Stage One study for North West Cardiff.

2.7 Objectives

Identification of Objectives

- 2.7.1 The objectives for the interventions have been derived from general and transport-specific objectives as set by the Welsh Government and through considering the national well-being goals as set out in the Future Generations of Wales (2015) Act. The Impacts Assessment Report sets out how stakeholders have informed the development of the objectives and how the proposed objectives positively contribute to Welsh Government policy and well-being.
- 2.7.2 The final objectives for the interventions are as outlined in Table 4. This includes an overview of what success would look like and how this can be measured in the WelTAG Stage Two Plus assessment.

Table 4 Final Proposed Objectives

Ref	Objective	What will success look like?	How will success be measured?
1	Enhance connectivity to Cardiff Airport and strategic employment sites in the region.	Reduced and more reliable journey times between strategic network and Cardiff Airport and St Athan.	Forecast journey times.
2	Increase transport options for strategic access and access to and from local communities.	Increased use of sustainable travel modes by residents of local communities.	Length of walking and cycling links provided or improved. Bus journey times.
3	Improve network resilience and road safety on the M4, A48 and A4232 corridors and other connecting roads.	Reduced accidents and delay on adjacent strategic routes.	Journey times, accident rates per vehicle kilometre.
4	Protect and enhance the historic, built and natural environment including the landscape and settlement character of the study area.	Transport network is improved with at least neutral impact on historic, built and natural assets.	Number of historic assets, area of ecological features, area of flood zone affected.
5	Minimise impacts on communities and support social inclusion and health and well-being.	Transport network is improved with at least neutral impact on social and cultural facilities, businesses and residential properties.	Number of properties affected, length of walking and cycling links provided.

Verification of Objectives

2.7.3 The objectives have been verified to determine how they contribute to:

- Resolving problems of the study area.
- The Well-being of Future Generations Act Well-being Goals.
- Wales Transport Strategy outcomes.
- The Welsh Government’s Strategic Priorities as set out in the Wales Transport Strategy and
- The Economic Action Plan Priorities.

2.7.4 Table 5 illustrates the extent to which the objectives address the transport problems. The appraisal demonstrates that each of the identified problems are directly addressed by at least one objective.

Table 5 Relationship of Objectives to Problems

Objectives	Potential Problems							
	P01	P02	P03	P04	P05	P06	P07	P08
1	+++	+++	++	++	++	++	++	++
2	0	+++	+++	++	++	++	0	+
3	+++	++	++	++	++	++	++	+++
4	0	++	++	0	+	+++	0	0
5	+	++	+	+	++	++	+	+

2.7.5 The WelTAG guidance states that ‘when using WelTAG it is essential to comply with the duties set out in the Well-being of Future Generations (Wales) Act 2015. They are to follow the sustainable development principle through following the five ways of working and set well-being objectives that maximise contribution to the seven well-being goals.’ Table 6 shows a positive relationship between the objectives and the seven well-being goals.

Table 6 Relationship of Objectives to Well-being Goals

Well-being of Future Generations (Wales) Act Outcomes		Objectives				
		1	2	3	4	5
Seven Well-being Goals	A prosperous Wales	+++	+++	++	++	++
	A resilient Wales	+	+	+++	++	+
	A healthier Wales	++	++	+	+	+++
	A more equal Wales	+	++	+	+	+
	A Wales of cohesive communities	++	++	+	+	+
	A Wales of vibrant culture and Welsh language	0	0	0	++	+
	A globally responsible Wales	+	+	+	+++	+

2.7.6 The objectives have been assessed against the Wales Transport Strategy outcomes as outlined in Table 7. A positive relationship has been identified.

Table 7 Objectives Relating to the Wales Transport Strategy Outcomes

Wales Transport Strategy Outcomes		Objectives				
		1	2	3	4	5
Social	Improve access to healthcare	+	++	+	0	++
	Improves access to education, training and lifelong learning	+	++	+	0	++
	Improving access to shopping and leisure facilities	+	++	+	0	++
	Encourage healthy lifestyles	+	++	0	+	++
	Improve the actual and perceived safety of travel	+	++	+++	0	++
Economic	Improve access to employment opportunities	+++	++	+	0	++
	Improve connectivity within Wales and internationally	+++	++	++	0	+
	Improve the efficient, reliable and sustainable movement of people	++	+++	+	+	++
	Improve access to visitor attractions	+	+	+	0	++
Environment	Increase the use of more sustainable materials	0	0	0	0	+
	Reduce the contribution of transport to greenhouse gas emissions	+	+++	+	++	++
	Adapt to the impacts of climate change	+	+++	+	++	++
	Reduce the contribution of transport to air pollution and other harmful emissions	+	+++	+	++	++
	Improve the impact of transport on the local environment	+	+++	+	++	+
	Improve the impact of transport on our heritage	+	++	0	++	+
	Improve the impact of transport on biodiversity	+	++	0	++	+

2.7.7 In addition, Table 8 shows a positive relationship between the objectives and the Strategic Priorities as set out in the Wales Transport Strategy.

Table 8 Objectives Relating to the Strategic Priorities

Strategic Priorities	Objectives				
	1	2	3	4	5
Reducing greenhouse gas emissions and other environmental impacts from transport	+	++	+	+++	++

Strategic Priorities	Objectives				
	1	2	3	4	5
Integrating local transport	+	++	+	0	++
Improving access between key settlements and sites	+++	++	+++	0	++
Enhancing international connectivity	+++	++	+	0	+
Increasing safety and security	+	++	+++	+	+

2.7.8 Table 9 shows the relationship between the objectives and the priorities of the Economic Action Plan for Wales.

Table 9 Objectives Relating to the Economic Action Plan Priorities

Strategic Priorities	Objectives				
	1	2	3	4	5
Support people and businesses to drive prosperity	++	++	++	0	++
Tackle regional inequality and promote fair work	++	++	++	0	++
Drive sustainable growth and combat climate change	+	+	+	+++	+
Build ambition and encourage learning for life	0	0	0	0	++
Equip everyone with the right skills for a changing world	0	0	0	0	++
Deliver modern and connected infrastructure	+++	+++	+++	+	++
Promote and protect Wales' place in the world	+	+	+	++	+

2.7.9 In summary, the above appraisal demonstrates that the proposed objectives positively contribute to the well-being goals, the Welsh Government's Strategic Priorities, the Wales Transport Strategy outcomes and Economic Action Plan priorities, together with overcoming the identified problems.

2.8 WeITAG Stage Two Plus | Option Development

Background

2.8.1 The WeITAG Stage Two Plus commission has been tasked with further analysing the offline Western and Eastern alignments that formed part of the WeITAG Stage One recommendations, together with analysis of an additional online option for improving the existing infrastructure without the need for a new offline road. The project has since evolved due to optioneering as part of the highway engineering task to encapsulate two sub-options for the online alignment – this has primarily been considered and subsequently presented to demonstrate the challenges of establishing a DMRB

compliant design given the characteristics (vertical and horizontal alignments) of the existing sub-standard road.

2.8.2 The study is therefore appraising the following four highway options, in comparison to the Do-Minimum scenario, the descriptions of which have been included in Table 10.

- M4 Junction 34 to A48 | Option A – Highway Route East of Pendoylan
- M4 Junction 34 to A48 | Option B – Highway Route West of Pendoylan
- M4 Junction 34 to A48 | Option C1 – Existing Infrastructure (Online) Enhancement
- M4 Junction 34 to A48 | Option C2 – Existing Infrastructure (Online) Enhancement

Table 10 Highway Option Descriptions

Highway Option	Description
Do-Minimum	<p>Assumes continued delivery of transport enhancements via the Local Transport Plan and Welsh Government expenditure and utilising existing sources of funding but assumes no step change in the level of funding or delivery of any major transport enhancements within the study area (assumes current levels of investment).</p> <p>Assumes the continuation of local bus services and community transport at a similar level as present utilising funding at similar levels to existing.</p> <p>Assumes continued work by local authorities and stakeholders to deliver improvements to the transport network, with the overall aim of addressing the identified problems and the outcomes of the relevant transport policies.</p> <p>The Do-Minimum is represented by the Reference Case scenario of the South East Wales Transport Model (SEWTM) in 2036. The Base Year 2015 and Reference Case 2036 flows are included in the Impacts Assessment Report. The version of the Reference Case used for the initial assessment is described in the technical note included as part of the Impacts Assessment Report.</p> <p>In particular, the Reference Case includes the Five Mile Lane improvement and includes the construction of the first part of the Eastern Bay Link in Cardiff. However, the model retains tolls on the Severn Bridge at present (albeit at a reduced level) pending further model development. Note that an updated version of the SEWTM Reference Case would need to be used for a Full Business Case, taking account of updated developments and transport schemes.</p>
Option A Highway Route East of Pendoylan	<p>The 5.56km Highway Route East of Pendoylan would connect from just south of Junction 34 of the M4 to the A48 at Sycamore Cross. The northern and southern sections would involve online improvements, the northern section of which allows for a substantial section of ancient woodland to be avoided. The remainder of the route between these two junctions would be offline and bypass Pendoylan to the east of the village.</p> <p>The route would be a single carriageway of national speed limit standard and include segregated walking and cycling route infrastructure alongside the carriageway with the potential to provide integral public transport, as well as provision of connectivity for existing PRoW.</p> <p>The option assumes a combination of principal and minor site access junctions along the route connecting to the network encompassing:</p> <ul style="list-style-type: none"> • Hensol – Ghost Island Junction with dedicated right turn heading southbound

Highway Option	Description
	<ul style="list-style-type: none"> • Hensol Driving Range and Farm – Access Junction • Pendoylan/ Clawdd-Coch – Ghost Island Junction with dedicated right turn heading southbound • Pendoylan/ Peterston-Super-Ely – Roundabout • A48 Sycamore Cross – Crossroads with traffic lights <p>The SEWTM modelling assumes only minor changes to the Sycamore Cross junction as completed for the recent Five Mile Lane scheme, although there are options to remove the staggered junction which would increase the scheme benefits. Similarly, the modelling work has not included improvements to Junction 34 to increase capacity, but the bringing forward of improvements for the junction would enhance the benefits of the option together with reconfiguration of the Renishaw access junction (circa 150m south of Junction 34) giving priority to north/ south traffic.</p> <p>Refer to drawings included in Appendix B.</p>
<p>Option B Highway Route West of Pendoylan</p>	<p>The 5.691km Highway Route West of Pendoylan would connect from just south of Junction 34 of the M4 to the A48 at Sycamore Cross. The northern and southern sections would involve online improvements, the northern section of which allows for a substantial section of ancient woodland to be avoided. The remainder of the route between these two junctions would be offline and bypass Pendoylan to the west of the village and require two bridge structures to cross over the existing road interconnecting with Pendoylan.</p> <p>The route would be a single carriageway of national speed limit standard and include segregated walking and cycling route infrastructure alongside the carriageway with the potential to provide integral public transport, as well as provision of connectivity for existing PRoW.</p> <p>The option assumes a combination of principal and minor site access junctions along the route connecting to the network encompassing:</p> <ul style="list-style-type: none"> • Hensol – Ghost Island Junction with dedicated right turn heading southbound • Hensol Driving Range and Farm – Access Junction • Pendoylan/ Clawdd-Coch – Ghost Island Junction with dedicated right turn heading southbound • Pendoylan/ Peterston-Super-Ely – Roundabout • A48 Sycamore Cross – Crossroads with traffic lights <p>The SEWTM modelling assumes only minor changes to the Sycamore Cross junction as completed for the recent Five Mile Lane scheme, although there are options to remove the staggered junction which would increase the scheme benefits.</p> <p>Similarly, the modelling work has not included improvements to Junction 34 to increase capacity, but the bringing forward of improvements for the junction would enhance the benefits of the option together with reconfiguration of the Renishaw access junction (circa 150m south of Junction 34) giving priority to north/ south traffic.</p> <p>Refer to drawings included in Appendix C.</p>

Highway Option	Description
<p>Option C1</p> <p>Existing Infrastructure (Online) Enhancement</p>	<p>The new section of road has been designed to stay predominantly online throughout the existing route between M4 Junction 34 to the A48 at Sycamore Cross, although has required a 30mph design speed and offline sections to be incorporated in order to achieve DMRB compliance.</p> <p>Due to restrictions on space, significant impacts on properties and, with regard to Pendoylan, adverse impacts on the designated Conservation Area, enhancement proposals terminate either side of Pendoylan and Clawdd-Coch. The existing road sections through Pendoylan village and Clawdd-Coch would not therefore be upgraded and would remain non-compliant to DMRB design standards.</p> <p>The new section of road would be a single carriageway and include a segregated 3.5m wide shared walking/ cycle route adjacent to the carriageway in order to comply with the Active Travel (Wales) Act. Access to existing junctions will remain, although there are likely to be some impacts on driveways and farm access points.</p> <p>Refer to drawings included in Appendix D.</p>
<p>Option C2</p> <p>Existing Infrastructure (Online) Enhancement</p>	<p>The new section of road has been designed to stay predominantly online throughout the existing route between M4 Junction 34 to the A48 at Sycamore Cross, although whilst a 30mph design speed is required for safety reasons and some offline sections have been incorporated into the design, the alignment remains non-compliant to DMRB standards due to the horizontal and vertical curvature of the existing road.</p> <p>Due to restrictions on space, significant impacts on properties and, with regard to Pendoylan, adverse impacts on the designated Conservation Area, enhancement proposals terminate either side of Pendoylan and Clawdd-Coch. The existing road sections through Pendoylan village and Clawdd-Coch would not therefore be upgraded and would remain non-compliant to DMRB design standards.</p> <p>The new section of road extends the width of the carriageway to ensure a constant 6m width throughout and does not include a new footway/ cycleway along its length. Access to existing junctions will remain, although there are likely to be some impacts on driveways and farm access points.</p> <p>Refer to drawings included in Appendix E.</p>

Highway Design | West and East Alignments (Options A and B)

2.8.3 The Western and Eastern alignments are based on the following criteria:

- Alignment complies with DMRB and contains no departures from standards for a 60mph speed limit (100kph design speed) single carriageway. Carriageway width of 3.65m per lane + 1m hardstrips (total carriageway width of 9.3m) plus verge width of 2.5m either side of the carriageway.
- A 3.5m wide shared footway/ cycleway on one side of the carriageway designed in accordance with DMRB requirements and Active Travel design guidance.
- Total cross section width of 17.8m + earthworks slopes, where required.
- The alignment has been developed to fit into the landscape and where possible avoid constraints as provided by the Vale of Glamorgan Council.

- The vertical alignment is based on LiDAR (Light Detection and Ranging) Data which has an accuracy to +/- 2m.
- Earthworks are assumed to be 1 in 3 embankment and cutting slopes – to be confirmed at a later stage subject to ground investigation and the materials present.
- Outfall points for drainage are not known at this stage. Costs have been estimated.

Standards Used

- 2.8.4 The Eastern and Western options are compliant with DMRB and in accordance with TD 9, TD 27 and TA 90.

Assumptions

- 2.8.5 For both alignments, to remove the number of structures required to traverse over the existing road at two locations (and therefore reduce the level for the new carriageway) the existing connections have been removed. The locations are shown on drawings shown in [Appendix B](#) (Eastern alignment) and [Appendix C](#) (Western alignment) and are situated at Clawdd-Coch and the road interconnecting with Gwen-y-Steeple. This means that access onto the proposed alignment would not be possible and traffic would be rerouted to the new junctions shown.
- 2.8.6 In order to keep the existing alignment in operation for the Western alignment, bridges have been used to span side roads where required, therefore in two areas the road would be elevated to provide the height for the bridge. However, embankment slopes of 1 in 3 allow for environmental mitigation and landscaping for noise and visual impact improvements.
- 2.8.7 Due to the steepness of the gradients used around chainage 950-1900m on the Eastern route and 1200-1800m on the Western route, DMRB recommends a climbing lane is used if the gradient is over 500m in length and that there is a requirement for overtaking. The length on the Eastern and Western routes is 950m and 600m respectively. The additional climbing lane has not been included subject to the completion of a full topographical survey at the next stage of assessment. Further detailed data is required to inform the vertical alignment and therefore confirm if an additional lane is required. However, the cost of an additional lane is covered within the Optimism Bias and Risk amount.
- 2.8.8 On both routes, at the southern end of the alignments, a large cutting is required due to the topography. In order to minimise the amount of cut required and also minimise the amount of material to go off site, the gradient has been increased beyond 6%, a relaxation allowed within DMRB to extend up to 8%. For the Eastern alignment the gradient is 7.42% over 950m and for the Western alignment 6.71% over 600m. This would need to be subject to more detailed design in a later stage with a full topographical survey.

Environmental Constraints

- 2.8.9 Environmental constraints as established in the Impacts Assessment Report and accompanying environmental technical reports have been used to help inform the design. Alignments have been developed, where possible, to avoid environmentally sensitive areas.

Structures

- 2.8.10 The structures that have been used on the Western alignment have been positioned so that they provide a minimum height above the existing side road of 5.3m, in accordance with DMRB. A value of 0.7m has been allowed for the construction thickness of the structure.

Junctions

- 2.8.11 Access is required from the existing road through Pendoylan onto the new alignment. The proposed options include for junctions at locations highlighted on drawings 10028657-ARC-XX-XX-DR-HE-0008 & 0009. These junctions are indicative only with an estimate on earthworks provided in the lump sum cost junction items. Detailed traffic data and survey work would be required in order to inform the design of each junction. The junctions and type of junction currently allowed for consist of the following:

- Hensol – Ghost Island Junction with dedicated right turn heading southbound
- Hensol Driving Range and Farm – Access Junction
- Pendoylan/ Clawdd-Coch – Ghost Island Junction with dedicated right turn heading southbound
- Pendoylan/ Peterston-Super-Ely – Roundabout
- A48 Sycamore Cross – Crossroads with traffic lights

A48 Sycamore Cross Junction

2.8.12 A signalised crossroad junction has been considered for the development of the A48 Sycamore Cross junction. This option has been estimated within the construction cost estimate and is included as a lump sum. It should be noted that the inclusion of the junction is likely to impact on the A48, Cottrell Park Golf Resort and possibly the ancient woodland which lies adjacent to the A48. However, exact impacts are unable to be determined at this stage and would require further investigation and survey work during the next phase of the project.

Public Rights of Way

2.8.13 There are several PRow affected by the options. It is anticipated that crossings will be rationalised by PRow re-alignment and provision of crossing points under/ over the proposed carriageway to maintain existing PRow. Where PRow cross the proposed road where it is on embankment, culverts have been proposed and where it crosses in cut, 3m wide bridges have been used.

Highway Design | Online Alignments (Options C1 and C2)

- 2.8.14 Online Alignment Option C1 includes a compliant DMRB cross section with a 3.5m wide shared footway/ cycleway (similar to the Eastern and Western alignments), whilst Online Alignment Option C2 is a 6m wide carriageway with no footway/ cycleway and does not comply with DMRB design standards due to the horizontal and vertical curvature of the existing road.
- 2.8.15 Both of the online options do not include upgrade works through Pendoylan village or Clawdd-Coch due to constraints (as widening would have a significant impact on properties in the village and the Pendoylan Conservation Area), so utilise the existing carriageway. Due to the existing alignment constraints associated with these options, they have been developed with a 30mph design speed.
- 2.8.16 Both options will significantly affect the adjacent hedge lines adjacent to the existing Pendoylan road. It is likely that over the lengths of the new roads, both sides of the hedge would need to be removed to allow for construction.
- 2.8.17 For both options, access to existing junctions would remain, although there are likely to be some localised impacts on driveways and small farm accesses due to some areas requiring cut and fill to achieve a reasonable vertical alignment. Online Alignment Option C1 has a greater impact on these accesses and an overall greater impact to the earthworks required to achieve a compliant vertical and horizontal alignment.
- 2.8.18 The gradient at the southern end of the road is very steep. Online Alignment Option C2 has a gradient of 11.83%, which is significantly above the 8% maximum threshold and therefore well below standard. This design has been established to stay as close to the existing levels as possible and minimise earthworks.
- 2.8.19 Online Alignment Option C1 in the same area has a gradient of 8% representing the maximum the relaxation can go to without becoming a departure from standards. This option does however create a significant volume of earthworks, increasing the footprint with a subsequent impact on the landscape.
- 2.8.20 There would be substantial impacts during construction for the online sub-options, both to the users of the existing Pendoylan road and to residents/ business owners within Pendoylan itself. Extensive diversion routes would be required to allow for construction and would likely be in place for a significant length of time. This in turn would impact on time and cost and encounter risks such as

additional diversions of statutory undertaker’s apparatus, access to the primary school and adverse impacts on the environment.

- 2.8.21 It should be noted that this work has been undertaken as a feasibility option study and in order to confirm its accuracy, further surveys, investigations and design would be required such as a topographical survey, environmental surveys, ground investigation and stakeholder consultation.

Standards Used

- 2.8.22 The new road sections of Online Alignment Option C1 are compliant with DMRB and in accordance with TD 9, TD 27 and TA 90. The new road sections of Online Alignment Option C2 do not comply with DMRB design standards due to the horizontal and vertical curvature of the existing road.
- 2.8.23 As noted and due to restrictions on space, significant impacts on properties and, with regard to Pendoylan, adverse impacts on the designated Conservation Area, enhancement proposals terminate either side of Pendoylan and Clawdd-Coch. The existing road sections through Pendoylan village and Clawdd-Coch would not therefore be upgraded and would remain non-compliant to DMRB design standards.

Assumptions

- 2.8.24 Embankment slopes of 1 in 3 allow for environmental mitigation and landscaping for noise and visual impact improvements.

Environmental Constraints

- 2.8.25 Environmental constraints as established in the Impacts Assessment Report and accompanying environmental technical reports have been used to help inform the design. Alignments have been developed, where possible, to avoid environmentally sensitive areas.

A48 Sycamore Cross Junction

- 2.8.26 A signalised crossroad junction has been considered for the development of the A48 Sycamore Cross junction. This option has been estimated within the construction cost estimate and is included as a lump sum. The junction is indicative only with an estimate on earthworks provided in the lump sum cost of the item items Detailed traffic data and survey work would be required in order to inform the design of the junction.
- 2.8.27 It should be noted that the inclusion of the junction is likely to impact on the A48, Cottrell Park Golf Resort and possibly the ancient woodland which lies adjacent to the A48. However, exact impacts are unable to be determined at this stage and would require further investigation and survey work during the next phase of the project.

Public Rights of Way

- 2.8.28 There are several PRoW affected by the options. It is anticipated that crossings will be rationalised by PRoW re-alignment and provision of crossing points under/ over the proposed carriageway to maintain existing PRoW. Where PRoWs cross the proposed road where it is on embankment, culverts have been proposed and where it crosses in cut, 3m wide bridges have been used.

Highway Design Constraints

- 2.8.29 The constraints and how the alignment designs seek to address them are summarised in Table 11.

Table 11 Route Alignment Constraints and Potential Impacts

Constraint	Description
River Ely Floodplain	The flood modelling work undertaken shows minimal impact on all of the considered alignments. The main issue is towards the north of the scheme near the Hensol junction. It is understood that this area floods during some instances under current conditions. To overcome this issue, all alignments have been raised and a culvert estimated at 8.5m ² in area is anticipated to be required

Constraint	Description
	<p>underneath the road to mitigate any current and future flooding issues. This will also be required for the online options. Confirmation of the exact culvert size to be adopted will need to be developed based on more accurate survey data and design work.</p>
Ancient Woodland	<p>The study area contains areas of ancient woodland. The highway alignments have been designed to minimise impact but there is anticipated to be some impact, although this would be limited to the outer areas.</p> <p>The ancient woodland towards the south of the scheme is currently impacted by the proposed Eastern and Western alignments (circa chainage 800m on both offline options). To mitigate the impacts, consideration at the next stage of design will need to be considered further upon receipt of more detailed ground data.</p>
Pendoylan Village	<p>All considered offline options bypass the village of Pendoylan either to the east or to the west. Neither of the online options include any upgrade to the highway through Pendoylan village or Clawdd-Coch due to extant constraints.</p>
Cottrell Park Golf Resort	<p>The Cottrell Park Golf Resort to the south of the project lies adjacent to the A48. The road off the proposed roundabout which would connect the existing Pendoylan road to the new carriageway runs through the northern end of the golf course to achieve a compliant layout and provide sufficient visibility when entering the new roundabout.</p> <p>In addition, there is a possibility that some of the earthworks may encroach onto land occupied by the golf course. However, other than the roundabout access road these are not envisaged to be significant. The subway underneath the existing road will need further investigation due to the additional traffic loading and width of new road.</p> <p>There is a possibility that this would have to be relocated or extended. If the realignment of the A48 junction was to be undertaken as part of the improvements (whether a roundabout or crossroad junction is considered), impacts are likely to be significant to the golf course in the area of the proposed junctions (see drawings 10028657-ARC-XX-XX-DR-HE-0008 & 0009), especially the sheds contained within the land adjacent to the A48 Sycamore Cross junction.</p>
Vale Resort	<p>Towards the northwest of the project is the Vale Resort. There are no direct impacts anticipated in all options considered.</p>
Keeping the existing road open	<p>Due to the need to keep the existing road through Pendoylan open to maintain access for the community and businesses, the road would need to be elevated in some areas to grade separate side roads. In addition, for the Eastern and Western alignments, the side road has been proposed to be closed at two locations (see drawings 10028657-ARC-XX-XX-DR-HE-0008 & 0009). This is to ensure the elevation of the road remains as close to the existing levels where possible, while also minimising the amount of material that would need to be taken off site.</p>
Archaeology	<p>The study area has a range of known archaeological and the options have been designed to avoid these assets accordingly. It is also anticipated (due to known issues at the Five Mile Lane road scheme to the south) that there is unknown archaeology within the area that would require further investigation at the next stage of appraisal.</p>

Constraint	Description
Hedge line along existing route	This will be impacted greatest by the online options. In some areas, the hedge line will need to be removed over long lengths in order to accommodate the new carriageway.

Highway Design Risks

2.8.30 The following key design risks have been identified as part of the WelTAG Stage Two Plus design appraisal, with a summary of risk impact on each option included within Table 12.

- **OS Data** | Design to date is based on OS contours at 5m intervals and is accurate to +/- 2m, which could affect earthworks and accuracy of design.
- **Unknown Archaeology** | Unknown archaeology could be encountered during construction.
- **River Ely Bridge** | The existing bridge over the River Ely at the northern end of the alignments may require strengthening and further works to be suitable for possible future traffic loadings. This will need a condition survey and assessment at future stages.
- **South Wales Main Line Railway Bridge** | In all options, the railway bridge may require strengthening and further works to be suitable for possible future traffic loadings. This will need a condition survey and assessment at future stages.
- **Detailed Ground Data** | Without Ground Investigation data, it is unknown what degree of excavated material might be suitable fill material, therefore requiring import of suitable fill material and export of unsuitable.
 - Note | For the purposes of the WelTAG Stage Two Plus study, an early phase Geotechnical Feasibility Desk Study (10028657-ARC-XX-XX-RP-GEO-0001) has been completed by Arcadis specialists for the study area and presents the findings of a high-level desk-based review of publicly available information. With regard to a preference of offline alignments at this stage, the ground conditions on the Western route around Pendoylan are more favourable being Glacial Till rather than less favourable Alluvium on the Eastern route. The Western route is also further away from the River Ely, associated tributaries and river valley itself which is more favourable topographical and from a groundwater interaction perspective. The report can be located within the accompanying Impacts Assessment Report.
- **Subway Crossing at Cottrell Park Golf Resort** | The subway crossing could impact on the design due to increases in traffic loadings, resulting in structural issues with the subway. The subway might need to be re-located.
- **Climbing Lane** | A climbing lane may be required for both of the offline sections towards the southern end of the project. This will be determined by the client's requirements for overtaking along the particular section affected, together with detailed design upon receipt of detailed ground information.

Table 12 Highway Design Risk Summary

Risk	Option A Highway Route East of Pendoylan	Option B Highway Route West of Pendoylan	Option C1 Existing Infrastructure (Online) Enhancement	Option C2 Existing Infrastructure (Online) Enhancement
OS Data	x	x	x	x

Risk	Option A Highway Route East of Pendoylan	Option B Highway Route West of Pendoylan	Option C1 Existing Infrastructure (Online) Enhancement	Option C2 Existing Infrastructure (Online) Enhancement
Unknown Archaeology	x	x	x	x
River Ely Bridge	x	x	x	x
SWML Railway Bridge	x	x	x	x
Detailed Ground Data	x	x	x	x
Subway Crossing at Cottrell Park Golf Resort	x	x	x	
Climbing Lane	x	x		

Highway Design Summary

2.8.31 The four options considered as part of the WelTAG Stage Two Plus study have been summarised in Table 13, which identifies the main design differences between each option.

Table 13 Highway Option Design Summary

Element	Option A Highway Route East of Pendoylan	Option B Highway Route West of Pendoylan	Option C1 Existing Infrastructure (Online) Enhancement	Option C2 Existing Infrastructure (Online) Enhancement
Design Speed	60mph	60mph	30mph	30mph
Bypass Pendoylan	To the east	To the west	N/A	N/A
Length of Proposed Carriageway	5,560m	5,691m	5,107m	5,107m
Cut and Fill Balance	Disposal of 396,500m ³	Disposal of 318,000m ³	Import 96,000m ³	Disposal of 77,000m ³
Public Right of Way Impacts	3 Bridges 1 Culvert	1 Bridge 3 Culverts	0	0
No of Structures	0	2	1	1
Archaeology Affected	0	0	0	0

Element	Option A Highway Route East of Pendoylan	Option B Highway Route West of Pendoylan	Option C1 Existing Infrastructure (Online) Enhancement	Option C2 Existing Infrastructure (Online) Enhancement
Length of Floodplain affected	100m	100m	100m	100m
Ancient Woodland	4 Areas	4 Areas	3 Areas	3 Areas
TPO Affected	0	1	2	2
Current Day Construction Cost	£41.017M	£34.370M	£28.969M	£16.976M
Current Day Total Scheme Cost	£76.844M	£66.332M	£59.844M	£40.513M

2.9 Strategic Option Appraisal

2.9.1 The options have been assessed in Table 14 to Table 18 in terms of how each would tackle the identified problems, to what extent it meets the objectives, including contributing to local, regional, and national well-being objectives, as well as key risks, adverse impacts, constraints and dependencies. The appraisal of each option against the well-being goals and the project objectives is described using the WelTAG seven-point assessment scale as set out in Table 1. For the strategic case, the impacts of the Do-Minimum are also set out compared to the base year situation. This enables an understanding of what will happen if only limited investment is made in the transport connections and provides a basis for comparing the performance of the do-something options.

Table 14 Strategic Option Appraisal | Do-Minimum (2036 Scenario)

Do-Minimum (2036 Scenario)	
Description	<p>Assume continued delivery of transport enhancements via the Local Transport Plan and Welsh Government expenditure and utilising existing sources of funding but assumes no step change in the level of funding or delivery of any major transport enhancements within the study area (assumes current levels of investment).</p> <p>Assumes the continuation of local bus services and community transport at a similar level as present utilising funding at similar levels to existing. Assumes continued work by local authorities and stakeholders to deliver improvements to the transport network, with the overall aim of addressing the identified problems and the outcomes of the relevant transport policies.</p> <p>The Do-Minimum is represented by the Reference Case scenario of the South East Wales Transport Model (SEWTM) in 2036. The Base Year 2015 and Reference Case 2036 flows are included in the Impacts Assessment Report. The version of the Reference Case used for the initial assessment is described in the technical note included within the Impacts Assessment Report. In particular, the Reference Case includes the Five Mile Lane improvement and includes the construction of the first part of the Eastern Bay Link in Cardiff. However, the model retains tolls on the Severn Bridge at present (albeit at a reduced level) pending further model development. Note that an updated version of the SEWTM Reference Case would need to be used for a Full Business Case, taking account of updated developments and transport schemes.</p>

Do-Minimum (2036 Scenario)			
How it tackles the problems	<p>Limited available funding (both capital and revenue) and resources are unlikely to make a step difference in overcoming the identified problems. The Reference Case shows a further deterioration in the performance of the road network with increased traffic flows by 2036 on the key routes of the M4 between Junction 33 and Junction 34 of 28% on the 2015 base year in the AM peak and 26% in the PM peak, 33% between Junction 34 and Junction 35 in the AM peak and 32% in the PM peak and 27% in the AM peak and 25% in the PM peak on the A4232 between Junction 33 and Culverhouse Cross. The A48 west of Sycamore Cross is also anticipated to see a 25% increase in the AM peak and 18% in the PM peak. Traffic routing through Pendoylan area is forecast to increase by 25% in the AM peak and 18% in the PM peak. The existing problems would be significantly exacerbated.</p>		
How it Contributes to Well-Being Goals	A prosperous Wales	--	
	A resilient Wales	--	
	A healthier Wales	-	
	A more equal Wales	-	
	A Wales of cohesive communities	-	
	A Wales of vibrant culture and Welsh language	-	
	A globally responsible Wales	0	
Objectives Review	<p>Overall, the Do-Minimum option is considered to have an adverse effect at meeting the objectives, due to the modest levels of funding currently able to be invested in transport infrastructure and public transport services. It subsequently assumes that background increases in population and traffic growth exceed investment provision to mitigate increasing impacts and pressure on the existing transport network.</p> <p>It should be noted that policies and programmes are in place to facilitate improved transport services, but limited funding means that beneficial enhancements are currently difficult to achieve.</p> <p>A negative impact on the environment is forecast as the traffic levels between Junction 34 and the A48 would continue to increase, as well as those on the strategic network, whilst the limited funding means that the connectivity issues associated with strategic employment sites and the Airport are anticipated to pose a constraint on the economy. The well-being of local communities in the local appraisal area would be anticipated to deteriorate, with limited investment in schemes to promote health and well-being and increased traffic impacts.</p>		
Objectives Scoring	O1	Enhance connectivity to Cardiff Airport and strategic employment sites in the region.	-
	O2	Increase transport options for strategic access and access to and from local communities.	-
	O3	Improve network resilience and road safety on the M4, A48 and A4232 corridors and other connecting roads.	-
	O4	Protect and enhance the historic, built and natural environment including the landscape and settlement character of the study area.	0

Do-Minimum (2036 Scenario)		
	O5	Minimise impacts on communities and support social inclusion and health and well-being.
Key Risks	<p>Potential reductions in available funding and resources leading to poor investment in public transport and local highway infrastructure.</p> <p>Do-Minimum option will mean that connectivity to residential areas, strategic economic centres and key services/ facilities (including Cardiff Airport) remains a key issue, and not being seen to tackle existing issues or support local and regional development aspirations.</p>	
Adverse Impacts	<p>The anticipated increase in annual traffic volumes (general background traffic growth plus local LDP development) is anticipated to have a significant adverse impact on the environment compared to the existing situation.</p> <p>A poor transport connection remains from the M4 corridor would affect potential users' choices for accessing employment centres and key services, including accessibility to and from Cardiff Airport.</p> <p>Potential for a deterioration in highway safety on routes between M4 Junction 34 and A48, most notably through Pendoylan with potential for local increases in traffic flow.</p> <p>Potential for increased congestion on the alternative routes to strategic employment sites including the A4232 and A48.</p> <p>Potential for adverse development of socio-economic opportunities with restrained accessibility to sustainable travel opportunities.</p> <p>Deterioration of the quality of environment and journey times on the Pendoylan corridor as well as the strategic road network (M4, A4232 and A48) encompassing increase journey time delay, environmental issues, and anticipated worsening of highway junction capacity.</p>	
Constraints	<p>The Do-Minimum is considered to be relatively unconstrained although any restriction with regard to the availability of funding and resources could jeopardise standard maintenance/ enhancement proposals.</p>	
Dependencies	<p>The implementation of the Five Mile Lane improvement will impact on transport in the study area. The growth of the Airport and strategic employment sites in the sub-region is related to the level of impacts, as well as the transport issues in the Do-Minimum potentially constraining growth.</p>	

Table 15 Strategic Option Appraisal | Option A – Highway Route East of Pendoylan

Option A – Highway Route East of Pendoylan	
Description	<p>The 5.56km Highway Route East of Pendoylan would connect from just south of Junction 34 of the M4 to the A48 at Sycamore Cross. The northern and southern sections would involve online improvements, the northern section of which allows for a substantial section of ancient woodland to be avoided. The remainder of the route between these two junctions would be offline and bypass Pendoylan to the east of the village. The route would be a single carriageway of national speed limit standard and include segregated walking and cycling route infrastructure alongside the carriageway with the potential to provide integral public transport, as well as provision of connectivity for existing PRoW.</p>

Option A – Highway Route East of Pendoylan		
	<p>The option assumes a combination of principal and minor site access junctions along the route connecting to the network encompassing:</p> <ul style="list-style-type: none"> • Hensol – Ghost Island Junction with dedicated right turn heading southbound • Hensol Driving Range and Farm – Access Junction • Pendoylan/ Clawdd-Coch – Ghost Island Junction with dedicated right turn heading southbound • Pendoylan/ Peterston-Super-Ely – Roundabout • A48 Sycamore Cross – Crossroads with traffic lights <p>The SEWTM modelling assumes only minor changes to the Sycamore Cross junction as completed for the recent Five Mile Lane scheme, although there are options to remove the staggered junction which would increase the scheme benefits. Similarly, the modelling work has not included improvements to Junction 34 to increase capacity, but the bringing forward of improvements for the junction would enhance the benefits of the option together with reconfiguration of the Renishaw access junction (circa 150m south of Junction 34) giving priority to north/ south traffic.</p>	
How it tackles the problems	<p>Option A Highway Route East of Pendoylan has the potential to tackle the following problems – P01 / P02 / P04 / P05 / P07 / P08</p> <p>The option would represent a significant highway infrastructure improvement between M4 Junction 34 and A48 with improved vehicle journey time and reliability, as well as provide robust infrastructure to support the promotion and development of sustainable transport options.</p> <p>Congestion issues at M4 Junction 34 could be mitigated via the implementation of localised junction improvements and there is the opportunity to provide integral bus infrastructure, as well as walking and cycling infrastructure encompassing connectivity to existing routes.</p> <p>The option would provide a new route compliant with current DMRB design standards in comparison to the broadly non-compliant existing routes through the study area. Improved accessibility for HGV's would also be realised.</p>	
How it Contributes to Well-Being Goals	<p>A prosperous Wales</p> <p>A resilient Wales</p> <p>A healthier Wales</p> <p>A more equal Wales</p> <p>A Wales of cohesive communities</p> <p>A Wales of vibrant culture and Welsh language</p> <p>A globally responsible Wales</p>	<p>++</p> <p>+</p> <p>+</p> <p>++</p> <p>++</p> <p>++</p> <p>+</p>
Objectives Review	O1	<p>The option should significantly improve strategic connectivity in the region including accessibility to and from local/ regional employment centres and communities, as well as access to services and facilities including Cardiff Airport. The option provides direct interconnectivity with Five Mile Lane via the Sycamore Cross junction (A48) allowing for improved journey time potential to and from the EZ and Cardiff Airport.</p>

Option A – Highway Route East of Pendoylan

	O2	The option provides additional route choices for access between the M4 and strategic employment locations and the airport. Whilst the implementation of a new highway route has the potential to significantly promote the development of other transport mode options by establishing infrastructure anticipated to support the improvement of vehicle journey times and reliability, this is a highways-based option. The highway benefits noted are therefore likely to establish an increase in car trips as opposed to deliver increased trips by sustainable modes of transport. However, cycling and bus infrastructure would be integrated with the scheme, bringing some benefits for sustainable travel options.	
	O3	A new route implemented to current highway design standards in combination with the associated junction improvements is anticipated to significantly improve network resilience and road safety. Reduced traffic flow through the settlements of Pendoylan and Clawdd-Coch is also anticipated to enhance local highway conditions along the predominantly sub-standard route, both day-to-day and following periods of disruption (diverted traffic) associated with the M4 corridor. The results of the traffic modelling show there would be changes in traffic routing on the strategic network with the do-something compared to the Do-Minimum, with a reduction in traffic on the M4 west of Junction 34, on the A48 east of Sycamore Cross and the A4232/ A48 Culverhouse Cross. There is anticipated to be increased traffic flow resulting from the new route around Junction 34, which would lead to the need to separately consider improvements at the junction to facilitate the additional traffic on the link and mitigate any delays on the A4119 corridor as a result.	
	O4	The option has the potential for a moderate adverse impact with regard to the natural and built environment both through the construction of a new by-pass (predominantly upon an existing green field site), the transposition of existing hedgerow adjacent to existing online sections of highway, adverse visual impact affecting the extant rural landscape characteristics of the area, and the potential increase in road traffic impacting on noise and air quality impacts for dwellings situated close the route.	
	O5	This option would minimise transport impacts on the existing community of Pendoylan and of Clawdd-Coch by leading to a reduction in traffic through the communities. There is potential to proactively enhance social inclusion throughout the region by affording improved access to local services and facilities. There would be increased traffic impacts on properties in the immediate vicinity of the route but overall, this number is low in comparison to those benefitting from reduced traffic.	
Objectives Scoring	O1	Enhance connectivity to Cardiff Airport and strategic employment sites in the region	+++
	O2	Increase transport options for strategic access and access to and from local communities	++
	O3	Improve network resilience and road safety on the M4, A48 and A4232 corridors and other connecting roads	++
	O4	Protect and enhance the historic, built and natural environment including the landscape and settlement character of the study area	--

Option A – Highway Route East of Pendoylan			
	O5	Minimise impacts on communities and support social inclusion and health and well-being	+
Key Risks	<p>Requires a high level of capital investment.</p> <p>Delivery would be in the medium to long-term, given the planning requirements, likely funding constraints in current programmes and development work required to take the option forward.</p> <p>There are already a number of large-scale transport schemes currently in the Welsh Government’s infrastructure delivery which require significant capital funding and resources. There may be the opportunity for funding under the City Deal. Any proposal would need to demonstrate robust regional/ national value against other large-scale transport schemes and City Deal proposals.</p> <p>Land acquisitions (time and cost).</p> <p>Environmental considerations, including the potential for protected species to be located along the route and the risks associated with potential impacts on the floodplain, which may lead to the requirement for a design incorporating stilts.</p> <p>Buried archaeological features have the potential to add time and cost to any scheme and may impact on route alignments.</p> <p>Existing bridge over River Ely at the north end of route may require strengthening and further works to be suitable for possible future traffic loadings. This will need a condition survey and assessment at future stages.</p> <p>The railway bridge may require strengthening and further works to be suitable for possible future traffic loadings. This will need a condition survey and assessment at future stages.</p> <p>Route uncertainties (including topography) make it difficult to fully understand the engineering constraints and potential costs, and associated impacts.</p> <p>Without Ground Investigation data, it is unknown what degree of excavated material might be suitable fill material, therefore requiring import of suitable fill material and export of unsuitable.</p> <p>Subway crossing at Cottrell Park Golf Resort could impact on design due to increase in traffic loadings resulting in structural issues with the subway. The subway might need to be re-located.</p> <p>There is a need to also bring forward proposed capacity improvements to the M4 Junction 34 to minimise knock on impacts and maximise journey time benefits.</p>		
Adverse Impacts	<p>Potential significant adverse impact on the environment including landscape, biodiversity, cultural heritage, noise and air quality.</p> <p>Impact on residents situated adjacent or near to the proposed route (predominantly affecting the settlements of Pendoylan and Clawdd-Coch).</p> <p>Impact on local communities during construction.</p> <p>Delay to road users (car, HGVs and public and community transport) during construction.</p> <p>Would require a high level of capital investment, which may have implications on the delivery of other capital schemes in the region for a number of years.</p>		
Constraints	Availability of funding and resources.		

Option A – Highway Route East of Pendoylan	
	<p>Environmental considerations including the potential for protected species along the proposed route, archaeology and flooding issues.</p> <p>Land ownership constraints and the need to accommodate access to existing properties.</p>
Dependencies	<p>Masterplan proposals for Cardiff Airport and St Athan EZ, as well as other major developments in the region.</p> <p>Impacts on available revenue/ maintenance budgets.</p> <p>Ability to acquire all land required to facilitate the option.</p> <p>Proposals to improve capacity on the M4 corridor including Junction 34, as well as the A4119/ A473 and Cardiff North West Corridor.</p>

Table 16 Strategic Option Appraisal | Option B – Highway Route West of Pendoylan

Option B – Highway Route West of Pendoylan	
Description	<p>The 5.691km Highway Route West of Pendoylan would connect from just south of Junction 34 of the M4 to the A48 at Sycamore Cross. The northern and southern sections would involve online improvements, the northern section of which allows for a substantial section of ancient woodland to be avoided. The remainder of the route between these two junctions would be offline and bypass Pendoylan to the west of the village and require two bridge structures to cross over the existing road interconnecting with Pendoylan.</p> <p>The route would be a single carriageway of national speed limit standard and include segregated walking and cycling route infrastructure alongside the carriageway with the potential to provide integral public transport, as well as provision of connectivity for existing PRow.</p> <p>The option assumes a combination of principal and minor site access junctions along the route connecting to the network encompassing:</p> <ul style="list-style-type: none"> • Hensol – Ghost Island Junction with dedicated right turn heading southbound • Hensol Driving Range and Farm – Access Junction • Pendoylan/ Clawdd-Coch – Ghost Island Junction with dedicated right turn heading southbound • Pendoylan/ Peterston-Super-Ely – Roundabout • A48 Sycamore Cross – Crossroads with traffic lights <p>The SEWTM modelling assumes only minor changes to the Sycamore Cross junction as completed for the recent Five Mile Lane scheme, although there are options to remove the staggered junction which would increase the scheme benefits. Similarly, the modelling work has not included improvements to Junction 34 to increase capacity, but the bringing forward of improvements for the junction would enhance the benefits of the option together with reconfiguration of the Renishaw access junction (circa 150m south of Junction 34) giving priority to north/ south traffic.</p>
How it tackles the problems	<p>Option B Highway Route West of Pendoylan has the potential to tackle the following problems – P01 / P02 / P04 / P05 / P07 / P08</p> <p>The option would represent a significant highway infrastructure improvement between M4 Junction 34 and A48 with improved vehicle journey time and reliability, as well as</p>

Option B – Highway Route West of Pendoylan

	<p>provide robust infrastructure to support the promotion and development of sustainable transport options.</p> <p>Congestion issues at M4 Junction 34 could be mitigated via the implementation of localised junction improvements and there is the opportunity to provide integral bus infrastructure, as well as walking and cycling infrastructure encompassing connectivity to existing routes.</p> <p>The option would provide a new route compliant with current DMRB design standards in comparison to the broadly non-compliant existing routes through the study area. Improved accessibility for HGV's would also be realised.</p>	
How it Contributes to Well-Being Goals	A prosperous Wales	++
	A resilient Wales	+
	A healthier Wales	+
	A more equal Wales	++
	A Wales of cohesive communities	++
	A Wales of vibrant culture and Welsh language	++
	A globally responsible Wales	+
Objective Review	O1	<p>The option should significantly improve strategic connectivity in the region including accessibility to and from local/ regional employment centres and communities, as well as access to services and facilities including Cardiff Airport. The option provides direct interconnectivity with Five Mile Lane via the Sycamore Cross junction (A48) allowing for improved journey time potential to and from the EZ and Cardiff Airport.</p>
	O2	<p>The option provides additional route choices for access between the M4 and strategic employment locations and the airport. Whilst the implementation of a new highway route has the potential to significantly promote the development of other transport modes options by establishing infrastructure anticipated to support the improvement of vehicle journey times and reliability, this is a highways-based option. The highway benefits noted are therefore likely to establish an increase in car trips as opposed to deliver increased trips by sustainable modes of transport. However, cycling and bus infrastructure would be integrated with the scheme, bringing some benefits for sustainable travel options.</p>
	O3	<p>A new route implemented to current highway design standards in combination with the associated junction improvements is anticipated to establish improved network resilience and road safety. Reduced traffic flows through the settlements of Pendoylan and Clawdd-Coch are also anticipated to enhance local highway conditions along the predominantly sub-standard route, both day-to-day and following periods of disruption (diverted traffic) associated with the M4 corridor.</p> <p>The results of the traffic modelling show there would be changes in traffic routing on the strategic network that would lead to reduced traffic through the M4 Junction 33, and A4232/ A48 Culverhouse Cross, with significant traffic reductions anticipated on the A48 both east and west of Sycamore Cross. There is anticipated to be increased traffic flow resulting from the new route on</p>

Option B – Highway Route West of Pendoylan

		the M4 Junction 34, which would lead to the need to separately consider improvements at the junction to facilitate the additional traffic on the link and mitigate any delays on the A4119 corridor as a result.	
	O4	The option has the potential for a moderate adverse impact with regard to the natural and built environment both through the construction of a new road alignment, (predominantly upon an existing green field site), the transposition of existing hedgerow adjacent to existing extensive online sections of highway, adverse visual impact affecting the extant rural landscape characteristics of the area, and the potential increase in road traffic leading to air quality and noise pollution for dwellings situated close the route.	
	O5	This option would reduce transport impacts on the existing community of Pendoylan and Clawdd-Coch. There is potential to proactively enhance social inclusion throughout the region by affording improved access to local services and facilities. There would be increased traffic impacts on properties in the immediate vicinity of the route but overall, this number is low in comparison to those benefitting from reduced traffic	
Objectives Scoring	O1	Enhance connectivity to Cardiff Airport and strategic employment sites in the region	+++
	O2	Increase transport options for strategic access and access to and from local communities	++
	O3	Improve network resilience and road safety on the M4, A48 and A4232 corridors and other connecting roads	++
	O4	Protect and enhance the historic, built and natural environment including the landscape and settlement character of the study area	--
	O5	Minimise impacts on communities and support social inclusion and health and well-being	+
Key Risks	<p>Requires a high level of capital investment.</p> <p>Delivery would be in the medium to long-term, given the planning requirements, likely funding constraints in current programmes and development work required to take the option forward.</p> <p>There are already a number of large-scale transport schemes currently in the Welsh Government’s infrastructure delivery programmes (such as the M4 motorway and Five Mile Lane, for example) which require significant capital funding and resources. There may be the opportunity for funding under the City Deal. Any proposal would need to demonstrate robust regional/ national value against other large-scale transport schemes and City Deal proposals.</p> <p>Land acquisitions (time and cost).</p> <p>Environmental considerations, including the potential for protected species to be located along the route.</p> <p>Buried archaeological features have the potential to add time and cost to any scheme and may impact on route alignments.</p> <p>Existing bridge over River Ely at the north end of route may require strengthening and further works to be suitable for possible future traffic loadings. This will need a condition survey and assessment at future stages.</p>		

Option B – Highway Route West of Pendoylan	
	<p>The railway bridge may require strengthening and further works to be suitable for possible future traffic loadings. This will need a condition survey and assessment at future stages.</p> <p>Route uncertainties (including topography) make it difficult to fully understand the engineering constraints and potential costs, and associated impacts.</p> <p>Without Ground Investigation data, it is unknown what degree of excavated material might be suitable fill material, therefore requiring import of suitable fill material and export of unsuitable.</p> <p>Subway crossing at Cottrell Park Golf Resort could impact on design due to increase in traffic loadings resulting in structural issues with the subway. The subway might need to be re-located.</p> <p>There is a need to also bring forward capacity improvements to Junction 34 to minimise knock on impacts and maximise journey time benefits.</p>
Adverse Impacts	<p>Potential significant adverse impact on the environment including landscape, biodiversity, cultural heritage as well as impacts on air quality and noise.</p> <p>Impact on residents situated adjacent or near to the proposed route (predominantly affecting the settlements of Pendoylan and Clawdd-Coch).</p> <p>Impact on local communities during construction.</p> <p>Delay to road users (car, HGVs and public and community transport) during construction.</p> <p>Would require a high level of capital investment, which may have implications on the delivery of other capital schemes in the region for a number of years, including the delivery of more sustainable measures.</p>
Constraints	<p>Availability of funding and resources.</p> <p>Environmental considerations including the potential for protected species along the proposed route and archaeology.</p> <p>Land ownership constraints and the need to accommodate access to existing properties.</p>
Dependencies	<p>Masterplan proposals for Cardiff Airport and St Athan EZ, as well as other major developments in the region.</p> <p>Impacts on available revenue/ maintenance budgets.</p> <p>Ability to acquire all land required to facilitate the option.</p> <p>Emerging proposals to improve capacity on the M4 corridor including Junction 34, as well as the A4119/ A473.</p>

Table 17 Strategic Option Appraisal | Option C1 – Existing Infrastructure (Online) Enhancement

Option C1 – Existing Infrastructure (Online) Enhancement	
Description	<p>The new section of road has been designed to stay predominantly online throughout the existing route between M4 Junction 34 to the A48 at Sycamore Cross, although has required a 30mph design speed and offline sections to be incorporated in order to achieve DMRB compliance.</p>

Option C1 – Existing Infrastructure (Online) Enhancement

	<p>Due to restrictions on space, significant impacts on properties and, with regard to Pendoylan, adverse impacts on the designated Conservation Area, enhancement proposals terminate either side of Pendoylan and Clawdd-Coch. The existing road sections through Pendoylan village and Clawdd-Coch would not therefore be upgraded and would remain non-compliant to DMRB design standards.</p> <p>The new section of road would be a single carriageway and include a segregated 3.5m wide shared walking/ cycle route adjacent to the carriageway in order to comply with the Active Travel (Wales) Act. Access to existing junctions will remain, although there are likely to be some impacts on driveways and farm access points.</p>	
<p>How it tackles the problems</p>	<p>The option has the potential to tackle the following problems – P01 / P02 / P05 / P08</p> <p>The option would establish a predominantly DMRB compliant road between the M4 Junction 34 and A48 in comparison to the broadly non-compliant existing route through the study area. The existing road sections through Pendoylan and Clawdd-Coch would however remain non-compliant.</p> <p>It is anticipated that improved vehicle journey time and reliability would be experienced, which in turn would support the promotion and development of sustainable transport options, although the benefits would be constrained given the applied 30mph design speed and the retention of existing road sections through Pendoylan and Clawdd-Coch – the latter constraint of which will retain interfaces with existing vehicle access points and junctions, together with the presence of on-street parking in some instances. These issues would likely be exacerbated as increased daily traffic flows would be expected as improved network resilience is established.</p> <p>The majority of the route would provide a new shared walking and cycling path, although again this would not be applicable through Pendoylan and Clawdd-Coch where no enhancement to the highway is proposed. Whilst accessibility for all vehicles would also be improved, on-street parking through Pendoylan would adversely impact accessibility for HGVs and other large vehicles, potentially leading to a deterioration of local road safety conditions unless traffic regulation orders are imposed to restrict access and mitigate impacts accordingly.</p>	
<p>How it Contributes to Well-Being Goals</p>	<p>A prosperous Wales</p> <p>A resilient Wales</p> <p>A healthier Wales</p> <p>A more equal Wales</p> <p>A Wales of cohesive communities</p> <p>A Wales of vibrant culture and Welsh language</p> <p>A globally responsible Wales</p>	<p>+</p> <p>+</p> <p>+</p> <p>+</p> <p>+</p> <p>+</p> <p>0</p>
<p>Objective Review</p>	<p>O1 The option should improve strategic connectivity in the region including accessibility to and from local/ regional employment centres and communities, as well as access to services and facilities including Cardiff Airport. The option provides direct interconnectivity with Five Mile Lane via the Sycamore Cross junction (A48) allowing for improved journey time potential to and from the Enterprise Zones and Cardiff Airport. However, journey time and reliability are anticipated to be constrained by the 30mph design speed and the absence of highway improvements through Pendoylan and Clawdd-Coch. Access for</p>	

Option C1 – Existing Infrastructure (Online) Enhancement

		HGVs and other large vehicles may also need to be restricted to avoid the potential for adverse road safety conditions through the village.	
	O2	The option provides an improved route choice for access between the M4 Junction 34 and strategic employment locations and the airport. Whilst the implementation of a new highway route has the potential to support the promotion and development of sustainable transport options, this remains a highways-based option. The highway benefits noted are therefore likely to establish an increase in car trips as opposed to deliver increased trips by sustainable modes of transport. However, partial cycling and bus infrastructure would be integrated with the scheme, bringing some benefits for sustainable travel options.	
	O3	An enhanced route implemented to current highway design standards in combination with the associated junction improvements is anticipated to establish improved network resilience and road safety. However, journey time and reliability are anticipated to be constrained by the 30mph design speed and the absence of highway improvements through Pendoylan and Clawdd-Coch. Access for HGVs and other large vehicles may need to be restricted to avoid the potential for adverse road safety conditions through the village.	
	O4	The option has the potential for a moderate adverse impact with regard to the natural and built environment both through the construction of an enhanced road alignment (including sections of existing green field sites), the extensive transposition of existing hedgerow adjacent to online sections of highway, and the anticipated increase in road traffic leading to local air quality and noise pollution for dwellings situated close the route and especially those living within the villages of Pendoylan and Clawdd-Coch.	
	O5	Whilst there is potential to proactively enhance social inclusion throughout the region by affording improved access to local services and facilities, the assumed increase in traffic through the villages of Pendoylan and Clawdd-Coch as a result of enhanced connectivity has the potential to significantly increase transport impacts adversely impacting on health and well-being, as well as wider community impacts with regard to pedestrian severance and amenity. This includes the potential adverse impacts increased traffic flows would have on the primary school as well as local residents.	
Objectives Scoring	O1	Enhance connectivity to Cardiff Airport and strategic employment sites in the region	++
	O2	Increase transport options for strategic access and access to and from local communities	+
	O3	Improve network resilience and road safety on the M4, A48 and A4232 corridors and other connecting roads	+
	O4	Protect and enhance the historic, built and natural environment including the landscape and settlement character of the study area	--
	O5	Minimise impacts on communities and support social inclusion and health and well-being	--
Key Risks	During the construction phase, there would be substantial impacts to the users of the existing Pendoylan road and to residents/ business owners within Pendoylan itself.		

Option C1 – Existing Infrastructure (Online) Enhancement

Diversion routes would be required to allow the construction to develop and could be in place for a significant length of time. This in turn will impact on time and cost and encounter additional risks, such as additional diversions of statutory undertaker’s apparatus, access to schools, impact on the environment. Both of the online options consider the additional preliminaries required as a result of diverting traffic and impacts on the surrounding Pendoylan area during construction.

Requires a high level of capital investment.

Delivery would be in the medium to long-term, given the planning requirements, likely funding constraints in current programmes and development work required to take the option forward.

There are already a number of large-scale transport schemes currently in the Welsh Government’s infrastructure delivery programmes which require significant capital funding and resources. There may be the opportunity for funding under the City Deal. Any proposal would need to demonstrate robust regional/ national value against other large-scale transport schemes and City Deal proposals.

Land acquisitions (time and cost).

Environmental considerations, including the potential for protected species to be located along the route.

Buried archaeological features have the potential to add time and cost to any scheme and may impact on route alignments.

Existing bridge over River Ely at the north end of route may require strengthening and further works to be suitable for possible future traffic loadings. This will need a condition survey and assessment at future stages.

The railway bridge may require strengthening and further works to be suitable for possible future traffic loadings. This will need a condition survey and assessment at future stages.

Route uncertainties (including topography) make it difficult to fully understand the engineering constraints and potential costs, and associated impacts.

Without Ground Investigation data, it is unknown what degree of excavated material might be suitable fill material, therefore requiring import of suitable fill material and export of unsuitable.

Subway crossing at Cottrell Park Golf Resort could impact on design due to increase in traffic loadings resulting in structural issues with the subway. The subway might need to be re-located.

<p>Adverse Impacts</p>	<p>Potential significant adverse impact on the environment predominantly including biodiversity, air quality and noise.</p> <p>Impact on residents situated adjacent or near to the proposed route (predominantly affecting the settlements of Pendoylan and Clawdd-Coch).</p> <p>Significant impact on local communities during construction including a delay to road users (car, HGVs and public and community transport) during construction.</p> <p>Would require a high level of capital investment, which may have implications on the delivery of other capital schemes in the region for a number of years, including the delivery of more sustainable measures.</p>
<p>Constraints</p>	<p>Availability of funding and resources.</p>

Option C1 – Existing Infrastructure (Online) Enhancement	
	<p>Environmental considerations including the potential for protected species along the proposed route and archaeology.</p> <p>Land ownership constraints and the need to accommodate access to existing properties.</p>
Dependencies	<p>Masterplan proposals for Cardiff Airport and St Athan EZ, as well as other major developments in the region.</p> <p>Impacts on available revenue/ maintenance budgets.</p> <p>Ability to acquire all land required to facilitate the option.</p>

Table 18 Strategic Option Appraisal | Option C2 – Existing Infrastructure (Online) Enhancement

Option C2 – Existing Infrastructure (Online) Enhancement	
Description	<p>The new section of road has been designed to stay predominantly online throughout the existing route between M4 Junction 34 to the A48 at Sycamore Cross, although whilst a 30mph design speed is required for safety reasons and some offline sections have been incorporated into the design, the alignment remains non-compliant to DMRB standards due to the horizontal and vertical curvature of the existing road.</p> <p>Due to restrictions on space, significant impacts on properties and, with regard to Pendoylan, adverse impacts on the designated Conservation Area, enhancement proposals terminate either side of Pendoylan and Clawdd-Coch. The existing road sections through Pendoylan village and Clawdd-Coch would not therefore be upgraded and would remain non-compliant to DMRB design standards.</p> <p>The new section of road extends the width of the carriageway to ensure a constant 6m width throughout and does not include a new footway/ cycleway along its length. Access to existing junctions will remain, although there are likely to be some impacts on driveways and farm access points.</p>
How it tackles the problems	<p>Whilst the option would deliver an enhanced route in comparison to the existing situation, the alignment would nevertheless remain predominantly non-compliant to DMRB design standards, including both the new sections of road and the existing alignments through Pendoylan village and Clawdd-Coch. Of particular note, the gradient at the southern end of the road is very steep with the alignment retaining a gradient of 11.83%, significantly above the 8% maximum threshold and therefore well below standard.</p> <p>It is anticipated that improved vehicle journey time and reliability would be experienced, which in turn would support the promotion and development of sustainable transport options, although the benefits would be constrained given the applied 30mph design speed and the retention of existing road sections through Pendoylan and Clawdd-Coch – the latter constraint of which will retain interfaces with existing vehicle access points and junctions, together with the presence of on-street parking in some instances. These issues would likely be exacerbated as increased daily traffic flows would be expected as improved network resilience is established.</p> <p>Enhancement of the route could support the promotion and development of sustainable transport options, although a significant improvement would not be anticipated as the highway retains non-compliant status. Whilst accessibility for all vehicles would be improved, the non-compliant status of the road and existing on-street parking through Pendoylan would likely make accessibility for HGVs and other large vehicles unsuitable leading to a deterioration of local road safety conditions. It is</p>

Option C2 – Existing Infrastructure (Online) Enhancement

	anticipated that traffic regulation orders would be required to restrict access and mitigate impacts accordingly.	
How it Contributes to Well-Being Goals	A prosperous Wales	+
	A resilient Wales	0
	A healthier Wales	0
	A more equal Wales	0
	A Wales of cohesive communities	0
	A Wales of vibrant culture and Welsh language	+
	A globally responsible Wales	0
Objective Review	O1	The option would improve local connectivity to the villages of Pendoylan and Clawdd-Coch, although be unlikely to establish resilient strategic connectivity to and from local/ regional employment centres and communities, as well as access to services and facilities including Cardiff Airport. The route would remain non-compliant to DMRB design standards with improvements in journey time and reliability likely to be constrained by the 30mph design speed and the absence of highway improvements through Pendoylan and Clawdd-Coch. Access for HGVs and other large vehicles may also need to be restricted to avoid the potential for adverse road safety conditions through the villages.
	O2	The option would improve local connectivity to the villages of Pendoylan and Clawdd-Coch, although be unlikely to establish resilient strategic connectivity to and from local/ regional employment centres and communities, as well as access to services and facilities including Cardiff Airport. Whilst the implementation of a new highway route has the potential to support the promotion and development of sustainable transport options, significant improvement would not be anticipated as the highway retains non-compliant DMRB status and fundamentally remains a highways-based option. Enhancement of the highway is therefore likely to establish an increase in car trips as opposed to deliver increased trips by sustainable modes of transport and in addition, the option does not retain integrated cycling infrastructure.
	O3	Whilst the enhanced route would provide improved connectivity to local communities, the alignment would remain non-compliant to DMRB design standards and unlikely to supported enhanced strategic network resilience. Journey time and reliability would be constrained by the 30mph design speed and the absence of highway improvements through Pendoylan and Clawdd-Coch. Access for HGVs and other large vehicles may also need to be restricted to avoid the potential for adverse road safety conditions through the villages.
	O4	The option has the potential for a moderate adverse impact with regard to the natural and built environment both through the construction of an enhanced road alignment (including sections of existing green field sites), the extensive transposition of existing hedgerow adjacent to online sections of highway, and the anticipated increase in road traffic leading to local air quality and noise

Option C2 – Existing Infrastructure (Online) Enhancement			
		pollution for dwellings situated close the route and especially those living within the villages of Pendoylan and Clawdd-Coch.	
	05	<p>Whilst there is potential to proactively enhance social inclusion throughout the region by affording improved access to local services and facilities, the assumed increase in traffic through the villages of Pendoylan and Clawdd-Coch as a result of enhanced connectivity has the potential to increase transport impacts adversely impacting on health and well-being, as well as wider community impacts with regard to pedestrian severance and amenity. This includes the potential adverse impacts increased traffic flows would have on the primary school as well as local residents.</p> <p>The community impacts are considered less than those anticipated for Online Alignment Option C1 as the non-compliant DMRB status of the road is anticipated to constrain the potential for traffic growth along the route.</p>	
Objectives Scoring	O1	Enhance connectivity to Cardiff Airport and strategic employment sites in the region	+
	O2	Increase transport options for strategic access and access to and from local communities	0
	O3	Improve network resilience and road safety on the M4, A48 and A4232 corridors and other connecting roads	0
	O4	Protect and enhance the historic, built and natural environment including the landscape and settlement character of the study area	--
	O5	Minimise impacts on communities and support social inclusion and health and well-being	--
Key Risks	<p>During the construction phase, there would be substantial impacts to the users of the existing Pendoylan road and to residents/ business owners within Pendoylan itself. Diversion routes would be required to allow the construction to develop and could be in place for a significant length of time. This in turn will impact on time and cost and encounter additional risks, such as additional diversions of statutory undertaker's apparatus, access to schools, impact on the environment. Both of the online options consider the additional preliminaries required as a result of diverting traffic and impacts on the surrounding Pendoylan area during construction.</p> <p>Requires a high level of capital investment.</p> <p>Delivery would be in the medium to long-term, given the planning requirements, likely funding constraints in current programmes and development work required to take the option forward.</p> <p>There are already a number of large-scale transport schemes currently in the Welsh Government's infrastructure delivery programmes (such as the M4 motorway and Five Mile Lane, for example) which require significant capital funding and resources. There may be the opportunity for funding under the City Deal. Any proposal would need to demonstrate robust regional/ national value against other large-scale transport schemes and City Deal proposals.</p> <p>Land acquisitions (time and cost).</p> <p>Environmental considerations, including the potential for protected species to be located along the route.</p>		

Option C2 – Existing Infrastructure (Online) Enhancement	
	<p>Buried archaeological features have the potential to add time and cost to any scheme and may impact on route alignments.</p> <p>Existing bridge over River Ely at the north end of route may require strengthening and further works to be suitable for possible future traffic loadings. This will need a condition survey and assessment at future stages.</p> <p>The railway bridge may require strengthening and further works to be suitable for possible future traffic loadings. This will need a condition survey and assessment at future stages.</p> <p>Route uncertainties (including topography) make it difficult to fully understand the engineering constraints and potential costs, and associated impacts.</p> <p>Without Ground Investigation data, it is unknown what degree of excavated material might be suitable fill material, therefore requiring import of suitable fill material and export of unsuitable.</p> <p>Subway crossing at Cottrell Park Golf Resort could impact on design due to increase in traffic loadings resulting in structural issues with the subway. The subway might need to be re-located.</p>
Adverse Impacts	<p>Potential significant adverse impact on the environment predominantly including biodiversity.</p> <p>Impact on residents situated adjacent or near to the proposed route (predominantly affecting the settlements of Pendoylan and Clawdd-Coch).</p> <p>Significant impact on local communities during construction including a delay to road users (car, HGVs and public and community transport) during construction.</p> <p>Would require a high level of capital investment, which may have implications on the delivery of other capital schemes in the region for a number of years, including the delivery of more sustainable measures.</p>
Constraints	<p>Availability of funding and resources.</p> <p>Environmental considerations including the potential for protected species along the proposed route and archaeology.</p> <p>Land ownership constraints and the need to accommodate access to existing properties.</p>
Dependencies	<p>Masterplan proposals for Cardiff Airport and St Athan EZ, as well as other major developments in the region.</p> <p>Impacts on available revenue/ maintenance budgets.</p> <p>Ability to acquire all land required to facilitate the option.</p>

2.10 Summary of Contribution to Problems, Objectives and Well-being Goals

2.10.1 A summary of how the proposed options align with the Well-being of Future Generations (Wales) Act 2015 is provided in Table 19. The appraisal suggests that whilst Online Alignment Option C1 broadly demonstrates a positive relationship to the well-being goals, the offline Eastern and Western alignments illustrate an enhanced correlation, specifically with regard to a prosperous and more equal Wales, as well as a Wales of vibrant culture and Welsh language and cohesive communities. In addition, Table 20 summaries the correlation between the project’s WelTAG objectives and the

proposed options, whereby the two offline options demonstrate enhanced compatibility in comparison to the online options.

- 2.10.2 The outcomes of this analysis are broadly related to how the identified problems have been addressed by each of the proposals. A significant benefit of the offline options is because it implements a fully compliant highway to DMRB standards of a national speed limit carriageway and integral walking and cycling infrastructure. This compares to the online options, both of which retain a 30mph speed limit and non-compliance to DMRB standards – the latter of which adversely impacts Online Alignment Option C1 through Pendoylan village and Clawdd-Coch, whilst non-compliances apply to both the new sections of road and the Pendoylan/ Clawdd-Coch sections for Online Alignment Option C2.
- 2.10.3 The extent to which the online options can support the strategic objectives and goals appraised is therefore considered to be constrained, limiting the potential to which problems can be addressed and opportunities realised. In all instances, the Do-Minimum scenario outlines a neutral to adverse connection with the well-being goals and project objectives in the absence of a step-change in funding to support enhancement of the network and continued traffic growth exacerbating the existing problems.

Table 19 Strategic Option Appraisal | Relationship of Well-being Goals to Options

Well-being Goal	Do-Minimum (2036 Scenario)	Option A Highway Route East of Pendoylan	Option B Highway Route West of Pendoylan	Option C1 Existing Infrastructure (Online) Enhancement	Option C2 Existing Infrastructure (Online) Enhancement
A prosperous Wales	--	++	++	+	+
A resilient Wales	--	+	+	+	0
A healthier Wales	-	+	+	+	0
A more equal Wales	-	++	++	+	0
A Wales of cohesive communities	-	++	++	+	0
A Wales of vibrant culture and Welsh language	-	++	++	+	+
A globally responsible Wales	0	+	+	0	0

Table 20 Strategic Option Appraisal | Relationship of Objectives to Options

Objective	Do-Minimum (2036 Scenario)	Option A Highway Route East of Pendoylan	Option B Highway Route West of Pendoylan	Option C1 Existing Infrastructure (Online) Enhancement	Option C2 Existing Infrastructure (Online) Enhancement
1	-	+++	+++	++	+
2	-	++	++	+	0
3	-	++	++	+	0
4	0	--	--	--	--
5	-	+	+	--	--

3 Transport Case

3.1 Overview

3.1.1 The aim of the transport case is to explain the expected impacts of the project, how the project will contribute to the well-being goals and whether a project will provide value for public money. The social, cultural, environmental and economic costs and benefits of each option are considered. The transport case presents the approach and assessment of impacts of each option under the headings of social, cultural, environment and economic and an evidence-based assessment of the following:

- What the impacts will be?
- What is the scale of those impacts?
- Where will they occur?
- Who/ what will experience them?

3.2 Approach to Impact Assessment

3.2.1 The anticipated impact of the East and West options on traffic and the subsequent economic, social and environmental impacts has been quantified through the use of SEWTM. A model run was commissioned by the Vale of Glamorgan Council to incorporate a 60mph single carriageway road from just south of Hensol to the Sycamore Cross junction on the A48. The longest of the two highway route alignments was used as a worst case for journey times. It was assumed that there would be three junctions with local roads on the route and the Sycamore Cross junction would be an improved staggered signalised junction, in line with the work completed as part of the Five Mile Lane upgrade.

3.2.2 Model flows, journey times and user benefits were obtained for the Base Year 2015 and for the With and Without Scheme in 2036. This has enabled Arcadis to undertake a Cost Benefit Analysis for the East and West route options, including accident benefits and prepare a Transport Economic Efficiency (TEE) table for each option. It is recognised that the modelling was undertaken in early 2018 and the Base Year and Without Scheme flows have been updated by Transport for Wales since that time. There will be a need to update the business case at WelTAG Stage Three using SEWTM and incorporating the refinements to the options. All SEWTM traffic flow forecasts are included as part of the Impacts Assessment Report. The results of the Cost Benefit Analysis have subsequently been considered and a qualitative commentary provided to support corresponding analysis of the online highway options.

3.2.3 To facilitate enhanced collation of WelTAG Stage Two Plus baseline environmental conditions, a range of desktop studies and early phase environmental surveys has been completed by technical specialists to acquire a greater understanding of the potential impacts of the options, identify and minimise risk at an early stage of the study, inform the design process and ensure that environmental works are adequately addressed in the project programme. The scope of work was informed through stakeholder and public consultation, output stemming from the Review Group held on 2nd October 2018 and subsequent endorsement by the Vale of Glamorgan Council Environment and Regeneration Scrutiny Committee and Cabinet. Further detailed environmental surveys to facilitate completion of a full Environmental Impact Assessment (EIA) would need to be progressed in a Stage Three Study.

3.2.4 At this stage, social and cultural impacts have been assessed through measurement of receptors likely to be affected.

Social Impacts

3.2.5 The social impacts have been assessed with reference to the guidance in WebTAG Unit A4.⁴ The assessment is qualitative with the exception of accidents for the two offline options, for which a

⁴<https://www.gov.uk/government/publications/webtag-tag-unit-a4-1-social-impact-appraisal-december-2017>

quantified analysis has been undertaken using COBALT from the traffic modelling results. A qualitative appraisal of accidents for the online options has been made using output for the Do-Minimum and offline options as comparative measures. The topics covered are physical activity, journey quality, accidents, security, access to employment, access to services, personal affordability severance and option and non-use values.

Cultural Impacts

- 3.2.6 The Future Generations of Wales (2015) Act has a well-being goal of ‘*A Wales of vibrant culture and thriving Welsh language.*’ It is noted that this well-being goal will be achieved through ‘*a society that promotes and protects culture, heritage and the Welsh language, and which encourages people to participate in the arts, and sports and recreation.*’ For this assessment, the cultural assessment is a qualitative commentary on any impacts on cultural assets and the Welsh language. Cultural assets considered include arts and cultural centres, visitor attractions, sports facilities and cultural heritage.

Environmental Impacts

- 3.2.7 The environmental impacts appraisal for this Stage Two Plus report is based on WebTAG Unit A3.5. The topics covered are noise, air quality, greenhouse gases, landscape, townscape, historic environment, biodiversity and water environment.
- 3.2.8 The scope of works for the early phase environmental surveys has focussed on the two offline (east and west) options, although environmental data has been extracted accordingly to inform the online option appraisal as the existing road is within the same study area. The Impacts Assessment Report includes all of the environmental data collated including the following key reports and activities:
- **Biodiversity (Ecology) – Preliminary Ecological Appraisal (10028657-ARC-XX-XX-RP-EA-0001)** | A desk study was undertaken in order to identify any existing ecological information relating to the study area and assigned search area. In addition, an extended Phase 1 habitat survey was undertaken by Arcadis Ecologists in July 2019.
 - **Water Environment – River Ely Hydraulic Modelling (10028657-ARC-XX-XX-RP-CW-00XX-02)** | A hydraulic model of the River Ely and its floodplain has been developed through an agreed process with NRW. The model has generated robust flood risk data to inform appraisal of the Stage Two Plus options and development of a detailed Flood Consequence Assessment (FCA) should the study progress to the next stage of WelTAG assessment.
 - **Historic Environment (Cultural Heritage) – Cultural Heritage Desk-Based Assessment (10028657-ARC-XX-XX-RP-CH-0001)** | A Cultural Heritage Desk-Based Assessment was undertaken to ensure that selection of options is informed by a robust evidence base in terms of understanding the cultural heritage resource. To support the desk-based assessment, a walkover survey was undertaken in July 2019 to acquire a more detailed understanding of the potential cultural heritage impacts.
 - **Early Phase Landscape Visual Impact Assessment (LVIA)** | An early phase LVIA has been completed for all options encompassing a desk-based assessment together with a site visit to inform the assessment.
- 3.2.9 With respect to greenhouse gases, this is assessed in accordance with the WebTAG Guidance (TAG Unit A3) which calculates change in the emissions for greenhouse gases for vehicles based on energy consumption and emissions rates.

Economic Impacts

- 3.2.10 The economic impacts appraisal considers the changes in journey time, reliability and accidents as derived from the traffic modelling using the outputs from the SEWTM in accordance with the WebTAG guidance (TAG Unit A1-1). The methodology for undertaking the modelling by the consultants for Transport for Wales are contained in a technical note within the Impacts Assessment

⁵https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/638648/TAG_unit_a3_envir_imp_app_dec_15.pdf

Report. Arcadis has used the outputs to subsequently undertake the economic assessment. The WebTAG guidance highlights that wider economic impacts can also be appraised. The wider economic appraisal is a short qualitative statement at present, pending further analysis in a Stage Three assessment. The Department for Transport (DfT) WebTAG guidance includes assessment of the wider economic benefits related to induced investment, employment effects and productivity impacts (TAG Unit A2-1). A qualitative approach has been taken as a proportionate approach at this stage.

3.3 Impact Assessment | Summary

3.3.1 The summary of results has been outlined within Table 21 with the detailed assessment of impacts for each of the options included in Appendix F. Each assessment is in comparison to the Do-Minimum in 2036. The WelTAG seven-point assessment scale, as set out in Table 1 has been used to present the scale of the impact. The accompanying Impacts Assessment Report contains the WebTAG worksheets for the Eastern alignment, Western alignment and online proposals.

Table 21 Impact Assessment Summary

Impact	Do-Minimum (2036 Scenario)	Option A Highway Route East of Pendoylan	Option B Highway Route West of Pendoylan	Option C1 Existing Infrastructure (Online) Enhancement	Option C2 Existing Infrastructure (Online) Enhancement
Social					
Physical Activity	-	+	+	+	0
Journey Quality	-	+++	+++	++	+
Accidents	-	++	++	+	0
Security	0	++	++	+	+
Access to Employment	-	++	++	+	+
Access to Services	-	++	++	+	+
Affordability	-	0	0	0	0
Severance	0	+	+	-	-
Option and Non-Use Values	-	++	++	+	0
Cultural					
Cultural Facilities	-	++	++	+	+
Welsh Language	0	0	0	0	0
Environment					
Noise	0	-	-	-	-
Air Quality	0	-	-	-	-

Impact	Do-Minimum (2036 Scenario)	Option A Highway Route East of Pendoylan	Option B Highway Route West of Pendoylan	Option C1 Existing Infrastructure (Online) Enhancement	Option C2 Existing Infrastructure (Online) Enhancement
Greenhouse Gases	0	+	+	0	0
Landscape	0	--	--	--	--
Townscape	0	0	0	0	0
Historic Environment	0	-	-	-	-
Biodiversity	0	--	--	-	-
Water Environment	0	-	-	-	-
Residential Amenity	0	--	--	--	--
Economic					
Journey Time Changes	-	+++	+++	++	+
Journey Time Reliability Changes	-	++	++	+	+
Transport Costs	-	++	++	+	+
Wider Economic Impacts	-	++	++	+	+
Land and Property	0	--	--	--	--
PVB	N/A	£151.295M	£151.295M	N/A	N/A
PVC	N/A	£50.376M	£43.413M	N/A	N/A
NPV	N/A	£100.919M	£107.882M	N/A	N/A
BCR	N/A	3.00	3.49	N/A	N/A

3.3.2 Options C1 and C2 perform less favourably than the offline options in respect of the economic, social and cultural criteria. With respect to the environment, the options perform better than the offline options for biodiversity. Option C2 is the least beneficial in terms of social and economic criteria. The reasoning supporting these scores is specific to each of the options – reference should be made to the transport case appraisal tables in [Appendix F](#), together with the appraisal worksheets included within the Impacts Assessment Report.

3.4 Value for Money Assessment

3.4.1 This section sets out the impact on Public Accounts (PA) and the results of the Analysis of Monetised Costs and Benefits (AMCB) for the highway options, based on the costs calculated by Arcadis and the benefits derived from the outputs of the SEWTM. Full discussion of the methodology

and results is included in the accompanying Impacts Assessment Report. Table 22 shows the effects of the options on public finances, considering the impact on the broad transport budget after allowing for changes in revenues. It also includes changes in the broader indirect tax revenues which accrue to the government.

Table 22 Public Accounts (PVC £000's 2010 prices discounted to 2010)

Scheme Costs	Option A Highway Route East of Pendoylan	Option B Highway Route West of Pendoylan
Investment Costs	50,376	43,413
Operator Costs	-	-
Revenue	-	-
Indirect Tax Revenue	-2,460	-2,460

3.4.2 The indirect tax revenue values shown are increase in revenue to the wider public finances and, in accordance with WebTAG guidance, are included in the calculation of the Present Value of Benefits (PVB). The sign of the value in the PA table is therefore reversed in the AMCB table because the PA table presents costs to the public accounts as positive values. The AMCB tables combine results from the TEE tables and the PA tables supplemented by information on accidents and environmental effects.

3.4.3 A sensitivity test was undertaken to provide further information regarding the impact of the straight-line interpolation/ extrapolation methodology undertaken due to a lack of transport model data. This sensitivity used a National Trip End Model (NTEM) derived trip reduction factor to estimate the impact a reduced level of traffic in 2023 would have on the scheme benefits. The resultant Table 23 the AMCB including the impact of a reduced 2023 trip matrix on the PVBs and Benefit Cost Ratios (BCR).

Table 23 AMCB Summary Table for Sensitivity Test (prices in £000's, discounted to 2010)

	Scheme costs	Option A Highway Route East of Pendoylan	Option B Highway Route West of Pendoylan
A	Accidents	16,591	16,591
B	Economic efficiency: Commuting	35,745	35,745
C	Economic efficiency: Other	49,471	49,471
D	Economic efficiency: Business	52,020	52,020
E	Wider Public Finances (ITR)	-2,532	-2,532
F	PVB (A+B+C+D+E)	151,295	151,295

	Scheme costs	Option A Highway Route East of Pendoylan	Option B Highway Route West of Pendoylan
G	PVC	50,376	43,413
H	NPV (F-G)	100,919	107,882
I	BCR (F/G)	3.00	3.49

- 3.4.4 The benefits for the Eastern and Western alignments have been assumed to be the same with the only difference being introduced with the costs.
- 3.4.5 The methodology used to undertake the transport user benefits using TUBA will likely lead to an overestimation of benefits, whereas in case of accident benefits using COBALT, there might be an underestimation of the benefits. However, given the context and specific data provided, it has been deemed as the most robust approach.
- 3.4.6 The Western alignment has a higher BCR of 3.49 and NPV of £107.9M than the Eastern alignment which has a BCR of 3.0 and NPV of £100.9M. This is due to providing the lowest cost estimate of around £43M for the Western alignment (at 2010 prices). The model runs in SEWTM did not include for a substantial improvement to the A48 Sycamore Cross junction or any improvements to the M4 Junction 34. It would be anticipated that the benefits of the link would increase with these improvements. Further modelling in Stage Three would be able to refine the cost benefit results.
- 3.4.7 The online Options C1 and C2 have not been tested using the SEWTM and thus the comparable benefits are not available. However, the accident and journey time benefits (A to D in the table above) are anticipated to be substantially lower than for Options A and B given the lower standard of the route and the 30mph design speed throughout. The costs of Option C1 is 91% and Option C2 is 62.5% of the cost of Option B (the cheapest and highest performing offline option). The value of benefits would need to be corresponding proportionate for Option C1 and C2 in order to achieve the same BCR as the Western alignment of the offline routes.
- 3.4.8 On the basis of greatest economic advantage, Option B (Highway Route West of Pendoylan) is the best performing option, although it is recognised that economic performance is only one of the elements which must be considered in decision making. With regard to the online options, the overall economic benefits are subsequently considered to be not as high given the lower design speed for both options (30mph) adversely impacting on journey times and the retention of non-compliant DMRB sections throughout both options impacting on journey time reliability.

3.5 Transport Case Summary

- 3.5.1 The summary table of impacts across social, cultural, environmental and economic criteria shows that the two offline highway options perform the same across all aspects of the appraisal. The additional work undertaken as part of the WelTAG Stage Two Plus study has updated the appraisal and identified that the previously identified potential differences in water environment and residential amenity are now assessed to be the same in terms of scoring. However, the commentary on the assessment should be referred to in order to understand minor differences between options. When referring to the details contained in the transport case appraisal tables, the topics of landscape, ecology and cultural heritage anticipate less environmental impacts from the Option B Highway Route West of Pendoylan.
- 3.5.2 Options C1 and C2 perform less favourably than the offline options in respect of the economic, social and cultural criteria. With respect to the environment, the options perform better than the offline options for biodiversity. Option C2 is the least beneficial in terms of social and economic criteria.

- 3.5.3 On the basis of greatest economic advantage, Option B, the offline Western alignment route, is the best performing option, although it is recognised that economic performance is only one of the elements which must be considered in decision making. With regard to the online options, the overall economic benefits are subsequently considered to be not as high given the lower design speed for both options (30mph) adversely impacting on journey times and the retention of non-compliant DMRB sections throughout both options impacting on journey time reliability.
- 3.5.4 The transport case in summary shows Option B, the offline Western alignment route, as being the highest performing option in terms of Value for Money and is anticipated to have the same benefits and impacts as Option A (which are more beneficial than Option C1 or C2), with less environmental impacts anticipated to arise when considering the detail in the appraisal tables.

4 Financial Case

4.1 Overview

- 4.1.1 The financial case *'presents information on whether an option is affordable in the first place and long-term financial viability. It covers both capital and annual revenue requirements over the life cycle of the project and the implications of these for the balance sheet, income and expenditure accounts of public sector organisations.'*

4.2 Option Costs

- 4.2.1 This section sets out the costs in detail of delivering the four highway options. At this stage, the lifetime costs of the options have not been estimated. Costs presented are the implementation costs, including the further development and assessment work required in later WelTAG stages to take the option forward. The costs would fall from the start of Stage Three WelTAG up to and including delivery of the scheme. Costs beyond the scheme delivery would relate to ongoing maintenance and monitoring. The maintenance costs are dependent on the number and characteristics of structures. A commentary is provided.

Cost Build-Up

- 4.2.2 The costing of the options has been developed with the following assumptions:

- The following items have been taken from the average cost of three live projects (based on construction cost value):
 - Preliminaries Offline (25%)
 - Preliminaries Online (50%)
 - Detailed Design (4.5%)
 - Supervision (2%)
 - Contractors Fee (9%)
 - Without NRSWA C2 enquiries to identify the stats involved we have assumed Statutory Undertakers diversion costs of £1.5M. This is based on our experience of other similar schemes, however, C2 enquiries at a later stage will be required to confirm the budget.
 - Based on other projects, Employers Agent fees have been assumed at £1.5M, with an estimated Employers Risk of £2.5M, £3.5M for online options due to the unknown below existing ground level and effects on adjacent buildings, driveways etc.
 - An allowance of £2M has been placed against the Sycamore Cross Junction Improvements.
- A risk item of 14% has been used to build up the cost for the offline alignment options and 20% for the online options. This is due to the unknown access/Statutory Undertakers apparatus and additional risks the online options provide.
- An Optimism Bias (OB) is included of 15% which is based on recommendations from TAG Unit A1.2; OB is used in order for additional junctions/accommodation works that may come about as further investigative and survey works are carried out. It is considered that the 30% used in the previous stage 2 study was relevant, however due to the additional data confirmed (flood modelling and geotechnical desk top study) and the confirmation of junction types, the 30% can be reduced to 15% in line with the above referenced recommendation.
- The costs have been inflated by 7% (3.5%) per year since the scheme was originally budgeted for (2018) and to bring it in line with current day values.
- Employer's risk has been assumed at 9% of the construction cost (same as Stage 2). However, due to unknown archaeology found at Five Mile Lane an additional £1M has been added to the risk.

Bill Items

Preliminaries

- 4.2.3 Using live project rates, a percentage of the estimated construction cost of has been used to establish the amount for preliminaries.

Site Clearance

- 4.2.4 The site clearance has been determined by the extent of the project with boundaries taken to the extent of earthworks. A hedge has been assumed within each parcel of land that the proposed option intersects with, this has been estimated at 30m in length multiplied by the number of parcels.
- 4.2.5 All offline and online options require the removal of properties, the estimated costs of which have been included (plus inflation) and allows for possible asbestos. Further site clearance items have been allowed for and are indicated as items as quantities are unable to be estimated at this stage. For these items, values have been taken from live projects.

Fencing

- 4.2.6 To determine fencing requirements, it has been assumed that the entire length of both sides of the road will require fencing to separate land. Fencing has been assumed to be a Timber Post and Four Rail Fence in accordance with Highways Construction Detail (HCD) HCD/13. Steel gates for Accommodation Works have been allowed for where existing parcels of land have been segregated, this has been determined from analysis of the OS data available.
- 4.2.7 Gates would be in accordance with HCD/H19. Where the road passes a number of houses an element of 4m high Acoustic Fencing has been allowed for.

Road Restraint Systems

- 4.2.8 Safety barrier has been allowed for on both sides of the new carriageway in order to protect cyclists from live running traffic and also protect traffic from embankment areas. It is considered that through further design and the completion of a Road Restraint Risk Assessment Process (RRRAP) assessment the length of road restraint can be reduced.

Drainage

- 4.2.9 Carriageway drainage has been assumed as a drainage channel placed in the verge areas, which will drain to gullies then into a carrier drain below. Cut-off drainage via concrete channels has also been allowed for at back of cycleway in cuttings. Formal drainage outfall points cannot be determined at this stage however, six outfalls have been allowed for with drainage pipes/ headwalls etc. in the cost estimate.

Earthworks

- 4.2.10 Earthworks have been determined using the Ordnance Survey and LiDAR data which has been input into Civils 3D. From this, using 1 in 3 embankments the cut and fill has been determined.

Pavements

- 4.2.11 Pavement calculations have been performed from information obtained from the Five Mile Lane project which indicates poor ground conditions. Taking this into account the greatest depth of sub-base has been allowed within the construction make up of 450mm with a geotextile membrane. Other elements of the pavement make up are as below:
- Surface Course – 40mm thick
 - Binder Course – 60m thick
 - Base Course – 200mm thick
 - Sub-Base – 450mm thick
 - Geotextile membrane

Footway/ Cycleway

- 4.2.12 The footway/ cycleway (where included) has been positioned on the same side of the village of Pendoylan on both proposals, so where the carriageway passes Pendoylan to the east, the footway/ cycleway would be positioned on the west for direct access from the village, and where it passes Pendoylan to the west the footway/ cycleway would be positioned on the east. For Online Alignment Option C1, the footway/ cycleway has been included on the east side of the carriageway.
- 4.2.13 The shared footway/ cycleway has been designed as 3.5m wide and allows for no segregation of pedestrians and cyclists. The vertical and horizontal alignment would follow that of the proposed carriageway option. However, where junctions need to be negotiated, there would be localised amendments to the alignment. This would be identified during the next stage of the project where junctions have been designed and greater knowledge of the surrounding area is understood. The makeup of the footway/ cycleway is assumed to be:
- Surface Course – 40mm thick
 - Binder Course – 60mm thick
 - Sub-base – 100mm thick

Signage and Road Markings

- 4.2.14 An estimate has been allowed for the cost of signs and road markings as £130k (plus inflation) for both offline options and £65k (plus inflation) for the online options, which has been based on similar projects. Carriageway centre line and edge of carriageway ribbed lines have been determined based on the length of road considered.

Lighting and Electricity

- 4.2.15 Lighting has been considered at roundabouts and new junctions only, due to the rural nature of the route.

Lighting of Footway/ Cycleway

- 4.2.16 LTN 2/04 states *'Pedestrians and cyclists dislike using unlit facilities after dark for personal security reasons, particularly when they are located away from well used routes. On facilities alongside existing carriageways, street lighting may be adequate, but old or sub-standard street lighting may need to be replaced to improve conditions to encourage greater use. New lighting may need to be considered on new facilities away from the carriageway. If lighting cannot be provided or is deemed undesirable, a lit on-road alternative should be signed where available. Issues of light pollution should be considered, particularly in rural areas. Adequate lighting and sightlines, and the absence of any hiding places close to the route can help to provide a sense of security for pedestrians and cyclists. This is particularly important for isolated facilities.'*
- 4.2.17 Taking this statement into account and in accordance with Sustrans Guidance 5m high columns have been chosen for the length of the cycleway at 35m centre and included within the cost makeup for each option. It is recommended that due to the close proximity to the proposed carriageway that a risk assessment be carried out during the next stage to ensure that the lighting does not confuse traffic.

Ducting

- 4.2.18 Communication ducting has been allowed for the entire length of new road, with road crossings included where required. This has been included in all options. For the online options an allowance has been made for excavating the existing footpath through Pendoylan to include this communication ducting through the length.

Structures

- 4.2.19 In order to determine the cost of the structures, the square area costs have been calculated from a live project of a similar type bridge to that required. This square area cost has then been multiplied by the estimated square area for each bridge. Structures have an assumed headroom clearance of

5.3m above existing ground level with an estimate of 0.7m on top to allow for the structure construction depth.

Accommodation Works and Statutory Undertakers

4.2.20 A percentage cost for Accommodation Works has been determined from the average of three live projects. Due to the current stage of the project, we are unable to determine the extent of Statutory Undertakers works required and any accommodation works due to unknown landowner and extents of land owned by others. Therefore, an amount of £1.5M (plus inflation) has been allowed for Statutory Undertakers Works with a 3% value of the construction cost allowed for Accommodation Works. For the online options it is expected that the diversion costs will be greater than that of the offline options due to the positions the apparatus are in, therefore an allowance of £3M (plus inflation) has been made.

Landscaping and Environmental Works

4.2.21 A percentage cost for Landscaping and Environmental Works has been determined from the average of three live projects, due to the current stage of the project it is difficult to calculate actual costs, therefore it was considered that a percentage allowance of 1.84% would be the best way to inform the cost.

Inflation

4.2.22 The inflation included within the costs allows for the increase from September 2017 (Stage Two original estimate) up to current day value. The estimate does not include inflation going forward.

Land Costs

4.2.23 The cost of land has been determined using the estimate included within the Five Mile Lane tender and prorating this estimate in accordance with the length of the alignment options.

4.3 Option Cost Summary

4.3.1 The costs of each of the highway options is summarised in Table 24. A design summary is provided in Table 13 with detailed cost summaries provided in [Appendix G](#) for each option.

Table 24 Option Cost Summary

Element	Option A Highway Route East of Pendoylan	Option B Highway Route West of Pendoylan	Option C1 Existing Infrastructure (Online) Enhancement	Option C2 Existing Infrastructure (Online) Enhancement
Current Day Construction Cost	£41.017M	£34.370M	£28.969M	£16.976M
Current Day Total Scheme Cost	£76.844M	£66.332M	£59.844M	£40.513M

4.4 Funding and Accounting Implications

4.4.1 There are no certainties with respect to funding sources for taking the highway options forward at present. Funding would be required for scheme design and development from Welsh Government, and this has not specifically been confirmed to be available at the current time. However, whilst no funding is specifically identified for scheme delivery, a connection from the M4 Junction 34 to the A48 is named in the National Transport Finance Plan as updated in December 2018 as *Improving Vale of Glamorgan Connectivity* Scheme NEW 3. This relates to the funding of the WelTAG study rather than a commitment to the delivery of the project.

4.4.2 It is assumed that the scheme would be delivered by the Vale of Glamorgan Council with funding support from Welsh Government and potentially from the City Deal. If any public-sector borrowing is undertaken for the project, it is assumed that this would be paid back over time by the local authority. There may be potential for some private contributions from strategic developments via Section 106 agreements, and this would need to be explored.

4.4.3 On-going revenue costs of maintaining the scheme are assumed to be met by the Vale of Glamorgan Council through highways maintenance budgets. The costs of the scheme and ongoing costs are assumed to be captured on the Council’s budget accounting procedures, although the source of grant funding would also fall on the grant body (e.g., Welsh Government).

4.5 Financial Case Assessment

4.5.1 The financial case for all options is summarised in Table 25.

Table 25 Financial Case Assessment

Options	Lifetime Costs of the Project	Source of Funding	Accounting Implications	
All Options	High initial capital costs to deliver a new highway route. Revenue implications are likely to exist throughout the lifetime of the project in terms of maintaining the asset, with the potential to adversely impact on the increasingly stretched local authority revenue budgets.	Local transport fund (capital) Welsh Government (capital and revenue)	Capital	Welsh Government Local Authority Cardiff Capital Region City Deal
		Local authority funding (capital and revenue) Road safety grant (capital) Cardiff Capital Region City Deal		Revenue

5 Commercial Case

5.1 Overview

- 5.1.1 The commercial case covers *‘whether it is going to prove possible to procure the scheme and then to continue with it in the future.’* The case considers the level and type of involvement from the private sector, as well as potential effects on the on-going viability of the option/ scheme.

5.2 Procurement Strategy

Full Business Case and Consents

- 5.2.1 A WelTAG Stage Three study would need to be commissioned to progress development of the full business case for the preferred option. Concurrently, the scheme would be designed to preliminary level and an EIA would be prepared together with all documents for a planning application. The study would need to undertake the relevant environmental and topographical surveys, together with a ground investigation assessment to support progression of the preferred route option. In addition, the business case would need to be refined with further transport modelling to test the final scheme and junction arrangements and provide an update to the cost benefit analysis. A wider economic impact assessment should also be undertaken.
- 5.2.2 At this stage it is anticipated that the Vale of Glamorgan Council would procure the WelTAG Stage Three, preliminary design and EIA study via competitive tender or framework, however the proposed procurement strategy is subject to confirmation.

Scheme Implementation

- 5.2.3 Upon completion of the WelTAG Stage Three Study and taking the project through the statutory processes a consultant, contractor or a combination of both would be required to take the project forward through the Detailed Design, Construction and Aftercare. Alternatively, the employer could utilise one of the options below (excluding option C) to complete the WelTAG Stage Three assessment and follow up with taking the scheme through the statutory process. The different procurement options available for this are outlined below:
- **Early Contractor Involvement (ECI)** | Under ECI, the Contractor is appointed under a two-stage design and build Engineering and Construction Contract (ECC) before the final scheme design has been fully developed and priced. The ECI contractor (usually in partnership with a designer) takes the project through the Preliminary Design/Statutory Process (Key Stages 3 & 4) and into Key Stage 6 where the contractor completes the detailed design and construction of the works. This form of procurement misses out the Key Stage 5 element because the contractor is already on board. This procurement method has its advantages where the project is of a larger scale and some aspects of the construction are complex. In this procurement method the contractor would be responsible for the design of the works.
 - **Build Only (Employer’s Design)** | Under an Employer’s Design Contract, the Employer employs a consultant under a Professional Services Contract (PSC) who takes the project through the design and statutory process (Key Stages 3 & 4). The Consultant would be required to progress the design through the detailed design stage (Key Stage 6) once the contractor is employed on a construct only contract to complete the construction works. This procurement method is more suited to the smaller simpler type of projects whose scope is very clearly defined and where a contractor wouldn’t have much to bring to the design stages. In this procurement method the Employer would be responsible for the design of the works.
 - **Design and Build (Employer’s Design)** | Under an Employer’s Design Contract, the Employer employs a consultant under a Professional Services Contract (PSC) who takes the project through the design and statutory process (Key Stages 3 & 4). Upon completion of the statutory process contractors tender for the work under a design and build contract, which would be let during Key Stage 5. This procurement method is more suited to more straightforward medium size projects that contain elements of the design that could be refined through value engineering

by a design and build contractor. In this procurement method the design and build Contractor would be responsible for the design of the works.

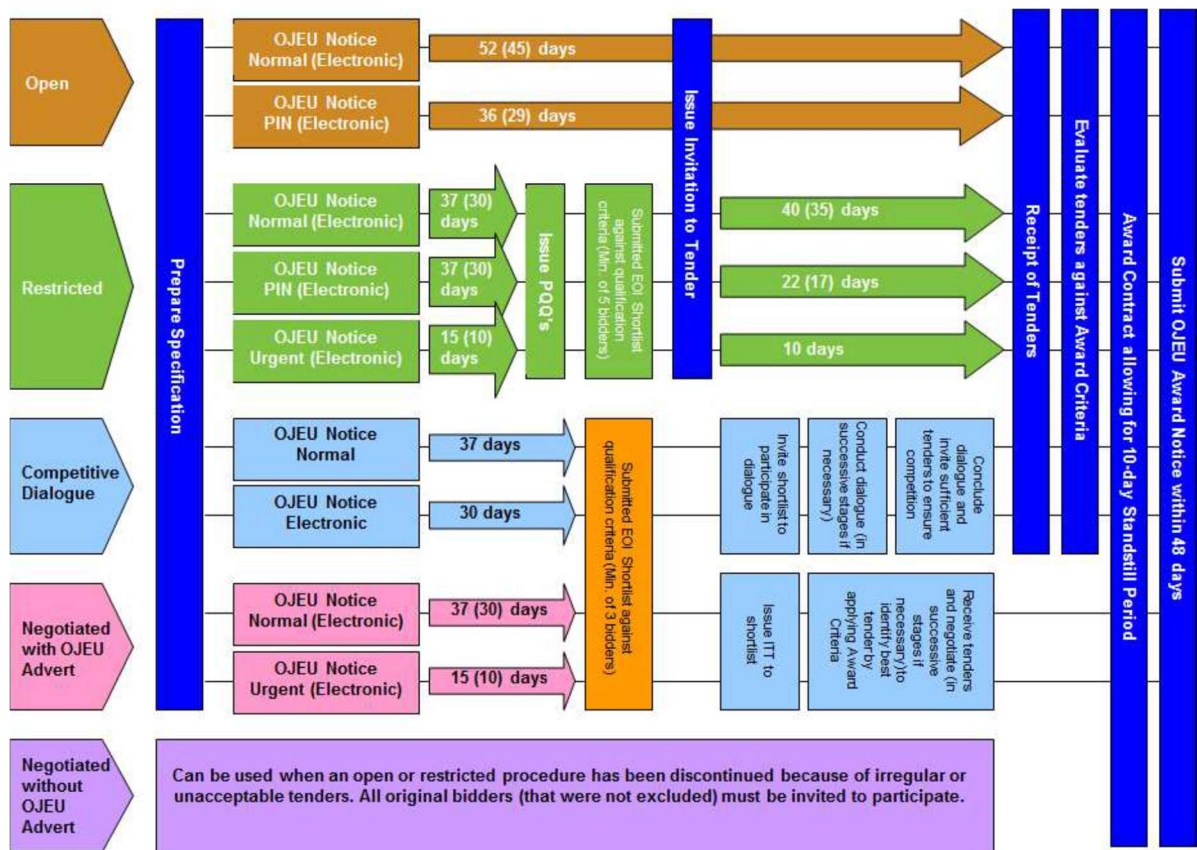
5.3 Contract Type

5.3.1 Depending on which of the above options chosen, depends on what type of contract will be used. For all options, it is recommended that one of the options from the NEC ECC suite of contracts is used, ideally a Target Cost option (ECC Option C) which provides the client and chosen consultant/contractor with a fair allocation of risk and also allows for a fair pain/gain result. Due to the nature of the project, it is not advised to use a Bill of Quantities option (ECC Option B) as this would place the client at risk due to unknown quantities. For the design and Build contract either ECC Option A (Activity Schedule) or Option C would be recommended.

5.4 Procurement Process

5.4.1 The procurement process for the Detailed Design, Construction and Aftercare should comply with the corresponding UK Public Contract Regulations 2015 and aligned with the Welsh Government Key Stage Approval process. Given the estimated contract value, an OJEU Prior Information Notice (PIN) would need to be published, giving potential bidders notification of the proposed contract. The PIN will detail the scope of works along with the cost estimate of the scheme. The procurement strategy adopted would follow the OJEU Restricted process as set out in Figure 4. This would mean that potential bidders for the work would need to complete and submit a Pre-Qualification Questionnaire (PQQ).

Figure 4 OJEU Process⁶



⁶ Source: <http://www.hacw.nhs.uk/our-services/procurement/ojeu-tenders/>

- 5.4.2 Bidders who successfully completed the PQQ process would then be invited to tender for the works in accordance with the procurement method whether it be an ECI, Build Only or Employers Design and Build contract.

5.5 Suppliers

- 5.5.1 The Employer can insert additional clauses into the contract which stipulates that the employed contractor/ consultant should use make use of local resources/materials/suppliers where possible. A percentage of overall costs may also be inserted into the contract which ensures the employed contractor/ consultant complies with the relevant clauses and uses all local resources/ materials/ suppliers.

5.6 Contract Length

- 5.6.1 Within the Contract Notice, the duration of the chosen contract is estimated by providing a given an estimated start and end date. In addition, the contract would be likely structured around key stages, aligned to Welsh Government's Transport Division's linear Key Stage Approval process which is used to obtain approval for projects through all stages of design, construction and aftercare.

5.7 Allocation of Risk

- 5.7.1 The identification of risks would need to be covered in a Project Risk Register following Risk Workshops conducted throughout the project design stage and further in the construction stage. Allocation of risk would also be specified in the chosen contracts, utilising contract conditions and any additional clauses required by the Employer.

5.8 Payment Mechanisms

- 5.8.1 The chosen contract will stipulate what the payment mechanisms/arrangements are for each stage. However, the employer may make amendments to these payment process to suit their requirements, any amendments will be detailed in the relevant contract documents. If a Target Cost contract is utilised a pain / gain mechanism would need to be developed identifying the necessary, share. Therefore, any over-spend or under-spend is shared between the Employer and Consultant/Contractor in accordance with these share ranges.

5.9 Whole Life Costs

- 5.9.1 There would be on-going revenue support required for each of the options. It is however also anticipated that the delivery of a new offline highway route between the M4 Junction 34 and the A48 would have the potential to adversely impact on existing maintenance budgets which are already under considerable pressure.

6 Management Case

6.1 Overview

- 6.1.1 The management case considers the delivery arrangements for the project and how the project is going to be managed through its lifetime. The management case shows the project is achievable and identifies the different arrangements put in place to deliver the project.

6.2 Project Plan

- 6.2.1 How the project is to be delivered is to be determined at the next stage, however the three options available are to Procure an ECI Contractor, procure a Build Only Contractor and a separate designer to conduct the employers design or to Procure via a Design and Build Contract.
- 6.2.2 Early Contractor Involvement (ECI) – design and build contract using the NEC Professional Services and Engineering Construction target cost Contracts. These types of contract have been successfully used on a number of schemes including the A40 Penblewin to Slebech Park, A477 St Clears to Red Roses and A487 Caernarfon and Bontnewydd Bypass.
- 6.2.3 As mentioned above, which ever procurement method is chosen, the project would align with the Welsh Government Approvals Process. The KSA process provides a staged financial approval system to manage the process of projects from inception, through to construction and initial maintenance and complies with the principles of PRINCE2 project management.

6.3 Legal Requirements

- 6.3.1 The Scheme will be required to conform to all legal requirements and would be delivered under the Highways Act 1980 and Acquisition of Land Act 1981, giving powers to the Local Authority to make orders with respect to side roads and compulsory purchase of land. A planning application would be made under the Town and Country Planning Act 1990 to give consent for the development, which would be accompanied by an Environmental Statement. Design and construction of the project should be undertaken with due consideration of the following:
- Construction (Design and Management) Regulations 2015
 - Equality Act 2010
 - Active Travel (Wales) Act 2013
 - The Wellbeing and Future Generations (Wales) Act 2015
 - Wales Act 2017 and Welsh Language Standards (Welsh Ministers, County and County Borough Councils, and National Park Authorities) Regulations 2015
 - The project should also conform to all EU and UK Environmental Legislation

6.4 Governance

Organisational Structure

- 6.4.1 Depending on the type of procurement method used for further design and construction, the anticipated core parties involved in the delivery of the project would be:
- **The Employer** | Representing the Vale of Glamorgan Council.
 - **The Employer's Agent** | Acting as the Vale of Glamorgan Council's representative, providing financial, project management, contract and technical advice throughout the project.

ECI Contract

- 6.4.2 ECI Contractor – commissioned to develop the outline design, undertake EIA, prepare the required drawings and documents for planning approval, undertake the required public consultation and if successful then to undertake the detailed design, construction and aftercare of the project.

- 6.4.3 ECI Contractor's Designers – employed by the ECI Contractor to carry out the preliminary environmental and engineering design for the preferred route and consents and orders process, and to complete detailed design.

Design and Build Contract (Employer's Design)

- 6.4.4 Designers – commissioned by the Employer to carry out the preliminary environmental and engineering design for the preferred route, as well as undertake all activities necessary for the consents and orders process.
- 6.4.5 Design & Build Contractor – commissioned to undertake the detailed design, construction and aftercare of the project.

Build Only (Employer's Design)

- 6.4.6 Designers – commissioned by the Employer to carry out the preliminary environmental and engineering design for the preferred route, as well as undertake all activities necessary for the consents and orders process, and to complete detailed design.
- 6.4.7 Build Only Contractor – commissioned by the employer at Key Stage 6 to carry out the construction of the works based on the employer's detailed design.

6.5 Project Reporting

- 6.5.1 The project would be managed following the principles of the PRINCE2 project management process combined with a compatible web-based project management system. The Key Stages of the project will form the Stage Boundaries within PRINCE2 and will require Project Board approval.
- 6.5.2 The project will be led by the Vale of Glamorgan Council as the Employer.

6.6 Communications and Stakeholder Management

- 6.6.1 To ensure the management of stakeholders and communication on the project is managed correctly, a Communications Plan should be drafted which identifies how all communications between project team members and external parties will be managed. All parties adhering to the communications plan should ensure that the needs of the Employer are met, and the project is delivered successfully.

6.7 Risk Management

- 6.7.1 Risk will be managed on the project in accordance with the procedures set out in the latest version of the Value for Money Manual – Risk Analysis and Management. A risk workshop should be conducted early in the next stage of the project (WelTAG Stage Three). A Risk Register should then be developed and reviewed and updated (where required) as a minimum every 3 months throughout the project's duration.

6.8 Monitoring and Evaluation

- 6.8.1 Monitoring that would be required to be undertaken during the life of the project is outlined below:
- Environmental aftercare
 - Annual Environmental Performance and Monitoring Report (AEPMR)
 - Health and Safety File
 - Safety audits following completion of design and then construction works
- 6.8.2 WelTAG 2017 includes the requirement for a detailed monitoring and evaluation plan to be drawn up in Stage Three. This plan would describe what evidence would be used in the project's evaluation report and how it will be collected. Evidence is required on the actual inputs used when implementing the scheme and during its on-going operation, what was actually delivered, the impacts experienced, to what extent the intervention met its objectives and how they were achieved.

7 Conclusions and Recommendations

7.1 Introduction

- 7.1.1 The WelTAG Stage Two Plus report has developed and appraised options to address the study objectives and thereby counter the problems identified and contribute to the goals of the Well-being of Future Generations (Wales) Act 2015, together with Welsh Government strategies and outcomes.
- 7.1.2 This represents an Outline Business Case, for which a quantitative assessment of the value for money of the scheme, and appraisal of the social, environmental, cultural and economic impacts has been undertaken.
- 7.1.3 At the end of WelTAG Stage Two the guidance sets out that the report should:
- Determine whether there are any transport options that can address the issues identified, contributes positively to the well-being goals and objectives, and can be delivered within technical and financial constraints.
 - Select a preferred option to be taken forward to Stage Three.
 - Agree the methods to be used to provide additional evidence where required for Stage Three.
 - Identify any legislative requirements that need to be met during Stage Three.
 - Document the decisions of the Stage Two Review Group, and the basis for these decisions.
- 7.1.4 The Stage Two Plus report follows on from the previous Stage Two report and the Review Group recommendations to undertake additional investigations to inform the decision-making process.

7.2 Preferred Transport Options

Do-Minimum

- 7.2.1 The Outline Business Case has considered the Do-Minimum situation and identified the relative changes from the do-something options in comparison. Without an intervention, traffic conditions on the corridor are anticipated to worsen, with significant forecast increases in traffic on the strategic and local road network with deterioration in the transport network performance and more accidents. The transport problems are likely to impact on development aspirations for the area and the attractiveness of the Vale of Glamorgan as a place to work, live and invest.

Offline Options (A and B) Eastern and Western Alignments

- 7.2.2 Following the appraisal of the four options against the Do-Minimum scenario, it is considered on the basis of the available information that the offline options are able to more comprehensively address the issues identified, can contribute positively to well-being goals and objectives and pending further investigations, are likely to be deliverable within technical and financial constraints.
- 7.2.3 An offline strategic link between the M4 Junction 34 and the A48 offers potentially substantial benefits in terms of connectivity and appears to represent high value for money. The two offline highway options vary in terms of cost with the Western alignment estimated to cost less, primarily as the cut and fill balance (earthworks) is more favourable than that of the Eastern alignment. In addition, and whilst the WelTAG Stage Two Plus assessment has demonstrated that the Eastern alignment option would not impact the River Ely flood plain, it is expected that the ground conditions will be less favourable given the proximity to the river catchment area and cost allowances have been made accordingly.
- 7.2.4 The transport case summary appraisal table (Table 21) shows that the Eastern and Western highway options perform similarly in terms of the social, environmental, cultural and economic assessment. The differences are slight with the following key factors noted:
- On the basis of greatest economic advantage, the Western alignment is the best performing option with a BCR score of 3.49 compared to 3.0 for the Eastern alignment, although it is

recognised that economic performance is only one of the elements which must be accounted for in decision making. In addition:

- The level of journey time savings to users' totals £138M through the provision of a link, as forecast using the traffic model, which represents a substantial beneficial improvement.
- A qualitative appraisal of the wider economic benefits has also been considered, which identifies benefits including the potential for additional strategic development arising due to improved connectivity to the airport and businesses, beneficial labour supply impacts by improving connectivity between the employment sites and population centres and the potential relocation of more productive jobs to the area, again as a result of enhanced connectivity. Moreover, productivity in the Cardiff Capital Region is very low compared to other UK City Regions, so improving connectivity to the Vale of Glamorgan may form part of a package of measures to address this.
- The adverse impact on properties is broadly similar between the two offline options and would require further detailed assessment and consideration at the next stage of assessment to establish full impacts and mitigation.
- The environmental impacts are broadly similar between the East and West alignments, although slight differences have been identified that suggest the Western alignment would establish less of an impact on the environment.
 - The two offline highway options feature many of the same important ecological features and, from what can be determined from the currently available data, are similar in ecological value. However, the Eastern alignment option does have the greater ecological impact due to the slightly higher number of SINC's, larger area of species-rich Marshy grassland (likely to be classed as a Priority Habitat) and greater number of hedgerows to be impacted. It is anticipated at this stage that the impacts can be mitigated via the implementation of standard techniques in accordance with best practice guidelines. Further ecological surveys would be required at the next stage of assessment to fully establish baseline conditions within the study area, allowing for the accurate and complete assessment of impacts and the design of an appropriate mitigation strategy for the scheme.
 - The Western alignment would impact known non-designated assets (a lime kiln, a quarry and two non-extant field boundaries), although would have a lesser impact on cultural heritage with less of an impact on extant historic landscape features and on the setting of designated heritage assets, whilst the eastern option would impact existing medieval strip fields and a greater number of key views from the Pendoylan Conservation Area.
 - Due to there being no significant impact in the southern area of interest (where the Eastern alignment aligns in close proximity to the River Ely floodplain) there is no obvious preference for either of the offline alignments from a flood risk perspective.
 - In terms of the effect on landscape and townscape character there is little to differentiate between the two offline options. Both options will establish a moderate adverse corridor of disturbance running from the M4 Junction 34 to the A48 and require the felling of trees and the removal of hedgerows, together with some disruption of the field pattern. It is considered that the greatest impacts will be during the construction stage but will be of relatively short duration. The Western alignment does require two bridges to cross over the existing Pendoylan road, although once replacement planting/ mitigation is established, adverse impacts on the landscape are anticipated to be reduced for both offline options in the long-term. Further detailed assessment would be required at the next stage of appraisal.
 - Slight adverse impacts have been identified for noise and air quality, both of which would require detailed appraisal at the next stage of assessment.
 - Slight positive impacts have been identified with regard to greenhouse gasses, whereby the change in greenhouse gas emissions with the road link (compared to the Do-Minimum) has been calculated as an output of the traffic modelling. This gives a benefit valued at £1.1M.

The reduction in emissions will be based on the reduced overall journey distances and it is recognised that the appraisal is based on emissions from vehicles only and wider carbon impacts (embodied in materials for example) would need to be appraised as part of an EIA.

- For the purposes of the WelTAG Stage Two Plus study, an early phase Geotechnical Feasibility Desk Study (10028657-ARC-XX-XX-RP-GEO-0001) has been completed by Arcadis specialists for the study area and presents the findings of a high-level desk-based review of publicly available information. With regard to a preference of alignment at this stage for the offline route proposals, the ground conditions on the Western route around Pendoylan are more favourable being Glacial Till rather than less favourable Alluvium on the Eastern route. The Western route is also further away from the River Ely, associated tributaries and river valley itself which is more favourable topographical and from a groundwater interaction perspective.
- The implementation of a DMRB compliant single carriageway road with a national speed limit and integral walking and cycling infrastructure demonstrates extensively positive change with regard to social impacts for both the East and West alignments.
 - For access to employment, the traffic modelling completed to assess the route option has quantified user and provider benefits (£000's PVB 2010 prices discounted to 2010) for the new link totalling £36M for commuters and £52M for business.
 - For access to services, the traffic modelling completed to assess the route option has quantified user and provider benefits (£000's PVB 2010 prices discounted to 2010) for the new link totalling £49.8M for other consumers than commuters or business.
 - The completion of WebTAG Social Impact Appraisals (TAG Unit A4.1) has identified further beneficial impacts for journey quality, security and severance, whilst additional benefits are also anticipated for physical activity with specific regard to the integral walking and cycling infrastructure.
 - The traffic forecasting has enabled a calculation of accident benefits using the DfT software COBALT. The results show positive scheme benefits with a reduction in accident cost of £16.6M, over the 60-year period in 2010 prices. The analysis also shows that the scheme will reduce 446 accidents, which is a significant reduction of 9% compared to the Do-Minimum.
- Whilst no discernible benefit is realised for the Welsh language (as a consequence of scheme implementation), the study considers moderate benefits to cultural facilities with improved strategic connectivity between the M4 and A4119 corridors and the cultural attractions of the coast, including Barry Island, Porthkerry Country Park and the beaches.

Online Options (C1 and C2)

7.2.5 Option C1 and Option C2 perform less favourably than the offline options in respect of the economic, social and cultural criteria. With respect to the environment, the options perform better than the offline options for biodiversity. Option C2 is the least beneficial in terms of social and economic criteria.

7.2.6 It is noted that due to the constraints on the village environments through Pendoylan village and Clawdd-Coch, both online enhancement proposals terminate either side of these settlements. The existing road sections through Pendoylan and Clawdd-Coch would not therefore be upgraded and would remain non-compliant to DMRB design standards. In addition, and regardless of the 30mph design speed and implementation of some offline sections, new road sections of Online Alignment Option C2 also remain non-compliant to DMRB standards due to the horizontal and vertical curvature of the existing road and would raise issues regarding road safety compliance.

7.2.7 **On the basis of the appraisal of options, it is considered that the Western alignment is the preferred option for further consideration, given in particular that the alignment performs more favourably than the online options, achieves the greatest economic advantage and is considered to establish less of an impact on the environment of the two offline options.**

7.3 Consultation on Options

WelTAG Stage Two

- 7.3.1 Following preparation of the original draft WelTAG Stage Two report (10013270-ARC-XX-XX-RP-TP-0001; Version D01; March 2018), consultation took place with stakeholders and the public on the two online options between April and July 2018, including three days of public exhibition where members of the study team and Vale of Glamorgan Council officers were available to discuss the study with attendees. The responses received to the consultation from the various sources (online, paper survey forms and written emails and letters) were provided to Arcadis. These responses were analysed, and a Consultation Report was prepared. In preparing the WelTAG Stage Two Plus report, the consultation responses have been considered and have led to refinements to the highway alignments where possible, as well as consideration of the online option.

WelTAG Stage Two Plus

- 7.3.2 A further public consultation exercise has since been completed to support consideration of the WelTAG Stage Two Plus options. In response to the COVID-19 pandemic, the consultation was completed virtually between 30th September 2020 and 23rd December 2020. Feedback stemming from the consultation has been captured as part of a standalone Consultation Report, including consideration of several key themes following concerns and comments raised by members of the public.

7.4 Recommendations | Next Steps

- 7.4.1 On the basis of the Stage Two Plus study appraisal, it is considered that Option B (Highway Route West of Pendoylan) has merit in being taken forward for further consideration in a Stage Three WelTAG, based on the potential social, cultural and economic benefits and value for money identified in this Outline Business Case, whilst recognising that the alignment is anticipated to give rise to significant effects on the environment.
- 7.4.2 However, in response to the concerns and issues raised as part of the public consultation exercise, it is recommended that all options are taken forward for further WelTAG Stage Two analysis. Whilst completion of further analysis is subject to funding and consideration by the Vale of Glamorgan Council, it is anticipated that the additional assessment would encompass the following key activities:
- Review the case for change, taking into further consideration the Welsh Government and Vale of Glamorgan Council climate emergency declarations and emerging impacts of COVID-19.
 - Update SEWTM traffic modelling and economic appraisal, encompassing a value for money assessment and consideration of changes to TAG Databook v1.14 and the July 2020 Office for Budget Responsibility forecasts, which considers COVID-19 impacts.
 - Local junction traffic modelling (Sycamore Cross, M4 Junction 34 and new/ existing junctions interconnecting with offline options).
 - Completion of a designing out Carbon Workshop and Carbon Assessment and Climate Resilience Report.
 - Health Impact Assessment and Equality Impact Assessment.
 - Update Impacts Assessment Report.
 - Update WelTAG Stage Two Plus Outline Business Case report.

7.5 WelTAG Stage Three

- 7.5.1 A decision on whether to ultimately go forward to Stage Three with a recommended option is a matter for the Review Group and Vale of Glamorgan Council to make on completion of WelTAG Stage Two. As set out in the guidance, the Stage Three WelTAG study purpose *'is to make a full and detailed assessment of the preferred option to inform a decision as to whether or not to proceed to*

implementation. It should therefore be noted that until such time as a Review Group and the local authority has considered the outcomes of a Stage Three study, and the statutory planning processes have taken place, no decision would be made to deliver a scheme.

- 7.5.2 The guidance on Stage Three notes that the detailed design and appraisal work should be used to refine the design and to inform any complementary measures that are needed in order to more fully realise the benefits of the proposal and seek to maximise contribution to the well-being goals, whilst helping to mitigate any adverse impacts and resolving potential conflicts. The completion of Stage Three will provide much of the information needed for applications to funding organisations and any mode-specific appraisal procedures. The Stage Two Plus study has involved provision of more detail on a number of aspects that might normally be undertaken as part of Stage Three but used to inform the decision-making process.
- 7.5.3 The Stage Three will require the preparation of a full business case and an Environmental Statement (ES) based on the undertaking of an EIA. Subject to the business case and EIA, a planning application would be submitted, and orders made under the Highways Act 1980 to deliver the scheme, which would be subject to a public inquiry.
- 7.5.4 Whilst the scope of the ES would be formally agreed during the process, it is anticipated that it would be undertaken in accordance with DMRB Guidance⁷ which requires consideration of the following topics:
- Air Quality
 - Cultural Heritage
 - Landscape and Visual Effects
 - Biodiversity
 - Geology and Soils
 - Material Assets and Waste
 - Noise and Vibration
 - Population and Human Health
 - Road Drainage and Water Environment
 - Climate
- 7.5.5 Subject to a decision on moving forward for further work on a recommended option, a WelTAG Stage Three study with the EIA would need to include the aspects set out below. This can be undertaken in a stepped way with surveys undertaken to clarify risks and impacts as a first stage, which would make prudent use of public resources.

Surveys and Investigations

- 7.5.6 A full programme of environmental surveys and investigations would need to be undertaken, agreed through the EIA scoping process. Further surveys which would help to de-risk the scheme include:
- Phase 2 habitat surveys of the corridor including woodland habitats to identify potential for protected species.
 - Devise and undertake a programme of ecological surveys including European protected species and ancient woodland surveys, agreeing scope with County ecologists and NRW.
 - Undertake a desk top study of archaeological remains and identify requirements and undertake further investigations including geophysical surveys and potentially trial trenching.

⁷ https://standardsforhighways.co.uk/dmrb/search?discipline=SUSTAINABILITY_AND_ENVIRONMENT

Design Considerations

- 7.5.7 The Stage Two Plus design is concept based on known information. For a Stage Three, topographical survey information would be required together with information on land ownership boundaries and constraints. The design up to the planning stage should consider the following:
- Design of the junctions including A48 Sycamore Cross, roundabout access for Peterston-Super-Ely and the Hensol junction.
 - Minimising visual and noise intrusion through landscaping and other mitigation measures.
 - Ecological mitigation.
 - Drainage and water quality mitigation.
 - Archaeological mitigation.
 - Consideration of carbon impacts and measures to achieve gain through construction design and mitigation.
- 7.5.8 In addition, there are concerns regarding the congestion issues at Weycock Cross. There would be advantages in considering the feasibility of linking from Five Mile Lane to a location on the A4226 west of the Weycock Cross roundabout. This could assist in maximising the strategic benefits of a link from the M4 Junction 34.

Business Case

- 7.5.9 At Stage Three there is a need for the preparation of a Full Business Case with a revised economic appraisal. The updated version of the SEWTM Base Year and Reference Case should be used to test a refined scheme taking account of updated developments and transport schemes, including:
- A Do-Minimum model run incorporating updated transport network changes and any changes in development proposals in the area.
 - A do-something option with the stagger removed from the A48 Sycamore Cross junction and junction provision on the route following design revisions.
 - Incorporation of improvements at the M4 Junction 34 as considered in a separate WelTAG study for M4 Junction 33 to Junction 35.
 - Inclusion of a link from Five Mile Lane to the west of Weycock Cross (to be confirmed).
 - Updated costs based on the revised option.

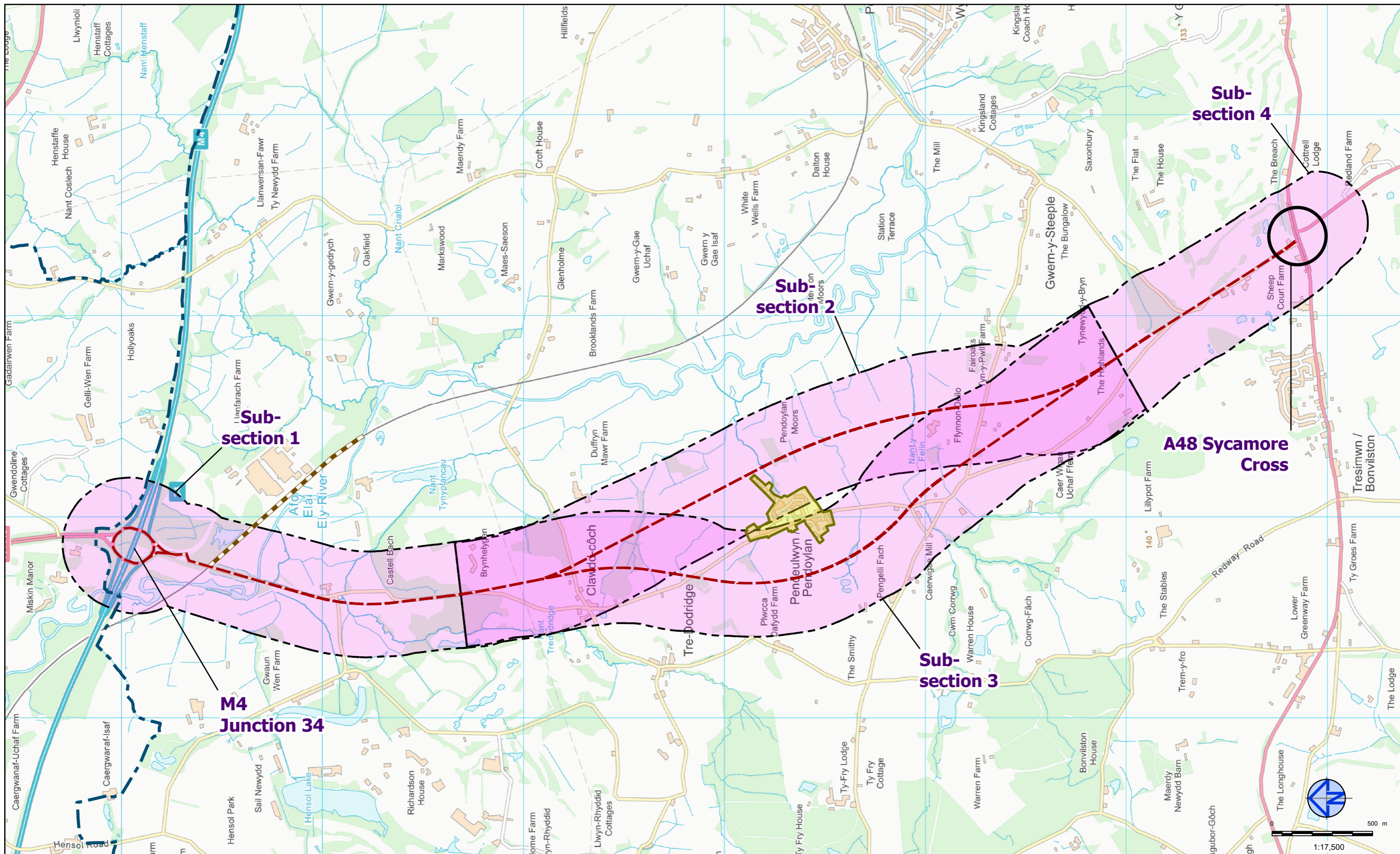
Glossary of Terms and Acronyms

AADT	Annual Average Daily Traffic
AEPMR	Annual Environmental Performance and Monitoring Report
AMCB	Analysis of Monetarised Costs and Benefits
BCR	Benefit Cost Ratio
CAA	Civil Aviation Authority
CCTV	Closed Circuit Television
COBALT	COst and Benefit to Accidents – Light Touch
DfT	Department for Transport
DMRB	Design Manual for Roads and Bridges
D&B	Design & Build
EAP	Economic Action Plan
ECI	Early Contractor Involvement
ED	Employers Design
EIA	Environmental Impact Assessment
EU	European Union
EZ	Enterprise Zone
FCA	Flood Consequence Assessment
GRIP	Guide to Rail Investment Process
GVA	Gross Value Added
HCD	Highways Construction Detail
HGV	Heavy Goods Vehicle
KPH	Kilometres per Hour
KS	Key Stage
LDP	Local Development Plan
LiDAR	Light Detection and Ranging
LTN	Local Transport Note
MPH	Miles per Hour
NO2	Nitrogen Dioxide
NRW	Natural Resources Wales
NPV	Net Present Value
NRSWA	New Roads and Street Works Act 1991 (and amendments)
NTEM	National Trip End Model
OB	Optimism Bias
Offline	Separate work to construct new sections of road away from the existing road alignment
Online	Improvements to the existing road
OJEU	Official Journal of the European Union

OS	Ordinance Survey
PA	Public Accounts
PBA	Peter Brett Associates
PIN	Prior Information Notice
PQQ	Pre-Qualification Questionnaire
PRINCE2	PRojects IN Controlled Environments
PRoW	Public Right of Way
PVB	Present Value of Benefits
RCT	Rhondda Cynon Taf
RRRAP	Road Restraints Risk Assessment Process
SEWTM	South East Wales Transport Model
SINC	Site of Nature Conservation
SOA	Strategic Opportunity Areas
SSSI	Site of Special Scientific Interest
SWML	South Wales Main (Railway) Line
TEE	Transport Economic Efficiency
UK	United Kingdom
VOG	Vale of Glamorgan
WebTAG	Web-based Transport Analysis Guidance
WelTAG	Welsh Transport Appraisal Guidance
WFD	Water Framework Directive
WTS	Wales Transport Strategy

Appendix A

Study Area



REV	Date	Description	Drawn	Check	Approv

Notes :
Contains OS data © Crown Copyright OS VectorMap® District 320

Legend :

- Proposed route options
- Passing loop
- Sub-sections study area and overall study area
- Unitary Authority Boundaries
- Settlement boundary

Client

VALE of GLAMORGAN

Vale of Glamorgan Council

Site
 Vale of Glamorgan Council
 Civic Offices
 Holton Road
 Barry
 CF63 4RU
 01446 700111
 www.valeofglamorgan.gov.uk

Suitability Description:
Issued for information

Designed	M. Azzopardi	Date	13 OCT 2020	Signed	
Drawn	M. Azzopardi	Date	13 OCT 2020	Signed	
Checked	M. Fry	Date	13 OCT 2020	Signed	
Approved	M. Fry	Date	13 OCT 2020	Signed	
Scale:	1:17,500	Datum:	AOD		
Original Size:	A3	Grid:	OS		
Suitability Code:	S2	Project Number:	10028657		

PROJECT:
M4 Junction 34 to A48
WelTAG Stage Two
- Highway Link Study

TITLE:
Study Area
Overall Sub-Sections

ARCADIS Design & Consultancy
for natural and built assets

Registered office: Arcadis House
34 York Way,
London
N1 9AB

Coordinating office: Arcadis Cymru House
Fortran Road
St Mellons, Cardiff
CF3 0EY

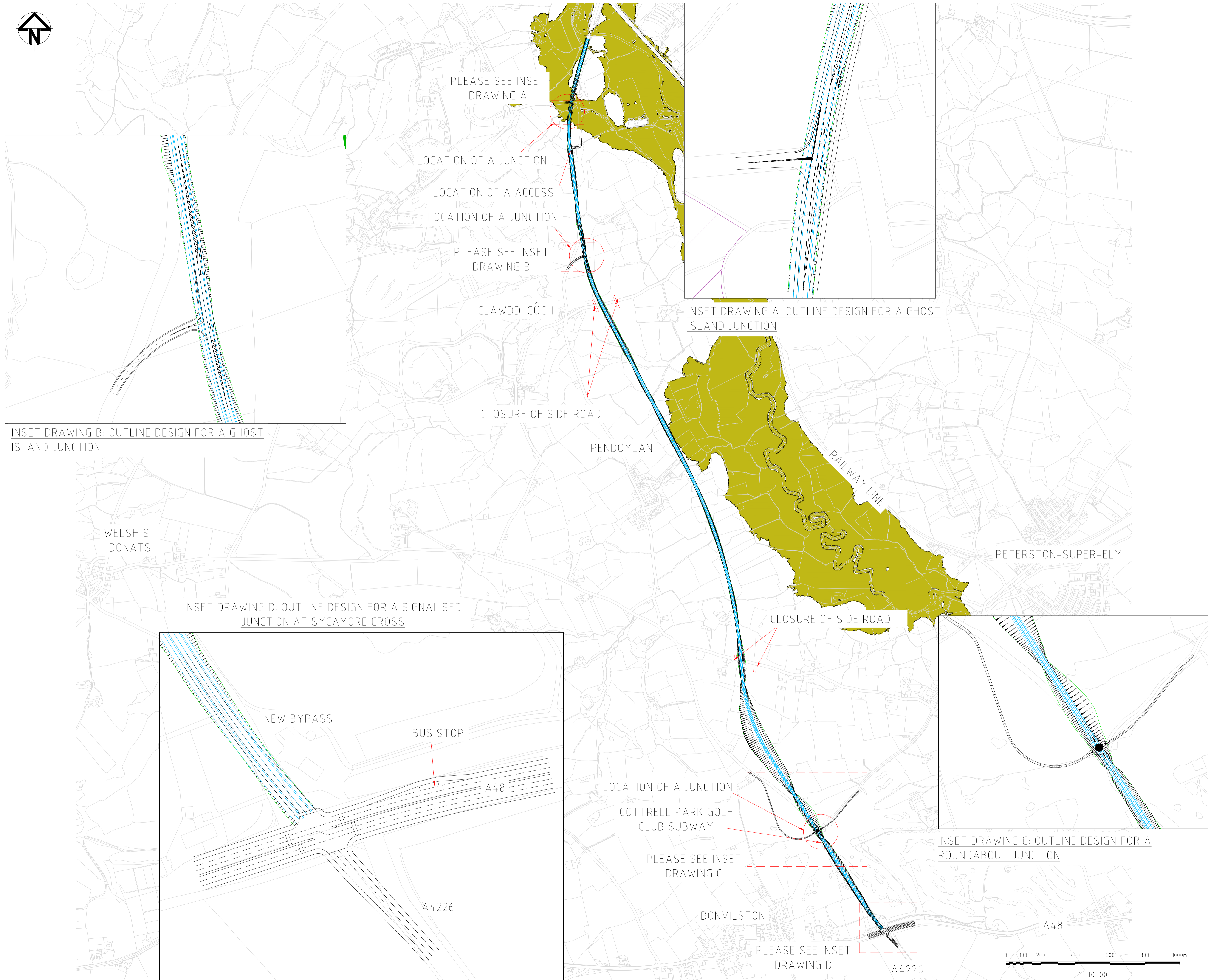
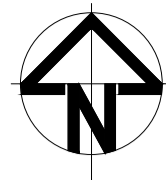
www.arcadis.com

Drawing Number:
10028657-ARC-XX-XX-DR-EA-0059

Revision:
P2

Appendix B

Drawings | Option A – Highway Route East of Pendoylan



INSET DRAWING B: OUTLINE DESIGN FOR A GHOST ISLAND JUNCTION

INSET DRAWING A: OUTLINE DESIGN FOR A GHOST ISLAND JUNCTION

INSET DRAWING D: OUTLINE DESIGN FOR A SIGNALISED JUNCTION AT SYCAMORE CROSS

INSET DRAWING C: OUTLINE DESIGN FOR A ROUNDABOUT JUNCTION

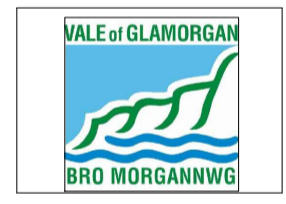
NOTES:

LEGEND:

- EXISTING ROUTE
- FLOOD AREA

Rev	Date	Description	Drawn	Check	Approv
P05	17MAR20	ADJUSTMENT TO VERTICAL ALIGNMENT	NC	MT	DR
P04	20FEB20	ADJUSTMENT TO JUNCTIONS	NC	MT	DR
P03	14FEB20	FLOODING ANALYSIS ADJUSTMENT	NC	MT	DR
P02	25SEP19	JUNCTION DESIGNS INCLUDED	NC	MT	DR
P01	20MAR19	FIT FOR INFORMATION	MS	CB	GH

Vale of Glamorgan



PROJECT:
M4 JUNCTION
34 TO A48
WeITAG S2 PLUS

Site	Client
	Civic Offices Halton road Barry CF63 4RU Phone +44 (0)1446 704 768 Fax ccameron@valeofglamorgan.gov.uk www.valeofglamorgan.gov.uk



Registered office: Arcadis House 34 York Way London N1 9AB	Coordinating office: Arcadis Cymru House Fortran Road, St Mellons Cardiff, CF3 0EY Tel: 44 (0)29 2092 6700
--	--

www.arcadis.com

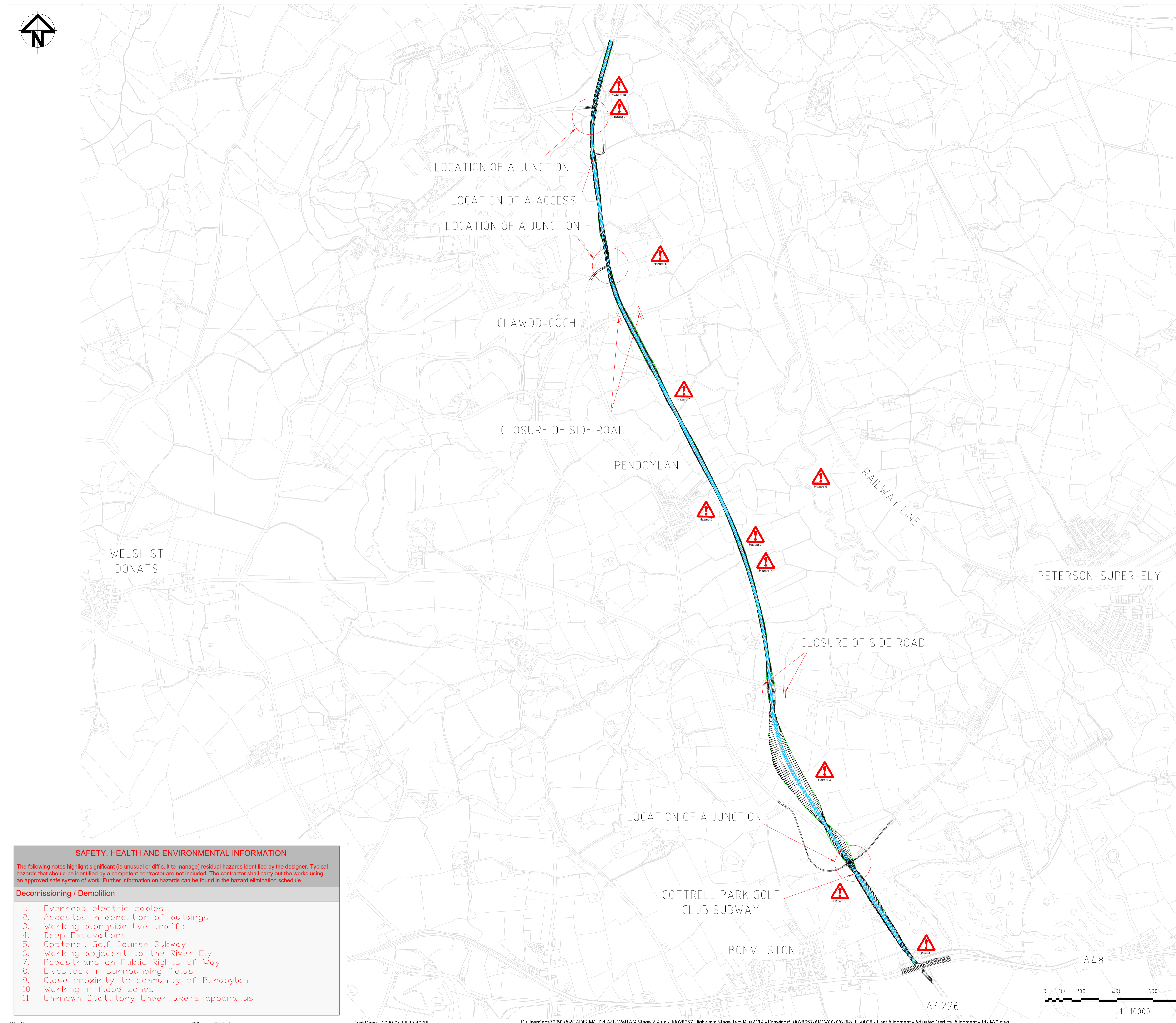
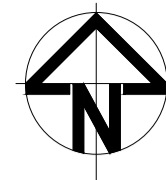
TITLE:

East Alignment
Adjusted Vertical Profile

Designed	R. ELLIS	Signed	Date
Drawn	M. SMITH	Signed	20MAR19
Checked	C. BURGHAM	Signed	20MAR19
Approved	G. HARRIS	Signed	20MAR19
Scale:	1:10000	Datum:	AOD
Original Size:	A1	Grid:	OS
Suitability Code:	S2	Project Number:	10028657

Suitability Description:
FIT FOR INFORMATION

Drawing Number: 10028657-ARC-XX-XX-DR-HE-0008	Revision: P05
--	------------------



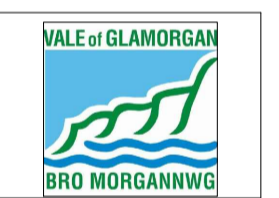
NOTES:

LEGEND:

EXISTING ROUTE

Rev	Date	Description	Drawn	Check	Approv
P02	08APR20	FIT FOR INFORMATION	NC	MT	DR
P01	05MAR18	FIT FOR INFORMATION	MS	MT	GH

Vale of Glamorgan



PROJECT:
**M4 JUNCTION
 34 TO A48
 WeITAG S2 PLUS**

Site	Client
	Civic Offices Holton road Barry CF63 4RU Phone +44 (0)1446 704 768 Fax ccameron@valeofglamorgan.gov.uk www.valeofglamorgan.gov.uk



Registered office:
 Arcadis House
 34 York Way
 London
 N1 9AB

Coordinating office:
 Arcadis Cymru House
 Fortran Road, St Mellons
 Cardiff, CF3 0EY
 Tel: 44 (0)29 2092 6700

www.arcadis.com

TITLE: East Alignment Hazards

Designed	R. ELLIS	Signed	Date
Drawn	M. SMITH	Signed	05MAR18
Checked	M. THOMAS	Signed	05MAR18
Approved	G. HARRIS	Signed	05MAR18
Scale:	1:10000	Datum:	AOD
Original Size:	A1	Grid:	OS
Suitability Code:	S2	Project Number:	10028657

Suitability Description:
FIT FOR INFORMATION

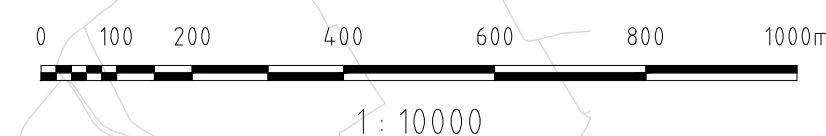
Drawing Number: 10028657-ARC-XX-XX-DR-0012	Revision: P02
---	------------------

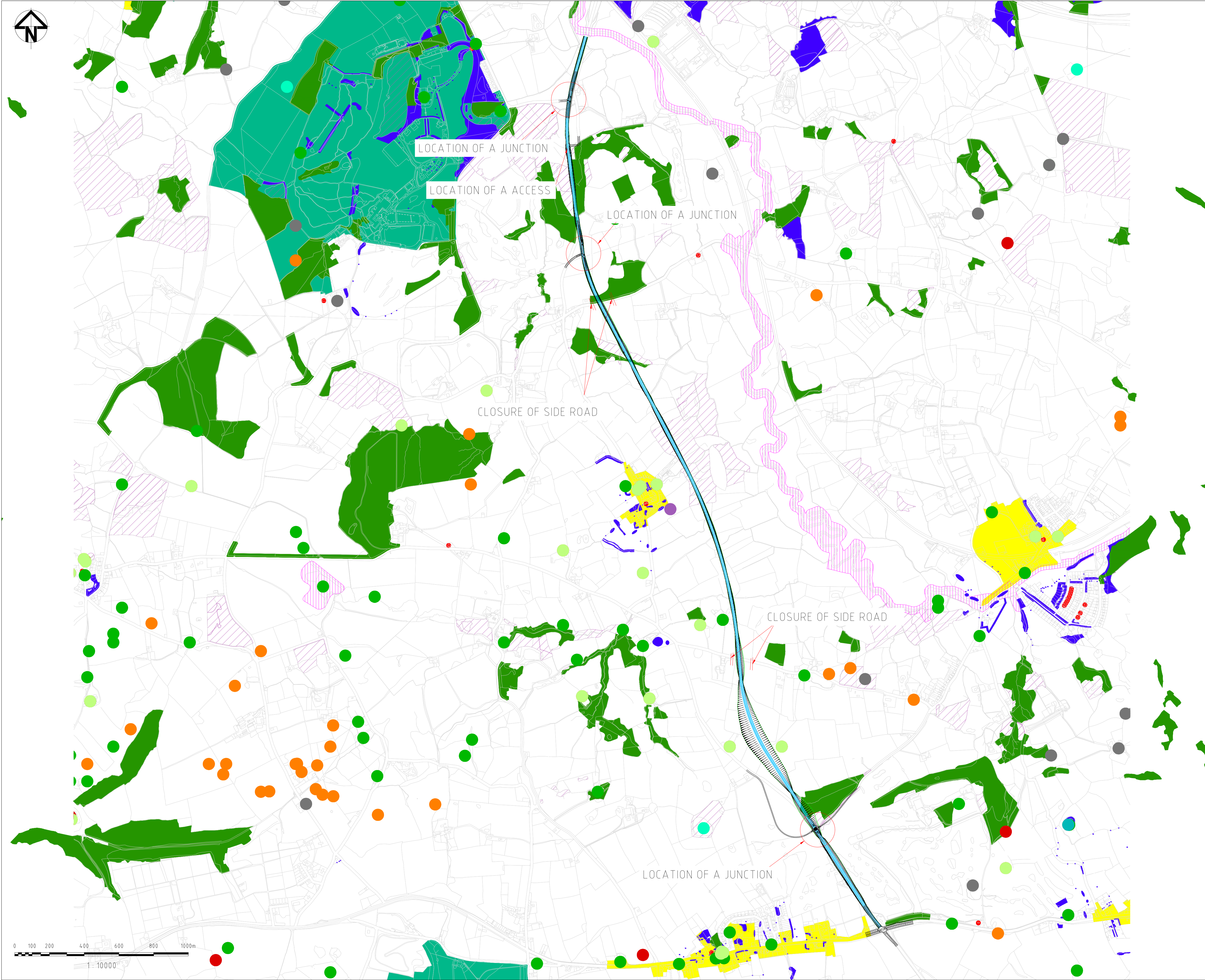
SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

The following notes highlight significant (ie unusual or difficult to manage) residual hazards identified by the designer. Typical hazards that should be identified by a competent contractor are not included. The contractor shall carry out the works using an approved safe system of work. Further information on hazards can be found in the hazard elimination schedule.

Decommissioning / Demolition

- Overhead electric cables
- Asbestos in demolition of buildings
- Working alongside live traffic
- Deep Excavations
- Cottrell Golf Course Subway
- Working adjacent to the River Ely
- Pedestrians on Public Rights of Way
- Livestock in surrounding fields
- Close proximity to community of Pendoylan
- Working in flood zones
- Unknown Statutory Undertakers apparatus





NOTES:

- LEGEND:**
- ARCHAEOLOGICAL FEATURES:**
- ROMAN
 - BRONZE AGE
 - NEOLITHIC
 - MEDIEVAL
 - POST MEDIEVAL
 - EARLY MEDIEVAL
 - IRON AGE
 - METHOLITHIC
 - MODERN
 - MULTI PERIOD
 - PREHISTORIC
 - UNKNOWN
- EXISTING ROUTE**
- PUBLIC RIGHT OF WAY**
- ECOLOGY AND NATURE CONSERVATION:**
- SITE OF SPECIAL SCIENTIFIC INTEREST
 - SITES OF IMPORTANCE FOR NATURE CONSERVATION
 - TREE PRESERVATION ORDER
 - AIR QUALITY MANAGEMENT AREA
- DESIGNATED HERITAGE ASSETS:**
- SCHEDULED MONUMENTS
 - LISTED BUILDINGS
 - CONSERVATION AREA
 - PARKS AND GARDENS
 - ANCIENT WOODLAND

P02 08APR20	FIT FOR INFORMATION	NC	MT	DR	
P01 21FEB18	FIT FOR INFORMATION	MS	MT	GH	
Rev	Date	Description	Drawn	Check	Approv

Vale of Glamorgan

PROJECT:
M4 JUNCTION
34 TO A48
WellTAG S2 PLUS

Site	Client
	Civic Offices Holton road Barry CF63 4RU Phone +44 (0)1446 704 768 Fax ccameron@valeofglamorgan.gov.uk www.valeofglamorgan.gov.uk



Registered office:
 Arcadis House
 34 York Way
 London
 N1 9AB

Coordinating office:
 Arcadis Cymru House
 Fortran Road, St Mellons
 Cardiff, CF3 0EY
 Tel: 44 (0)29 2092 6700

www.arcadis.com

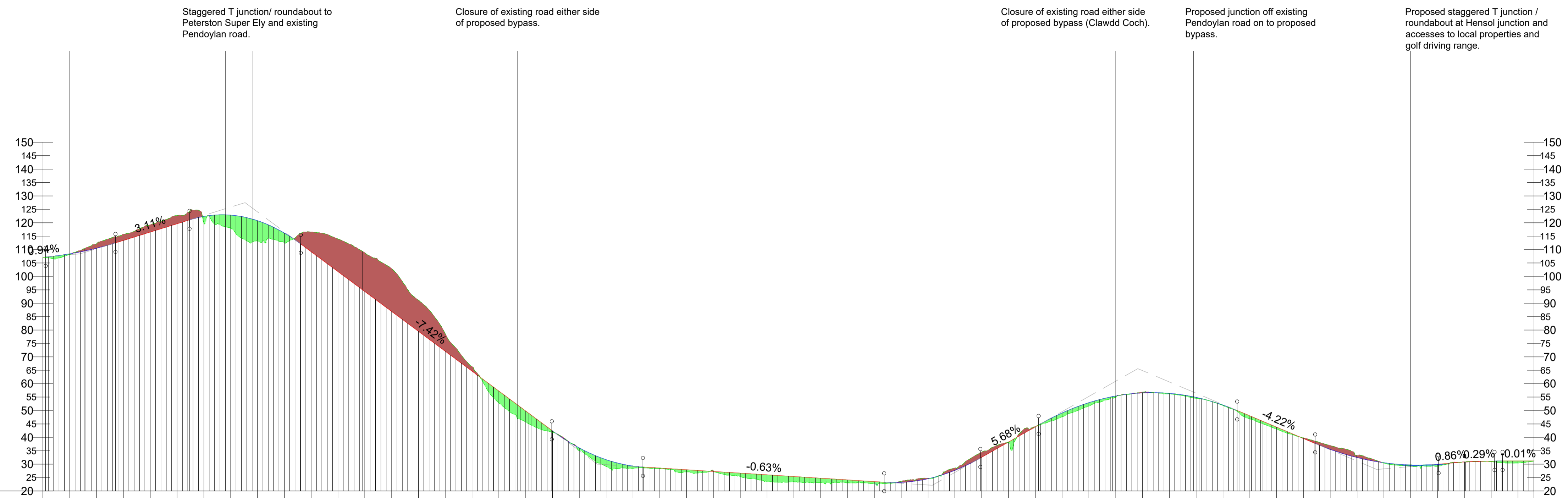
TITLE:
East Alignment
With Environmental Constraints

Designed	R. ELLIS	Signed	Date	21FEB18
Drawn	M. SMITH	Signed	Date	21FEB18
Checked	M. THOMAS	Signed	Date	21FEB18
Approved	G. HARRIS	Signed	Date	21FEB18
Scale:	1:10000	Datum:	AOD	
Original Size:	A1	Grid:	OS	
Suitability Code:	S2	Project Number:	10028657	

Suitability Description:
FIT FOR INFORMATION

Drawing Number:	10028657-ARC-XX-XX-DR-HE-0014	Revision:	P02
-----------------	-------------------------------	-----------	-----

East Alignment
SCALE: H 1:10000,V 1:1000
DATUM: 20.000



Chainage	Existing Ground Levels	Proposed Levels	Horizontal Geometry	Vertical Geometry	Level Difference
00.000	107.135	107.135			0.000
100.000	108.135	108.413	R=1020.000 L=9499.142	G=0.940% L=260.149	0.278
200.000	112.168	110.519		R=12009.193 K=120.092 L=260.149	-1.639
300.000	115.704	113.421		G=3.106% L=276.294	-2.283
400.000	119.233	116.527			-2.706
500.000	122.689	119.634			-3.065
600.000	119.969	122.374			2.405
700.000	117.895	122.848		R=3936.624 K=39.366 L=414.537	4.953
800.000	113.241	120.782			7.541
900.000	112.427	116.175			3.747
1000.000	116.523	109.222			-7.301
1100.000	113.980	101.798			-12.182
1200.000	108.792	94.374			-14.418
1300.000	102.883	86.950	R=1020.000 L=489.215		-15.943
1400.000	91.150	79.526	L=132.528		-11.624
1500.000	78.627	72.102		G=-7.424% L=936.296	-6.525
1600.000	66.355	64.877			-1.677
1700.000	52.829	57.253			4.424
1800.000	45.706	49.629			4.123
1900.000	41.874	42.406			0.532
2000.000	35.106	36.038		R=5000.000 K=50.000 L=339.617	0.932
2100.000	29.167	31.670			2.503
2200.000	28.455	29.302			0.847
2300.000	28.337	28.534			0.197
2400.000	27.060	27.903			0.843
2500.000	27.430	27.271			-0.159
2600.000	25.344	26.639			1.295
2700.000	23.559	26.007		G=-0.632% L=899.912	2.449
2800.000	23.489	25.376			1.887
2900.000	23.108	24.744			1.636
3000.000	23.049	24.112			1.064
3100.000	22.667	23.481			0.814
3200.000	23.362	23.201			-0.161
3300.000	24.786	24.564			-0.223
3400.000	28.544	27.687		R=5679.485 K=56.795 L=358.227	-0.857
3500.000	34.391	32.569			-1.822
3600.000	38.144	38.245		G=5.676% L=217.308	0.100
3700.000	43.966	43.920			-0.046
3800.000	47.663	49.081			1.419
3900.000	51.640	52.916			1.276
4000.000	54.911	55.413			0.502
4100.000	56.818	56.574			-0.244
4200.000	56.244	56.398			0.154
4300.000	54.508	54.885			0.377
4400.000	51.912	52.035			0.123
4500.000	46.870	47.999			1.130
4600.000	43.140	43.779			0.639
4700.000	39.777	39.559			-0.218
4800.000	36.866	35.516			-1.350
4900.000	33.216	32.473			-0.743
5000.000	30.422	30.534			0.112
5100.000	29.236	29.699			0.462
5200.000	29.224	29.968			0.744
5300.000	30.826	30.826			0.000
5400.000	30.916	31.111			0.196
5500.000	30.456	31.181			0.724
5559.778	31.173	31.173			0.000

Rev	Date	Description	Drawn	Check	Approv
P03	17MAR20	ADJUSTMENT TO THE VERTICAL ALIGNMENT	NC	MT	DR
P02	14FEB20	FIT FOR INFORMATION	NC	MT	DR
P01	20MAR19	FIT FOR INFORMATION	RE	CB	GH

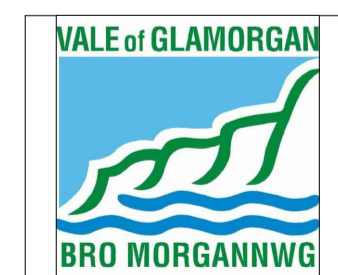
NOTES:

100mm on Original

Print Date: 2020-04-08 17:18:23

C:\Users\inca76293\ARCADIS\M4 J34 A48 WeiTAG Stage 2 Plus - 10028657 Highways Stage Two Plus\Xref\3D Models\10028657-ARC-XX-XX-M3-HE-0003 - East Options - Altered Vertical Alignment(11-03-2020).dwg

Vale of Glamorgan



Site

Client

Civic Offices
Hillon Road
Barny
CF63 4RU
Phone +44 (0)1446 704 768
Fax
cameron@valeofglamorgan.gov.uk
www.valeofglamorgan.gov.uk

Suitability Description:

DRAFT

Designed	R. ELLIS	Date	20MAR19	Signed	
Drawn	R. ELLIS	Date	20MAR19	Signed	
Checked	C. BURGHAM	Date	20MAR19	Signed	
Approved	G.HARRIS	Date	20MAR19	Signed	
Scale:	As shown	Datum:	ACD		
Original Size:	A1	Grid:	OS		
Suitability Code:	S2	Project Number:	10028657		

PROJECT:

M4 JUNCTION 34
TO A48 WeiTAG
S2 PLUS

TITLE:

East Alignment
Longsection
Adjusted Vertical Profile



Registered office:
Arcadis House
34 York Way
London
N1 9AB

Coordinating office:
Unit 17 Innovation Centre
Bridge of Don
Aberdeen AB23 8GX
Tel: 44 (0)1224 822494

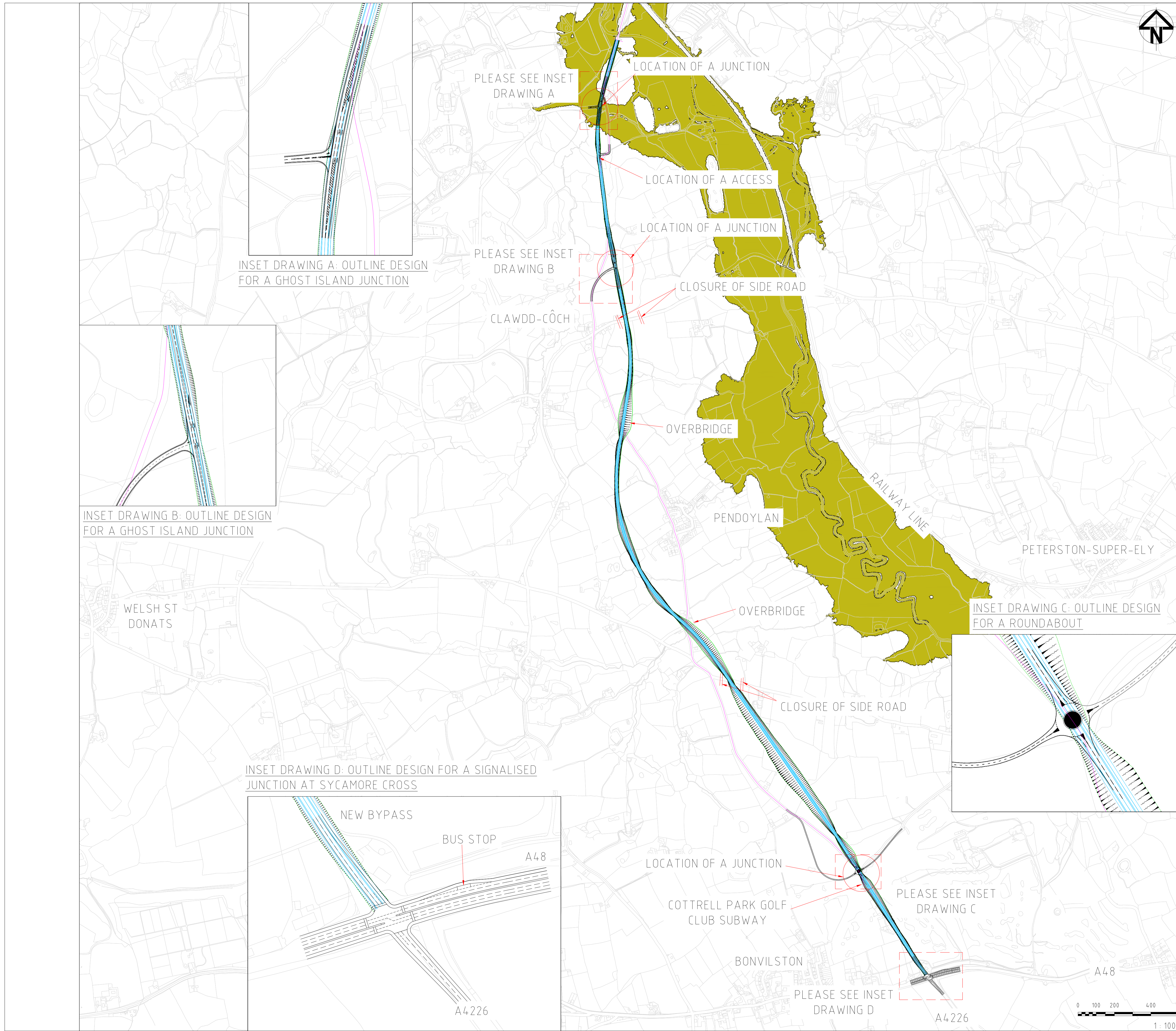
www.arcadis.com
Drawing Number:
10028657-ARC-XX-XX-DR-HE-0010

Revision:
P03

© Copyright reserved

Appendix C

Drawings | Option B – Highway Route West of Pendoylan



NOTES:

LEGEND:
 EXISTING ROUTE
 FLOOD AREA

Rev	Date	Description	Drawn	Check	Approv
P05	17MAR20	ADJUSTMENT TO VERTICAL ALIGNMENT	NC	MT	DR
P04	14FEB20	ADJUSTMENT TO JUNCTIONS	NC	MT	DR
P03	14FEB20	FLOODING ANALYSIS ADJUSTMENT	NC	MT	DR
P02	25SEP19	JUNCTION DESIGNS INCLUDED	NC	MT	DR
P01	20MAR19	FIT FOR INFORMATION	MS	CB	GH

Vale of Glamorgan

PROJECT:
**M4 JUNCTION
 34 TO A48
 WeITAG S2 PLUS**

Site: _____ Client: _____
 Civic Offices
 Holton road
 Barry
 CF63 4RU
 Phone +44 (0)1446 704 768
 Fax
 ccameron@valeofglamorgan.gov.uk
 www.valeofglamorgan.gov.uk



Registered office: Arcadis House, 34 York Way, London N1 9AB
 Coordinating office: Arcadis Cymru House, Fortran Road, St Mellons Cardiff, CF3 0EY
 Tel: 44 (0)29 2092 6700

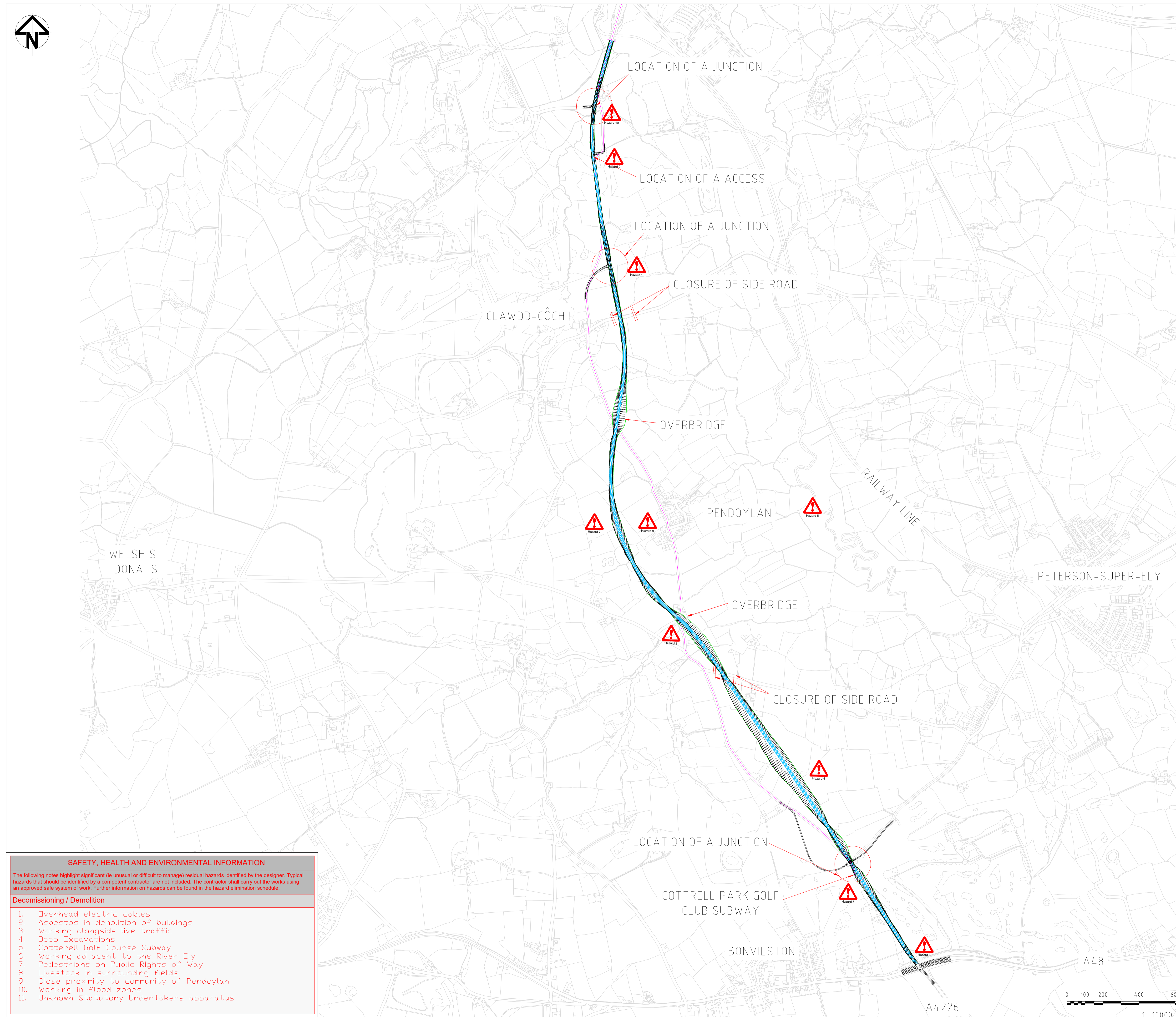
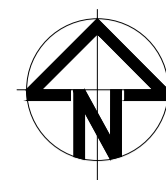
www.arcadis.com

TITLE:
**West Alignment
 Adjusted Vertical Profile**

Designed	R. ELLIS	Signed	Date	20MAR19
Drawn	M. SMITH	Signed	Date	20MAR19
Checked	C. BURGHAM	Signed	Date	20MAR19
Approved	G. HARRIS	Signed	Date	20MAR19
Scale:	1:10000	Datum:	AOD	
Original Size:	A1	Grid:	OS	
Suitability Code:	S2	Project Number:	10028657	

Suitability Description:
FIT FOR INFORMATION

Drawing Number: 10028657-ARC-XX-XX-DR-0009 Revision: P05



SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

The following notes highlight significant (ie unusual or difficult to manage) residual hazards identified by the designer. Typical hazards that should be identified by a competent contractor are not included. The contractor shall carry out the works using an approved safe system of work. Further information on hazards can be found in the hazard elimination schedule.

Decommissioning / Demolition

1. Overhead electric cables
2. Asbestos in demolition of buildings
3. Working alongside live traffic
4. Deep Excavations
5. Cotterell Golf Course Subway
6. Working adjacent to the River Ely
7. Pedestrians on Public Rights of Way
8. Livestock in surrounding fields
9. Close proximity to community of Pendoylan
10. Working in flood zones
11. Unknown Statutory Undertakers apparatus

NOTES:

LEGEND:
EXISTING ROUTE

PO2 08APR20	FIT FOR INFORMATION	NC	MT	DR	
PO1 05MAR18	FIT FOR INFORMATION	MS	MT	GH	
Rev	Date	Description	Drawn	Check	Approv

Vale of Glamorgan

PROJECT:
M4 JUNCTION
34 TO A48
WeITAG S2 PLUS

Site	Client
	Civic Offices Holton road Barry CF63 4RU Phone +44 (0)1446 704 768 Fax ccameron@valeofglamorgan.gov.uk www.valeofglamorgan.gov.uk

ARCADIS Design & Consultancy
for roads and built assets

Registered office:
Arcadis House
34 York Way
London
N1 9AB

Coordinating office:
Arcadis Cymru House
Fortran Road, St Mellons
Cardiff, CF3 0EY
Tel: 44 (0)29 2092 6700

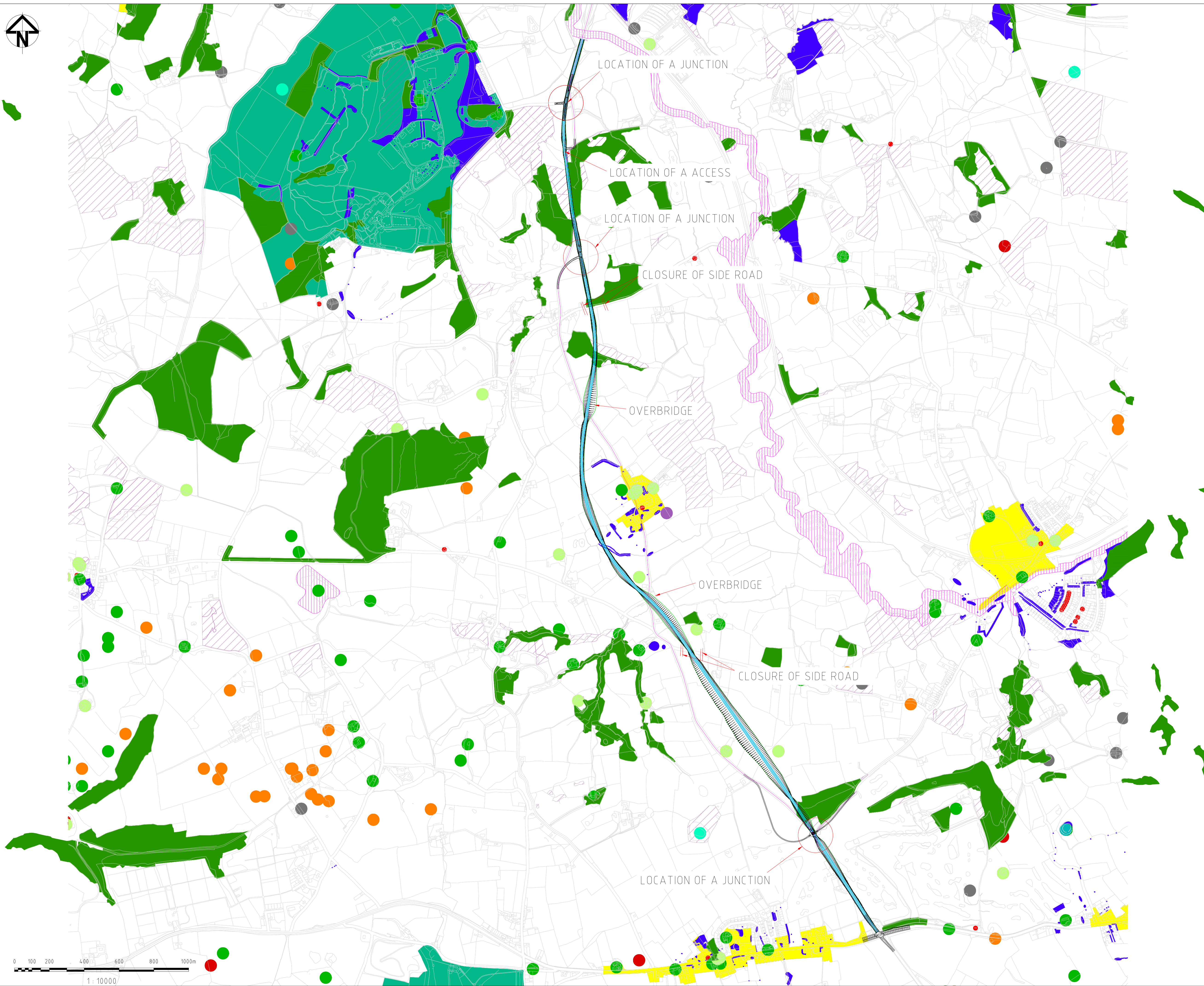
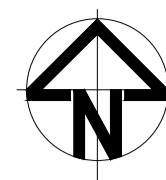
www.arcadis.com

TITLE: West Alignment Hazards

Designed	R. ELLIS	Signed	Date	05MAR18
Drawn	M. SMITH	Signed	Date	05MAR18
Checked	M. THOMAS	Signed	Date	05MAR18
Approved	G. HARRIS	Signed	Date	05MAR18
Scale:	1:10000	Datum:	AOD	
Original Size:	A1	Grid:	OS	
Suitability Code:	S2	Project Number:	10028657	

FIT FOR INFORMATION

Drawing Number:	10028657-ARC-XX-XX-DR-0013	Revision:	P02
-----------------	----------------------------	-----------	-----



NOTES:

- LEGEND:**
- ARCHAEOLOGICAL FEATURES:**
- ROMAN
 - BRONZE AGE
 - NEOLITHIC
 - MEDIEVAL
 - POST MEDIEVAL
 - EARLY MEDIEVAL
 - IRON AGE
 - METHOLITHIC
 - MODERN
 - MULTI PERIOD
 - PREHISTORIC
 - UNKNOWN
- EXISTING ROUTE**
- PUBLIC RIGHT OF WAY**
- ECOLOGY AND NATURE CONSERVATION:**
- SITE OF SPECIAL SCIENTIFIC INTEREST
 - SITES OF IMPORTANCE FOR NATURE CONSERVATION
 - TREE PRESERVATION ORDER
 - SPECIAL LANDSCAPE AREAS
 - AIR QUALITY MANAGEMENT AREA
- DESIGNATED HERITAGE ASSETS:**
- SCHEDULED MONUMENTS
 - LISTED BUILDINGS
 - CONSERVATION AREA
 - PARKS AND GARDENS
 - ANCIENT WOODLAND

P02 08APR20	FIT FOR INFORMATION	NC	MT	DR	
P01 22FEB18	FIT FOR INFORMATION	MS	MT	GH	
Rev	Date	Description	Drawn	Check	Approv

Vale of Glamorgan

PROJECT:
M4 JUNCTION
34 TO A48
WelTAG S2 PLUS

Site	Client
	Civic Offices Holton road Barry CF63 4RU Phone +44 (0)1446 704 768 Fax ccameron@valeofglamorgan.gov.uk www.valeofglamorgan.gov.uk

ARCADIS Design & Consultancy for natural and built assets

Registered office:
Arcadis House
34 York Way
London
N1 9AB

Coordinating office:
Arcadis Cymru House
Fortran Road, St Mellons
Cardiff, CF3 0EY
Tel: 44 (0)29 2092 6700

www.arcadis.com

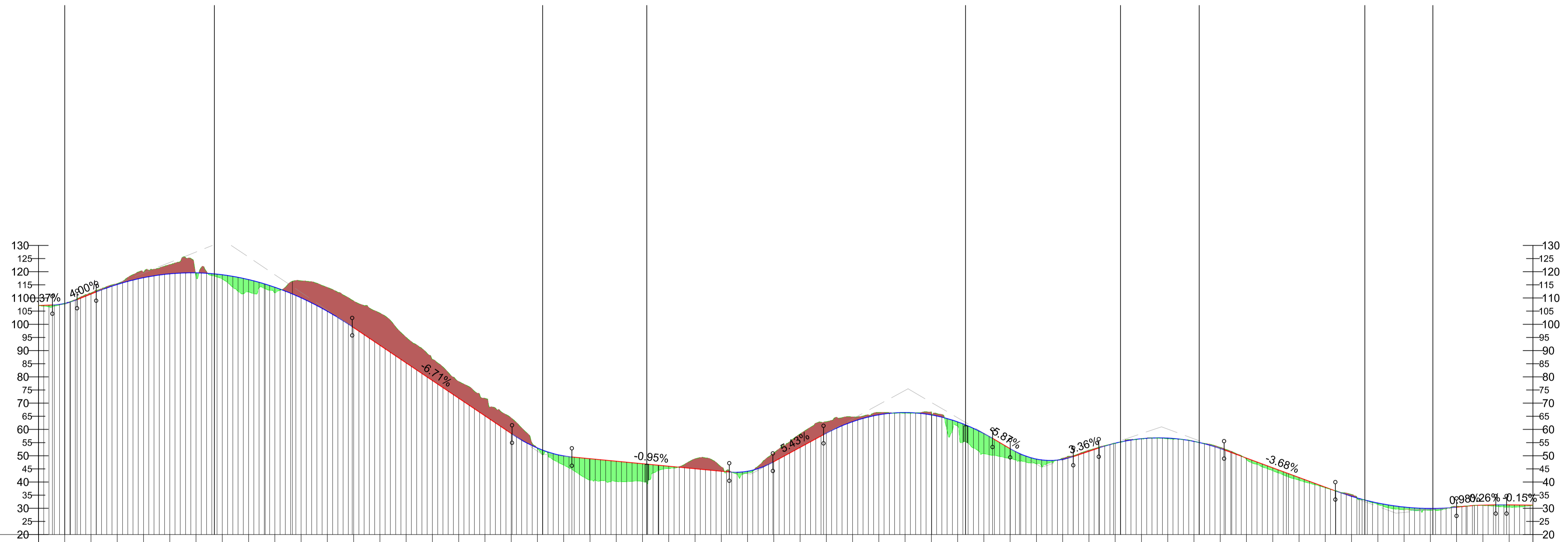
TITLE: West Alignment With Environmental Constraints

Designed	R. ELLIS	Signed	Date	22FEB18
Drawn	M. SMITH	Signed	Date	22FEB18
Checked	M. THOMAS	Signed	Date	22FEB18
Approved	G. HARRIS	Signed	Date	22FEB18
Scale:	1:10000	Datum:	AOD	
Original Size:	A1	Grid:	OS	
Suitability Code:	S2	Project Number:	10028657	

Suitability Description:
FIT FOR INFORMATION

Drawing Number: 10028657-ARC-XX-XX-DR-HE-0015	Revision: P02
--	------------------

West Alignment
SCALE: H 1:10000, V 1:1000
DATUM: 20.000



Chainage	00.000	100.000	200.000	300.000	400.000	500.000	600.000	700.000	800.000	900.000	1000.000	1100.000	1200.000	1300.000	1400.000	1500.000	1600.000	1700.000	1800.000	1900.000	2000.000	2100.000	2200.000	2300.000	2400.000	2500.000	2600.000	2700.000	2800.000	2900.000	3000.000	3100.000	3200.000	3300.000	3400.000	3500.000	3600.000	3700.000	3800.000	3900.000	4000.000	4100.000	4200.000	4300.000	4400.000	4500.000	4600.000	4700.000	4800.000	4900.000	5000.000	5100.000	5200.000	5300.000	5400.000	5500.000	5600.000	5690.661												
Existing Ground Levels	107.139	107.920	111.924	115.520	119.885	122.702	118.006	117.216	112.331	111.958	116.507	114.029	108.880	104.274	95.016	86.633	78.228	71.833	64.363	52.668	46.431	40.729	40.251	40.175	45.129	48.051	44.100	45.713	43.489	51.073	58.287	62.952	64.724	66.475	66.200	66.577	62.866	61.272	58.456	50.799	48.926	48.059	52.160	54.758	54.893	56.515	56.440	55.509	52.736	53.183	48.627	44.239	41.726	40.717	38.051	37.761	34.565	35.262	32.015	31.466	29.457	29.248	29.943	30.422	30.646	31.171	31.085	31.308	30.425	31.173
Proposed Levels	107.139	107.998	111.510	115.156	117.724	119.194	119.585	118.837	117.010	114.085	110.081	104.939	98.719	92.008	85.297	78.586	71.875	65.164	58.453	52.926	49.926	48.854	47.903	46.952	46.002	45.051	44.100	44.081	47.727	53.156	58.577	62.947	65.560	66.418	66.520	62.866	58.456	52.685	48.926	48.626	51.678	54.758	54.893	56.466	56.689	55.456	52.736	49.077	45.402	41.726	38.051	34.565	32.015	30.474	29.943	29.943	30.422	31.171	31.308	30.425	31.173									
Horizontal Geometry	R: 1020.000 L: 121.778		L = 741.622				R: 2880.000 L: 103.729		L = 1130.738										R: 1020.000 L: 262.352		R: 1020.000 L: 1039.118		L = 334.020		R: 1020.000 L: 357.895		L = 450.432		R: 2880.000 L: 207.878		L = 277.829		R: 1020.000 L: 406.217		L = 254.925																																			
Vertical Geometry	R = 2600.000 G = -3.226000% K = 26.000 L = 52.685		R = 9101.857 K = 91.019 L = 974.909				G = -6.711% L = 608.639		R = 3954.391 K = 39.544 L = 227.790		G = -0.951% L = 599.399		R = 2600.000 K = 26.000 L = 165.887		G = 5.430% L = 193.349		R = 5694.732 K = 56.947 L = 643.210		G = -3.865% L = 67.411		R = 2600.000 K = 26.000 L = 239.965		G = 3.364% L = 97.601		R = 6774.839 K = 67.748 L = 476.921		G = -3.675% L = 423.894		R = 9900.713 K = 99.007 L = 461.195		G = 0.980% L = 67.411		R = 10000.000 K = 100.000 L = 700.000		G = 0.149% L = 700.000																																			
Level Difference	0.000	0.018	-0.413	-0.363	-2.161	-3.508	1.588	1.621	4.679	2.127	-6.445	-9.090	-10.161	-12.266	-9.719	-8.047	-6.353	-6.669	-6.911	0.258	3.495	8.125	7.652	6.777	0.872	-3.768	-1.612	0.592	-3.346	-5.131	-4.375	-1.777	-0.914	0.218	-1.057	1.584	7.656	3.760	1.690	-0.433	-0.481	0.075	-0.048	0.259	-0.053	-0.447	0.450	1.163	1.010	0.290	-0.696	0.549	1.017	0.695	-0.226	0.086	0.883	0.000												

NOTES:

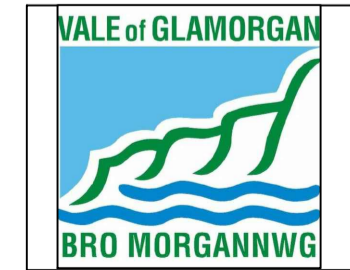
P03	17MAR20	ADJUSTMENT TO THE VERTICAL ALIGNMENT	NC	MT	DR
P02	14FEB20	FIT FOR INFORMATION	NC	MT	DR
P01	20MAR19	FIT FOR INFORMATION	RE	CB	GH
Rev	Date	Description	Drawn	Check	Approv

100mm on Original

Print Date: 2020-03-17 15:56:27

C:\Users\inca76293\ARCADIS\M4 J34 A48 WeiTAG Stage 2 Plus - 10028657 Highways Stage Two Plus\Xrefs\3D Models\10028657-ARC-XX-XX-M3-HE-0004 - West Options - Altered Vertical Alignment(11-03-2020).dwg

Vale of Glamorgan



Client
Civic Offices
Hollon Road
Burry
CF63 4RU
Phone +44 (0)1446 704 768
Fax
cameron@valeofglamorgan.gov.uk
www.valeofglamorgan.gov.uk

Suitability Description:
FIT FOR INFORMATION

Designed	R. ELLIS	Date	20MAR19	Signed	
Drawn	R. ELLIS	Date	20MAR19	Signed	
Checked	C. BURGHAM	Date	20MAR19	Signed	
Approved	G.HARRIS	Date	20MAR19	Signed	
Scale:	As shown	Datum:	AOD		
Original Size:	A1	Grid:	OS		
Suitability Code:	S2	Project Number:	10028657		

PROJECT:

M4 JUNCTION 34
TO A48 WeiTAG
S2 PLUS

TITLE:
West Alignment
Longsection
Adjusted Vertical Profile



Registered office:
Arcadis House
34 York Way
London
N1 9AB

Coordinating office:
Unit 17 Innovation Centre
Bridge of Don
Aberdeen AB23 8GX
Tel: 44 (0)1224 822494

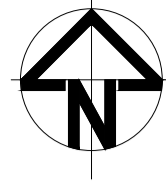
Drawing Number:
10028657-ARC-XX-XX-DR-HE-0011

Revision:
P03

Copyright reserved



Appendix D

Drawings | Option C1 – Existing Infrastructure (Online) Enhancement



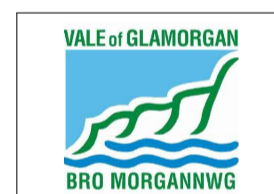
NOTES:

LEGEND:

-  EXISTING ROUTE
-  FLOOD AREA

Rev	Date	Description	Drawn	Check	Approv
P01	08APR20	FIT FOR INFORMATION		NC	MT DR

Vale of Glamorgan



PROJECT:
M4 JUNCTION
34 TO A48
WeITAG S2 PLUS

Site	Client
	Civic Offices Halton road Barry CF63 4RU Phone +44 (0)1446 704 768 Fax ccameron@valeofglamorgan.gov.uk www.valeofglamorgan.gov.uk



Registered office:
Arcadis House
34 York Way
London
N1 9AB

Coordinating office:
Arcadis Cymru House
Fortran Road, St Mellons
Cardiff, CF3 0EY
Tel: 44 (0)29 2092 6700

www.arcadis.com

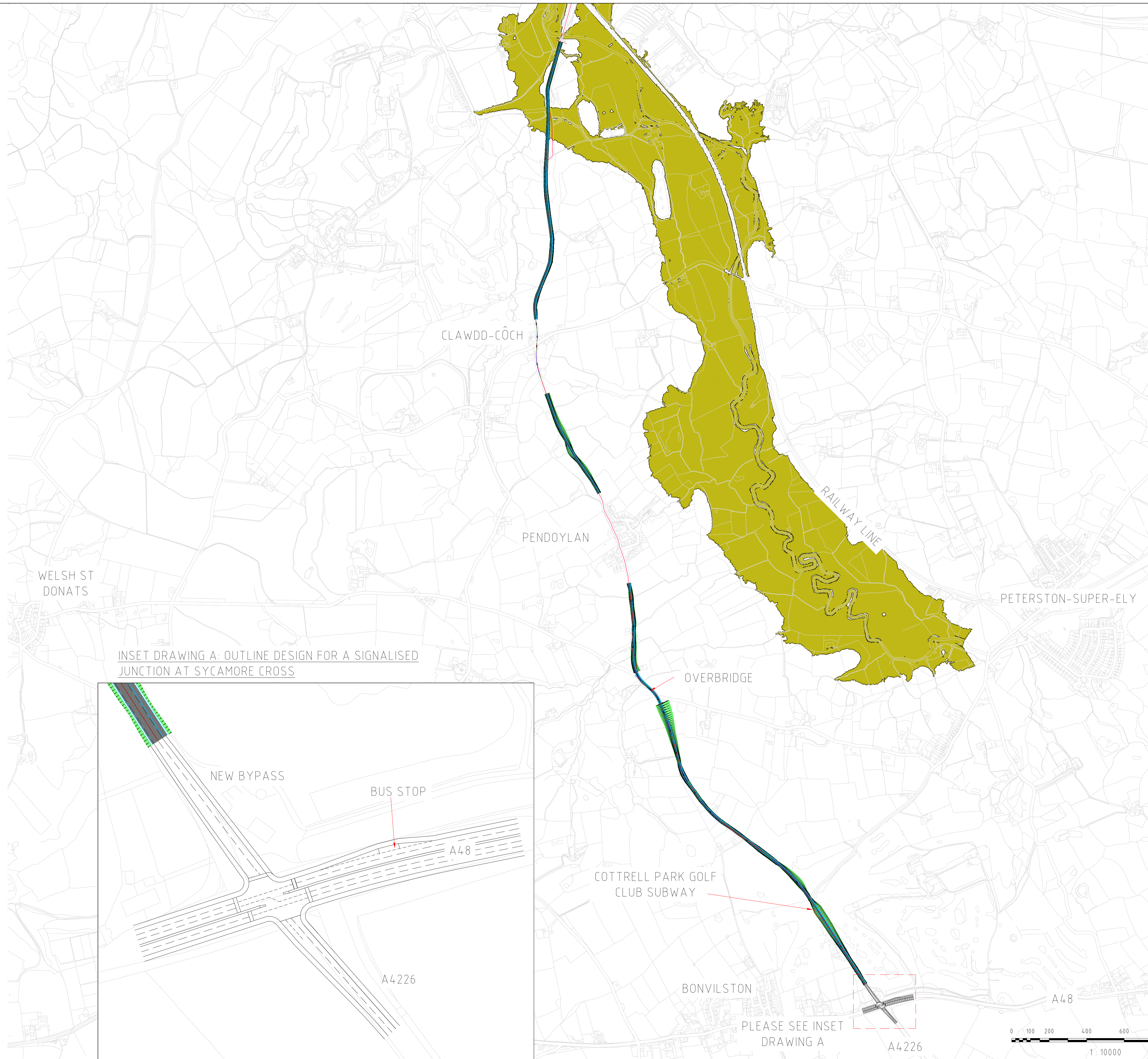
TITLE:

ONLINE
SUB OPTION 1
PLAN

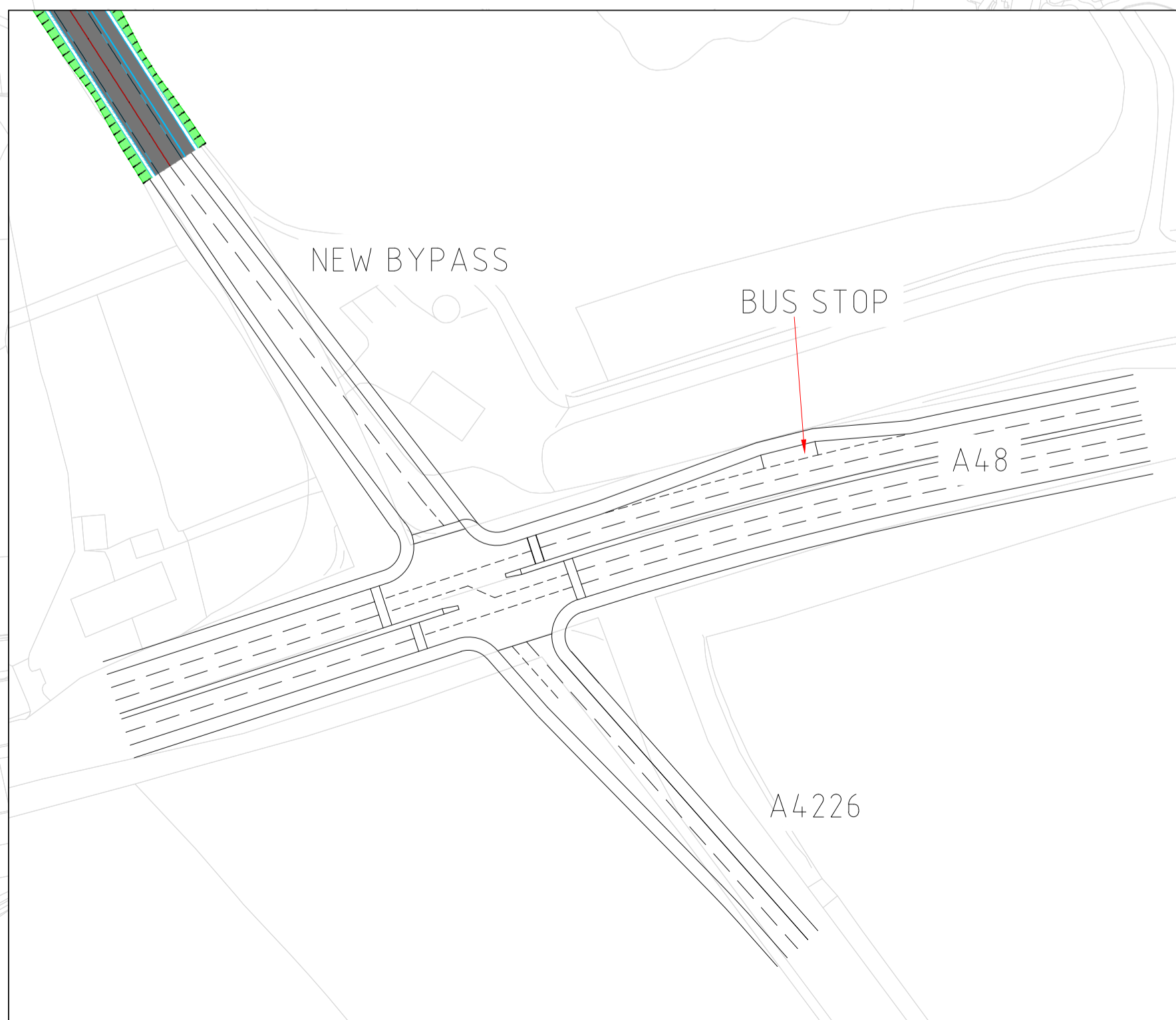
Designed	R. ELLIS	Signed	Date	20MAR19
Drawn	M. SMITH	Signed	Date	20MAR19
Checked	C. BURGHAM	Signed	Date	20MAR19
Approved	G. HARRIS	Signed	Date	20MAR19
Scale:	1:10000	Datum:	AOD	
Original Size:	A1	Grid:	OS	
Suitability Code:	S2	Project Number:	10028657	

Suitability Description:
FIT FOR INFORMATION

Drawing Number:	10028657-ARC-XX-XX-DR-HE-0020	Revision:	P01
-----------------	-------------------------------	-----------	-----



INSET DRAWING A: OUTLINE DESIGN FOR A SIGNALISED JUNCTION AT SYCAMORE CROSS

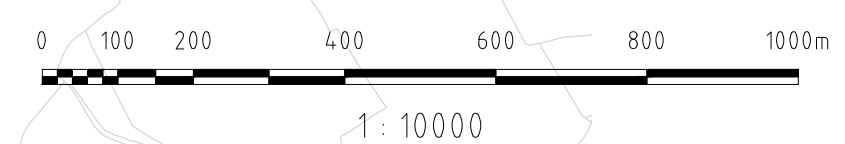


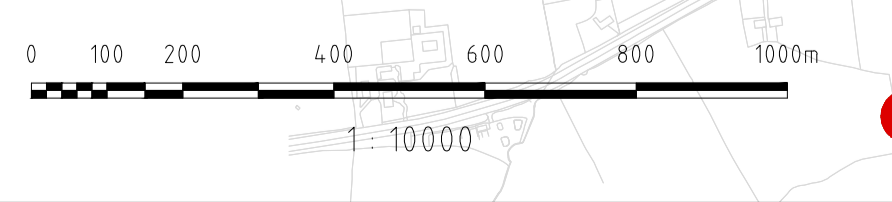
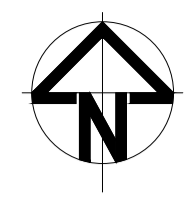
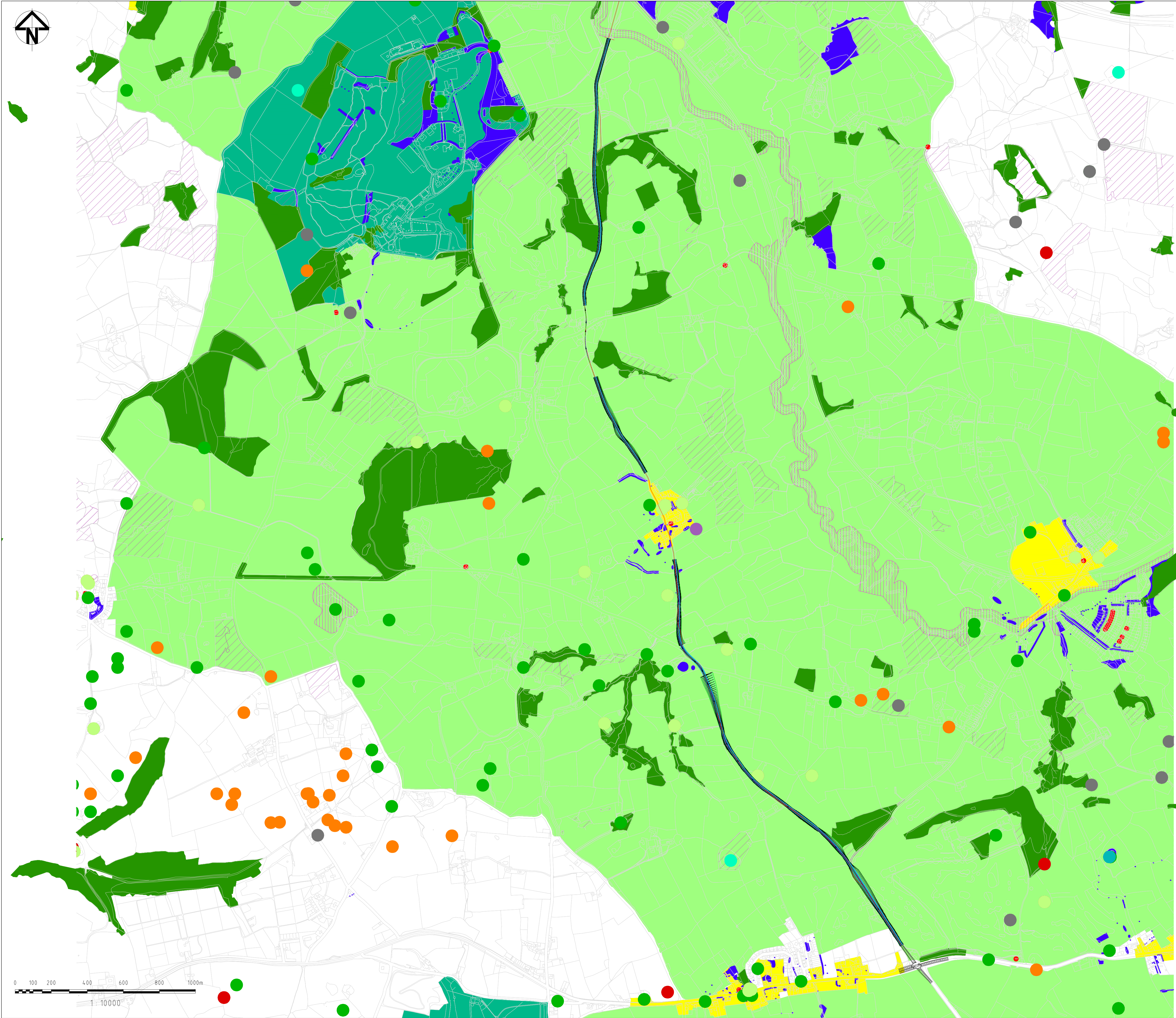
OVERBRIDGE

COTTRELL PARK GOLF CLUB SUBWAY

BONVILSTON

PLEASE SEE INSET DRAWING A





NOTES:

LEGEND:

- ARCHAEOLOGICAL FEATURES:**
- ROMAN
 - BRONZE AGE
 - NEOLITHIC
 - MEDIEVAL
 - POST MEDIEVAL
 - EARLY MEDIEVAL
 - IRON AGE
 - METHOLITHIC
 - MODERN
 - MULTI PERIOD
 - PREHISTORIC
 - UNKNOWN
- EXISTING ROUTE**
- PUBLIC RIGHT OF WAY**
- ECOLOGY AND NATURE CONSERVATION:**
- SITE OF SPECIAL SCIENTIFIC INTEREST
 - SITES OF IMPORTANCE FOR NATURE CONSERVATION
 - TREE PRESERVATION ORDER
 - SPECIAL LANDSCAPE AREAS
 - AIR QUALITY MANAGEMENT AREA
- DESIGNATED HERITAGE ASSETS:**
- SCHEDULED MONUMENTS
 - LISTED BUILDINGS
 - CONSERVATION AREA
 - PARKS AND GARDENS
 - ANCIENT WOODLAND

Rev	Date	Description	NC	MT	DR
P01	18AUG20	EXHIBITION			

Vale of Glamorgan



PROJECT:
M4 JUNCTION
34 TO A48
WellTAG S2 PLUS

Site	Client
	Civic Offices Hollon road Barry CF63 4RU Phone +44 (0)1446 704 768 Fax ccameron@valeofglamorgan.gov.uk www.valeofglamorgan.gov.uk



Registered office:
Arcadis House
34 York Way
London
N1 9AB

Coordinating office:
Arcadis Cymru House
Fortran Road, St Mellons
Cardiff, CF3 0EY
Tel: 44 (0)29 2092 6700

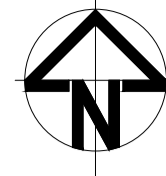
www.arcadis.com

TITLE:
**ONLINE
SUB OPTION 1
ENVIRONMENTAL CONSTRAINTS
EXHIBITION**

Designed	N. CLEMENTS	Signed	Date	28NOV19
Drawn	N. CLEMENTS	Signed	Date	28NOV19
Checked	M. THOMAS	Signed	Date	28NOV19
Approved	D. ROWLANDS	Signed	Date	28NOV19
Scale:	1:10000	Datum:	AOD	
Original Size:	A1	Grid:	OS	
Suitability Code:	S2	Project Number:	10028657	

Suitability Description:
FIT FOR INFORMATION

Drawing Number:	10028657-ARC-XX-XX-DR-0028	Revision:	P01
-----------------	----------------------------	-----------	-----



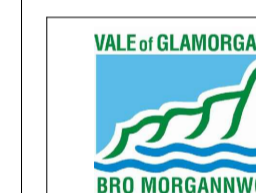
NOTES:

LEGEND:

EXISTING ROUTE

Rev	Date	Description	Drawn	Check	Approv	
P01	18AUG20	EXHIBITION		NC	MT	DR

Vale of Glamorgan



PROJECT:
M4 JUNCTION
34 TO A48
WeITAG S2 PLUS

Site: _____ Client: _____

Civic Offices
Holton road
Barry
CF63 4RU
Phone +44 (0)1446 704 768
Fax
ccameron@valeofglamorgan.gov.uk
www.valeofglamorgan.gov.uk

ARCADIS Design & Consultancy
for natural and built assets

Registered office:
Arcadis House
34 York Way
London
N1 9AB

Coordinating office:
Arcadis Cymru House
Fortran Road, St Mellons
Cardiff, CF3 0EY
Tel: 44 (0)29 2092 6700

www.arcadis.com

TITLE:
**ONLINE
SUB OPTION 1
HAZARDS
EXHIBITION**

Designed	R. ELLIS	Signed	Date	05MAR18
Drawn	M. SMITH	Signed	Date	05MAR18
Checked	M. THOMAS	Signed	Date	05MAR18
Approved	G. HARRIS	Signed	Date	05MAR18
Scale:	1:10000	Datum:	AOD	
Original Size:	A1	Grid:	OS	
Suitability Code:	S2	Project Number:	10028657	

FIT FOR INFORMATION

Drawing Number:
10028657-ARC-XX-XX-DR-0029

Revision:
P01

SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

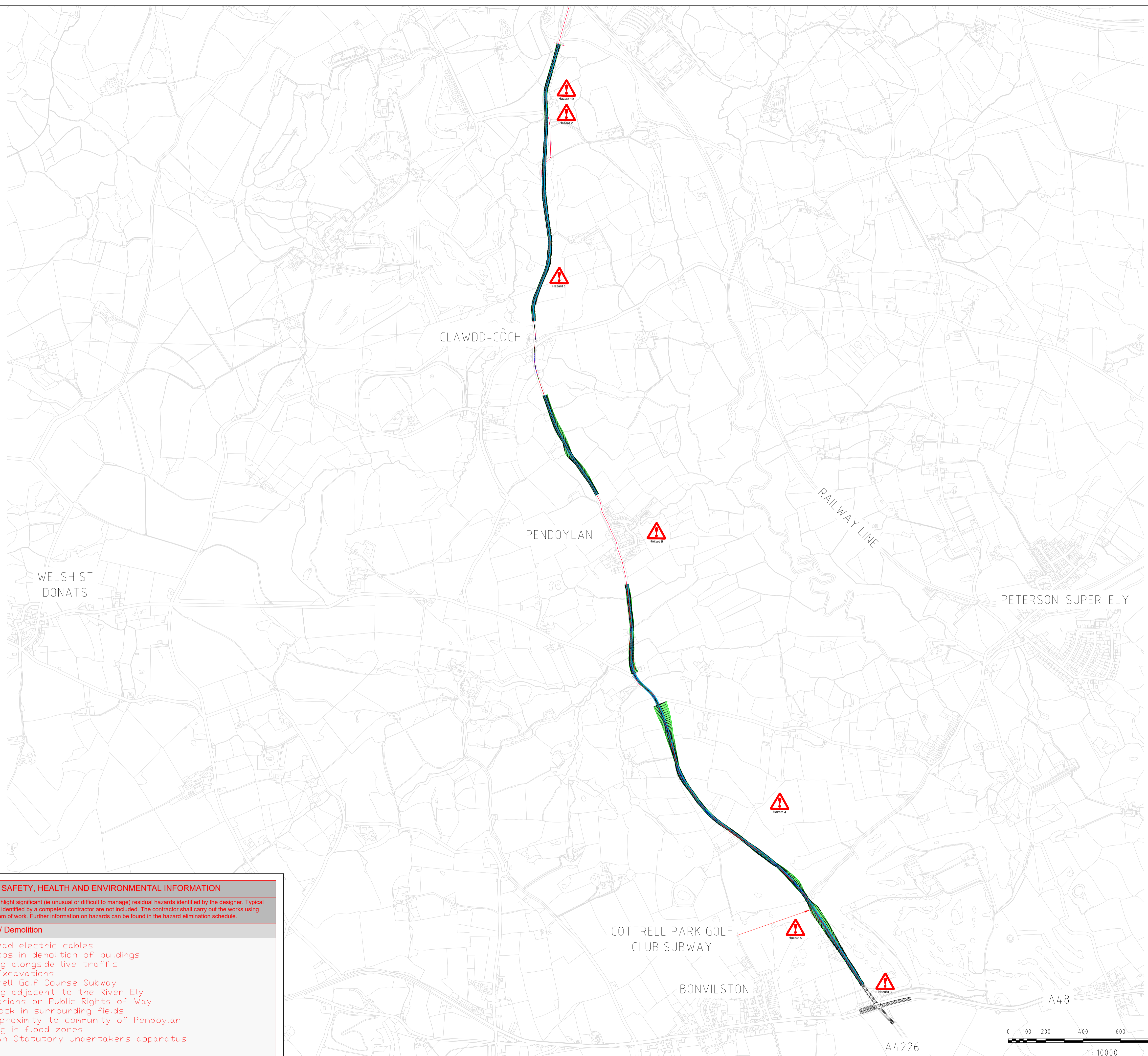
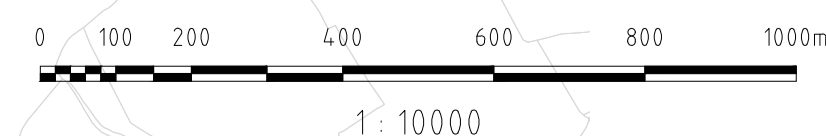
The following notes highlight significant (ie unusual or difficult to manage) residual hazards identified by the designer. Typical hazards that should be identified by a competent contractor are not included. The contractor shall carry out the works using an approved safe system of work. Further information on hazards can be found in the hazard elimination schedule.

Decommissioning / Demolition

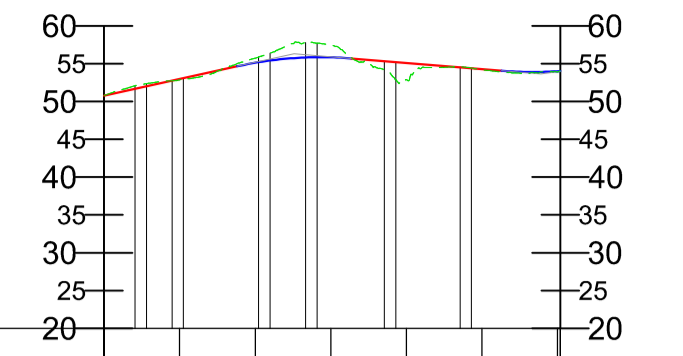
1. Overhead electric cables
2. Asbestos in demolition of buildings
3. Working alongside live traffic
4. Deep Excavations
5. Cottrell Golf Course Subway
6. Working adjacent to the River Ely
7. Pedestrians on Public Rights of Way
8. Livestock in surrounding fields
9. Close proximity to community of Pendoylan
10. Working in flood zones
11. Unknown Statutory Undertakers apparatus

Print Date: 2020-09-24 09:57:13

C:\Users\inca76293\ARCADIS\M4 J34 A48 WeITAG Stage 2 Plus - 10028657 Highways Stage Two Plus\Highways Deliverables - Stage 2 Plus\Drawings\Exhibition\3.Online Option - 30mph With Footpath and Compliant Cross Section.dwg

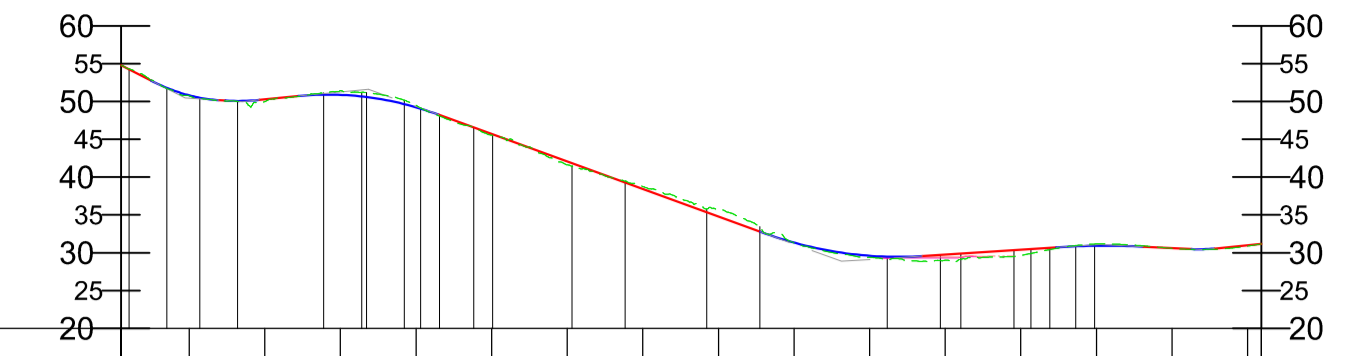


50kph Online Option North - CL
SCALE: H 1:10000,V 1:1000
DATUM: 20.000



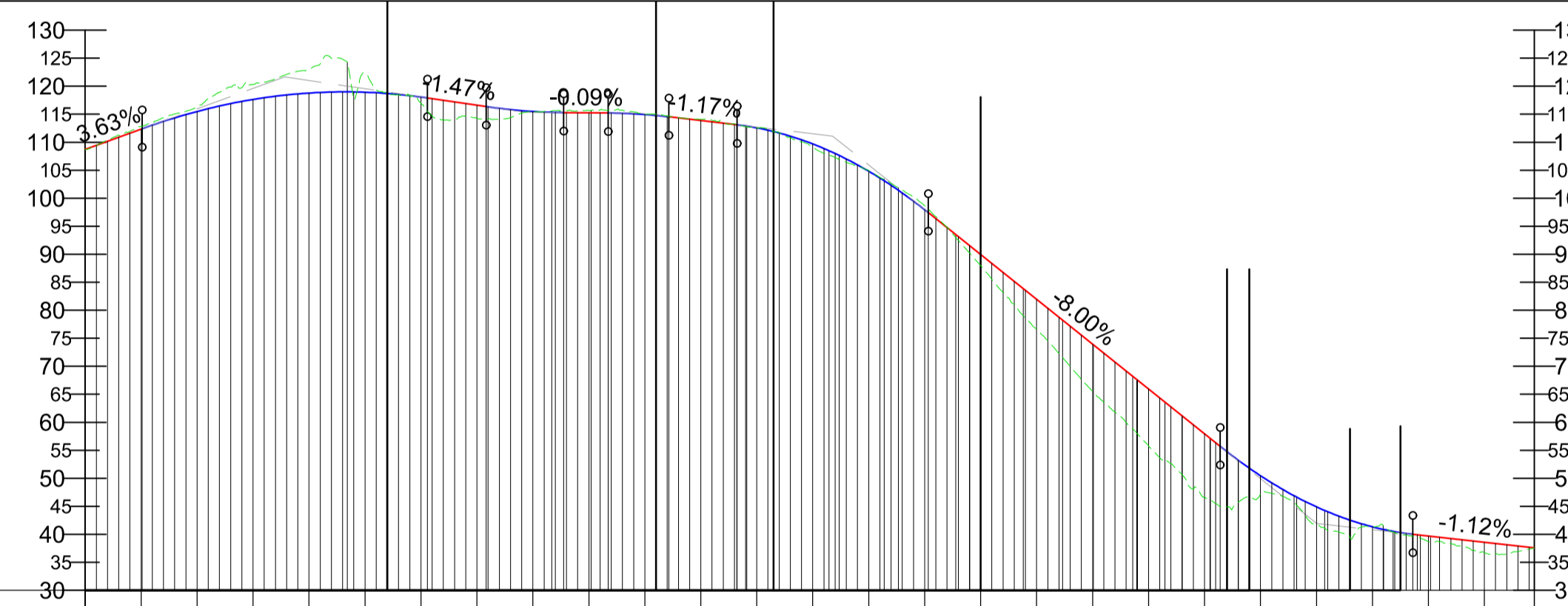
Chainage	00.000	100.000	200.000	300.000	400.000	500.000	600.000	603.690
Existing Ground Levels	50.779	52.852	55.730	57.499	52.893	54.215	53.916	54.032
Proposed Levels	50.779	52.976	55.116	56.837	55.092	54.274	54.006	54.032
Horizontal Geometry								
Vertical Geometry								
Level Difference	0.000	0.124	-0.614	-1.662	2.199	0.059	0.090	0.000

50kph Online Option North - CL
SCALE: H 1:10000,V 1:1000
DATUM: 20.000



Chainage	1009.985	1100.000	1200.000	1300.000	1400.000	1500.000	1600.000	1700.000	1800.000	1900.000	2000.000	2100.000	2200.000	2300.000	2400.000	2500.000	2518.141
Existing Ground Levels	54.796	50.761	49.992	51.448	49.513	45.555	41.622	38.746	35.768	31.306	29.399	29.015	29.638	31.159	30.578	30.883	31.173
Proposed Levels	54.782	50.810	50.271	50.876	49.227	45.688	42.059	38.420	34.781	31.341	29.595	28.758	30.408	30.916	30.607	30.992	31.173
Horizontal Geometry																	
Vertical Geometry																	
Level Difference	-0.014	0.049	0.279	-0.573	-0.285	0.143	0.437	-0.326	-0.988	0.035	0.196	0.743	0.769	-0.243	0.029	0.109	0.000

50kph Online Option South - CL
SCALE: H 1:10000,V 1:1000
DATUM: 30.000

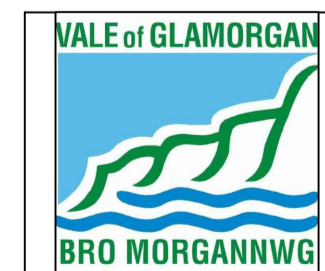


Chainage	00.000	100.000	200.000	300.000	400.000	500.000	600.000	700.000	800.000	900.000	1000.000	1100.000	1200.000	1300.000	1400.000	1500.000	1600.000	1700.000	1800.000	1900.000	2000.000	2100.000	2200.000	2300.000	2400.000	2500.000	2599.349	
Existing Ground Levels	108.715	112.817	116.254	120.309	122.966	122.304	116.940	114.319	115.537	115.641	114.995	114.074	112.575	109.121	104.934	98.660	87.985	76.596	65.524	55.801	46.582	47.270	41.793	41.413	38.701	36.686	37.580	
Proposed Levels	108.715	112.817	116.254	120.309	122.966	122.304	116.940	114.319	115.537	115.641	114.995	114.074	112.575	109.121	104.934	98.660	87.985	76.596	65.524	55.801	46.582	47.270	41.793	41.413	38.701	36.686	37.580	
Horizontal Geometry																												
Vertical Geometry																												
Level Difference	0.000	-0.476	-0.768	-2.677	-4.189	-3.392	1.128	2.285	-0.054	-0.394	-0.050	-0.210	-0.008	0.570	-0.118	-0.720	1.959	5.347	8.419	10.143	11.362	3.192	3.109	-0.072	1.001	1.895	0.000	

NOTES:

P01	18AUG20	EXHIBITION	NC	MT	GH
Rev	Date	Description	Drawn	Check	Approv

Vale of Glamorgan



Site

Client

Civic Offices
Hollon Road
Burry
CF63 4RU
Phone +44 (0)1446 704 768
Fax
ccameron@valeofglamorgan.gov.uk
www.valeofglamorgan.gov.uk

Suitability Description:

FIT FOR INFORMATION

Designed	N. CLEMENTS	Date	30OCT19	Signed
Drawn	N. CLEMENTS	Date	30OCT19	Signed
Checked	M. THOMAS	Date	30OCT19	Signed
Approved	D. ROWLANDS	Date	30OCT19	Signed
Scale:	As shown	Datum:	AOD	
Original Size:	A1	Grid:	OS	
Suitability Code:	S2	Project Number:	10028657	

PROJECT:

M4 JUNCTION 34
TO A48 WeITAG
S2 PLUS

TITLE:

ONLINE
SUB OPTION 1
LONG SECTION PROFILE
EXHIBITION



Registered office:
Arcadis House
34 York Way
London
N1 9AB

Coordinating office:
Unit 17 Innovation Centre
Bridge of Don
Aberdeen AB23 8GX
Tel: 44 (0)1224 822494

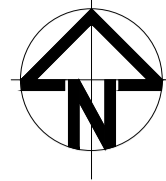
www.arcadis.com

Drawing Number:
10028657-ARC--XX-DR-HE-0030

Revision:
P01



Appendix E

Drawings | Option C2 – Existing Infrastructure (Online) Enhancement



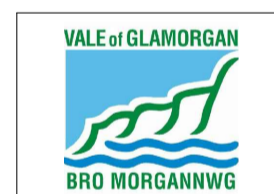
NOTES:

LEGEND:

-  EXISTING ROUTE
-  FLOOD AREA

Rev	Date	Description	Drawn	Check	Approv
P01	08APR20	FIT FOR INFORMATION		NC	MT DR

Vale of Glamorgan



PROJECT:
**M4 JUNCTION
 34 TO A48
 WeITAG S2 PLUS**

Site	Client
	Civic Offices Halton road Barry CF63 4RU Phone +44 (0)1446 704 768 Fax ccameron@valeofglamorgan.gov.uk www.valeofglamorgan.gov.uk



Registered office:
 Arcadis House
 34 York Way
 London
 N1 9AB

Coordinating office:
 Arcadis Cymru House
 Fortran Road, St Mellons
 Cardiff, CF3 0EY
 Tel: 44 (0)29 2092 6700

www.arcadis.com

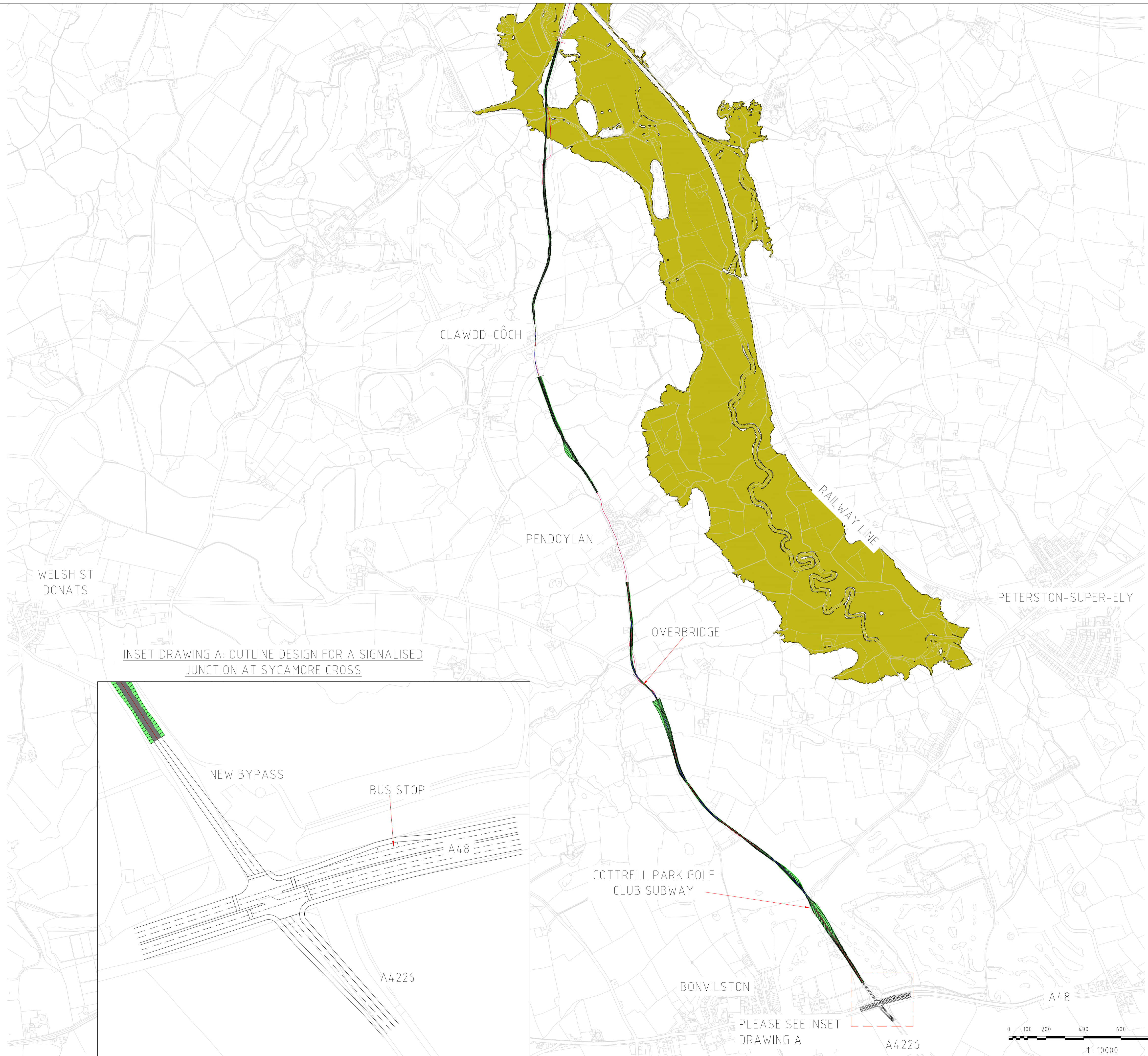
TITLE:

**ONLINE
 SUB OPTION 2
 PLAN**

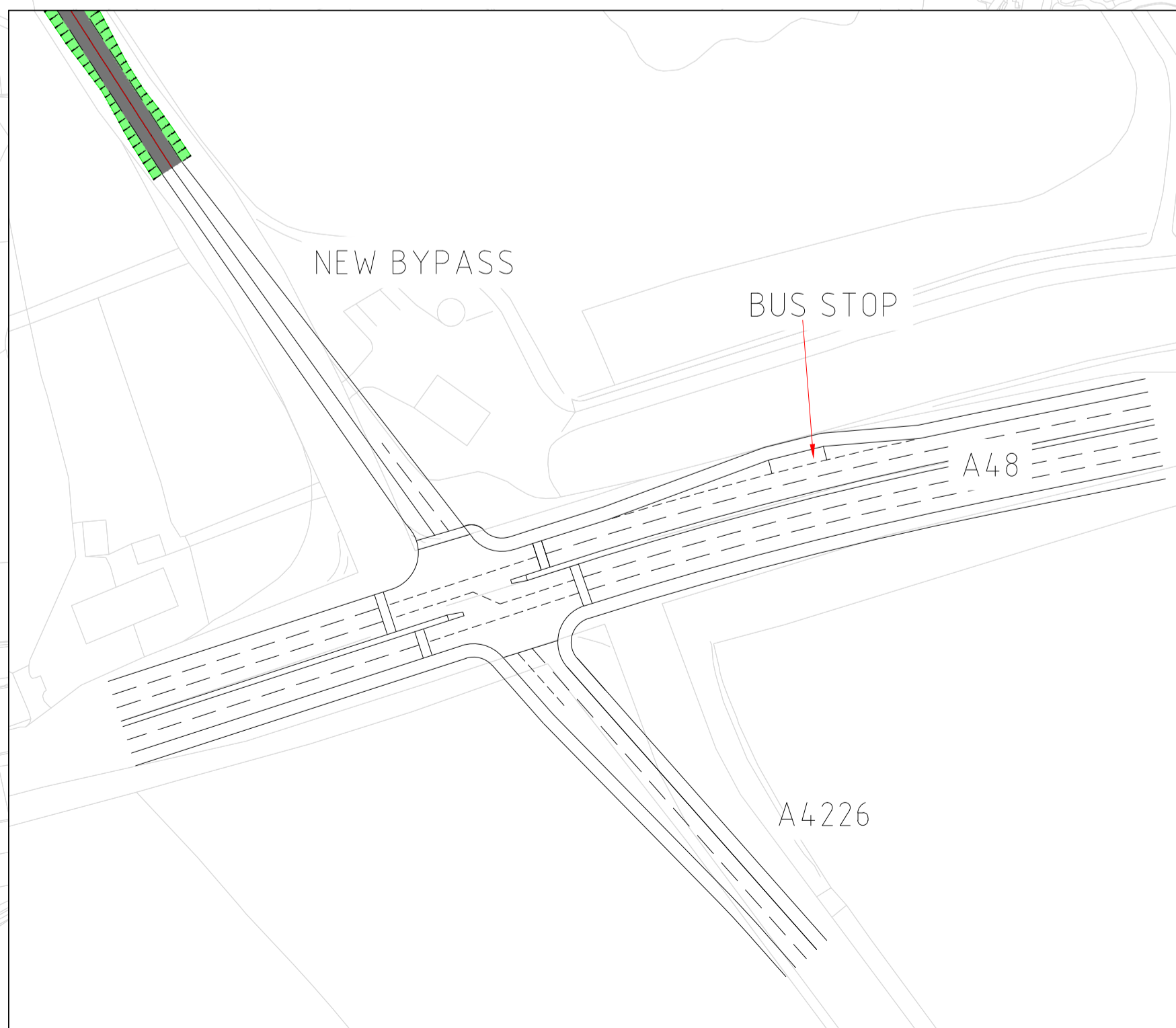
Designed	R. ELLIS	Signed	Date	20MAR19
Drawn	M. SMITH	Signed	Date	20MAR19
Checked	C. BURGHAM	Signed	Date	20MAR19
Approved	G. HARRIS	Signed	Date	20MAR19
Scale:	1:10000	Datum:	AOD	
Original Size:	A1	Grid:	OS	
Suitability Code:	S2	Project Number:	10028657	

Suitability Description: **FIT FOR INFORMATION**

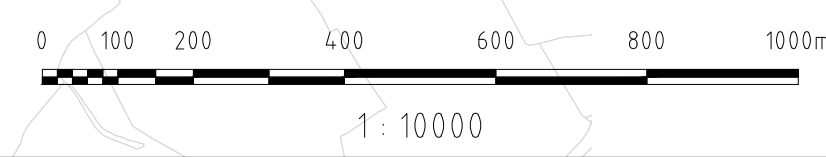
Drawing Number:	10028657-ARC-XX-XX-DR-HE-0016	Revision:	P01
-----------------	-------------------------------	-----------	-----

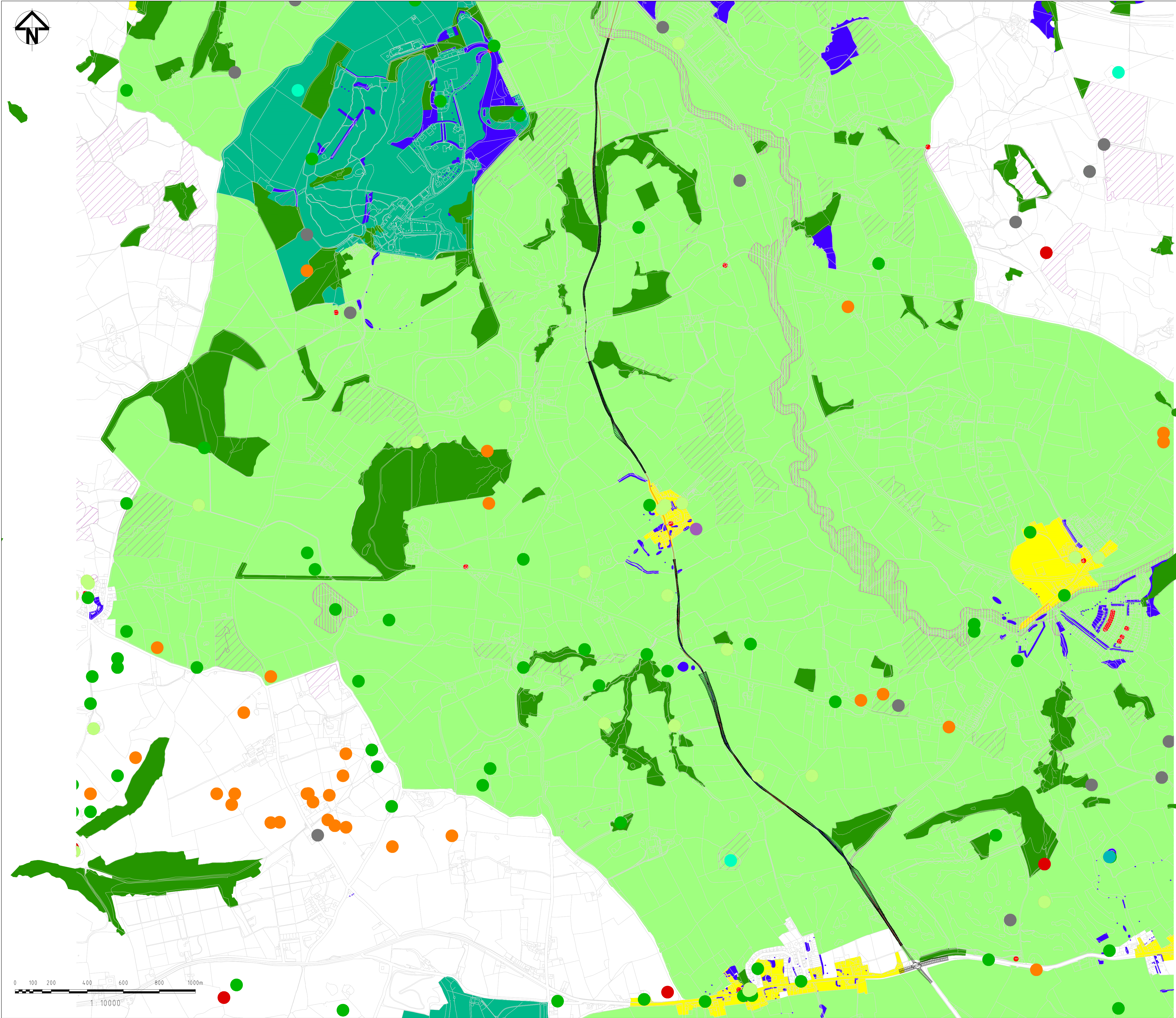


INSET DRAWING A: OUTLINE DESIGN FOR A SIGNALISED JUNCTION AT SYCAMORE CROSS



PLEASE SEE INSET DRAWING A





NOTES:

LEGEND:

- ARCHAEOLOGICAL FEATURES:
- ROMAN
 - BRONZE AGE
 - NEOLITHIC
 - MEDIEVAL
 - POST MEDIEVAL
 - EARLY MEDIEVAL
 - IRON AGE
 - METHOLITHIC
 - MODERN
 - MULTI PERIOD
 - PREHISTORIC
 - UNKNOWN
- EXISTING ROUTE
- PUBLIC RIGHT OF WAY
- ECOLOGY AND NATURE CONSERVATION:
- SITE OF SPECIAL SCIENTIFIC INTEREST
 - SITES OF IMPORTANCE FOR NATURE CONSERVATION
 - TREE PRESERVATION ORDER
 - SPECIAL LANDSCAPE AREAS
 - AIR QUALITY MANAGEMENT AREA
- DESIGNATED HERITAGE ASSETS:
- SCHEDULED MONUMENTS
 - LISTED BUILDINGS
 - CONSERVATION AREA
 - PARKS AND GARDENS
 - ANCIENT WOODLAND

Rev	Date	Description	Drawn	Check	Approv	
P01	18AUG20	EXHIBITION		NC	MT	DR

Vale of Glamorgan

VALE OF GLAMORGAN
BRO MORGANNWG

PROJECT:
**M4 JUNCTION
34 TO A48
WeITAG S2 PLUS**

Site	Client
	Civic Offices Hollon road Barry CF63 4RU Phone +44 (0)1446 704 768 Fax ccameron@valeofglamorgan.gov.uk www.valeofglamorgan.gov.uk



Registered office:
Arcadis House
34 York Way
London
N1 9AB

Coordinating office:
Arcadis Cymru House
Fortran Road, St Mellons
Cardiff, CF3 0EY
Tel: 44 (0)29 2092 6700

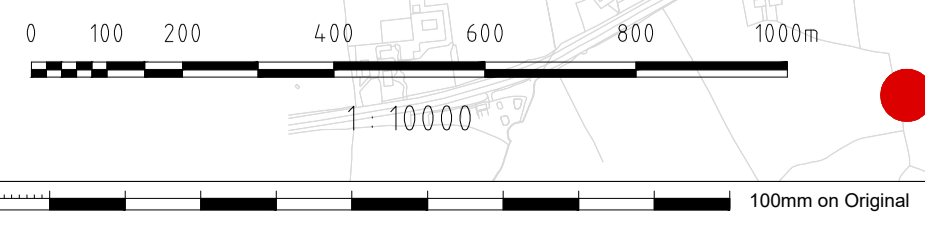
www.arcadis.com

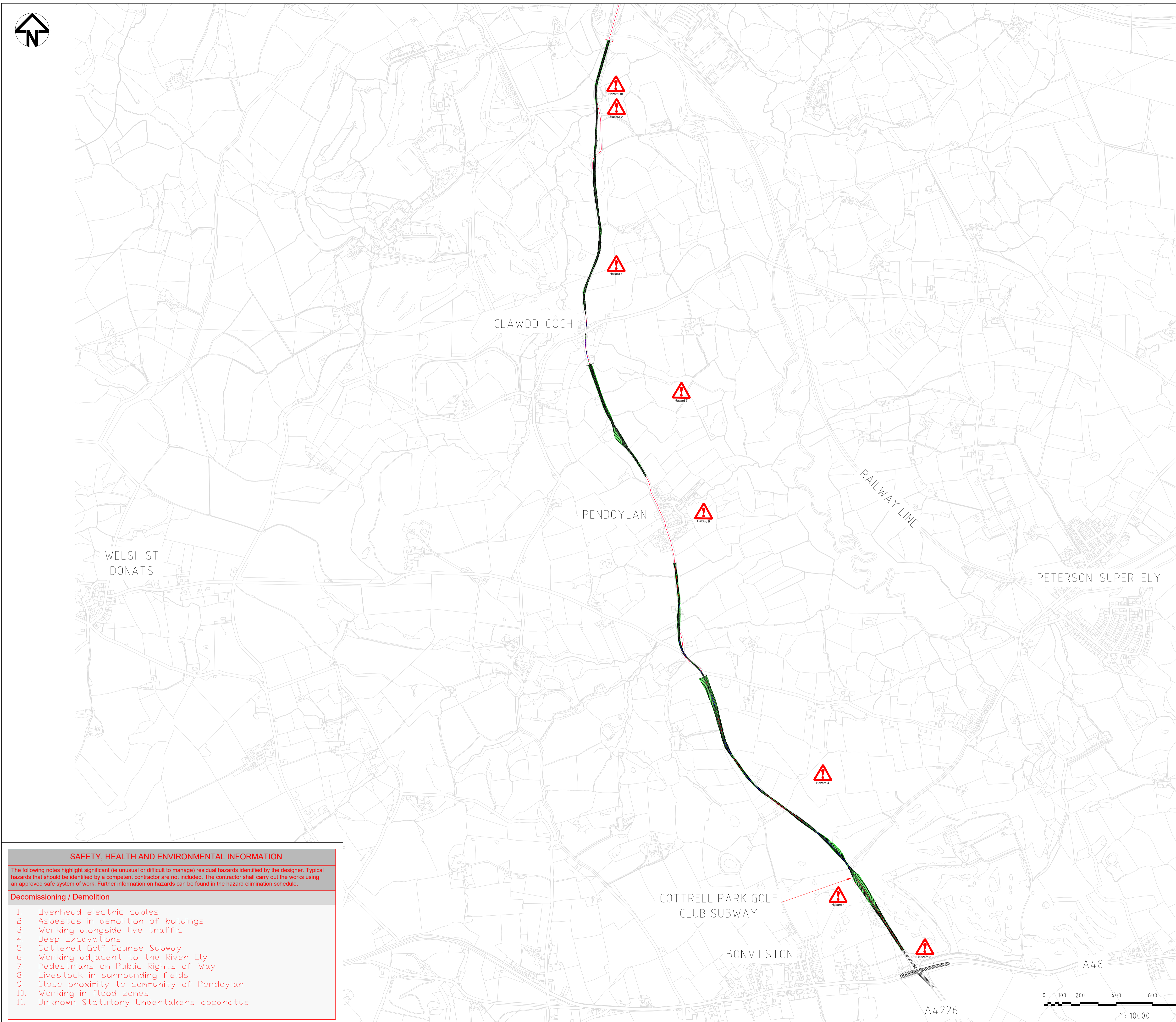
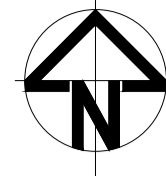
TITLE:
**ONLINE
SUB OPTION 2
ENVIRONMENTAL CONSTRAINTS
EXHIBITION**

Designed	N. CLEMENTS	Signed	Date	29OCT19
Drawn	N. CLEMENTS	Signed	Date	29OCT19
Checked	M. THOMAS	Signed	Date	29OCT19
Approved	D. ROWLANDS	Signed	Date	29OCT19
Scale:	1:10000	Datum:	AOD	
Original Size:	A1	Grid:	OS	
Suitability Code:	S2	Project Number:	10028657	

Suitability Description:
FIT FOR INFORMATION

Drawing Number: 10028657-ARC-XX-XX-DR-HE-0031	Revision: P01
--	------------------





NOTES:

LEGEND:

EXISTING ROUTE

Rev	Date	Description	Drawn	Check	Approv
P01	18AUG20	EXHIBITION			

Vale of Glamorgan



PROJECT:
M4 JUNCTION
34 TO A48
WeITAG S2 PLUS

Site	Client
	Civic Offices Holton road Barry CF63 4RU Phone +44 (0)1446 704 768 Fax ccameron@valeofglamorgan.gov.uk www.valeofglamorgan.gov.uk



Registered office:
Arcadis House
34 York Way
London
N1 9AB

Coordinating office:
Arcadis Cymru House
Fortran Road, St Mellons
Cardiff, CF3 0EY
Tel: 44 (0)29 2092 6700

www.arcadis.com

TITLE:
ONLINE
SUB OPTION 2
HAZARDS
EXHIBITION

Designed	R. ELLIS	Signed	Date	05MAR18
Drawn	M. SMITH	Signed	Date	05MAR18
Checked	M. THOMAS	Signed	Date	05MAR18
Approved	G. HARRIS	Signed	Date	05MAR18
Scale:	1:10000	Datum:	AOD	
Original Size:	A1	Grid:	OS	
Suitability Code:	S2	Project Number:	10028657	

FIT FOR INFORMATION

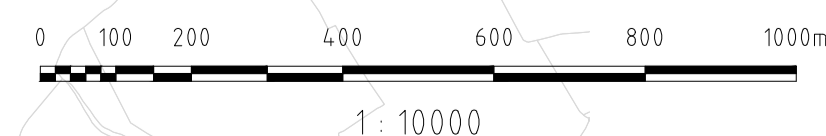
Drawing Number:	10028657-ARC-XX-XX-DR-0032	Revision:	P01
-----------------	----------------------------	-----------	-----

SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

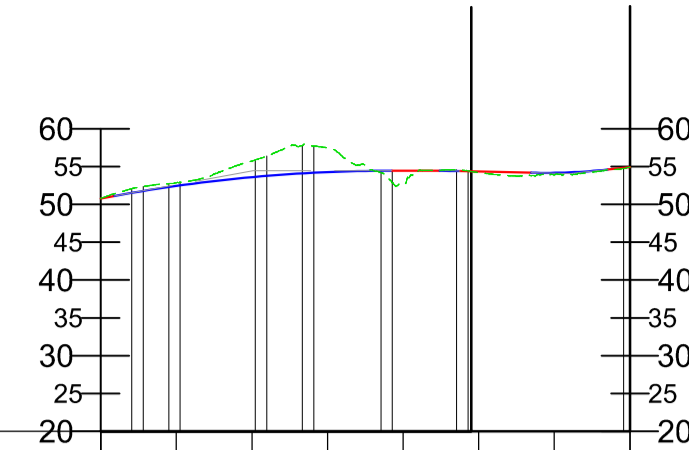
The following notes highlight significant (ie unusual or difficult to manage) residual hazards identified by the designer. Typical hazards that should be identified by a competent contractor are not included. The contractor shall carry out the works using an approved safe system of work. Further information on hazards can be found in the hazard elimination schedule.

Decommissioning / Demolition

- Overhead electric cables
- Asbestos in demolition of buildings
- Working alongside live traffic
- Deep Excavations
- Cottrell Golf Course Subway
- Working adjacent to the River Ely
- Pedestrians on Public Rights of Way
- Livestock in surrounding fields
- Close proximity to community of Pendoylan
- Working in flood zones
- Unknown Statutory Undertakers apparatus

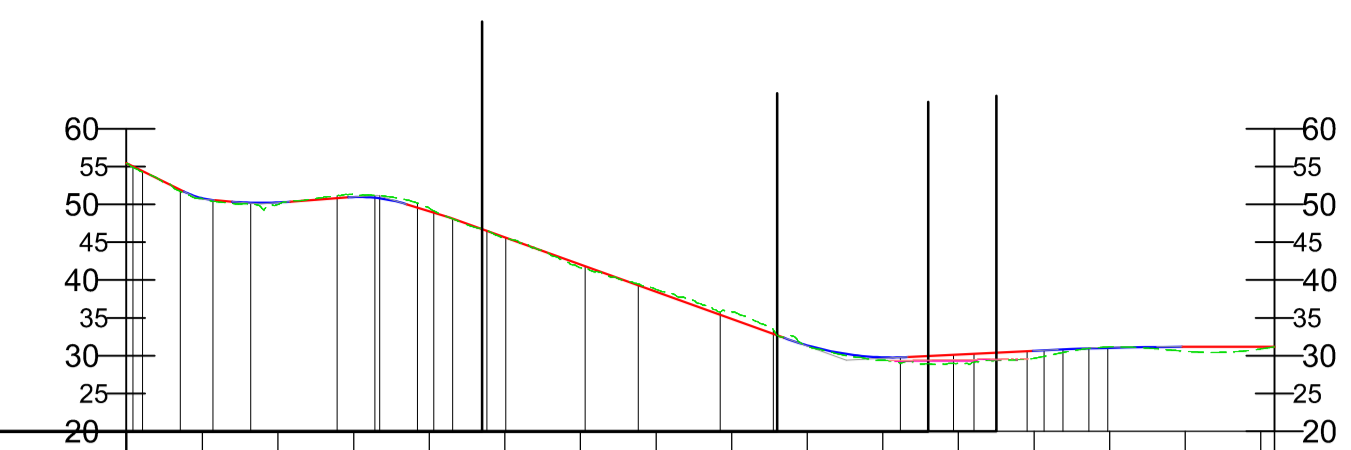


50kph Online Option North - CL
SCALE: H 1:10000,V 1:1000
DATUM: 20.000



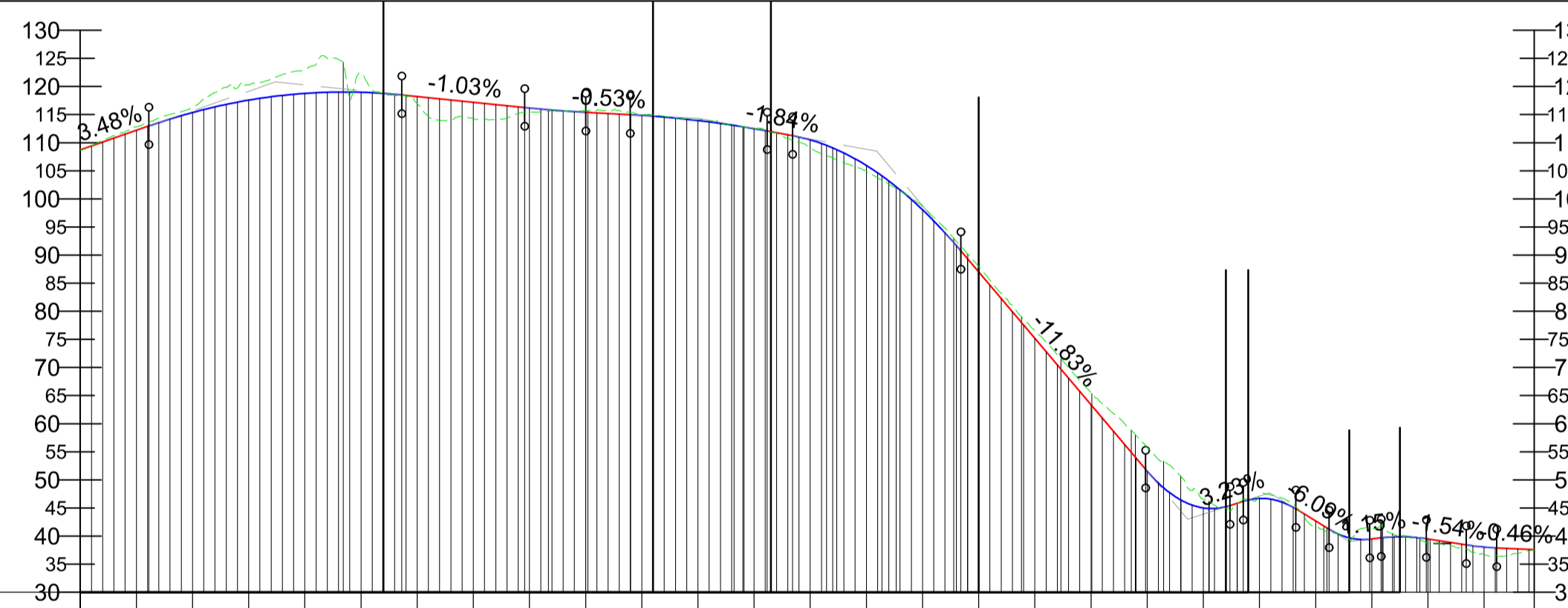
Chainage	00.000	100.000	200.000	300.000	400.000	500.000	600.000	700.000
Existing Ground Levels	50.779	52.852	55.730	57.499	52.883	54.215	53.916	54.928
Proposed Levels	50.779	52.437	53.602	54.267	54.438	54.345	54.178	54.928
Horizontal Geometry								
Vertical Geometry								
Level Difference	0.000	-0.415	-2.128	-3.232	1.546	0.130	0.262	0.001

50kph Online Option North - CL
SCALE: H 1:10000,V 1:1000
DATUM: 20.000



Chainage	999.371	1000.000	1100.000	1200.000	1300.000	1400.000	1500.000	1600.000	1700.000	1800.000	1900.000	2000.000	2100.000	2200.000	2300.000	2400.000	2500.000
Existing Ground Levels	55.882	50.761	49.992	51.448	49.513	45.555	41.622	38.746	35.768	31.306	29.399	28.015	29.638	31.159	30.578	30.883	
Proposed Levels	55.446	50.803	50.252	50.961	49.080	45.621	42.025	38.430	34.834	31.356	29.775	30.141	30.649	31.028	31.157	31.171	
Horizontal Geometry																	
Vertical Geometry																	
Level Difference	0.059	0.042	0.260	-0.488	-0.433	0.066	0.403	-0.316	-0.934	0.050	0.376	1.127	1.010	-0.131	0.578	0.288	0.000

50kph Online Option South - CL
SCALE: H 1:10000,V 1:1000
DATUM: 30.000



Chainage	00.000	100.000	200.000	300.000	400.000	500.000	600.000	700.000	800.000	900.000	1000.000	1100.000	1200.000	1300.000	1400.000	1500.000	1600.000	1700.000	1800.000	1900.000	2000.000	2100.000	2200.000	2300.000	2400.000	2500.000	2589.349	
Existing Ground Levels	108.715	112.817	116.254	120.309	122.966	122.304	116.940	114.319	115.537	115.641	114.995	114.074	112.575	109.121	104.934	98.660	87.985	76.596	65.524	55.801	46.582	47.270	41.793	41.413	38.701	36.686	37.580	
Proposed Levels	108.715	112.193	115.369	117.569	118.769	118.970	116.207	117.182	116.158	115.398	114.853	113.941	112.492	110.500	105.944	98.054	87.001	75.176	63.350	51.529	45.013	46.702	42.686	39.493	39.482	38.040	37.580	
Horizontal Geometry																												
Vertical Geometry																												
Level Difference	0.000	-0.624	-0.885	-2.740	-4.197	-3.335	1.267	2.863	0.621	-0.244	-0.142	-0.133	-0.083	1.379	1.010	-0.605	-0.984	-1.421	-2.174	-4.271	-1.570	-0.568	0.884	-1.920	0.781	1.354	0.000	

NOTES:

P01	18AUG20	EXHIBITION	NC	MT	DR
Rev	Date	Description	Drawn	Check	Approv

100mm on Original

Print Date: 2020-09-24 11:58:56

C:\Users\inca76293\ARCADIS\M4 J34 A48 WeITAG Stage 2 Plus - 10028657 Highways Stage Two Plus\Xrefs\3D Models\4.30mph - Online Options Without Footpath - (Clawd Coch Adjustment).dwg

Vale of Glamorgan



Site

Client

Civic Offices
Hollon Road
Burry
CF63 4RU
Phone +44 (0)1446 704 768
Fax
ccameron@valeofglamorgan.gov.uk
www.valeofglamorgan.gov.uk

Suitability Description:

FIT FOR INFORMATION

Designed	N. CLEMENTS	Date	30OCT19	Signed	
Drawn	N. CLEMENTS	Date	30OCT19	Signed	
Checked	M. THOMAS	Date	30OCT19	Signed	
Approved	D. ROWLANDS	Date	30OCT19	Signed	
Scale:	As shown	Datum:	AOD		
Original Size:	A1	Grid:	OS		
Suitability Code:	S2	Project Number:	10028657		

PROJECT:

M4 JUNCTION 34
TO A48 WeITAG
S2 PLUS

TITLE:

ONLINE
SUB OPTION 2
LONG SECTION PROFILE
EXHIBITION



Registered office:
Arcadis House
34 York Way
London
N1 9AB

Coordinating office:
Arcadis Cymru House
Fortran Road, St Mellons
Cardiff, CF3 0EY
Tel: 44 (0)29 2092 6700

www.arcadis.com

Drawing Number:
10028657-ARC-XX-XX-DR-HE-0033

Revision:
P01

Copyright reserved

Appendix F

Transport Case | Impact Assessment Tables

Impact Assessment | Do-Minimum (2036 Scenario)

Do-Minimum (2036 Scenario)		
	Impacts	Scale
Social		
Physical Activity	There would be no change to existing provision for active travel and increased traffic in the future is more likely to discourage trips by walking and cycling in the absence of suitable infrastructure.	-
Journey Quality	The existing road is non-compliant to DMRB standards retaining winding and undulating curvatures and characterised by high hedgerows adjacent to the alignment. The existing journey quality is poor on the current strategic and local road network, especially regarding existing bus services travelling along the route and diverted traffic following incidents on the adjoining M4 corridor. A deterioration to traveller's care, views and stress (frustration, fear of potential accidents and route uncertainty) is anticipated as planned investment and maintenance is unlikely to alleviate the existing problems, which in turn are likely to worsen due to forecast increases in local and regional trips by car in the medium to long-term.	-
Accidents	A deterioration to accidents in the study area is anticipated as planned investment and maintenance is unlikely to alleviate the existing problems, which in turn are likely to worsen due to forecast increases in local and regional trips by car in the medium to long-term.	-
Security	Planned investment and maintenance to existing security features including boundaries and lighting is unlikely to improve the existing security of the route. No change is therefore anticipated.	0
Access to Employment	Access to employment is anticipated to deteriorate should the status quo remain as planned investment and maintenance is unlikely to alleviate the existing problems, which in turn are likely to worsen due to forecast increases in local and regional trips by car in the medium to long-term.	-
Access to Services	Access to services is subsequently anticipated to deteriorate should the status quo remain as planned investment and maintenance is unlikely to alleviate the existing problems, which in turn are likely to worsen due to forecast increases in local and regional trips by car in the medium to long-term.	-
Affordability	The potential to divert trips from the car to public transport is low as journey time and journey time reliability for buses remains poor with the car remaining as the dominant mode of travel in the region.	-
Severance	No change to severance is anticipated.	0
Option and Non-Use Values	The do-minimum scenario provides no alternative means of travel to the car and therefore travel is reliant on the existing transport network, with no step-change in transport options provided.	-
Cultural		
Cultural Facilities	Access to cultural facilities (such as tourist destinations at Barry) is anticipated to deteriorate should the status quo remain as planned investment and maintenance is unlikely to alleviate the existing problems,	-

Do-Minimum (2036 Scenario)		
	which in turn are likely to worsen due to forecast increases in local and regional trips by car in the medium to long-term.	
Welsh Language	No change in impacts on Welsh language is anticipated.	0
Environment		
Noise	No change to noise is anticipated. Local increases in noise could result as an increase in local/ regional traffic would be anticipated, although no significant or quantifiable change is assumed.	0
Air Quality	<p>Based upon the 2018 Air Quality Progress (APR) Report for the Vale of Glamorgan, the APR confirms that in 2017 air quality within the Vale of Glamorgan continues to meet the relevant air quality objectives¹. From the 47 locations monitored throughout the Vale Borough with the use of passive diffusion tubes, no sites breach the national NO₂ annual objective of 40µg/m³ or the NO₂ 1-hour objective (200µg/m³, not to be exceeded more than 18 times per year). Based on the 2017 datasets it can be concluded that the NO₂ 1-hour objective was not breached. There are no Air Quality Management Areas (AQMAs) within or near to the project's study area.</p> <p>No change to air quality is anticipated in the local study area. A local deterioration in air quality could result as an increase in local/ regional traffic, although no significant or quantifiable change is assumed given the existing constraints of the road network through the Pendoylan corridor.</p>	0
Greenhouse Gases	No change to greenhouse gases has been calculated. Greenhouse gases will be impacted by increases in traffic flow but also in vehicle energy consumption and emissions rates. The options appraisal calculates change in GNG compared to the Do-Minimum.	0
Landscape	No change to landscape is anticipated.	0
Townscape	No change to townscape is anticipated.	0
Historic Environment	No change to historic environment is anticipated.	0
Biodiversity	No change to biodiversity is anticipated.	0
Water Environment	No change to water environment is anticipated.	0
Residential Amenity	No change to residential amenity is anticipated.	0
Economic		
Journey Time Changes	It is assumed that a continued increase in car-based trips throughout the region would adversely impact on journey times as congestion worsens, particularly on the M4, A4232 and A48 but also on the A4119 north of M4 Junction 34. This would lead to increased pressure on the local road network as traffic diverts to avoid congestion.	-

¹ Vale of Glamorgan Council Air Quality Progress Report 2018


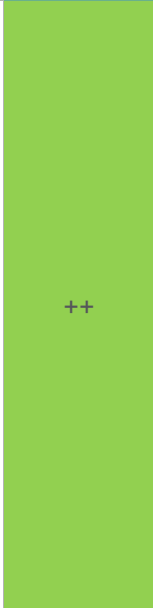
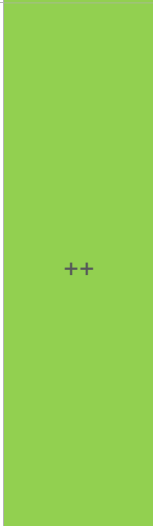
Do-Minimum (2036 Scenario)

Journey Time Reliability Changes	It is assumed that a continued increase in car-based trips throughout the region would adversely impact on journey time reliability as congestion worsens, particularly on the M4, A4232 and A48 but also on the A4119 north of M4 Junction 34. This would lead to increased pressure on the local road network as traffic diverts to avoid congestion.	-
Transport Costs	Worsening journey times throughout the region are anticipated to increase transport costs for road users. The existing network constraints and poor journey time reliability would continue to adversely impact public transport operating costs, with bus services also anticipated to be impacted by increasing car trips through the Pendoylan corridor as regional increases in traffic growth are forecast.	-
Wider Economic Impacts	The increasing journey times and impacts on reliability and issues of connectivity to strategic employment sites will constrain the wider economy and be likely to negatively impact on investment, employment and productivity.	-
Land and Property	No change to land and property is anticipated.	0

Impact Assessment | Option A – Highway Route East of Pendoylan

Option A – Highway Route East of Pendoylan		
	Impacts	Scale
Social		
Physical Activity	<p>It is expected that a new highway route would have a slight beneficial impact on physical activity with the integral provision of segregated walking and cycling infrastructure that would connect southwards to join the route adjacent to Five Mile Lane. It could also improve conditions for walkers and cyclists along the existing corridor including between the settlements of Pendoylan and Clawdd-Coch.</p>	+
Journey Quality	<p>It is anticipated that the implementation of a new highway route to the east of Pendoylan would establish improvements in journey quality in comparison to the do-minimum scenario with enhancements to traveller's care, views and stress. The broadly qualitative assessment completed using DMRB 11.3.9.2 (travellers' views) and 11.3.9.3/4 (traveller stress) has subsequently been considered alongside traveller care elements noted within TAG Unit A4.1.6 (Journey Quality Impacts). It is noted that these DMRB Volume 11 Section 3 Part 9 references are now withdrawn, although the appraisal has been completed in line with the existing TAG Unit A4.1.6 guidance.</p> <p>The study area between the M4 Junction 34 and the A48 at Sycamore Cross is predominantly an area of high-quality scenic countryside interspersed with ancient woodland, important nature conservation sites, SSSI and conservation areas. The existing highway route interconnecting via Pendoylan is primarily bounded by tall hedgerow with restrictive views of the surrounding landscape. In contrast, the new route would afford more people/drivers to see the surrounding scenery. Whilst views would in part be intermittent with the route traversing through cuttings, this is unlikely to adversely detract from a traveller's perception of the scene with the impacts on views broadly comparable between the east and west alignment.</p> <p>In addition, it is anticipated that there would be an improvement regarding traveller stress following implementation of a new road. A range of factors can affect a traveller's exposure to driver stress primarily encompassing frustration, fear of potential accidents, and uncertainty relating to the route being followed. The existing Pendoylan corridor, especially the route section between the village and the A48 Sycamore Cross junction is subsequently characterised by an undulating and narrow sub-standard highway with limited passing places and subsequent potential for vehicle conflict and moderate to high traveller stress.</p> <p>DMRB outlines the impact of traffic volume on driver stress categorising the average peak hourly flow per lane (in flow units/ 1 hour) for a 60mph single-carriageway road as low (<600 vehicles), moderate (600-800 vehicles) and high (over 800 vehicles). Implementation of the link road designed to current DMRB standards could subsequently establish high levels of driver stress during the AM and PM peak with maximum forecast peak hourly flows per lane of 1,234 and 1,200 vehicles respectively, both in relation to the northbound direction of flow. The guidance does however note that the advised thresholds are provided for guidance only and that the assessment of specific routes can only be made in the light of full knowledge of local conditions. It is therefore anticipated that the forecast level of traffic flow for the road link would be offset by the superior design standards to which the new scheme would be built with perceived improvements to driver frustration, route uncertainty and fear of potential accidents establishing a low to moderate level of stress in comparison to the existing route. Views out from</p>	+++

Option A – Highway Route East of Pendoylan

	<p>the road can also provide interest which can further be considered to help alleviate driver stress.</p> <p>Traveller care is less influential regarding the proposed highway scheme with cleanliness, facilities and information factors considered to retain a neutral impact against the do-minimum scenario. Improvements would however be identified regarding the traveller’s environment with enhanced driver capability anticipated as a result of a new and improved route, as well as potential to establish an improved condition and smoothness of ride.</p> <p>The implementation of the new highway route would provide further benefits to walkers and cyclists through enhanced infrastructure provision and interconnectivity. Implementation of an integral shared walking/ cycling route would provide improved traveller care (information, environment), views (similar benefits to those noted for the highways review), and stress with perceived reductions in frustration, fear of potential accidents and route uncertainty. Whilst no new public transport infrastructure or services are specifically proposed as part of this option, the highway route would facilitate more attractive journeys for buses with similar highway benefits as noted herewith.</p> <p>In line with TAG Unit A4.1.6, a high rating has subsequently been applied to the scoring as the number of travellers affected is forecast to be in excess of 10,000 per day.</p>	
<p>Accidents</p>	<p>The provision of a new highway route by-passing Pendoylan is anticipated to reduce traffic flow and with the potential to improve road safety conditions along the existing Pendoylan corridor. In addition, provision of a new highway route to current DMRB highway standards also affords the likelihood of minimising accidents together with the opportunity to integrate segregated sustainable travel measures as part of the integral design.</p> <p>The traffic forecasting has enabled a calculation of accident benefits using the DfT software COBALT. The impacted links were identified by finding the change in AADT (Annual Average Daily Flows) as a result of the scheme and using the standard criteria of finding the links where the change in flows is 5% or more with a flow change of +/- 500 AADT for 2036. The accident benefit assessment has been undertaken for the impacted links only instead of a cordon area.</p> <p>The results show positive scheme benefits with a reduction in accident cost of £16.6m, over the 60-year period in 2010 prices. The analysis also shows that the scheme will reduce 446 accidents, which is a significant reduction of 9% compared to the Do-Minimum.</p>	 <p style="text-align: center;">++</p>
<p>Security</p>	<p>A review of security has been completed in line with TAG Unit A4.1.4 (Security Impacts) to assess the implementation of the route alignment. In summary, a moderate beneficial impact is considered reasonable given the new road will be DMRB compliant with improvements to several factors including lighting and visibility, landscaping, informal surveillance and site perimeters.</p> <p>Due to the rural nature of the proposed route, new highway lighting for the benefit of vehicles has only been considered at new junctions. This will be implemented to current standards to enhance upon existing provision. In addition, and in accordance with Sustrans guidance, 5m high lighting columns have been chosen for the length of the cycleway at 35m intervals and included within the cost makeup for the option. It is however recommended that due to the proximity to the proposed carriageway that a risk assessment be carried out during the next stage to ensure that the lighting does not adversely affect traffic using the bypass.</p>	 <p style="text-align: center;">++</p>

Option A – Highway Route East of Pendoylan

	<p>There are also considered to be slight improvements to the site perimeter, landscaping and natural surveillance. The existing route predominantly consists of narrow lanes with tall hedgerow on both sides of the carriageway adversely impacting on visibility. For the new road it has been assumed that the entire length of both sides of the road will require fencing to separate land with provision of Timber Post and Four Rail Fence in accordance with Highways Construction Detail (HCD) HCD/13. Where the road passes several houses, 4m high Acoustic Fencing has also been allowed for (based on length). In the long-term the establishment of hedgerow would be anticipated; however, this is likely to be managed to maintain suitable safety and security for users of the proposed route including pedestrians and cyclists.</p> <p>It is also noted within the TAG Unit A4.1 guidance that improved natural visibility out from the road subsequently has the potential to provide an enhanced perception of safety and security in comparison to the existing route corridor with its significant visibility constraints.</p>	
<p>Access to Employment</p>	<p>The traffic modelling completed to assess the route option has quantified user and provider benefits (£000's PVB 2010 prices discounted to 2010) for the new link totalling £36M for commuters and £52M for business. This indicates that the new strategic highway route would afford significant benefits for access to work and for businesses in the region. This would include accessibility to strategic sites in the region including the three sites identified as the Cardiff Airport to St Athan Enterprise Zone (EZ) encompassing Cardiff Airport, St Athan Aerospace Business Park and Gateway Development Zone, as well as employment sites at M4 Junction 34 and 'sub-regional' employment opportunities particularly along the A4119 corridor, at the Mwyndy/ Talbot Green strategic site, and the Llanilid strategic opportunity corridor, by providing a new link with reduced journey times and improved journey time reliability.</p> <p>As highlighted within the Welsh Government PBA report, '<i>Vale of Glamorgan Connectivity Study – The Case for Change (2017)</i>', the proposed commercial developments at the Cardiff Airport to St Athan EZ represent an investment of strategic significance in the Vale of Glamorgan with the Vale of Glamorgan Local Development Plan identifying the need for transport connectivity improvements if the potential of these strategic sites is to be maximised. Furthermore, the report identifies that '<i>facilitating the travel-to-work market, business-to-business interactions and freight movements will require a transport network which facilitates efficient movement to, from and within the Vale of Glamorgan</i>' for which the proposed route option could establish significant value.</p> <p>Improved highway conditions are anticipated to promote the development of more sustainable transport modes for access to employment. It would enable bus services to be enhanced between the A4119 corridor and employment sites in the Vale by providing a suitable highway connection. The Welsh Government PBA report referenced herewith subsequently concludes that '<i>improving the transport connectivity of the Vale of Glamorgan is considered necessary to support national, regional and local economic performance.</i>'</p>	<p>++</p>
<p>Access to Services</p>	<p>The traffic modelling completed to assess the route option has quantified user and provider benefits (£000's PVB 2010 prices discounted to 2010) for the new link totalling £49.8M for other consumers than commuters or business. This indicates that the new strategic highway route could afford significant benefits for access to services in the region. It is therefore considered that a new strategic highway link with reduced journey times and improved journey time reliability would afford significant potential to improve accessibility to services and facilities including strategically to and from the A4119/ Rhondda</p>	<p>++</p>

Option A – Highway Route East of Pendoylan

	<p>Valleys and the Vale/ Barry area, and locally for residents within the study area.</p> <p>In addition to the benefits that would be assumed for vehicles travelling along this route, improved highway conditions would also be anticipated to improve the conditions for sustainable transport modes for access to services.</p>	
Affordability	<p>The potential to divert trips from the car to public transport as a result of likely improved journey time and journey time reliability for buses is mitigated by the potential for the option to retain the car as the dominant mode of travel in the region. A neutral impact is envisaged.</p>	0
Severance	<p>A new route by-passing Pendoylan and Clawdd-Coch is anticipated to reduce traffic flow through the small settlements with the potential to lessen the impact of severance. In line with TAG Unit A4.1.5 (Severance Impacts) a slight positive impact is anticipated with less than 200 residents estimated to benefit from any reductions in traffic flow.</p> <p>There are several public rights of way affecting the proposed route alignment. It is anticipated that crossings will however be rationalised by public right of way re-alignment and provision of crossing points under/ over the proposed bypass to maintain existing connectivity. Culverts have been proposed where public rights of way cross the proposed bypass at in-fill sections, and where it crosses through cut sections 3m wide bridges have been assumed.</p> <p>It is not anticipated that the new route will lead to severance issues as existing routes and connections are to be retained.</p> <p>In addition, former DMRB 11.3.8 (although still referenced for appraisal in TAG Unit A4.1.5) provides guidance on the relief of severance using proportional improvement to traffic flows (note that severance in DMRB is now contained in LA112 Population and Human Health without the guidance). Given that relief of severance is not considered significant where traffic flows are already relatively low, the guidance does not apply to roads with an existing AADT flow of less than 8,000 vehicles. The guidance does however acknowledge that a review of any severance relief that can be gained needs to be seen in the context of the size of the community affected noting low to moderate decreases in traffic flow are likely to be more significant for small communities in comparison to larger urban areas.</p>	+
Option and Non-Use Values	<p>In line with TAG Unit A4.1.7, <i>'Option and non-use values should be assessed if the scheme being appraised includes measures that will substantially change the availability of transport services within the study area (e.g. the opening or closure of a rail service, or the introduction or withdrawal of buses serving a particular rural area).'</i></p> <p>Whilst the option does not therefore retain specific measures to enhance public transport, a new strategic highway route affords significant potential to establish robust journey times and journey time reliability. These improved highway conditions are anticipated to assist the development of bus services, although at the same time facilitating car use. The implementation of integral walking and cycling infrastructure also affords some opportunity for alternate modes of travel away from use of the private car. A score of moderate beneficial is therefore considered reasonable within the context of the proposed option.</p>	++
Cultural		
Cultural Facilities	<p>The proposed road link may have a minor negative impact on the Cottrell Park Golf Course where the road would require widening, as well as changes to access to the Hensol Golf Driving Range and the Vale Resort. However,</p>	++

Option A – Highway Route East of Pendoylan

	access to all facilities will be accommodated. More strategically, there will be improved connectivity between the M4 and A4119 corridors and the cultural attractions of the coast, including Barry Island, Porthkerry Country Park and the beaches.	
Welsh Language	The Vale of Glamorgan Council stated in the Local Development Plan that <i>'having assessed the densities of Welsh language use across the Vale of Glamorgan it is not considered to be an issue which requires addressing in the Plan. As a result, the proposals contained in the LDP are not considered to have a detrimental impact upon the Welsh language and culture or materially affect the linguistic balance of the Vale of Glamorgan or the communities within the Vale of Glamorgan.'</i> Subsequently, it is considered there would be no impacts on the Welsh language from the highway option.	0
Environment		
Noise	<p>This review is not yet quantifiable in the absence of quantitative data, but a minor adverse impact is considered reasonable to assume whilst also noting the impacts from short-term construction noise associated with the new route.</p> <p>The results acquired from the SEWTM for a new DMRB compliant road indicate peak AM and PM two-way traffic flows of 2026 and 1972 respectively which would establish increased noise pollution in the study area. In most cases mitigation measures should be available to alleviate any associated short and long-term noise pollution, but this would need to be considered against the potential to establish adverse landscape impacts (e.g. implementation of noise bunds).</p> <p>The eastern alignment passes to the east of Clawdd-Coch, whereas the current alignment passes through Clawdd-Coch. The new route would reduce traffic noise at most properties in Clawdd-Coch but would increase traffic noise at the residential property to the East of Clawdd-Coch.</p> <p>The East alignment passes Pendoylan immediately east of the filter beds and approximately 160m from the closest residential properties. The alignment would carry traffic away from Pendoylan and would expect to present an overall benefit to more properties than would experience an increase in noise as a result of the new alignment.</p> <p>To the south of Pendoylan the East alignment would result in an increase in noise at Ffynnon-deilo and Pendoylan Nursery. The area is however rural in nature with several isolated residential dwellings and the number of affected residential properties is expected to be low.</p> <p>The traffic noise impacts would however need to be modelled in accordance with DMRB to quantify the noise impacts and quantify the number of properties that are adversely affected by the road alignments and the number of properties that benefit compared to the Do-Minimum.</p>	-
Air Quality	Based upon the 2018 Air Quality Progress (APR) Report for the Vale of Glamorgan, the APR confirms that in 2017 air quality within the Vale of Glamorgan continues to meet the relevant air quality objectives ² . From the 47 locations monitored throughout the Vale Borough with the use of passive diffusion tubes, no sites breach the national NO ₂ annual objective of 40µg/m ³ or the NO ₂ 1-hour objective (200µg/m ³ , not to be exceeded more than 18 times per year). Based on the 2017 datasets it can be concluded that	-

² Vale of Glamorgan Council Air Quality Progress Report 2018

Option A – Highway Route East of Pendoylan

	<p>the NO2 1-hour objective was not breached. There are no Air Quality Management Areas (AQMAs) within or near to the project's study area.</p> <p>Implementation of a new highway route has the potential to improve local air quality through Pendoylan village with a reduction in local traffic flows forecast, plus the potential for existing car trips to divert to public transport as a result of improved journey times and journey time reliability. It could also have the effect of reducing congestion and air quality issues at Culverhouse Cross by diverting traffic onto the new link.</p> <p>In contrast, a new proposed alignment is forecast to significantly increase traffic flows through the Pendoylan corridor with the potential to establish adverse air quality in the vicinity of a new link. The potential for adverse air quality is most likely to occur at the key junctions north and south of the proposed route. The impact of construction on managing air quality/ dust as well as vibration impacts would also need to be considered.</p>	
Greenhouse Gases	<p>The change in greenhouse gas emissions with the road link compared to the Do-Minimum has been calculated as an output of the traffic modelling. This gives a benefit valued at £1.1M. The reduction in emissions will be based on the reduced overall journey distances.</p>	+
Landscape	<p>The local landscape pattern of the study area is a mosaic of small to medium pastoral fields within a network of strong hedgerows, hedgerow trees and scattered woodland. The key defining landscape characteristics of the study area are:</p> <p>Undulating landform rising to the A48 ridge.</p> <p>Extensive hedgerows outlining small irregular fields – predominately managed as pasture.</p> <p>Individual trees within hedgerows.</p> <p>Significant number of small woodlands.</p> <p>The proposals for the new road will involve the creation of a corridor of disturbance running from M4 Junction 34 to the A48. All will require the felling of trees and the removal of hedgerows, together with some disruption of the field pattern. It is assumed that replacement tree and hedgerow planting will be an integral part of the proposal for all options.</p> <p>In terms of the effect on landscape character there is little to differentiate between the two offline options. The potential impacts on the specific landscape elements are:</p> <ul style="list-style-type: none"> • Undulating landform rising to the A48 ridge Some significant new landforms are proposed – e.g. the cutting south of Pendoylan Nursery and the embankments associated with bridge abutments. However, these are generally of a scale that will not alter the overall characteristic undulating landform. • Extensive hedgerows outlining small irregular fields that are predominately managed as pasture All options will lead to loss of hedgerows that will require to be replaced. The field pattern will be disrupted locally by the works. Introducing a strong linear feature into the existing landscape pattern will be disruptive initially, however with appropriate mitigation the impact can be reduced over time. The existing mainline railway is generally well absorbed into the landscape. • Individual trees within hedgerows There will be some loss of mature hedgerow trees, although new tree planting would ensure no change to this character element in the longer term. 	

Option A – Highway Route East of Pendoylan

	<ul style="list-style-type: none"> • Significant number of small woodlands Both options would impact on existing small woods. Replacement woodland to maintain the landscape character would be an essential mitigation item. <p>The visual amenity of the area is an important characteristic and the study area includes a range of visual receptors with some extensive views across and along the Ely Valley. The following sensitive receptors are subsequently likely to experience significant adverse visual effects.</p> <ul style="list-style-type: none"> • Residential properties near Clawdd-Coch • Residential Properties on the East side of Heol St Cattwg Pendoylan • Residential and Farm Property South of Pendoylan • Residential Properties south of Trehedyn Lane <p>Regarding visual impact assessment, the option is therefore likely to generate moderate adverse visual impacts on some residential properties. It is considered that once replacement planting is established, adverse impacts on the landscape are likely to be reduced.</p> <p>The greatest impacts will be during the construction stage but will be of relatively short duration. It is considered that once replacement planting is established, adverse impacts on the landscape are likely to be reduced.</p> <p>The proposed Eastern option of road infrastructure through undulating land will degrade the existing landscape character and will generate some significant impacts on short distance views from some residential properties, which will also experience negative effects on night-time setting. The offline options both have significant impacts and would both therefore have moderate adverse impact overall. This could reduce to minor/ slight in the long-term with substantial mitigation. In comparison, the online options would have less earthworks and would not be introducing a new feature into the landscape. However, the extent of hedgerows and roadside trees lost would be greater so it would still be moderate adverse impact. Again, with new tree and hedge planting this could be reduced to minor/ slight in the very long-term once all the new replacement tree planting has matured.</p>	
Townscape	<p>Area assessed – Pendoylan village using the Vale of Glamorgan Pendoylan Conservation Area Appraisal and Management Plan (2009). Both the Eastern and Western alignment utilise the existing strategic network both to the north and south. Both routes by-pass the largest built up area (Pendoylan) and thus is unlikely to have any direct and indirect impacts on the townscape of the village. Either alignment would divert traffic away from Pendoylan by providing a route that would by-pass the village, this would have a beneficial impact on the setting of the village as traffic would be taken away from the rural settlement. This would help in keeping with the heritage feel of the village. Should there be inter-visibility of the alignment from Pendoylan this could have adverse impact to the setting of the townscape.</p>	0
Historic Environment	<p>The baseline assessment has completed a thorough analysis of known environmental and land-use characteristics for the study area. This has identified several sites of historic interest including scheduled monuments, listed buildings, archaeological sites and registered parks and gardens.</p> <p>On the basis of the information obtained through desk-based assessment and walkover survey it is concluded that there are no major constraints to the proposed road in Sub-Sections 1 and 4, where the works would be predominantly online improvements to the current road alignment.</p> <p>Of the eastern and western options in Sub-Sections 2 and 3 the conclusion is that the western option (Sub-Section 3) would have the lesser impact on</p>	-

cultural heritage. The eastern option (Sub-Section 2) would impact the medieval strip fields and a greater number of key views from the Pendoylan Conservation Area. The western option (Sub-Section 3) would impact known non-designated assets (a lime kiln, a quarry and two non-extant field boundaries) but would have less impact on extent historic landscape features and on the setting of designated heritage assets.

In order to produce a detailed assessment to support any planning application it is recommended that a programme of detailed archaeological assessment is undertaken at WelTAG Stage Three. This will provide greater certainty on the risk of currently unrecorded archaeology to be present within the Site, which will both inform the determination of any planning application and allow for accurate planning of any archaeological mitigation that may be required following planning consent in advance of construction.

Further consultation with the planning advice team at GGAT (as advisors to the local authority) will be necessary to determine the precise scope of this but this is likely to require a review of aerial photographs held at the Central Registry of Aerial Photography for Wales (CRAPW), geophysical survey and trial trenching. The scope of this work would need to be agreed through production of a Written Scheme of Investigation (WSI) submitted to the planning advice team at GGAT.

Biodiversity

The desk study and extended Phase 1 habitat survey has confirmed the presence within the study area of sites designated for nature conservation value and Priority Habitats as listed within Section 7 of the Environment Act (Wales) 2016. The designated sites and Priority Habitats identified within the study area detailed within the accompanying Preliminary Ecological Appraisal and encompass the Ely Valley SSSI, an extensive number of SINC allocations, ancient woodland, Tree Preservation Orders (TPOs), wet woodland, the River Ely, ponds and native species-rich hedges.

The extended Phase 1 habitat survey also confirmed the presence of several priority species including Violet Oil Beetle, Cinnabar Moth, Brown Hare and Hedgehog. Due to the presence of suitable habitat, there is the potential that other Protected and Priority Species may also be present within the study area. However, further botanical and fauna species/ species group specific surveys are required to accurately determine whether the study area supports these species.

A comparison of the results for Sub-Section 2 (east alignment) and Sub-Section 3 (west alignment) has been undertaken through the review of text and by studying the Phase 1 habitat survey plan (drawing 10028657-ARC-00-XX-DR-EC-0056-P1).

The two offline highway options feature many of the same important ecological features and, from what can be determined from the currently available data, are similar in ecological value. However, the east alignment option does have the greater ecological impact due to the slightly higher number of SINCS, larger area of species-rich Marshy grassland (likely to be classed as a Priority Habitat) and greater number of hedgerows to be impacted. Full details of this comparison exercise are provided within the Preliminary Ecological Appraisal.

It is anticipated at this stage that the impacts can be mitigated via the implementation of standard techniques in accordance with best practice guidelines. Further ecological surveys would be required at the next stage of assessment to fully establish baseline conditions within the study area, allowing for the accurate and complete assessment of impacts and the design of an appropriate mitigation strategy for the scheme.

Option A – Highway Route East of Pendoylan

<p>Water Environment</p>	<p>The flood modelling exercise completed focussed principally on the two offline highway options that cross the River Ely and intersect its floodplain (Flood Zones B and C2) at two locations. The existing River Ely model has subsequently been updated to be capable of informing baseline flood risk in the area of interest and testing the proposed scheme designs. All results are included within the accompanying River Ely Hydraulic Modelling report.</p> <p>Only the East alignment was modelled as both the East and West alignments follow the same route in the northern area of interest, and only the East alignment has the potential to impact on the southern area of interest. Outside of the northern area of interest, the West option does not cross the Ely floodplain and therefore there is no merit in modelling this separately.</p> <p>The results indicate that only the northern area of interest, where both alignments follow the same route, is shown to identify a change in peak flood level for the 1% AEP +CC event. This illustrates how the Scheme causes flood water to pond behind it, increasing water levels in this location by up to 450mm. For the 1% AEP, peak water levels are increased by up to 550mm and for the 0.1% AEP event, by up to 400mm. The peak flow at the proposed location of the Scheme does not change significantly from the baseline.</p> <p>The impacts of this predicted increase in flood risk should be reviewed in detail, and options and requirements for mitigation discussed with NRW and the Client in order to inform a Flood Consequence Analysis (FCA) to be undertaken at the detailed design phase. The mitigation options may include flood relief culverts under the proposed road. In addition, the results are likely to be impacted by the inclusion of the two structures which exist under the existing unnamed road (located to east of the proposed road), in the baseline model. Modelling of these structures could potentially change the magnitude of the impact that the Scheme has on water levels in the area.</p> <p>In the southern area of interest, the East alignment just touches the edge of the floodplain for all modelled events therefore the impact on floodplain storage is negligible. Consequently, there is no impact on flood levels and flows for any event.</p> <p>Due to there being no significant impact in the southern area of interest there is no obvious preference for either of the offline alignments from a flood risk perspective.</p> <p>In terms of water quality, the Ely and its tributaries are WFD waterbodies and the reach in the study area in the second cycle achieved status of Bad ecological status and Fail regarding chemical quality. The WFD groundwater body underlying the route is the South East Valleys Southern Devonian Old Red Sandstone and Triassic Mercia Mudstone. This waterbody achieves Good status in terms of both groundwater quality and quantity.</p> <p>With regards to aquifers, there are no groundwater Source Protection Zones along the alignment or in proximity to it. Potential for effects is likely to be relatively limited, there would be some scope for impacts if the new highway was drained to ground via soakaways (rather than discharges to watercourses), or if there were sections in cut (which may trigger the need for groundwater control measures e.g. dewatering).</p>	<p>-</p>
<p>Residential Amenity</p>	<p>The impact on residential amenity considers the cumulative impact of air quality, noise and visual intrusion on residential properties. The combined assessment from the above indicates that the properties in the communities of Clawdd-Coch and Pendoylan will largely benefit from reductions in traffic through the village. Several properties will experience adverse impacts due to proximity of the alignment. There are likely to be impacts of visual intrusion based on short distance views across the landscape. The effects on those</p>	<p>-</p>

Option A – Highway Route East of Pendoylan

	properties close to the route are likely to be significant and therefore the overall impact is assessed as moderate adverse, prior to detailed consideration at the next stage of the assessment.	
Economic		
Journey Time Changes	<p>The level of journey time savings to users' totals £138M through the provision of a link, as forecast using the traffic model, which represents a substantial beneficial improvement.</p> <p>The implementation of a new highway route designed to current DMRB standards would be anticipated to result in measurable improvements in journey times with increased average speeds between M4 Junction 34 and A48, together with integral junction improvements at the key junctions interconnecting with the highway route. For strategic journeys, the route would offer an alternative for travelling between the Vale/ Barry area and the Rhondda Valleys, and from west of M4 Junction 34, thus reducing journey times on the strategic network. There is also the potential, if active travel measures are delivered, that additional benefits to walkers and cyclists through enhanced infrastructure provision.</p>	+++
Journey Time Reliability Changes	It is anticipated that the implementation of a new highway route designed to current DMRB standards could establish measurable improvements in journey time reliability. At this stage, a full assessment has not been undertaken, but the reduction in traffic flows on the strategic network together with the provision of a new link between the M4 Junction34 and the A48 which is to standard, would be expected to increase reliability compared to the Do-Minimum.	++
Transport Costs	Transport costs for road users are anticipated to reduce compared to the Do-Minimum, reflecting the journey time savings. With regards to public transport operating costs, existing bus services would be anticipated to benefit from reduced traffic through Pendoylan and the opportunity to use the new route of good standard. It is therefore anticipated that delivery of a new road link and associated junction improvements would reduce the transport costs compared to the do-minimum option.	++
Wider Economic Impacts	<p>It is anticipated that there would be additional wider economic impacts associated with the option. This may include induced investment through additional strategic development arising due to improved connectivity to the EZ (existing connections are constraining growth). Moreover, there may be benefits to those larger commercial businesses (such as the airport and Aston Martin) through transport improvements where competitive markets are imperfect. In this case, it will assist by providing an improved level of connectivity for the airport and businesses.</p> <p>There may also be beneficial labour supply impacts by improving connectivity between the employment sites and population centres, notably assisting access to employment from the Rhondda Valleys to the EZ. Whilst the EZ presents a regionally significant opportunity, the labour market catchment of the site is limited by the current transport infrastructure and services. If this issue is not resolved, it may have longer term implications for firms currently located in the Vale of Glamorgan and in terms of the business location decisions of prospective investors. The limited labour market catchment of the EZ currently is also compounded by comparatively poor business-to-business accessibility.</p>	++

Option A – Highway Route East of Pendoylan

	<p>Moreover, the accessibility analysis undertaken found that relatively modest reductions in journey times to/ from the Vale of Glamorgan would significantly increase the labour market and business-to-business catchment of the EZ.</p> <p>The improvement in accessibility may also bring a relocation of more productive jobs to the area. As the proposed link forms a connection between functioning parts of the Capital Region, there may also be productivity impacts due to agglomeration benefits for the Vale of Glamorgan in terms of linking in developments in the area to similar businesses/ clusters in the region.</p> <p>Moreover, productivity in the Cardiff Capital Region is very low compared to other UK City Regions, so improving connectivity to the Vale of Glamorgan may form part of a package of measures to address this (and in part addressing the issue of a lack of appropriate industrial premises).</p>	
<p>Land and Property</p>	<p>Implementation of a new offline highway route will require significant areas of land predominantly in agricultural use to deliver a new highway route, in addition to land adjacent to existing routes to facilitate the online highway improvements. The exact extent and potential costs are unknown at this stage and would require further exploration, however a cost allowance has been included, as identified in the Financial Case.</p> <p>The concept design for the eastern option is currently anticipated to have the following impacts on buildings:</p> <ul style="list-style-type: none"> • Number of buildings directly impacted by alignment = 6 • Number of buildings directly and partly impacted by the alignment = 8 <p>Impacts are assessed as moderate given the relatively low number of properties impacted for a scheme of this length.</p>	

Impact Assessment | Option B – Highway Route West of Pendoylan

Option B – Highway Route West of Pendoylan		
	Impacts	Scale
Social		
Physical Activity	<p>It is expected that a new highway route would have a slight beneficial impact on physical activity with the integral provision of segregated walking and cycling infrastructure that would connect southwards to join the route adjacent to Five Mile Lane. It could also improve conditions for walkers and cyclists along the existing corridor including between the settlements of Pendoylan and Clawdd-Coch.</p>	+
Journey Quality	<p>It is anticipated that the implementation of a new highway route to the west of Pendoylan would establish improvements in journey quality in comparison to the do-minimum scenario with enhancements to traveller's care, views and stress. The broadly qualitative assessment completed using DMRB 11.3.9.2 (travellers' views) and 11.3.9.3/4 (traveller stress) has subsequently been considered alongside traveller care elements noted within TAG Unit A4.1.6 (Journey Quality Impacts). It is noted that these DMRB Volume 11 Section 3 Part 9 references are now withdrawn, although the appraisal has been completed in line with the existing TAG Unit A4.1.6 guidance.</p> <p>The study area between the M4 Junction 34 and the A48 at Sycamore Cross is predominantly an area of high-quality scenic countryside interspersed with ancient woodland, important nature conservation sites, SSSI and conservation areas. The existing highway route interconnecting via Pendoylan is primarily bounded by tall hedgerow with restrictive views of the surrounding landscape. In contrast, the new route would afford more people/drivers to see the surrounding scenery. Whilst views would in part be intermittent with the route traversing through cuttings, this is unlikely to adversely detract from a traveller's perception of the scene with the impacts on views broadly comparable between the east and west alignment.</p> <p>DMRB outlines the impact of traffic volume on driver stress categorising the average peak hourly flow per lane (in flow units/ 1 hour) for a 60mph single-carriageway road as low (<600 vehicles), moderate (600-800 vehicles) and high (over 800 vehicles). Implementation of the link road designed to current DMRB standards could subsequently establish high levels of driver stress during the AM and PM peak with maximum forecast peak hourly flows per lane of 1,234 and 1,200 vehicles respectively, both in relation to the northbound direction of flow. The guidance does however note that the advised thresholds are provided for guidance only and that the assessment of specific routes can only be made in the light of full knowledge of local conditions. It is therefore anticipated that the forecast level of traffic flow for the road link would be offset by the superior design standards to which the new scheme would be built with perceived improvements to driver frustration, route uncertainty and fear of potential accidents establishing a low to moderate level of stress in comparison to the existing route. Views out from the road can also provide interest which can further be considered to help alleviate driver stress.</p> <p>Traveller care is less influential regarding the proposed highway scheme with cleanliness, facilities and information factors considered to retain a neutral impact against the do-minimum scenario. Improvements would however be identified regarding the traveller's environment with enhanced driver</p>	+++

Option B – Highway Route West of Pendoylan

	<p>capability anticipated as a result of a new and improved route, as well as potential to establish an improved condition and smoothness of ride.</p> <p>The implementation of the new highway route would provide further benefits to walkers and cyclists through enhanced infrastructure provision and interconnectivity. Implementation of an integral shared walking/ cycling route would provide improved traveller care (information, environment), views (similar benefits to those noted for the highways review), and stress with perceived reductions in frustration, fear of potential accidents and route uncertainty. Whilst no new public transport infrastructure or services are specifically proposed as part of this option, the highway route would facilitate more attractive journeys for buses with similar highway benefits as noted herewith.</p> <p>In line with TAG Unit A4.1.6, a high rating has subsequently been applied to the scoring as the number of travellers affected is forecast to be in excess of 10,000 per day.</p>	
<p>Accidents</p>	<p>The provision of a new highway route by-passing Pendoylan has the potential to reduce traffic flow and improve road safety conditions along the existing Pendoylan corridor. In addition, provision of a new highway route to current DMRB highway standards also affords the likelihood of minimising accidents together with the opportunity to integrate segregated sustainable travel measures as part of the integral design.</p> <p>The traffic forecasting has enabled a calculation of accident benefits using the DfT software COBALT. The impacted links were identified by finding the change in AADT (Annual Average Daily Flows) as a result of the scheme and using the standard criteria of finding the links where the change in flows is 5% or more with a flow change of +/- 500 AADT for 2036. The accident benefit assessment has been undertaken for the impacted links only instead of a cordon area.</p> <p>The results show positive scheme benefits with a reduction in accident cost of £16.6m, over the 60-year period in 2010 prices. The analysis also shows that the scheme will reduce 446 accidents, which is a significant reduction of 9% compared to the Do-Minimum.</p>	<p>++</p>
<p>Security</p>	<p>A review of security has been completed in line with TAG Unit A4.1.4 (Security Impacts) to assess the implementation of the route alignment. In summary, a moderate beneficial impact is considered reasonable given the new road will be DMRB compliant with improvements to several factors including lighting and visibility, landscaping, informal surveillance and site perimeters.</p> <p>Due to the rural nature of the proposed route, new highway lighting for the benefit of vehicles has only been considered at roundabouts and new junctions. This will be implemented to current standards to enhance upon existing provision. In addition, and in accordance with Sustrans guidance, 5m high lighting columns have been chosen for the length of the cycleway at 35m intervals and included within the cost makeup for the option. It is however recommended that due to the proximity to the proposed carriageway that a risk assessment be carried out during the next stage to ensure that the lighting does not adversely affect traffic using the bypass.</p> <p>There are also considered to be slight improvements to the site perimeter, landscaping and natural surveillance. The existing route predominantly consists of narrow lanes with tall hedgerow on both sides of the carriageway adversely impacting on visibility. For the new road it has been assumed that</p>	<p>++</p>

Option B – Highway Route West of Pendoylan

	<p>the entire length of both sides of the road will require fencing to separate land with provision of Timber Post and Four Rail Fence in accordance with Highways Construction Detail (HCD) HCD/13. Where the bypass passes several houses, 4m high Acoustic Fencing has also been allowed for (based on length). In the long-term the establishment of hedgerow would be anticipated; however, this is likely to be managed to maintain suitable safety and security for users of the proposed route including pedestrians and cyclists.</p> <p>It is also noted within the TAG Unit A4.1 guidance that improved natural visibility out from the road subsequently has the potential to provide an enhanced perception of safety and security in comparison to the existing route corridor with its significant visibility constraints.</p>	
<p>Access to Employment</p>	<p>The traffic modelling completed to assess the route option has quantified user and provider benefits (£000's PVB 2010 prices discounted to 2010) for the new link totalling £36M for commuters and £52M for business. This indicates that the new strategic highway route would afford significant benefits for access to work and for businesses in the region. This would include accessibility to strategic sites in the region including the three sites identified as the Cardiff Airport to St Athan EZ encompassing Cardiff Airport, St Athan Aerospace Business Park and Gateway Development Zone, as well as employment sites at M4 Junction 34 and 'sub-regional' employment opportunities particularly along the A4119 corridor, at the Mwyndy/ Talbot Green strategic site, and the Llanilid strategic opportunity corridor, by providing a new link with reduced journey times and improved journey time reliability.</p> <p>As highlighted within the Welsh Government PBA report, '<i>Vale of Glamorgan Connectivity Study – The Case for Change (2017)</i>', the proposed commercial developments at the Cardiff Airport to St Athan EZ represent an investment of strategic significance in the Vale of Glamorgan with the Vale of Glamorgan Local Development Plan identifying the need for transport connectivity improvements if the potential of these strategic sites is to be maximised. Furthermore, the report identifies that '<i>facilitating the travel-to-work market, business-to-business interactions and freight movements will require a transport network which facilitates efficient movement to, from and within the Vale of Glamorgan</i>' for which the proposed route option could establish significant value.</p> <p>Improved highway conditions are anticipated to promote the development of more sustainable transport modes for access to employment. It would enable bus services to be enhanced between the A4119 corridor and employment sites in the Vale by providing a suitable highway connection. The Welsh Government PBA report referenced herewith subsequently concludes that '<i>improving the transport connectivity of the Vale of Glamorgan is considered necessary to support national, regional and local economic performance.</i>'</p>	<p>++</p>
<p>Access to Services</p>	<p>The traffic modelling completed to assess the route option has quantified user and provider benefits (£000's PVB 2010 prices discounted to 2010) for the new link totalling £49.8M for other consumers than commuters or business. This indicates that the new strategic highway route could afford significant benefits for access to services in the region. It is therefore considered that a new strategic highway link with reduced journey times and improved journey time reliability would afford significant potential to improve accessibility to services and facilities including strategically to and from the A4119/ Rhondda</p>	<p>++</p>

Option B – Highway Route West of Pendoylan

	<p>Valleys and the Vale/ Barry area, and locally for residents within the study area.</p> <p>The Welsh Government PBA report, ‘<i>Vale of Glamorgan Connectivity Study – The Case for Change (2017)</i>’ notes that ‘<i>there is a significant population base within the Vale of Glamorgan and surrounding areas which would be well placed to access the development opportunities emerging in that area. However, relatively poor north-south connectivity to / from the Vale of Glamorgan is seen by consultees to act as a factor constraining growth (both now and in the future), particularly for those without access to a car.</i>’</p> <p>In addition to the benefits that would be assumed for vehicles travelling along this route, improved highway conditions would also be anticipated to improve the conditions for sustainable transport modes for access to services.</p>	
Affordability	<p>The potential to divert trips from the car to public transport as a result of likely improved journey time and journey time reliability for buses is mitigated by the potential for the option to retain the car as the dominant mode of travel in the region. A neutral impact is envisaged.</p>	0
Severance	<p>A new route by-passing Pendoylan and Clawdd-Coch is anticipated to reduce traffic flow through the small settlements with the potential to lessen the impact of severance. In line with TAG Unit A4.1.5 (Severance Impacts) a slight positive impact is anticipated with less than 200 residents estimated to benefit from any reductions in traffic flow.</p> <p>There are several public rights of way affecting the proposed route alignment. It is anticipated that crossings will however be rationalised by public right of way re-alignment and provision of crossing points under/ over the proposed bypass to maintain existing connectivity. Culverts have been proposed where public rights of way cross the proposed bypass at in-fill sections, and where it crosses through cut sections 3m wide bridges have been assumed.</p> <p>It is not anticipated that the new route would lead to severance issues as existing routes and connections will be retained.</p> <p>In addition, former DMRB 11.3.8 (although still referenced for appraisal in TAG Unit A4.1.5) provides guidance on the relief of severance using proportional improvement to traffic flows. Given that relief of severance is not considered significant where traffic flows are already relatively low, the guidance does not apply to roads with an existing AADT flow of less than 8,000 vehicles. The guidance does however acknowledge that a review of any severance relief that can be gained needs to be seen in the context of the size of the community affected noting low to moderate decreases in traffic flow are likely to be more significant for small communities in comparison to larger urban areas.</p>	+
Option and Non-Use Values	<p>In line with TAG Unit A4.1.7, ‘<i>Option and non-use values should be assessed if the scheme being appraised includes measures that will substantially change the availability of transport services within the study area (e.g. the opening or closure of a rail service, or the introduction or withdrawal of buses serving a particular rural area).</i>’</p> <p>Whilst the option does not therefore retain specific measures to enhance public transport, a new strategic highway route affords significant potential to establish robust journey times and journey time reliability. These improved highway conditions are anticipated to assist the development of more sustainable transport modes, although at the same time facilitating car use. The implementation of integral walking and cycling infrastructure also affords</p>	++

Option B – Highway Route West of Pendoylan

	some opportunity for alternate modes of travel away from use of the private car. A score of moderate beneficial is therefore considered reasonable within the context of the proposed option.	
Cultural		
Cultural Facilities	The proposed road link may have a minor negative impact on the Cottrell Park Golf Course where the road would require widening, as well as changes to access to the Hensol Golf Driving Range and the Vale Resort. However, access to all facilities will be accommodated. More strategically, there will be improved connectivity between the M4 and A4119 corridors and the cultural attractions of the coast, including Barry Island, Porthkerry Country Park and the beaches.	++
Welsh Language	The Vale of Glamorgan Council stated in the Local Development Plan that <i>'having assessed the densities of Welsh language use across the Vale of Glamorgan it is not considered to be an issue which requires addressing in the Plan. As a result, the proposals contained in the LDP are not considered to have a detrimental impact upon the Welsh language and culture or materially affect the linguistic balance of the Vale of Glamorgan or the communities within the Vale of Glamorgan.'</i> Subsequently, it is considered there would be no impacts on the Welsh language from the highway option.	0
Environment		
Noise	This review is not yet quantifiable in the absence of quantitative data, but a minor adverse impact is considered reasonable to assume whilst also noting the impacts from short-term construction noise associated with the new route. The results acquired from the SEWTM for a new DMRB compliant road indicate peak AM and PM two-way traffic flows of 2026 and 1972 respectively which would establish increased noise pollution in the study area. In most cases mitigation measures should be available to alleviate any associated short and long-term noise pollution, but this would need to be considered against the potential to establish adverse landscape impacts (e.g. implementation of noise bunds). The western alignment passes to the east of Clawdd-Coch, whereas the current alignment passes through Clawdd-Coch. The new route would reduce traffic noise at most properties in Clawdd-Coch but will increase traffic noise at the residential property to the East of Clawdd-Coch. At Pendoylan, the West alignment passes approximately 135m from a cluster of properties at Kingswood and Little Orchard to the east and 240m from Old Vicarage to the west. The alignment would carry traffic away from Pendoylan and would expect to present an overall benefit to more properties than would experience an increase in noise as a result of the new alignment. To the south of Pendoylan, the West alignment would be closer to Pen-y-Bryn, Bryn Bedal and Tyn-y-Cae and would potentially affect more properties than the East alignment. The area is however rural in nature with several isolated residential dwellings and the number of affected residential properties is expected to be low.	-

Option B – Highway Route West of Pendoylan

	<p>The traffic noise impacts would however need to be modelled in accordance with DMRB to quantify the noise impacts and consider the detailed propagation path for both alignments. This would allow for a detailed comparison of the proposed alignments against the existing road layout (do-minimum) and quantify the number of properties that are adversely affected by both road alignments and the number of properties that benefit from the respective alignments.</p>	
Air Quality	<p>Based upon the 2018 Air Quality Progress (APR) Report for the Vale of Glamorgan, the APR confirms that in 2017 air quality within the Vale of Glamorgan continues to meet the relevant air quality objectives³. From the 47 locations monitored throughout the Vale Borough with the use of passive diffusion tubes, no sites breach the national NO₂ annual objective of 40µg/m³ or the NO₂ 1-hour objective (200µg/m³, not to be exceeded more than 18 times per year). Based on the 2017 datasets it can be concluded that the NO₂ 1-hour objective was not breached. There are no Air Quality Management Areas (AQMAs) within or near to the project's study area.</p> <p>Implementation of a new highway route has the potential to improve local air quality through Pendoylan village with a reduction in local traffic flows forecast, plus the potential for existing car trips to divert to public transport as a result of improved journey times and journey time reliability. It could also have the effect of reducing congestion and air quality issues at Culverhouse Cross by diverting traffic onto the new link.</p> <p>In contrast, a new proposed alignment is forecast to significantly increase traffic flows through the Pendoylan corridor with the potential to establish adverse air quality in the vicinity of a new link. The potential for adverse air quality is most likely to occur at the key junctions north and south of the proposed route.</p> <p>The impact of construction on managing air quality/ dust as well as vibration impacts would also need to be considered.</p>	-
Greenhouse Gases	<p>The change in greenhouse gas emissions with the road link compared to the Do-Minimum has been calculated as an output of the traffic modelling. This gives a benefit valued at £1.1M. The reduction in emissions will be based on the reduced overall journey distances.</p>	+
Landscape	<p>The local landscape pattern of the study area is a mosaic of small to medium pastoral fields within a network of strong hedgerows, hedgerow trees and scattered woodland. The key defining landscape characteristics of the study area are:</p> <p>Undulating landform rising to the A48 ridge.</p> <p>Extensive hedgerows outlining small irregular fields – predominately managed as pasture.</p> <p>Individual trees within hedgerows.</p> <p>Significant number of small woodlands.</p> <p>The proposals for the new road will involve the creation of a corridor of disturbance running from M4Junction 34 to A38. All will require the felling of trees and the removal of hedgerows, together with some disruption of the</p>	-

³ Vale of Glamorgan Council Air Quality Progress Report 2018

field pattern. It is assumed that replacement tree and hedgerow planting will be an integral part of the proposal.

In terms of the effect on landscape character there is little to differentiate between the two offline options. The potential impacts on the specific landscape elements are:

Undulating landform rising to the A48 ridge | Some significant new landforms are proposed - e.g. the cutting south of Pendoylan Nursery and the embankments associated with bridge abutments. However, these are generally of a scale that will not alter the overall characteristic undulating landform.

Extensive hedgerows outlining small irregular fields – predominately managed as pasture | All options will lead to loss of hedgerows that will require to be replaced. The field pattern will be disrupted locally by the works. Introducing a strong linear feature into the existing landscape pattern will be disruptive initially, however with appropriate mitigation the impact can be reduced over time. The existing mainline railway is generally well absorbed into the landscape.

Individual trees within hedgerows | There will be some loss of mature hedgerow trees however new tree planting would ensure no change to this character element in the longer term.

Significant number of small woodlands | Both options would impact on existing small woods. Replacement woodland to maintain the landscape character would be an essential mitigation item.

The visual amenity of the area is an important characteristic and the study area includes a range of visual receptors with some extensive views across and along the Ely Valley. The following sensitive receptors are subsequently likely to experience significant adverse visual effects.

- Residential properties in Clawdd-Coch
- Residential Properties south of Pendoylan
- Residential Properties south of Trehedyn lane

Regarding visual impact assessment, the option is therefore likely to generate moderate adverse visual impacts on some residential properties. It is considered that once replacement planting is established, adverse impacts on the landscape are likely to be reduced.

The proposed Western option of road infrastructure through undulating land will degrade the existing landscape character and will generate some significant impacts on short distance views from some residential properties, which will also experience negative effects on night-time setting. The offline options both have significant impacts and would both therefore have moderate adverse impact overall. This could reduce to minor/ slight in the long-term with substantial mitigation. In comparison, the online options would have less earthworks and would not be introducing a new feature into the landscape. However, the extent of hedgerows and roadside trees lost would be greater so it would still be moderate adverse impact. Again, with new tree and hedge planting this could be reduced to minor/ slight in the very long-term once all the new replacement tree planting has matured. The greatest impacts for all options will be during the construction stage but will be of relatively short duration.

Option B – Highway Route West of Pendoylan

<p>Townscape</p>	<p>Area assessed – Pendoylan village using the Vale of Glamorgan Pendoylan Conservation Area Appraisal and Management Plan (2009). Both the Eastern and Western alignment utilise the existing strategic network both to the north and south. Both routes by-pass the largest built up area (Pendoylan) and thus is unlikely to have any direct and indirect impacts on the townscape of the village. Either alignment would divert traffic away from Pendoylan by providing a route that would by-pass the village, this would have a beneficial impact on the setting of the village as traffic would be taken away from the rural settlement. This would help in keeping with the heritage feel of the village. Should there be inter-visibility of the alignment from Pendoylan this could have adverse impact to the setting of the townscape.</p>	<p>0</p>
<p>Historic Environment</p>	<p>The baseline assessment has completed a thorough analysis of known environmental and land-use characteristics for the study area. This has identified several sites of historic interest including scheduled monuments, listed buildings, archaeological sites and registered parks and gardens.</p> <p>On the basis of the information obtained through desk-based assessment and walkover survey it is concluded that there are no major constraints to the proposed road in Sub-Sections 1 and 4, where the works would be predominantly online improvements to the current road alignment.</p> <p>Of the eastern and western options in Sub-Sections 2 and 3 the conclusion is that the western option (Sub-Section 3) would have the lesser impact on cultural heritage. The eastern option (Sub-Section 2) would impact the medieval strip fields and a greater number of key views from the Pendoylan Conservation Area. The western option (Sub-Section 3) would impact known non-designated assets (a lime kiln, a quarry and two non-extant field boundaries) but would have less impact on extent historic landscape features and on the setting of designated heritage assets.</p> <p>In order to produce a detailed assessment to support any planning application it is recommended that a programme of detailed archaeological assessment is undertaken at WeITAG Stage Three. This will provide greater certainty on the risk of currently unrecorded archaeology to be present within the Site, which will both inform the determination of any planning application and allow for accurate planning of any archaeological mitigation that may be required following planning consent in advance of construction.</p> <p>Further consultation with the planning advice team at GGAT (as advisors to the local authority) will be necessary to determine the precise scope of this but this is likely to require a review of aerial photographs held at the Central Registry of Aerial Photography for Wales (CRAPW), geophysical survey and trial trenching. The scope of this work would need to be agreed through production of a Written Scheme of Investigation (WSI) submitted to the planning advice team at GGAT.</p>	<p>-</p>
<p>Biodiversity</p>	<p>The desk study and extended Phase 1 habitat survey has confirmed the presence within the study area of sites designated for nature conservation value and Priority Habitats as listed within Section 7 of the Environment Act (Wales) 2016. The designated sites and Priority Habitats identified within the study area detailed within the accompanying Preliminary Ecological Appraisal and encompass the Ely Valley SSSI, an extensive number of SINC allocations, ancient woodland, Tree Preservation Orders (TPOs), wet woodland, the River Ely, ponds and native species-rich hedges.</p> <p>The extended Phase 1 habitat survey also confirmed the presence of several priority species including Violet Oil Beetle, Cinnabar Moth, Brown Hare and</p>	<p>-</p>

Option B – Highway Route West of Pendoylan

	<p>Hedgehog. Due to the presence of suitable habitat, there is the potential that other Protected and Priority Species may also be present within the study area. However, further botanical and fauna species/ species group specific surveys are required to accurately determine whether the study area supports these species.</p> <p>A comparison of the results for Sub-Section 2 (east alignment) and Sub-Section 3 (west alignment) has been undertaken through the review of text and by studying the Phase 1 habitat survey plan (drawing 10028657-ARC-00-XX-DR-EC-0056-P1).</p> <p>The two offline highway options feature many of the same important ecological features and, from what can be determined from the currently available data, are similar in ecological value. However, the east alignment option does have the greater ecological impact due to the slightly higher number of SINCS, larger area of species-rich Marshy grassland (likely to be classed as a Priority Habitat) and greater number of hedgerows to be impacted. Full details of this comparison exercise are provided within the Preliminary Ecological Appraisal.</p> <p>It is anticipated at this stage that the impacts can be mitigated via the implementation of standard techniques in accordance with best practice guidelines. Further ecological surveys would be required at the next stage of assessment to fully establish baseline conditions within the study area, allowing for the accurate and complete assessment of impacts and the design of an appropriate mitigation strategy for the scheme.</p>	
<p>Water Environment</p>	<p>The flood modelling exercise completed focussed principally on the two offline highway options that cross the River Ely and intersect its floodplain (Flood Zones B and C2) at two locations. The existing River Ely model has subsequently been updated to be capable of informing baseline flood risk in the area of interest and testing the proposed scheme designs. All results are included within the accompanying River Ely Hydraulic Modelling report.</p> <p>Only the East alignment was modelled as both the East and West alignments follow the same route in the northern area of interest, and only the East alignment has the potential to impact on the southern area of interest. Outside of the northern area of interest, the West option does not cross the Ely floodplain and therefore there is no merit in modelling this separately.</p> <p>The results indicate that only the northern area of interest, where both alignments follow the same route, is shown to identify a change in peak flood level for the 1% AEP +CC event. This illustrates how the Scheme causes flood water to pond behind it, increasing water levels in this location by up to 450mm. For the 1% AEP, peak water levels are increased by up to 550mm and for the 0.1% AEP event, by up to 400mm. The peak flow at the proposed location of the Scheme does not change significantly from the baseline.</p> <p>The impacts of this predicted increase in flood risk should be reviewed in detail, and options and requirements for mitigation discussed with NRW and the Client in order to inform a Flood Consequence Analysis (FCA) to be undertaken at the detailed design phase. The mitigation options may include flood relief culverts under the proposed road. In addition, the results are likely to be impacted by the inclusion of the two structures which exist under the existing unnamed road (located to east of the proposed road), in the baseline model. Modelling of these structures could potentially change the magnitude of the impact that the Scheme has on water levels in the area.</p>	

Option B – Highway Route West of Pendoylan

	<p>In the southern area of interest, the East alignment just touches the edge of the floodplain for all modelled events therefore the impact on floodplain storage is negligible. Consequently, there is no impact on flood levels and flows for any event.</p> <p>Due to there being no significant impact in the southern area of interest there is no obvious preference for either of the offline alignments from a flood risk perspective.</p> <p>In terms of water quality, the Ely and its tributaries are WFD waterbodies and the reach in the study area in the second cycle achieved status of Bad ecological status and Fail regarding chemical quality. The WFD groundwater body underlying the route is the South East Valleys Southern Devonian Old Red Sandstone and Triassic Mercia Mudstone. This waterbody achieves Good status in terms of both groundwater quality and quantity.</p> <p>With regards to aquifers, there are no groundwater Source Protection Zones along the alignment or in proximity to it. Potential for effects is likely to be relatively limited, there would be some scope for impacts if the new highway was drained to ground via soakaways (rather than discharges to watercourses), or if there were sections in cut (which may trigger the need for groundwater control measures e.g. dewatering).</p>	
Residential Amenity	<p>The impact on residential amenity considers the cumulative impact of air quality, noise and visual intrusion on residential properties. The combined assessment from the above indicates that the properties in the communities of Clawdd-Coch and Pendoylan will largely benefit from reductions in traffic through the village. Several properties will experience adverse impacts due to proximity of the alignment. There are likely to be impacts of visual intrusion based on short distance views across the landscape. The effects on those properties close to the route are likely to be significant and therefore the overall impact is assessed as moderate adverse, prior to detailed consideration at the next stage of the assessment.</p>	
Economic		
Journey Time Changes	<p>The level of journey time savings to users' totals £138M through the provision of a link, as forecast using the traffic model, which represents a substantial beneficial improvement.</p> <p>The implementation of a new highway route designed to current DMRB standards would be anticipated to result in measurable improvements in journey times with increased average speeds between M4 Junction 34 and A48, together with integral junction improvements at the key junctions interconnecting with the highway route. For strategic journeys, the route would offer an alternative for travelling between the Vale/ Barry area and the Rhondda Valleys, and from west of M4 Junction 34, thus reducing journey times on the strategic network. There is also the potential, if active travel measures are delivered, that additional benefits to walkers and cyclists through enhanced infrastructure provision.</p>	
Journey Time Reliability Changes	<p>It is anticipated that the implementation of a new highway route designed to current DMRB standards could establish measurable improvements in journey time reliability. At this stage, a full assessment has not been undertaken, but the reduction in traffic flows on the strategic network together with the provision of a new link between the M4 Junction 34 and the A48</p>	

Option B – Highway Route West of Pendoylan

	<p>which is to standard, would be expected to increase reliability compared to the Do-Minimum.</p>	
Transport Costs	<p>Transport costs for road users are anticipated to reduce compared to the Do-Minimum, reflecting the journey time savings. With regards to public transport operating costs, existing bus services would be anticipated to benefit from reduced traffic through Pendoylan and the opportunity to use the new route of good standard. It is therefore anticipated that delivery of a new road link and associated junction improvements would reduce the transport costs compared to the do-minimum option.</p>	++
Wider Economic Impacts	<p>It is anticipated that there would be additional wider economic impacts associated with the option. This may include induced investment through additional strategic development arising due to improved connectivity to the EZ (existing connections are constraining growth). Moreover, there may be benefits to those larger commercial businesses (such as the airport and Aston Martin) through transport improvements where competitive markets are imperfect. In this case, it will assist by providing an improved level of connectivity for the airport and businesses.</p> <p>There may also be beneficial labour supply impacts by improving connectivity between the employment sites and population centres, notably assisting access to employment from the Rhondda Valleys to the EZ. Whilst the EZ presents a regionally significant opportunity, the labour market catchment of the site is limited by the current transport infrastructure and services. If this issue is not resolved, it may have longer term implications for firms currently located in the Vale of Glamorgan and in terms of the business location decisions of prospective investors. The limited labour market catchment of the EZ currently is also compounded by comparatively poor business-to-business accessibility.</p> <p>Moreover, the accessibility analysis undertaken found that relatively modest reductions in journey times to/ from the Vale of Glamorgan would significantly increase the labour market and business-to-business catchment of the EZ.</p> <p>The improvement in accessibility may also bring a relocation of more productive jobs to the area. As the proposed link forms a connection between functioning parts of the Capital Region, there may also be productivity impacts due to agglomeration benefits for the Vale of Glamorgan in terms of linking in developments in the area to similar businesses/ clusters in the region.</p> <p>Moreover, productivity in the Cardiff Capital Region is very low compared to other UK City Regions, so improving connectivity to the Vale of Glamorgan may form part of a package of measures to address this (and in part addressing the issue of a lack of appropriate industrial premises).</p>	++
Land and Property	<p>Implementation of a new offline highway route will require significant areas of land predominantly in agricultural use to deliver a new highway route, in addition to land adjacent to existing routes to facilitate the online highway improvements. The exact extent and potential costs are unknown at this stage and would require further exploration, however a cost allowance has been included, as identified in the Financial Case.</p> <p>The concept design for the western option is anticipated to have the following impacts on residential and business properties:</p> <ul style="list-style-type: none"> • Number of buildings directly impacted by alignment = 4 	

Option B – Highway Route West of Pendoylan

- Number of buildings directly and partly impacted by the alignment = 10
- Impacts are assessed as moderate given the relatively low number of properties impacted for a scheme of this length.

Impact Assessment | Option C1 – Existing Infrastructure (Online) Enhancement

Option C1 – Existing Infrastructure (Online) Enhancement		
	Impacts	Scale
Social		
Physical Activity	<p>It is expected that the alignment would have a slight beneficial impact on physical activity with the integral provision of segregated walking and cycling infrastructure. It could also improve conditions for walkers and cyclists along the existing corridor including improved interconnectivity between the settlements of Pendoylan/ Clawdd-Coch and the wider region.</p>	+
Journey Quality	<p>It is anticipated that the implementation of an enhanced online road would establish improvements in journey quality in comparison to the do-minimum scenario with enhancements to traveller's care, views and stress although offer less benefits than a new offline highway. The broadly qualitative assessment completed using DMRB 11.3.9.2 (travellers' views) and 11.3.9.3/4 (traveller stress) has subsequently been considered alongside traveller care elements noted within TAG Unit A4.1.6 (Journey Quality Impacts). It is noted that these DMRB Volume 11 Section 3 Part 9 references are now withdrawn, although the appraisal has been completed in line with the existing TAG Unit A4.1.6 guidance.</p> <p>The study area between the M4 Junction 34 and the A48 at Sycamore Cross is predominantly an area of high-quality scenic countryside interspersed with ancient woodland, important nature conservation sites, SSSI and conservation areas. The existing highway route interconnecting via Pendoylan is primarily bounded by tall hedgerow with restrictive views of the surrounding landscape. Existing vegetation would be extensively removed to facilitate construction of the option, although replacement tree and hedgerow planting will be an integral part of the proposal for both options and in the long-term restrict visibility of the surrounding countryside.</p> <p>It is anticipated that there would be an improvement regarding traveller stress following implementation of a new road. In line with DMRB 11.3.9.3/4, a range of factors can affect a traveller's exposure to driver stress primarily encompassing frustration, fear of potential accidents, and uncertainty relating to the route being followed. The existing Pendoylan corridor, especially the route section between the village and the A48 Sycamore Cross junction is subsequently characterised by an undulating and narrow sub-standard highway with limited passing places and subsequent potential for vehicle conflict and high traveller stress.</p> <p>In addition to route characteristics, the DMRB assessment also considers the impact of traffic volume on driver stress categorising the average peak hourly flow per lane (in flow units/ 1 hour) for a 30mph single-carriageway road as high for roads with <600 vehicles, 600-800 vehicles and over 800 vehicles per hour. Implementation of the option would subsequently retain high levels of driver stress during the AM and PM peak.</p> <p>The guidance stress categorisation does however note that the advised thresholds are provided for guidance only and that the assessment of specific routes can only be made in the light of full knowledge of local conditions. Additional benefit should therefore be recognised via implementation of the online option predominantly designed to current DMRB standards with perceived improvements to driver frustration, route uncertainty and fear of</p>	++

Option C1 – Existing Infrastructure (Online) Enhancement

	<p>potential accidents establishing a moderate level of stress in comparison to the existing route. The benefits would be somewhat constrained by the 30mph design speed and no modifications to the existing road section through Pendoylan and Clawdd-Coch – the latter constraint of which retains an interface with existing junctions and site access points, on-street parking and key land-uses including Pendoylan Church in Wales Primary School.</p> <p>Traveller care is less influential regarding the proposed highway scheme with cleanliness, facilities and information factors considered to retain a neutral impact against the do-minimum scenario. Improvements would however be identified regarding the traveller’s environment with enhanced driver capability anticipated as a result of a new and improved route, as well as potential to establish an improved condition and smoothness of ride.</p> <p>The implementation of the new highway route would provide further benefits to walkers and cyclists through enhanced infrastructure provision and interconnectivity. Implementation of an integral shared walking/ cycling route would provide improved traveller care (information, environment), views and stress with perceived reductions in frustration, fear of potential accidents and route uncertainty. Whilst no new public transport infrastructure or services are specifically proposed as part of this option, the highway route would facilitate more attractive journeys for buses with similar highway benefits as noted herewith.</p> <p>In line with TAG Unit A4.1.6, a moderate rating has subsequently been applied to the scoring as the number of travellers affected is forecast to be more than 500 users and less than 10,000 users per day.</p>	
<p>Accidents</p>	<p>The modified/ enhanced section of route through the Pendoylan corridor is designed to current DMRB highway standards affording the potential to improve road safety conditions and reduce road traffic accidents, together with the opportunity to integrate segregated sustainable travel measures as part of the integral design. However, given restrictions on space, no modifications to the existing road are proposed on the highway section through Pendoylan and Clawdd-Coch – the anticipated increase in traffic associated with the route enhancements could therefore lead to a deterioration of local highway conditions given the existing interface retained with junctions and site access points, on-street parking and key land-uses including Pendoylan Church in Wales Primary School.</p> <p>The results for the offline (East and West) options show positive scheme benefits with a reduction in accident cost of £16.6m, over the 60-year period in 2010 prices. The analysis also shows that the scheme will reduce 446 accidents, which is a significant reduction of 9% compared to the Do-Minimum. Whilst some benefits regarding a reduction in accidents are also anticipated for the online option, the impact is anticipated to be less given the retention of non-compliant DMRB sections throughout the route.</p>	<p>+</p>
<p>Security</p>	<p>A review of security has been completed in line with TAG Unit A4.1.4 (Security Impacts) to assess the implementation of the route alignment. In summary, a slight beneficial impact is considered reasonable given the new road will be predominantly DMRB compliant with improvements to several factors including lighting and visibility, landscaping, informal surveillance and site perimeters.</p> <p>Due to the rural nature of the proposed route, new highway lighting for the benefit of vehicles has only been considered for enhanced/ modified junctions (where applicable). This will be implemented to current standards to</p>	<p>+</p>

Option C1 – Existing Infrastructure (Online) Enhancement

	<p>enhance upon existing provision. In addition, and in accordance with Sustrans guidance, 5m high lighting columns have been chosen for the length of the cycleway at 35m intervals and included within the cost makeup for the option. It is however recommended that due to the proximity to the proposed carriageway that a risk assessment be carried out during the next stage to ensure that the lighting does not adversely affect traffic using the road.</p> <p>There are also considered to be slight improvements to the site perimeter, landscaping and natural surveillance. The existing route predominantly consists of narrow lanes with tall hedgerow on both sides of the carriageway adversely impacting on visibility. In the long-term the establishment of hedgerow would be anticipated; however, this is likely to be managed to maintain suitable safety and security for users of the proposed route including pedestrians and cyclists.</p> <p>It is also noted within the TAG Unit A4.1 guidance that improved natural visibility out from the road subsequently has the potential to provide an enhanced perception of safety and security in comparison to the existing route corridor with its significant visibility constraints.</p>	
<p>Access to Employment</p>	<p>The traffic modelling completed to assess the offline route option has quantified user and provider benefits (£000's PVB 2010 prices discounted to 2010) for the new link totalling £36M for commuters and £52M for business. This indicates that a new offline highway route would afford significant benefits for access to work and for businesses in the region.</p> <p>Whilst the improved highway conditions associated with this online option would also enhance the local road network through the Pendoylan corridor and promote the development of more sustainable transport modes for access to employment, the benefits are anticipated to be less than those forecast for the offline route proposals given the applied 30mph design speed and retention of the existing road through Pendoylan and Clawdd-Coch – the latter constraint of which would retain interfaces with existing junctions and site access points, on-street parking and key land-uses including Pendoylan Church in Wales Primary School.</p> <p>Increased accessibility for HGVs and other large vehicles would also need to be carefully considered to avoid a deterioration in local road safety conditions, especially through the villages of Clawdd-Coch and Pendoylan. The implementation of traffic regulation orders to restrict access for such vehicles may be considered necessary to mitigate impacts accordingly.</p>	<p>+</p>
<p>Access to Services</p>	<p>The traffic modelling completed to assess the offline route option has quantified user and provider benefits (£000's PVB 2010 prices discounted to 2010) for the new link totalling £49.8M for other consumers than commuters or business. This indicates that a new offline highway route could afford significant benefits for access to services in the region.</p> <p>Whilst the improved highway conditions associated with this online option would also enhance the local road network through the Pendoylan corridor and promote the development of more sustainable transport modes for access to employment, the benefits are anticipated to be less than those forecast for the offline route proposals given the applied 30mph design speed and retention of the existing road through Pendoylan and Clawdd-Coch – the latter of which would retain interfaces with existing junctions and site access points, on-street parking and key land-uses including Pendoylan Church in Wales Primary School.</p>	<p>+</p>

Option C1 – Existing Infrastructure (Online) Enhancement

	<p>Increased accessibility for HGVs and other large vehicles would also need to be carefully considered to avoid a deterioration in local road safety conditions, especially through the villages of Clawdd-Coch and Pendoylan. The implementation of traffic regulation orders to restrict access for such vehicles may be considered necessary to mitigate impacts accordingly.</p>	
Affordability	<p>The potential to divert trips from the car to public transport as a result of likely improved journey time and journey time reliability for buses is mitigated by the potential for the option to retain the car as the dominant mode of travel in the region. A neutral impact is envisaged.</p>	0
Severance	<p>An enhanced route is anticipated to increase traffic flow through the settlements of Pendoylan and Clawdd-Coch with the potential to heighten the impact of severance. In line with TAG Unit A4.1.5 (Severance Impacts) a slight adverse impact is anticipated with less than 200 residents estimated to be adversely affected from any increases in traffic flow.</p> <p>Former DMRB 11.3.8 (although still referenced for appraisal in TAG Unit A4.1.5) provides guidance on the relief of severance using proportional improvement to traffic flows. Given that relief of severance is not considered significant where traffic flows are already relatively low, the guidance does not apply to roads with an existing AADT flow of less than 8,000 vehicles. The guidance does however acknowledge that a review of any severance relief that can be gained needs to be seen in the context of the size of the community affected, noting low to moderate increases in traffic flow are likely to be more significant for small communities in comparison to larger urban areas.</p> <p>There are several public rights of way interconnecting with the existing route, although no long-term adverse impacts are anticipated as connections would be retained with the potential for local enhancements at access points.</p>	-
Option and Non-Use Values	<p>In line with TAG Unit A4.1.7, <i>'Option and non-use values should be assessed if the scheme being appraised includes measures that will substantially change the availability of transport services within the study area (e.g. the opening or closure of a rail service, or the introduction or withdrawal of buses serving a particular rural area).'</i></p> <p>Whilst the option does not therefore retain specific measures to enhance public transport, an enhanced online highway route affords potential to establish robust journey times and journey time reliability. These improved highway conditions are anticipated to assist the development of more sustainable transport modes, although at the same time facilitating car use. The implementation of integral walking and cycling infrastructure also affords some opportunity for alternate modes of travel away from use of the private car. A score of slight beneficial is therefore considered reasonable within the context of the proposed option, noting the limitations of design speed (30mph) and retention of existing highway conditions through Pendoylan and Clawdd-Coch.</p>	+
Cultural		
Cultural Facilities	<p>Access to all facilities will be accommodated. There will be improved connectivity between the M4 and A4119 corridors and the cultural attractions of the coast, including Barry Island, Porthkerry Country Park and the beaches. Overall a slight positive impact on cultural facilities is anticipated.</p>	+

Option C1 – Existing Infrastructure (Online) Enhancement

Welsh Language	The Vale of Glamorgan Council stated in the Local Development Plan that <i>'having assessed the densities of Welsh language use across the Vale of Glamorgan it is not considered to be an issue which requires addressing in the Plan. As a result, the proposals contained in the LDP are not considered to have a detrimental impact upon the Welsh language and culture or materially affect the linguistic balance of the Vale of Glamorgan or the communities within the Vale of Glamorgan.'</i> Subsequently, it is considered there would be no impacts on the Welsh language from the highway option.	0
Environment		
Noise	<p>This review is not yet quantifiable in the absence of quantitative data, but a minor adverse impact is considered reasonable to assume as a result of increased traffic through the Pendoylan corridor, whilst also noting the impacts from short-term construction noise associated with the new route.</p> <p>In most cases mitigation measures should be available to alleviate any associated short and long-term noise pollution, but this would need to be considered against the potential to establish adverse landscape impacts (e.g. implementation of noise bunds).</p> <p>The traffic noise impacts would however need to be modelled in accordance with DMRB to quantify the noise impacts and consider the detailed propagation path for the option. This would allow for a detailed comparison of the proposed alignments against the existing road layout (do-minimum) and quantify the number of properties that are adversely affected, as well as the number of properties that benefit from the respective options.</p>	-
Air Quality	<p>Based upon the 2018 Air Quality Progress (APR) Report for the Vale of Glamorgan, the APR confirms that in 2017 air quality within the Vale of Glamorgan continues to meet the relevant air quality objectives⁴. From the 47 locations monitored throughout the Vale Borough with the use of passive diffusion tubes, no sites breach the national NO₂ annual objective of 40µg/m³ or the NO₂ 1-hour objective (200µg/m³, not to be exceeded more than 18 times per year). Based on the 2017 datasets it can be concluded that the NO₂ 1-hour objective was not breached. There are no Air Quality Management Areas (AQMAs) within or near to the project's study area.</p> <p>Implementation of an enhanced online route has the potential to deteriorate local air quality through Pendoylan village with an increase in local traffic flows assumed. There is potential for existing car trips to divert to public transport as a result of improved journey times and journey time reliability. It could also have the effect of reducing congestion and air quality issues at Culverhouse Cross by diverting traffic onto the new link.</p> <p>The impact of construction on managing air quality/ dust as well as vibration impacts would also need to be considered.</p>	-
Greenhouse Gases	The change in greenhouse gas emissions with the offline road link compared to the Do-Minimum has been calculated as an output of the traffic modelling. This gives a benefit valued at £1.1M. The reduction in emissions will be based on the reduced overall journey distances. The benefits are anticipated to be less than those forecast for the offline route proposals given the applied 30mph design speed and retention of the existing road through Pendoylan	0

⁴ Vale of Glamorgan Council Air Quality Progress Report 2018

Option C1 – Existing Infrastructure (Online) Enhancement

	<p>and Clawdd-Coch – the latter constraint of which would retain interfaces with existing junctions and site access points, on-street parking and key land-uses including Pendoylan Church in Wales Primary School.</p>	
<p>Landscape</p>	<p>The online option will require the extensive felling of trees and the removal of hedgerows adjoining the existing road together with some disruption of the field pattern. There are likely to be some impacts on driveways and farm access points and some significant effects within Clawdd-Coch.</p> <p>The landscape character impacts of both online options are of a small scale in the overall landscape context. The greatest impacts will be during the construction stage but will be of relatively short duration. It is assumed that replacement tree and hedgerow planting will be an integral part of the proposal for both options and in the long-term, once mitigation/ replacement planting is established, any impacts on the landscape will less significant.</p> <p>The potential impacts on the specific landscape elements are:</p> <p>Undulating landform rising to the A48 ridge Some significant new landforms are proposed. However, these are generally of a scale that will not alter the overall characteristic undulating landform.</p> <p>Extensive hedgerows outlining small irregular fields – predominately managed as pasture Both options will lead to loss of hedgerows adjoining the that will require to be replaced, The field pattern will be disrupted locally by the works, however this will just reinforce the line of the existing road rather than introducing a new strong linear feature into the existing landscape . With appropriate mitigation the impact can be reduced over time. The existing mainline railway is generally well absorbed into the landscape.</p> <p>Individual trees within hedgerows There will be significant loss of roadside mature hedgerow trees however new tree planting would ensure no change to this character element in the longer term.</p> <p>Significant number of small woodlands Neither option would impact greatly on existing small woods - replacement woodland to maintain the landscape character would be an essential mitigation item.</p> <p>The study area includes a range of visual receptors and there are some extensive views across and along the Ely Valley. The main visual impacts will, however, be limited to the properties adjoining the existing road. It is likely that the impacts will be similar for both online options, although the detailed effects cannot be fully ascertained until more advanced design stages.</p> <p>The following sensitive receptors are likely to experience significant adverse visual effects in the short to medium-term (encompassing the construction and immediate post-construction phase), although no longer-term adverse impact/ change from the do-minimum is assumed once mitigation/ replacement planting is established.</p> <ul style="list-style-type: none"> • Residential properties in and south of Clawdd-Coch There are several properties close to the existing road that will experience significant visual impact. • Residential Properties south of Pendoylan There are semi-detached and detached houses which lie immediately adjacent to the existing road. • Residential Properties ‘The Cherries’ and ‘The Highlands’ These properties are both situated close to the existing road. 	

Option C1 – Existing Infrastructure (Online) Enhancement

	<p>The proposed online option of road infrastructure through undulating land will degrade the existing landscape character through the loss of existing hedgerows and roadside trees and will generate some significant impacts on short distance views from some residential properties. Mitigation to encompass landscape design along the route to reduce impact would encompass planting of new hedges and good landscape design (screening). The online options would have less earthworks than the offline options and would not be introducing a new feature into the landscape. However, the extent of hedgerows and roadside trees lost would be greater so it would still be moderate adverse impact. With new tree and hedge planting this could be reduced to minor/slight in the very long term once all the new replacement tree planting has matured. In comparison, the offline options both have significant impacts and would both therefore have moderate adverse impact overall. This could reduce to minor/slight in the long term with substantial mitigation. The greatest impacts for all options will be during the construction stage but will be of relatively short duration.</p> <p>In terms of the overall effect on the local landscape character there is little to differentiate between the two online options. However, Online Alignment Option C1 with its wider footprint and greater earthworks has a greater impact on the landscape. In terms of vegetation loss there is also little difference, although Online Alignment Option C1 also has greater impact on the woodland at Coed Waun-Lloff north of Clawdd-Coch.</p>	
<p>Townscape</p>	<p>Area assessed – Pendoylan village using the Vale of Glamorgan Pendoylan Conservation Area Appraisal and Management Plan (2009). Both online options broadly utilise the existing network, although Option C1 does retain a greater number of new offline sections. However, the road sections through Pendoylan and Clawdd-Coch would not be upgraded as part of either online option due to restrictions on space through the village and thus is unlikely to have any direct impacts on the townscape of the village.</p> <p>Both online alignments are anticipated to increase traffic through Pendoylan as a result of the enhanced road. This could have an indirect slight adverse impact on the cultural and human interaction aspects of the townscape character as the increased traffic could diminish the appreciation and interaction with the heritage townscape of the village.</p>	<p>0</p>
<p>Historic Environment</p>	<p>The baseline assessment has completed a thorough analysis of known environmental and land-use characteristics for the study area. This has identified several sites of historic interest including scheduled monuments, listed buildings, archaeological sites and registered parks and gardens.</p> <p>Based on the information obtained through desk-based assessment and walkover survey it is concluded that there are no major constraints as the works are predominantly online improvements to the current road alignment.</p> <p>However, the online alignment has the potential to have an adverse impact on unknown non-designated heritage assets. The proposed alignment has the potential to directly impact on buried archaeological remains which could result in the permanent and irreversible loss of assets. Online Sub Option 1 involves more ground intrusive works which would therefore increase the potential for impact on unknown archaeological remains.</p> <p>The proposed alignment would not have an effect on the survival of the designated assets, although may have an adverse effect on the survival of unidentified buried archaeological remains within the route of the scheme, however, this is not quantifiable at this stage.</p>	<p>-</p>

Option C1 – Existing Infrastructure (Online) Enhancement

	<p>The effect on the context of the Registered Park and Garden and Listed Building is likely to be neutral. Due to the lack of assessment on the archaeological features the effect of the alignment on the non-designated archaeological features known and unknown is unknown.</p> <p>The proposed alignments would not influence the periods of heritage assets and areas.</p>	
Biodiversity	<p>The main impact of the proposed widening would be removal of ancient and species rich hedgerows. However, hedgerows can be successfully translocated and re-planted so long-term impacts are not anticipated. The online option will have considerably less ecological impact than the offline route options as habitats in the vicinity of the road will already be disturbed by the road and there is less direct habitat loss. Further data including protected species surveys are required and potential mitigation activities should be recommended in an Ecological Impact Assessment.</p>	
Water Environment	<p>The flood modelling exercise completed focussed principally on the two offline highway options that cross the River Ely and intersect its floodplain (Flood Zones B and C2) at two locations. The existing River Ely model has subsequently been updated to be capable of informing baseline flood risk in the area of interest and testing the proposed scheme designs. All results are included within the accompanying River Ely Hydraulic Modelling report.</p> <p>The results indicate that only the northern area of interest, where both alignments follow the same route, is shown to identify a change in peak flood level for the 1% AEP +CC event. This illustrates how the Scheme causes flood water to pond behind it, increasing water levels in this location by up to 450mm. For the 1% AEP, peak water levels are increased by up to 550mm and for the 0.1% AEP event, by up to 400mm. The peak flow at the proposed location of the Scheme does not change significantly from the baseline.</p> <p>The impacts of this predicted increase in flood risk should be reviewed in detail, and options and requirements for mitigation discussed with NRW and the Client in order to inform a Flood Consequence Analysis (FCA) to be undertaken at the detailed design phase. The mitigation options may include flood relief culverts under the proposed road. In addition, the results are likely to be impacted by the inclusion of the two structures which exist under the existing unnamed road (located to east of the proposed road), in the baseline model. Modelling of these structures could potentially change the magnitude of the impact that the Scheme has on water levels in the area.</p> <p>In terms of water quality, the Ely and its tributaries are WFD waterbodies and the reach in the study area in the second cycle achieved status of Bad ecological status and Fail regarding chemical quality. The WFD groundwater body underlying the route is the South East Valleys Southern Devonian Old Red Sandstone and Triassic Mercia Mudstone. This waterbody achieves Good status in terms of both groundwater quality and quantity.</p> <p>With regards to aquifers, there are no groundwater Source Protection Zones along the alignment or in proximity to it. Potential for effects is likely to be relatively limited, there would be some scope for impacts if the new highway was drained to ground via soakaways (rather than discharges to watercourses), or if there were sections in cut (which may trigger the need for groundwater control measures e.g. dewatering).</p>	
Residential Amenity	<p>The impact on residential amenity considers the cumulative impact of air quality, noise and visual intrusion on residential properties. The combined</p>	

Option C1 – Existing Infrastructure (Online) Enhancement

	<p>assessment from the above indicates that the properties in the communities of Clawdd-Coch and Pendoylan will be adversely affected by increases in traffic through the village. Several properties will experience adverse impacts due to proximity of the alignment. There are likely to be impacts of visual intrusion based on short distance views across the landscape, the impacts of which are considered to be significant in the short to medium term (prior to detailed consideration at the next stage of the assessment), although the effects on those properties close to the route are likely to be neutral/ slight once the longer term benefits of replanting trees and hedgerow is fully established.</p>	
Economic		
Journey Time Changes	<p>The level of offline route (East and West) journey time savings to users' totals £138M through the provision of a link, as forecast using the traffic model, which represents a substantial beneficial improvement. However, whilst the enhancement of the existing highway route would also result in measurable improvements in journey times with increased average speeds between M4 Junction 34 and A48, journey time savings are considered to be less in relation to the offline options given the applied 30mph design speed and retention of non-complaint DMRB sections throughout the route.</p> <p>As this online option retains active travel measures, additional benefits to walkers and cyclists through enhanced infrastructure provision is anticipated.</p>	++
Journey Time Reliability Changes	<p>It is anticipated that the implementation of an enhanced highway route could establish measurable improvements in journey time reliability, although the benefits are anticipated to be less than the offline options given the applied 30mph design speed and retention of non-complaint DMRB sections throughout the route.</p>	+
Transport Costs	<p>Transport costs for road users are anticipated to reduce compared to the Do-Minimum, reflecting the journey time savings. It is therefore anticipated that delivery of an enhanced road would reduce the transport costs compared to the do-minimum option.</p>	+
Wider Economic Impacts	<p>It is anticipated that many of the wider economic benefits that would be realised for the offline options would also be realised for this option, including additional strategic development arising due to improved connectivity to the airport and businesses, beneficial labour supply impacts by improving connectivity between the employment sites and population centres and the potential relocation of more productive jobs to the area, again as a result of enhanced connectivity.</p> <p>However, these wider economic impacts are less beneficial for the online option given the applied 30mph design speed and retention of non-complaint DMRB sections throughout the route (with the potential compromise journey times and journey time reliability).</p> <p>In addition, increased accessibility for HGVs and other large vehicles would also need to be carefully considered to avoid a deterioration in local road safety conditions, especially through the villages of Clawdd-Coch and Pendoylan. The implementation of traffic regulation orders to restrict access for such vehicles may be considered necessary to mitigate impacts accordingly – any associated restrictions in access would likely reduce the potential realisation of wider economic benefits further.</p>	+

Option C1 – Existing Infrastructure (Online) Enhancement

Land

Implementation of an enhanced online route will have significant impacts on land and properties situated adjacent to the route. A cost allowance has been included as part of the Financial Case.

The concept design for the C1 option is anticipated to have the following impacts on residential and business properties:

- Number of buildings directly impacted by alignment = 3
- Number of buildings directly and partly impacted by the alignment = 9

Impacts are assessed as moderate given the relatively low number of properties impacted for a scheme of this length.

Impact Assessment | Option C2 – Existing Infrastructure (Online) Enhancement

Option C2 – Existing Infrastructure (Online) Enhancement		
	Impacts	Scale
Social		
Physical Activity	It is expected that the option would have a neutral impact on physical activity as no integral walking and cycling infrastructure is proposed.	0
Journey Quality	<p>It is anticipated that the implementation of an enhanced online road would establish improvements in journey quality in comparison to the do-minimum scenario with enhancements to traveller's care, views and stress although offer less benefits than a new offline highway and Online Alignment Option C1. The broadly qualitative assessment completed using DMRB 11.3.9.2 (travellers' views) and 11.3.9.3/4 (traveller stress) has subsequently been considered alongside traveller care elements noted within TAG Unit A4.1.6 (Journey Quality Impacts). It is noted that these DMRB Volume 11 Section 3 Part 9 references are now withdrawn, although the appraisal has been completed in line with the existing TAG Unit A4.1.6 guidance.</p> <p>The study area between the M4 Junction 34 and the A48 at Sycamore Cross is predominantly an area of high-quality scenic countryside interspersed with ancient woodland, important nature conservation sites, SSSI and conservation areas. The existing highway route interconnecting via Pendoylan is primarily bounded by tall hedgerow with restrictive views of the surrounding landscape. Existing vegetation would be extensively removed to facilitate construction of the option, although replacement tree and hedgerow planting will be an integral part of the proposal for both options and in the long-term restrict visibility of the surrounding countryside.</p> <p>In line with DMRB 11.3.9.3/4, a range of factors can affect a traveller's exposure to driver stress primarily encompassing frustration, fear of potential accidents, and uncertainty relating to the route being followed. It is anticipated that there would be an improvement regarding traveller stress following implementation of an enhanced road.</p> <p>In addition to route characteristics, the DMRB assessment also considers the impact of traffic volume on driver stress categorising the average peak hourly flow per lane (in flow units/ 1 hour) for a 30mph single-carriageway road as high for roads with <600 vehicles, 600-800 vehicles and over 800 vehicles per hour. Implementation of the option would subsequently retain high levels of driver stress during the AM and PM peak.</p> <p>The guidance stress categorisation does however note that the advised thresholds are provided for guidance only and that the assessment of specific routes can only be made in the light of full knowledge of local conditions. The benefits would be somewhat constrained by the retention of a non-compliant DMRB alignment, a 30mph design speed and no modifications to the existing road section through Pendoylan and Clawdd-Coch – the latter constraint of which retains an interface with existing junctions and site access points, on-street parking and key land-uses including Pendoylan Church in Wales Primary School.</p> <p>Traveller care is less influential regarding the proposed highway scheme with cleanliness, facilities and information factors considered to retain a neutral impact against the do-minimum scenario. Improvements would however be</p>	+

Option C2 – Existing Infrastructure (Online) Enhancement

	<p>identified regarding the traveller's environment with enhanced driver capability anticipated as a result of a new and improved route, as well as potential to establish an improved condition and smoothness of ride.</p> <p>There would be no associated benefits for walker and cyclists as no integral walking/ cycling route is proposed.</p>	
Accidents	<p>The enhanced road does not comply to current DMRB highway standards including the highway section through Pendoylan and Clawdd-Coch where restrictions on space prevent modifications to the existing road being implemented – the anticipated increase in traffic associated with the route enhancements could therefore lead to a deterioration of local highway conditions given the existing interface retained with junctions and site access points, on-street parking and key land-uses including Pendoylan Church in Wales Primary School.</p> <p>The results for the offline (East and West) options show positive scheme benefits with a reduction in accident cost of £16.6m, over the 60-year period in 2010 prices. The analysis also shows that the scheme will reduce 446 accidents, which is a significant reduction of 9% compared to the Do-Minimum. Whilst some slight benefits regarding a reduction in accidents are also anticipated for the online option, the impact is anticipated to be less given the retention of non-compliant DMRB sections throughout the route.</p>	0
Security	<p>A review of security has been completed in line with TAG Unit A4.1.4 (Security Impacts) to assess the implementation of the route alignment. In summary, a slight beneficial impact is considered reasonable with improvements to several factors including landscaping, informal surveillance and site perimeters.</p> <p>There are slight improvements to the site perimeter, landscaping and natural surveillance. The existing route predominantly consists of narrow lanes with tall hedgerow on both sides of the carriageway adversely impacting on visibility. In the long-term the establishment of hedgerow would be anticipated; however, this is likely to be managed to maintain suitable safety and security for users of the proposed route including pedestrians and cyclists.</p> <p>It is also noted within the TAG Unit A4.1 guidance that improved natural visibility out from the road subsequently has the potential to provide an enhanced perception of safety and security in comparison to the existing route corridor with its significant visibility constraints.</p>	+
Access to Employment	<p>The traffic modelling completed to assess the offline route option has quantified user and provider benefits (£000's PVB 2010 prices discounted to 2010) for the new link totalling £36M for commuters and £52M for business. This indicates that a new offline highway route would afford significant benefits for access to work and for businesses in the region.</p> <p>Whilst the improved highway conditions associated with this online option would improve the local road network through the Pendoylan corridor, the benefits are anticipated to be less than those forecast for the offline route proposals given the option is not compliant to DMRB design standards, retains an applied 30mph design speed, and retains the existing road through Pendoylan and Clawdd-Coch – the latter constraint of which would retain interfaces with existing junctions and site access points, on-street parking and key land-uses including Pendoylan Church in Wales Primary School.</p>	+

Option C2 – Existing Infrastructure (Online) Enhancement

	<p>Increased accessibility for HGVs and other large vehicles would also need to be carefully considered to avoid a deterioration in local road safety conditions, especially through the villages of Clawdd-Coch and Pendoylan. The implementation of traffic regulation orders to restrict access for such vehicles may be considered necessary to mitigate impacts accordingly.</p>	
Access to Services	<p>The traffic modelling completed to assess the offline route option has quantified user and provider benefits (£000's PVB 2010 prices discounted to 2010) for the new link totalling £49.8M for other consumers than commuters or business. This indicates that a new offline highway route could afford significant benefits for access to services in the region.</p> <p>Whilst the improved highway conditions associated with this online option would also enhance the local road network through the Pendoylan corridor and promote the development of more sustainable transport modes for access to employment, the benefits are anticipated to be less than those forecast for the offline route proposals given the option is not compliant to DMRB design standards, retains an applied 30mph design speed and the existing road through Pendoylan and Clawdd-Coch – the latter constraint of which would retain interfaces with existing junctions and site access points, on-street parking and key land-uses including Pendoylan Church in Wales Primary School.</p> <p>Increased accessibility for HGVs and other large vehicles would also need to be carefully considered to avoid a deterioration in local road safety conditions, especially through the villages of Clawdd-Coch and Pendoylan. The implementation of traffic regulation orders to restrict access for such vehicles may be considered necessary to mitigate impacts accordingly.</p>	+
Affordability	<p>The potential to divert trips from the car to public transport as a result of likely improved journey time and journey time reliability for buses is mitigated by the potential for the option to retain the car as the dominant mode of travel in the region. A neutral impact is envisaged.</p>	0
Severance	<p>An enhanced route is anticipated to increase traffic flow through the settlements of Pendoylan and Clawdd-Coch with the potential to heighten the impact of severance. In line with TAG Unit A4.1.5 (Severance Impacts) a slight adverse impact is anticipated with less than 200 residents estimated to be adversely affected from any increases in traffic flow.</p> <p>Former DMRB 11.3.8 (although still referenced for appraisal in TAG Unit A4.1.5) provides guidance on the relief of severance using proportional improvement to traffic flows. Given that relief of severance is not considered significant where traffic flows are already relatively low, the guidance does not apply to roads with an existing AADT flow of less than 8,000 vehicles. The guidance does however acknowledge that a review of any severance relief that can be gained needs to be seen in the context of the size of the community affected, noting low to moderate increases in traffic flow are likely to be more significant for small communities in comparison to larger urban areas.</p> <p>There are several public rights of way interconnecting with the existing route, although no long-term adverse impacts are anticipated as connections would be retained with the potential for local enhancements at access points.</p>	-

Option C2 – Existing Infrastructure (Online) Enhancement

Option and Non-Use Values	<p>In line with TAG Unit A4.1.7, <i>'Option and non-use values should be assessed if the scheme being appraised includes measures that will substantially change the availability of transport services within the study area (e.g. the opening or closure of a rail service, or the introduction or withdrawal of buses serving a particular rural area).'</i></p> <p>The option does not retain specific measures to enhance public transport and neither does it include integral walking and cycling infrastructure. The option is also considered unlikely to significantly assist the development of more sustainable transport modes given the option is not compliant to DMRB design standards, retains an applied 30mph design speed and the existing road through Pendoylan and Clawdd-Coch – the latter of which would retain interfaces with existing junctions and site access points, on-street parking and key land-uses including Pendoylan Church in Wales Primary School.</p>	0
Cultural		
Cultural Facilities	<p>Whilst there will be improved accessibility between the M4 Junction 34 and A48, the benefits are anticipated to be less than those forecast for the offline route proposals given the option is not compliant to DMRB design standards, retains an applied 30mph design speed and the existing road through Pendoylan and Clawdd-Coch – the latter constraint of which would retain interfaces with existing junctions and site access points, on-street parking and key land-uses including Pendoylan Church in Wales Primary School.</p>	+
Welsh Language	<p>The Vale of Glamorgan Council stated in the Local Development Plan that <i>'having assessed the densities of Welsh language use across the Vale of Glamorgan it is not considered to be an issue which requires addressing in the Plan. As a result, the proposals contained in the LDP are not considered to have a detrimental impact upon the Welsh language and culture or materially affect the linguistic balance of the Vale of Glamorgan or the communities within the Vale of Glamorgan.'</i> Subsequently, it is considered there would be no impacts on the Welsh language from the highway option.</p>	0
Environment		
Noise	<p>This review is not yet quantifiable in the absence of quantitative data, but a minor adverse impact is considered reasonable to assume as a result of increased traffic through the Pendoylan corridor, whilst also noting the impacts from short-term construction noise associated with the new route.</p> <p>In most cases mitigation measures should be available to alleviate any associated short and long-term noise pollution, but this would need to be considered against the potential to establish adverse landscape impacts (e.g. implementation of noise bunds).</p> <p>The traffic noise impacts would however need to be modelled in accordance with DMRB to quantify the noise impacts and consider the detailed propagation path for the option. This would allow for a detailed comparison of the proposed alignments against the existing road layout (do-minimum) and quantify the number of properties that are adversely affected, as well as the number of properties that benefit from the respective options.</p>	-
Air Quality	<p>Based upon the 2018 Air Quality Progress (APR) Report for the Vale of Glamorgan, the APR confirms that in 2017 air quality within the Vale of</p>	-

Option C2 – Existing Infrastructure (Online) Enhancement

	<p>Glamorgan continues to meet the relevant air quality objectives⁵. From the 47 locations monitored throughout the Vale Borough with the use of passive diffusion tubes, no sites breach the national NO₂ annual objective of 40µg/m³ or the NO₂ 1-hour objective (200µg/m³, not to be exceeded more than 18 times per year). Based on the 2017 datasets it can be concluded that the NO₂ 1-hour objective was not breached. There are no Air Quality Management Areas (AQMAs) within or near to the project's study area.</p> <p>Implementation of an enhanced online route has the potential to deteriorate local air quality through Pendoylan village with an increase in local traffic flows assumed. There is potential for existing car trips to divert to public transport as a result of improved journey times and journey time reliability. It could also have the effect of reducing congestion and air quality issues at Culverhouse Cross by diverting traffic onto the new link.</p> <p>The impact of construction on managing air quality/ dust as well as vibration impacts would also need to be considered.</p>	
Greenhouse Gases	<p>The change in greenhouse gas emissions with the offline road link compared to the Do-Minimum has been calculated as an output of the traffic modelling. This gives a benefit valued at £1.1M. The reduction in emissions will be based on the reduced overall journey distances. The benefits are anticipated to be less than those forecast for the offline route proposals given the applied 30mph design speed and retention of the existing road through Pendoylan and Clawdd-Coch – the latter constraint of which would retain interfaces with existing junctions and site access points, on-street parking and key land-uses including Pendoylan Church in Wales Primary School.</p>	0
Landscape	<p>The online option will require the extensive felling of trees and the removal of hedgerows adjoining the existing road together with some disruption of the field pattern. There are likely to be some impacts on driveways and farm access points and some significant effects within Clawdd-Coch.</p> <p>The landscape character impacts of both online options are of a small scale in the overall landscape context. The greatest impacts will be during the construction stage but will be of relatively short duration. It is assumed that replacement tree and hedgerow planting will be an integral part of the proposal for both options and in the long-term, once mitigation/ replacement planting is established, any impacts on the landscape will less significant.</p> <p>The potential impacts on the specific landscape elements are:</p> <p>Undulating landform rising to the A48 ridge Some significant new landforms are proposed. However, these are generally of a scale that will not alter the overall characteristic undulating landform.</p> <p>Extensive hedgerows outlining small irregular fields – predominately managed as pasture Both options will lead to loss of hedgerows adjoining the that will require to be replaced, The field pattern will be disrupted locally by the works, however this will just reinforce the line of the existing road rather than introducing a new strong linear feature into the existing landscape . With appropriate mitigation the impact can be reduced over time. The existing mainline railway is generally well absorbed into the landscape.</p>	

⁵ Vale of Glamorgan Council Air Quality Progress Report 2018

Option C2 – Existing Infrastructure (Online) Enhancement

Individual trees within hedgerows | There will be significant loss of roadside mature hedgerow trees however new tree planting would ensure no change to this character element in the longer term.

Significant number of small woodlands | Neither option would impact greatly on existing small woods - replacement woodland to maintain the landscape character would be an essential mitigation item.

The study area includes a range of visual receptors and there are some extensive views across and along the Ely Valley. The main visual impacts will, however, be limited to the properties adjoining the existing road. It is likely that the impacts will be similar for both online options, although the detailed effects cannot be fully ascertained until more advanced design stages.

The following sensitive receptors are likely to experience significant adverse visual effects in the short to medium-term (encompassing the construction and immediate post-construction phase), although no longer-term adverse impact/ change from the do-minimum is assumed once mitigation/ replacement planting is established.

- Residential properties in and south of Clawdd-Coch | There are several properties close to the existing road that will experience significant visual impact.
- Residential Properties south of Pendoylan | There are semi-detached and detached houses which lie immediately adjacent to the existing road.
- Residential Properties 'The Cherries' and 'The Highlands' | These properties are both situated close to the existing road.

The proposed online option of road infrastructure through undulating land will degrade the existing landscape character through the loss of existing hedgerows and roadside trees and will generate some significant impacts on short distance views from some residential properties. Mitigation to encompass landscape design along the route to reduce impact would encompass planting of new hedges and good landscape design (screening). The online options would have less earthworks than the offline options and would not be introducing a new feature into the landscape. However, the extent of hedgerows and roadside trees lost would be greater so it would still be moderate adverse impact. With new tree and hedge planting this could be reduced to minor/slight in the very long term once all the new replacement tree planting has matured. In comparison, the offline options both have significant impacts and would both therefore have moderate adverse impact overall. This could reduce to minor/slight in the long term with substantial mitigation. The greatest impacts for all options will be during the construction stage but will be of relatively short duration.

In terms of the overall effect on the local landscape character there is little to differentiate between the two online options. However, Online Alignment Option C1 with its wider footprint and greater earthworks has a greater impact on the landscape. In terms of vegetation loss there is also little difference, although Online Alignment Option C1 also has greater impact on the woodland at Coed Waun-Lloff north of Clawdd-Coch.

Townscape

Area assessed – Pendoylan village using the Vale of Glamorgan Pendoylan Conservation Area Appraisal and Management Plan (2009). Both online options broadly utilise the existing network, although Option C1 does retain a greater number of new offline sections. However, the road sections through Pendoylan and Clawdd-Coch would not be upgraded as part of either online

0

Option C2 – Existing Infrastructure (Online) Enhancement

	<p>option due to restrictions on space through the village and thus is unlikely to have any direct impacts on the townscape of the village.</p> <p>Both online alignments are anticipated to increase traffic through Pendoylan as a result of the enhanced road. This could have an indirect slight adverse impact on the cultural and human interaction aspects of the townscape character as the increased traffic could diminish the appreciation and interaction with the heritage townscape of the village.</p>	
<p>Historic Environment</p>	<p>The baseline assessment has completed a thorough analysis of known environmental and land-use characteristics for the study area. This has identified several sites of historic interest including scheduled monuments, listed buildings, archaeological sites and registered parks and gardens.</p> <p>Based on the information obtained through desk-based assessment and walkover survey it is concluded that there are no major constraints as the works are predominantly online improvements to the current road alignment.</p> <p>However, the online alignment has the potential to have an adverse impact on unknown non-designated heritage assets. The proposed alignment has the potential to directly impact on buried archaeological remains which could result in the permanent and irreversible loss of assets. Online Sub Option 1 involves more ground intrusive works which would therefore increase the potential for impact on unknown archaeological remains.</p> <p>The proposed alignment would not have an effect on the survival of the designated assets, although may have an adverse effect on the survival of unidentified buried archaeological remains within the route of the scheme, however, this is not quantifiable at this stage.</p> <p>The effect on the context of the Registered Park and Garden and Listed Building is likely to be neutral. Due to the lack of assessment on the archaeological features the effect of the alignment on the non-designated archaeological features known and unknown is unknown.</p> <p>The proposed alignments would not influence the periods of heritage assets and areas.</p>	-
<p>Biodiversity</p>	<p>The main impact of the proposed widening would be removal of ancient and species rich hedgerows. However, hedgerows can be successfully translocated and re-planted so long-term impacts are not anticipated. The online option will have considerably less ecological impact than the offline route options as habitats in the vicinity of the road will already be disturbed by the road and there is less direct habitat loss. Further data including protected species surveys are required and potential mitigation activities should be recommended in an Ecological Impact Assessment.</p>	-
<p>Water Environment</p>	<p>The flood modelling exercise completed focussed principally on the two offline highway options that cross the River Ely and intersect its floodplain (Flood Zones B and C2) at two locations. The existing River Ely model has subsequently been updated to be capable of informing baseline flood risk in the area of interest and testing the proposed scheme designs. All results are included within the accompanying River Ely Hydraulic Modelling report.</p> <p>The results indicate that only the northern area of interest, where both alignments follow the same route, is shown to identify a change in peak flood level for the 1% AEP +CC event. This illustrates how the Scheme causes flood water to pond behind it, increasing water levels in this location by up to 450mm. For the 1% AEP, peak water levels are increased by up to 550mm</p>	-

Option C2 – Existing Infrastructure (Online) Enhancement

	<p>and for the 0.1% AEP event, by up to 400mm. The peak flow at the proposed location of the Scheme does not change significantly from the baseline.</p> <p>The impacts of this predicted increase in flood risk should be reviewed in detail, and options and requirements for mitigation discussed with NRW and the Client in order to inform a Flood Consequence Analysis (FCA) to be undertaken at the detailed design phase. The mitigation options may include flood relief culverts under the proposed road. In addition, the results are likely to be impacted by the inclusion of the two structures which exist under the existing unnamed road (located to east of the proposed road), in the baseline model. Modelling of these structures could potentially change the magnitude of the impact that the Scheme has on water levels in the area.</p> <p>In terms of water quality, the Ely and its tributaries are WFD waterbodies and the reach in the study area in the second cycle achieved status of Bad ecological status and Fail regarding chemical quality. The WFD groundwater body underlying the route is the South East Valleys Southern Devonian Old Red Sandstone and Triassic Mercia Mudstone. This waterbody achieves Good status in terms of both groundwater quality and quantity.</p> <p>With regards to aquifers, there are no groundwater Source Protection Zones along the alignment or in proximity to it. Potential for effects is likely to be relatively limited, there would be some scope for impacts if the new highway was drained to ground via soakaways (rather than discharges to watercourses), or if there were sections in cut (which may trigger the need for groundwater control measures e.g. dewatering).</p>	
Residential Amenity	<p>The impact on residential amenity considers the cumulative impact of air quality, noise and visual intrusion on residential properties. The combined assessment from the above indicates that the properties in the communities of Clawdd-Coch and Pendoylan will be adversely affected by increases in traffic through the village. Several properties will experience adverse impacts due to proximity of the alignment. There are likely to be impacts of visual intrusion based on short distance views across the landscape, the impacts of which are considered to be significant in the short to medium term (prior to detailed consideration at the next stage of the assessment), although the effects on those properties close to the route are likely to be neutral/ slight once the longer term benefits of replanting trees and hedgerow is fully established.</p>	
Economic		
Journey Time Changes	<p>The level of offline route (East and West) journey time savings to users' totals £138M through the provision of a link, as forecast using the traffic model, which represents a substantial beneficial improvement. However, whilst the enhancement of the existing highway route would also result in measurable improvements in journey times with increased average speeds between M4 Junction 34 and A48, journey time savings are considered to be less in relation to the offline options given the applied 30mph design speed and retention of non-complaint DMRB sections throughout the route.</p> <p>No additional benefits to walkers and cyclists are realised as part of this option as the option does not include the implementation of an integral footway and cycleway.</p>	+
Journey Time	<p>It is anticipated that the implementation of an enhanced highway route could establish measurable improvements in journey time reliability, although the benefits are anticipated to be less given the option is not compliant to DMRB</p>	+

Option C2 – Existing Infrastructure (Online) Enhancement

Reliability Changes	design standards, retains an applied 30mph design speed and the existing road through Pendoylan and Clawdd-Coch – the latter constraint of which would retain interfaces with existing junctions and site access points, on-street parking and key land-uses including Pendoylan Church in Wales Primary School.	
Transport Costs	Transport costs for road users are anticipated to reduce compared to the Do-Minimum, reflecting the journey time savings. It is therefore anticipated that delivery of an enhanced road would reduce the transport costs compared to the do-minimum option.	+
Wider Economic Impacts	<p>It is anticipated that many of the wider economic benefits that would be realised for the offline options would also be realised for this option, including additional strategic development arising due to improved connectivity to the airport and businesses, beneficial labour supply impacts by improving connectivity between the employment sites and population centres and the potential relocation of more productive jobs to the area, again as a result of enhanced connectivity.</p> <p>However, these wider economic impacts are less beneficial for the online option given the applied 30mph design speed and retention of non-complaint DMRB sections throughout the route (with the potential compromise journey times and journey time reliability).</p> <p>In addition, increased accessibility for HGVs and other large vehicles would also need to be carefully considered to avoid a deterioration in local road safety conditions, especially through the villages of Clawdd-Coch and Pendoylan. The implementation of traffic regulation orders to restrict access for such vehicles may be considered necessary to mitigate impacts accordingly – any associated restrictions in access would likely reduce the potential realisation of wider economic benefits further.</p>	+
Land	<p>Implementation of an enhanced online route will have significant impacts on land and properties situated adjacent to the route. A cost allowance has been included as part of the Financial Case.</p> <p>The concept design for the C2 option is anticipated to have the following impacts on residential and business properties:</p> <ul style="list-style-type: none"> • Number of buildings directly impacted by alignment = 3 • Number of buildings directly and partly impacted by the alignment = 9 <p>Impacts are assessed as moderate given the relatively low number of properties impacted for a scheme of this length.</p>	-

Appendix G

Highway Option Costs | Summary Tables

M4 Junction 34 - A48 WeITAG Study: Stage 2

East Option

Cost Estimate	Stage of Study	Stage 2	Stage 2 +	Stage 2+ (inflated)
	% allowance	Total		
Series 100 - Preliminaries		5,190,754	6,425,590	6,875,382
Series 200 – Site Clearance		241,399	241,399	258,297
Series 300 – Fencing		458,191	461,497	493,802
Series 400 – Road Restraint Systems (Vehicle and Pedestrian)		423,670	411,799	440,625
Series 500 – Drainage and Service Ducts		2,716,349	1,955,038	2,091,891
Series 600 – Earthworks		5,858,595	13,921,103	14,895,580
Series 700 – Pavement		5,012,318	5,054,011	5,407,792
Series 1100 – Kerbs, Footways and Paved Areas		658,616	780,914	835,578
Series 1200 – Traffic Signs and Road Markings		157,802	165,849	177,459
Series 1300 – Road Lighting Columns and Brackets, CCTV Masts and Cantilever Masts		685,792	706,005	755,426
Series 1500 – Motorway Communications		299,974	289,838	310,127
Structures		3,291,772	528,343	565,327
Series 2700 – Accommodation Works, Works for Statutory Undertakers, Provisional Sums and Prime Cost Items (Not used)		594,134	735,474	786,957
Series 3000 – Landscaping and Ecology		364,402	451,091	482,667
A48 Junction Improvements		2,000,000	2,000,000	2,140,000
Roundabout and access roads		0	2,616,822	2,800,000
Hensol and Clawdd Coch Junctions with Access Roads		0	1,588,785	1,700,000
Series Sub-total		27,953,771	38,333,559	41,016,909
*Detailed Design fee %	4.5%	1,257,920	1,725,010	1,845,761
*Supervision fee %	2.0%	559,075	766,671	820,338
Detailed Design & Supervision Sub-total		1,816,995	2,491,681	2,666,099
DD, Supervision & Series Sub-total		29,770,766	40,825,241	43,683,008
** Contractors Risk Allowance	14.0%	4,167,907	5,715,534	6,115,621
**Optimism Bias (15%)	30 / 15%	28,931,230	6,123,786	6,552,451
Risk, DD, Supervision & Series Sub-total		62,869,903	52,664,561	56,351,080
direct fee percentage	9.0%	5,658,291	4,739,810	5,071,597
Fee, Risk, DD, Supervision & Series Sub-total		68,528,194	57,404,371	61,422,677
Employers Agent Fees		1,500,000	1,500,000	1,605,000
Employers Risk	9%	2,500,000	4,450,020	4,761,522
Statutory Undertakers		1,500,000	1,500,000	1,605,000
Land and Compensation		5,000,000	5,000,000	5,350,000
Further Design and Survey Work		2,000,000	2,000,000	2,140,000
Total Estimate of the remaining prices (EoRP)		81,028,194	71,854,391	76,884,199

M4 Junction 34 - A48 WeITAG Study: Stage 2

West Option

Cost Estimate	Stage of Study	Stage 2	Stage 2 +	Stage 2+ (inflated)
	% allowance	Total		
Series 100 - Preliminaries		5,523,523	5,583,191	5,974,014
Series 200 – Site Clearance		252,618	252,618	270,301
Series 300 – Fencing		468,470	468,470	501,262
Series 400 – Road Restraint Systems (Vehicle and Pedestrian)		456,530	432,788	463,083
Series 500 – Drainage and Service Ducts		1,765,419	1,998,836	2,138,754
Series 600 – Earthworks		6,393,457	7,037,656	7,530,292
Series 700 – Pavement		5,130,263	5,172,946	5,535,052
Series 1100 – Kerbs, Footways and Paved Areas		674,255	799,457	855,419
Series 1200 – Traffic Signs and Road Markings		158,416	166,463	178,116
Series 1300 – Road Lighting Columns and Brackets, CCTV Masts and Cantilever Masts		696,309	696,309	745,051
Series 1500 – Motorway Communications		307,137	296,691	317,459
Structures		3,141,764	2,353,364	2,518,100
Series 2700 – Accommodation Works, Works for Statutory Undertakers, Provisional Sums and Prime Cost Items (Not used)		291,670	295,134	315,793
Series 3000 – Landscaping and Ecology		357,781	362,031	387,373
A48 Junction Improvements		2,000,000	2,000,000	2,140,000
Roundabout and access roads		0	2,616,822	2,800,000
Hensol and Clawdd Coch Junctions with Access Roads		0	1,588,785	1,700,000
Series Sub-total		27,617,612	32,121,561	34,370,070
*Detailed Design fee %	4.5%	1,242,793	1,445,470	1,546,653
*Supervision fee %	2.0%	552,352	642,431	687,401
Detailed Design & Supervision Sub-total		1,795,145	2,087,901	2,234,055
DD, Supervision & Series Sub-total		29,412,757	34,209,463	36,604,125
** Contractors Risk Allowance	14%	4,117,786	4,789,325	5,124,577
**Optimism Bias (15%)	30 / 15%	8,823,827	5,131,419	5,490,619
Risk, DD, Supervision & Series Sub-total		42,354,370	44,130,207	47,219,321
direct fee percentage	9.0%	3,811,893	3,971,719	4,249,739
Fee, Risk, DD, Supervision & Series Sub-total		46,166,264	48,101,925	51,469,060
Employers Agent Fees		1,500,000	1,500,000	1,605,000
Employers Risk Allowance	9%	2,500,000	3,890,940	4,163,306
Statutory Undertakers		1,500,000	1,500,000	1,605,000
Land and Compensation		5,000,000	5,000,000	5,350,000
Further Design and Survey Work		2,000,000	2,000,000	2,140,000
Total Estimate of the remaining prices (EoRP)		58,666,264	61,992,866	66,332,366

M4 Junction 34 - A48 WeITAG Study: Stage 2

Compliant Online Option

Cost Estimate	Stage of Study	Stage 2 +	Stage 2+ (inflated)
	% allowance	Total	
Series 100 - Preliminaries	50.0%	9,689,600	10,367,872
Series 200 – Site Clearance		217,853	233,102
Series 300 – Fencing		320,652	343,098
Series 400 – Road Restraint Systems (Vehicle and Pedestrian)		368,705	394,514
Series 500 – Drainage and Service Ducts		2,227,360	2,383,276
Series 600 – Earthworks		4,772,965	5,107,073
Series 700 – Pavement		5,677,777	6,075,221
Series 1100 – Kerbs, Footways and Paved Areas		860,415	920,644
Series 1200 – Traffic Signs and Road Markings		98,748	105,660
Series 1300 – Road Lighting Columns and Brackets, CCTV Masts and Cantilever Masts		569,905	609,799
Series 1500 – Motorway Communications		249,755	267,238
Structures		1,095,000	1,171,650
Series 2700 – Accommodation Works, Works for Statutory Undertakers, Provisional Sums and Prime Cost Items (Not used)		768,207	821,981
Series 3000 – Landscaping and Ecology		282,700	302,489
A48 Junction Improvements		2,000,000	2,000,000
Series Sub-total		29,199,642	31,103,617
Reduction of Route through Clawdd Coch		2,003,897	2,134,562
Revised Total to reflect above		27,195,745	28,969,055
*Detailed Design fee %	4.5%	1,223,809	1,303,607
*Supervision fee %	2.0%	543,915	579,381
Detailed Design & Supervision Sub-total		1,767,723	1,882,989
DD, Supervision & Series Sub-total		28,963,468	30,852,043
** Contractors Risk Allowance	20.0%	5,792,694	6,170,409
**Optimism Bias (15%)	15.0%	4,344,520	4,627,807
Risk, DD, Supervision & Series Sub-total		39,100,682	41,650,259
direct fee percentage	9.0%	3,519,061	3,748,523
Fee, Risk, DD, Supervision & Series Sub-total		42,619,744	45,398,782
Employers Agent Fees		1,500,000	1,605,000
Employers Risk		4,500,000	4,815,000
Statutory Undertakers		3,000,000	3,210,000
Land and Compensation		2,500,000	2,675,000
Further Design and Survey Work		2,000,000	2,140,000
Total Estimate of the remaining prices (EoRP)		56,119,744	59,843,782

M4 Junction 34 - A48 WeITAG Study: Stage 2

Online Option - Sub Option 2

Cost Estimate	Stage of Study	Stage 2 +	Stage 2+ (inflated)
	% allowance	Total	
Series 100 - Preliminaries		4,995,858	5,345,568
Series 200 – Site Clearance		230,624	246,768
Series 300 – Fencing		422,994	452,603
Series 400 – Road Restraint Systems (Vehicle and Pedestrian)		392,447	419,918
Series 500 – Drainage and Service Ducts		1,850,078	1,979,584
Series 600 – Earthworks		2,985,404	3,194,382
Series 700 – Pavement		2,055,646	2,199,541
Series 1100 – Kerbs, Footways and Paved Areas		255,350	273,225
Series 1200 – Traffic Signs and Road Markings		88,748	94,960
Series 1300 – Road Lighting Columns and Brackets, CCTV Masts and Cantilever Masts		446,851	478,131
Series 1500 – Motorway Communications		276,600	295,962
Structures		562,500	562,500
Series 2700 – Accommodation Works, Works for Statutory Undertakers, Provisional Sums and Prime Cost Items (Not used)		285,913	305,927
Series 3000 – Landscaping and Ecology		175,360	187,635
A48 Junction Improvements		2,000,000	2,000,000
Series Sub-total		17,024,374	18,036,705
Reduction of Route through Clawdd Coch		1,001,434	1,060,983
Revised Total to reflect above		16,022,940	16,975,722
*Detailed Design fee %	4.5%	721,032	763,907
*Supervision fee %	2.0%	320,459	339,514
Detailed Design & Supervision Sub-total		1,041,491	1,103,422
DD, Supervision & Series Sub-total		17,064,431	18,079,144
** Contractors Risk Allowance	20.0%	3,412,886	3,615,829
**Optimism Bias (15%)	15.0%	2,559,665	2,711,872
Risk, DD, Supervision & Series Sub-total		23,036,982	24,406,845
direct fee percentage	9.0%	2,073,328	2,196,616
Fee, Risk, DD, Supervision & Series Sub-total		25,110,310	26,603,461
Employers Agent Fees		1,500,000	1,605,000
Employers Risk		4,500,000	4,815,000
Statutory Undertakers		3,000,000	3,210,000
Land and Compensation		2,000,000	2,140,000
Further Design and Survey Work		2,000,000	2,140,000
Total Estimate of the remaining prices (EoRP)		38,110,310	40,513,461

Arcadis Consulting (UK) Limited

Arcadis Cymru House
St Mellons Business Park
Fortran Road
Cardiff
CF3 0EY
United Kingdom
T: +44 (0)29 2079 9275

[arcadis.com](https://www.arcadis.com)

