

# A890 Stromeferry Bypass

Annual Slope Inspection Report 2022

The Highland Council

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The methodology adopted and the sources of information used by AECOM in providing its services are outlined in this Report. The work described in this Report was undertaken on 21<sup>st</sup> and 22<sup>nd</sup> June 2022 and is based on the conditions encountered and the information available during the said period of time. The scope of this Report and the services are accordingly factually limited by these circumstances. AECOM disclaim any undertaking or obligation to advise any person of any change in any matter affecting the Report, which may come or be brought to AECOM’s attention after the date of the Report.

# Table of Contents

- 1. Introduction..... 5
- 1.1 General ..... 5
- 1.2 Background ..... 5
- 1.3 Scope of Works..... 6
- 2. Risk Assessment Methodology ..... 7
- 2.1 Background ..... 7
- 2.2 Hazard Rating..... 7
- 2.3 Pathway Rating..... 7
- 2.4 Receptor Rating..... 8
- 2.5 Risk Rating ..... 8
- 3. Works Since 2021 Inspection ..... 10
- 3.1 THC Inspections ..... 10
  - 3.1.1 Emergency Inspection, May 2022 ..... 10
- 3.2 Scheduled Maintenance / Remedial Works ..... 10
- 4. 2022 Annual Inspection ..... 12
- 4.1 Summary of Findings ..... 12
- 5. Discussion and Recommendations ..... 14
- 5.1 Ongoing Risk Management ..... 14
- 5.2 Recommended Remedial Works..... 15
- 5.3 Maintenance of Roadside Rock Traps / Drainage Ditches..... 16
- 5.4 Additional Recommendations ..... 16
- Appendix A Drawings ..... 17
- Appendix B Emergency Inspection Report, May 2022 ..... 18
- Appendix C Inspection Record Sheet ..... 19
- Appendix D Photographs ..... 20
- Appendix E Roadside Geotechnical Assessment Sheets..... 21

## Figures

No table of figures entries found.

## Tables

- Table 2-1: Hazard Rating..... 7
- Table 2-2: Pathway Rating ..... 8
- Table 2-3: Receptor Rating..... 8
- Table 2-4: Risk Rating..... 8
- Table 3-1: Phase 12 works summary ..... 11
- Table 4-1: Relative Risk Level of Slopes ..... 13

# 1. Introduction

## 1.1 General

AECOM Limited (AECOM) was appointed by The Highland Council (THC) on 29<sup>th</sup> April 2022 (THC letter ref. YEHAS6098) to undertake annual inspections of rock faces along part of the A890 in Wester Ross in the Scottish Highlands. The site forming the subject of this report extends between the properties of Attadale and Ardnarff, known locally as the Stromeferry Bypass. The scope of work also included the inspection of rock slopes to the north of Attadale at Maman Hill, which is reported under separate cover. The works were commissioned under the Scotland Excel Framework for Engineering and Technical Consultancy Services: Ref. 0820 – A890 Stromeferry Bypass Rockworks, Job No: YEHAS6098 which runs until 2026.

AECOM (formerly URS) first undertook a detailed inspection of the slopes between Ardnarff and Attadale in May 2012 under the Highlands and Islands Consultancy Services Term Commission (Lot 3, Rock slope), which expired in April 2015. It was recommended that ongoing annual inspections were undertaken by suitably qualified engineering geologists using a combination of roadside and targeted roped access inspections.

Since 2012, AECOM has undertaken and reported the following annual inspections:

- May 2012 – ‘Stromeferry Bypass, The Scottish Highlands - A890 Slope Inspection Report,’ September 2012;
- April 2013 - ‘Stromeferry Bypass, The Scottish Highlands - A890 Annual Slope Inspection Report for 2013’, July 2013);
- June 2014 - ‘Stromeferry Bypass, The Scottish Highlands - A890 Annual Slope Inspection Report for 2014’, August 2014);
- (No inspection was undertaken in 2015);
- April 2016 - ‘A890 Stromeferry Bypass, Annual Slope Inspection Report 2016’, May 2016;
- April/May 2017 - ‘A890 Stromeferry Bypass, Annual Slope Inspection Report 2017’, August 2017;
- April 2018 - ‘A890 Stromeferry Bypass, Annual Slope Inspection Report 2018’, July 2018;
- April 2019 - ‘A890 Stromeferry Bypass, Annual Slope Inspection Report 2019’, July 2019;
- November 2020 (interim road level inspection during COVID-19 pandemic, reported on within the 2021 inspection report); and
- May 2021 – ‘A890 Stromeferry Bypass, Annual Slope Inspection Report 2021’, August 2021

AECOM has also been involved in the design, specification and supervision of several phases of planned maintenance / remedial works since 2012. Planned maintenance / remedial works are carried out approximately every one to two years, with the Phase 6 works completed in 2012, Phase 7 works in 2013, Phase 8 works in 2015, Phase 9 works in 2017, Phase 10 works in 2018, Phase 11 works in 2019 and Phase 12 works in 2021.

Additionally, since 2012, AECOM has been involved in several emergency call outs following rock falls or other slope instabilities, and the design, specification and supervision of associated remedial works.

## 1.2 Background

The A890 serves as the main link-road down the west coast of Scotland and is also a significant transit for east to west traffic travelling between the Isle of Skye and Inverness. It is mainly single carriageway but frequently reduces to single track with passing places along the stretch between Attadale and Ardnarff.

The road was opened in 1970 following the formation of a number of rock slopes along the road alignment on the landward side of the Inverness to Kyle railway line. Previous inspections have identified that over-blasting during construction resulted in the rock cuttings being left in a fractured state prone to rock falls. These conditions have also left the exposed rock mass susceptible to weathering, frost and root action.

There has been a history of rock falls at the site since the road was opened. In 1996 TRL Scotland undertook a risk assessment of the rock faces and a risk based maintenance management strategy was developed. Two phases

of remedial works were completed in 2002 to bring the slopes into a manageable condition. Following the completion of these remedial works, the slopes were managed by monthly and annual inspections. It was noted that ongoing maintenance would be required along with remedial works for rock falls that develop due to deterioration of the rock slopes (Nettleton, 2003). Rock falls have continued to occur and pose a risk to the road and users of the road, albeit the frequency of such events has reduced in the most recent years.

Further details on the site setting and geology are included in the 2012 A890 Slope Inspection Report (Ref. 46400079/GLRP0001, September 2012) and have not been discussed further in this report.

An approximately 500m length of the site, roughly centred on the 'avalanche shelter' is designated as a Site of Special Scientific Interest (SSSI) associated with exposures of structural and metamorphic geology. The site has no other environmental or historical designations, and AECOM is not aware of any ecological constraints affecting the site. This should, however, be confirmed during the planning of any physical works.

### 1.3 Scope of Works

In line with the recommendations of the 2012 inspection report the following inspection regime was implemented between 2012 and 2016:

- Detailed roadside and rope access inspections every 5 years (to include examination of the condition of all the rock faces at the site and examination of the existing remedial works);
- Supplemented with annual lower resolution inspections using a combination of road-side and targeted rope access inspections of the higher risk rock faces and less accessible upper rock faces, which are not visible from the road.

Following the 2017 inspection, which comprised a 'detailed inspection', it was recommended that an annual inspection regime should continue but that reference to 'detailed' and 'lower resolution' inspections be dropped. It was recommended that each annual inspection should involve the roadside inspection of all slopes and targeted rope access inspections of selected higher risk slopes, particularly where potential hazards have been identified during previous inspections, and less accessible 'upper' rock faces that are not visible from the road.

The following provides a summary of the works undertaken during the preparation of this report:

- Review of any maintenance and rock fall protection works carried out since the 2021 annual inspection;
- Review of any significant events that have occurred at the site since the 2021 annual inspection (with reference to THC inspection records);
- Road level inspections of the rock slopes along the A890 between Attadale and Ardnarff (including update of the rock slope geotechnical assessment sheets where necessary);
- Identification of areas of potential risk (updated risk assessment) and provision of recommendations for maintenance / remedial works (including recommended timescales).

AECOM undertook the 2022 annual inspection of the rock faces at road level only along the Stromeferry bypass on 21<sup>st</sup> and 22<sup>nd</sup> June. Given the high level of vegetation growth at this time of year it was agreed with THC that the inspections of the slopes would be limited to road level assessments initially. Should this identify any significant changes or areas of concern that warrant targeted inspection at height then a separate rope access inspection could then be arranged.

# 2. Risk Assessment Methodology

## 2.1 Background

The site has historically been split into a number of sections based on slope geometry and natural features (such as watercourses or gullies) to allow assessment and a relative risk level to be assigned to each section with regards to rock slope stability. AECOM has continued to use the historical slope reference numbers, which have been linked to a local chainage system that begins with chainage (Ch.) 0m and at the road closure gates at Ardnarff (NGR NG 89063 35689) and ends with Ch. 3892 at the road closure gates towards the Attadale end of the site (NGR NG 91807 38166). Where new slopes have been identified and assessed these have been given a suffix, typically either 'A' or 'Upper' to provide them with a unique reference.

The locations of the various slopes and their reference numbers are shown on the drawings included in Appendix A. THC installed permanent roadside chainage markers at 100m intervals in early 2017 and the start and end chainages of each slope were revised to tie in with these. Chainages for specific locations have been measured from the nearest permanent chainage marker. (NB: During the June 2022 inspection it was observed that many of the chainage markers were either obscured by vegetation or had been damaged by grass cutting equipment.)

A risk assessment approach has been adopted to rank the relative rock fall risk presented by each slope to the road and its users. The risk assessment used is bespoke to this site and gives a risk level relative to the rest of the slopes at the site. The assessment considers the size of a potential rock fall (the hazard), the potential likelihood of debris from the rock fall reaching the carriageway (the pathway) and the available sighting distance on the carriageway (the receptor). The ratings assigned to each of these criteria are multiplied together to give a risk rating. Further details are provided in Sections 2.2 to 2.5.

The potential consequence of a rock fall will clearly vary depending on the presence/absence of road users beneath or approaching the slope at the specific time. It must be appreciated that due to the number of variables involved this is impossible to predict. It should be recognised that the assigned level of risk takes a conservative approach and assumes the potential presence of road users beneath or approaching the slope at the time of a rock fall. A more likely scenario is that a rock fall occurs when no road users are directly beneath and fallen blocks which have come to rest on the road present a hazard to road users after the event. To differentiate and risk rank the slopes, (e.g. to prioritise remedial works) sightlines and stopping distances are also factored in to the assessment to recognise the higher potential for road users to interact with rock fall debris on the road at locations with poorer sightlines as opposed to straight sections of road (see section 2.4).

Following the initial risk assessment the inspecting geologists reviewed the relative risk rankings and, where necessary, adjusted the scoring to reflect the overall setting and their professional judgement.

## 2.2 Hazard Rating

Four categories of hazard rating have been selected based on the main sizes of rock falls (and potential rock falls) identified at the site, as detailed in Table 2-1. During the risk assessment the hazard rating representative of the scale of observed or potential rock falls at each slope was selected.

Table 2-1: Hazard Rating

Hazard Rating	Description
1	Small ravelling type rock falls (typically up to 0.02m <sup>3</sup> ).
2	Moderate rock falls (typically between 0.02m <sup>3</sup> and 1m <sup>3</sup> ).
3	Large rock falls (typically between 1m <sup>3</sup> and 10m <sup>3</sup> ).
4	Very large rock falls (typically greater than 10m <sup>3</sup> )

## 2.3 Pathway Rating

Each slope has been assigned a pathway rating (Table 2-2) based upon a qualitative inspection of the slope form (height, angle, profile/roughness, vegetation cover and presence or absence and suitability of existing remedial measures) between the position of a potential rock fall and the road. The rating also takes into account the

estimated termination location of failed material. If debris from previous rock falls was evident, the location of this was considered during this assessment.

The design rock fall volume for the passive rock fall ‘drape’ netting systems installed across many of the rock slopes prior to AECOM’s involvement at the site is unknown, however, based on the materials used and current design practices it would be estimated to be <math>1\text{m}^3</math>. During the risk assessment it has therefore been assumed that potential rock falls in excess of this volume that have not already been remediated by other means (e.g. rock dowels) could breach the drape netting systems.

**Table 2-2: Pathway Rating**

Pathway Rating	Description
1	No falling blocks are expected to reach the road (e.g. effective remedial measures and/or a wide verge or rock trap ditch).
2	Most falling blocks are not expected to reach the road (e.g. largely effective remedial measures/verge/rock trap ditch).
3	Approximately half of the falling blocks are expected to reach the road (e.g. partially effective remedial measures/verge/rock trap ditch).
4	Most falling blocks are expected to reach the road (e.g. no or ineffective remedial measures and/or narrow verge/shallow rock trap ditch).
5	All falling blocks are expected to reach the road (e.g. no or ineffective remedial measures and no verge or rock trap ditch - fallen blocks are likely to free fall or bounce directly onto the road).

## 2.4 Receptor Rating

For slopes with pathway ratings of  $\geq 2$  (i.e. at least some blocks are expected to reach the road), a receptor rating is included in the assessment to reflect the potential of a vehicle coming into contact with, or having to action to avoid, rock fall debris. The minimum sighting distance that a driver would have when driving adjacent to each of the slopes (in good weather conditions and during daylight hours) was estimated based on stopping distances from the Highway Code for cars travelling at 40mph and 60mph (36m and 73m respectively).

**Table 2-3: Receptor Rating**

Receptor Rating	Description
1	Sighting distance > 73m
1.2	Sighting distance 36 to 73m
1.4	Sighting distance < 36m

## 2.5 Risk Rating

The ratings assigned to the hazard, pathway and receptor were multiplied to give a risk rating for each of the slopes. The relative risk levels are described in Table 2-4, along with the colour coding used to depict these.

**Table 2-4: Risk Rating**

Risk Rating	Relative Level	Risk Description
<5	Low	Small to moderate sized rock falls with a low probability of causing damage to or closure of the road and/or injuries to road users. Risk normally acceptable.
5 to <10	Moderate	Moderate sized rock falls with potential to cause moderate damage to road and short term road closures (a few hours) but a low probability of causing injuries to road users. Risk likely to be tolerable but client needs to be made aware of hazards and monitor these.
10 to <15	High	Moderate to large sized rock falls with a higher probability of causing major damage to the road and/or road closures of a few days to a few weeks and potential of causing major injury or loss of life should road users be present beneath (or approaching) slope at time of rock fall. Risk likely to require remedial measures / risk management actions.



Risk Rating	Relative Level	Risk Description
>15	Very High	Large to very large rock falls which have a high probability of causing significant damage to road and/or long term road closures (weeks to months) and the potential of resulting in major injury or loss of life should road users be present beneath (or approaching) slope at time of rock fall. Risk likely to require remedial measures.

## 3. Works Since 2021 Inspection

### 3.1 THC Inspections

The ongoing management of the slopes alongside the A890 involves the completion of daily 'drive through' inspections and more detailed monthly 'walk through' inspections by local THC personnel familiar with the site and the inspection procedure. Any new rock falls or other slope instability hazards are reported directly to AECOM.

Since the completion of AECOM's last annual inspection on 14<sup>th</sup> May 2021, THC's routine inspections have not recorded any rock falls at the site.

Local THC personnel attended site on the evening of the 25<sup>th</sup> May 2022 after being notified of a rock fall, however, and AECOM subsequently carried out an emergency inspection of this. Further details are provided in Section 3.1.1.

#### 3.1.1 Emergency Inspection, May 2022

On the evening of 25<sup>th</sup> May 2022 a rock fall occurred at approx. Ch. 3065 (within slope reference AA18-19). Several blocks of rock landed on the road carriageway (up to 0.3m x 0.3m x 0.3m), with two blocks of rock landing within the boundary of the adjacent railway (up to 0.4m x 0.2m x 0.2m). THC attended site shortly after the incident and reported that rock fall debris had been cleared from the carriageway by members of the public. No members of the public were injured, however, it was reported that a passing vehicle was struck by a small block, causing minor damage. Network Rail also attended site on the evening of the incident and applied a temporary speed restriction to the line.

AECOM was made aware of the rock fall on the morning of 26<sup>th</sup> May 2022 and mobilised a rope access inspection team to carry out an inspection of the source area on 27<sup>th</sup> May 2022. Rope access support and traffic management was provided by Geo-rope Ltd. The site visit involved the inspection of the rock fall source area from road level by experienced geologists, followed by a targeted rope access inspection.

The key findings of the inspection are summarised below, with further details available in the appended site visit report (Appendix B):

- The rock fall originated from natural rock crags located 60-70m above road level. Fresher surfaces indicated a source area 3-4m wide and 2-3m high and was formed of fractured and weathered rock;
- The rock fall resulted in ca. 2m<sup>3</sup> of debris reaching the toe of the slope, with the vast majority retained in the roadside catch pit. Isolated blocks were observed up to 15-20m out from the toe of the slope, however, in the northern railway cess;
- Scree comprising blocks ca. 0.1-0.2m diameter was observed on the slope between the source area and the top of the drape netting system installed in 2014. This appeared to have accumulated over several years;
- Loose soil and fractured rock were observed around the rock fall source area and the potential for further rock falls was identified, particularly during and / or following periods of inclement weather;
- It was recommended that remedial works be undertaken at the earliest opportunity, including clearing out the catch pit and increasing its capacity and the completion of light scaling to remove loose material from the source area and accumulation of scree.

THC appointed Geo-rope Ltd. to carry out the required remedial works in June 2022 and, following a period of planning with Network Rail the works are scheduled to be completed in September 2022.

### 3.2 Scheduled Maintenance / Remedial Works

Remedial works (known as the Phase 12 works) designed by AECOM were carried out at slopes AA6A and AA20 Upper by Geo-rope Ltd. between September and December 2021. The Project Manager for the works was THC, with AECOM providing on-site technical support. The Phase 12 works aimed to address the "Category 3" (large scale rock fall protection) remedial works at slope AA6A and AA20 Upper which were rated as 'Very High Risk' during the 2021 inspection. Various "Category 1" (ongoing maintenance) works that were identified as being high priority during the 2019 and 2021 inspections were also carried out.

**Table 3-1: Phase 12 works summary**

<b>Slope ref.</b>	<b>Chainage</b>	<b>Scope of works carried out</b>
AA6A	Ch. 1500	Installation of 6m wide, 6m high catch fence in gully ca. 25m above road level.
AA20 Upper	Ch. 3170 to 3215	Installation of 30m wide, 6m high catch fence ca. 15m above road level.
AA2	Ch. 256 Ch. 200 to 230 Ch. 310 to 447	Clearance of rock and soil debris from drainage gully; Clearance of vegetation and rock / soil debris from roadside ditch. Clearance of vegetation and rock / soil debris from roadside ditch.
AA4	Ch. 0764	Scaling of rock mass ca. 1.5m x 0.5m x 0.4m with dilated fracture.
AA5	Ch. 1360 to 1382	Coppice ca. 12 trees and scale loose unstable rock mass from outcrop at Ch. 1365. Clearance of rock and soil debris from roadside ditch.
AA5 Upper	Ch. 1383	Clearance of debris from upslope drainage sump.
AA6B	Ch. 1770 to 1775	Light scaling of loose / fractured rock from small rock fall scar (ca. 5m <sup>2</sup> in area).
AA7	Ch. 1828	Clearance of debris from roadside gully.
AA16	Ch. 2890-2920	Widening and deepening of ditch to 1.5m wide and 0.5m depth and construction of low bund between ditch and carriageway.
AA22A	Ch. 3385-3425	Clearance of vegetation and other debris from roadside ditch. Construction of ditch along toe of rock face with low height bund.
AA23S	Ch. 3630-3650	Clearance of rock and soil debris from roadside ditch. NB: A rock fall occurred several days after the completion of the ditch improvement works. The blocks were removed from the ditch during the Phase 12 works.

The clearance of rock debris from the catch pits / basins at Frenchman's Burn (Ch. 2315) also formed part of the original scope of works but was de-scoped following the completion of these works by the local THC roads maintenance team.

Further details of the Phase 12 works can be found on AECOM Drawings 60629808-0001 to 0005, and the Georope Ltd. 'as built' records.

## 4. 2022 Annual Inspection

The 2022 annual inspection of the roadside rock faces was carried out by a team of two AECOM engineering geologists on the 21<sup>st</sup> and 22<sup>nd</sup> June 2022. The weather was generally mild and dry with occasional showers.

All of the roadside rock slopes were inspected from road level with the aim of identifying significant changes and/or potential hazards. As discussed in Section 1.3, rope access inspections at height were not included in the initial scope of the inspection due to the difficulties presented by high vegetation growth at the time of year. Where the road level inspections identified the need for targeted inspections at height these will be arranged separately.

Traffic management was provided by Alba Traffic Management Ltd. (a sub-contractor of Geo-rope Ltd.) for the duration of the inspection.

The inspections undertaken provide an indication of the stability / risk but are not considered definitive. Limitations included:

- Due to the extent of the slopes it was not practical for the inspectors to undertake a systematic inspection of the full extent of each rock face / slope. Assumptions have been made based on the area observed on foot. However, additional hazards that were not identified during the inspections may be present;
- Slopes covered or obscured by vegetation or soil could not be fully inspected;
- Rock faces which are covered by netting can be difficult to assess due to restricted vision.

### 4.1 Summary of Findings

A summary of the risk rating and recommended works for each slope is presented on the drawings included in Appendix A, with further details of the findings of the inspection included in Appendix C and a selection of photographs in Appendix D. Geotechnical assessment sheets for each of the roadside rock slopes are included in Appendix E.

The annual inspections record sheet (Appendix C) has been updated based on the observed condition of each slope during the 2022 annual inspection. The relative risk associated with each of the slopes is summarised in Table 4-1 below, ranked from highest to lowest risk. It is important to note that the risk ratings are relative and that a risk of 'low' does not mean that a rock fall will not occur, but that it is considered that the likelihood and/or consequences of a rock fall is lower than at other locations.

The 2022 inspection did not identify any hazards or features considered to pose an immediate risk of rock fall affecting the operation of the road nor did it identify the need for urgent maintenance works.

**Table 4-1: Relative Risk Level of Slopes**

Risk Ranking	Slope Ref.	Risk Rating	Relative Risk Level	Changes to 2021 Risk Rating
1	AA2	14.4	High	None
2	AA14 East	12.6	High	None
3	AA5	12.0	High	None
4	AA13 / 14 Upper	10.8	High	Not inspected in 2022. Risk rating as per 2021 inspection.
	AA15 Upper	10.8	High	Not inspected in 2022. Risk rating as per 2021 inspection.
	AA16 / 17 Upper	10.8	High	Not inspected in 2022. Risk rating as per 2021 inspection.
	AA17	10.8	High	None
5	AA4	9.0	Moderate	None
	AA4 Upper	9.0	Moderate	Not inspected in 2022. Risk rating as per 2021 inspection.
	AA10	9.0	Moderate	None
	AA21	9.0	Moderate	None
6	AA19 Upper	8.0	Moderate	Not inspected in 2022. Risk rating as per 2021 inspection.
	AA6A	8.0	Moderate	Risk re-assessed following completion of Phase 12 (2021) works. Reduced from 'very high'.
7	AA15	7.2	Moderate	None
	AA20	7.2	Moderate	None
	AA24	7.2	Moderate	None
	AA23S	7.2	Moderate	None
	AA20 Upper	7.2	Moderate	Risk re-assessed following completion of Phase 12 (2021) works. Reduced from 'very high'.
8	AA5A	6.0	Moderate	None
	AA9	6.0	Moderate	None
	AA16	6.0	Moderate	None
	AA22A	6.0	Moderate	None
	AA22B	6.0	Moderate	None
9	AA6B	4.8	Low	None
	AA7	4.8	Low	None
	AA11	4.8	Low	None
10	AA8	4.0	Low	None
	AA3	4.0	Low	Re-assessed following changes to receptor rating. Reduced from 4.8.
11	AA1	2.4	Low	None
	AA23N	2.4	Low	None
	AA13	2.4	Low	None.
12	AA19	2.0	Low	None
	AA3A	2.0	Low	None.
	AA6	2.0	Low	None.
	AA12	2.0	Low	None.
	AA2A	2.0	Low	Re-assessed following changes to receptor rating. Reduced from 2.4.
	AA14W	2.0	Low	Re-assessed following changes to receptor rating. Reduced from 2.4.
13	AA18-AA19	1.0	Low	None.
	AA18	1.0	Low	Re-assessed following changes to receptor rating. Reduced from 1.2.

## 5. Discussion and Recommendations

The Phase 6, 7, 8, 9, 10, 11 and 12 works, which were carried out in 2012, 2013, 2015, 2017, 2018, 2019 and 2021 respectively, have addressed a significant proportion of the hazards identified during AECOM's previous inspections. In particular, these remedial works have significantly reduced the risk associated with a number of formerly 'very high risk' and 'high risk' potential hazards following works including scaling and the installation of catch fences, restraining cables, spot dowels and active rock fall netting systems. Improvements to existing passive (draped) rock fall netting systems (e.g. replacing corroded elements and installing additional anchors) have also served to reduce the risk of relatively small scale rock falls reaching the road.

The most recent Phase 12 works were targeted to reduce the risk at two slopes formerly assessed as 'very high risk' (AA6A and AA20 Upper). Following these works the residual risk level for slopes AA6A and AA20 Upper was assessed to be moderate.

The updated 2022 risk assessment did not identify any 'very high risk' slopes, however, the risk of rock falls occurring throughout the site still remains, and seven slopes were assessed to pose a high risk to road users.

The occurrence of small to moderate scale rock falls (e.g. a few brick to breeze block sized rocks landing on the road) potentially occurring every few months to years and large to very large scale rock falls (e.g. rock falls similar in scale to the Dec 2011/Jan 2012 rock fall at AA19) potentially occurring every few years to decades will be ongoing due to the degradation of the near-surface rock mass from weathering, root action, etc. Guidance on the management of risk is given in the following sections and should include regular inspection of the slopes, maintenance of existing remedial systems and, where appropriate and budget permits, the completion of remedial works at the highest risk slopes.

### 5.1 Ongoing Risk Management

The following approach is recommended to manage the level of risk within the site.

*Continued weekday drive through of the site by THC:*

THC staff familiar with the site and inspection procedure should continue to drive along the bypass each weekday morning with the aim of identifying any rock falls / increased risk to the road. Observations should be reported internally within THC, with specialist geotechnical advice sought where appropriate.

*Continued monthly inspections by THC:*

For the monthly inspections to continue to provide an appropriate management tool it is important they are carried out on by personnel with knowledge of the site (preferably by the same inspector) and an understanding of the aims and objectives of the inspections. AECOM provided guidance to THC personnel involved in the inspections during a walk-through of the site on 23<sup>rd</sup> June 2022.

The main aims of the monthly inspections are to:

- Identify any new rock falls (including behind netting systems) and, where possible, mark associated blocks with spray paint. A record should be made of the size and location of rock falls (small rock falls can be a precursor to a larger rock falls and it is therefore important to record all newly identified blocks in the verge and ditch);
- Identify any areas of the roadside ditch where debris build up has reduced capacity to less than 50%;
- Identify any significant accumulations of debris behind netting systems that may require clearance;
- Identify any damage to existing installations by rock falls, vehicles, theft of metal components, etc.

For this method of risk management to be effective, the records of the monthly inspections should be reviewed monthly by AECOM geologists with knowledge of the site to assess the significance of any findings and identify the requirement for emergency inspections. This is particularly important when THC has identified a new rock fall.

### *On-going annual inspections by suitably qualified and experienced Engineering Geologists / Geotechnical Engineers:*

This should involve the roadside inspection of all slopes and targeted rope access inspections of selected higher risk slopes, particularly where potential hazards have been identified during previous inspections, and less accessible 'upper' rock faces that are not visible from the road. For maximum benefit, annual inspections should ideally be carried out in April, following the deleterious effects of winter and prior to the establishment of vegetation.

## **5.2 Recommended Remedial Works**

It is understood that THC is considering a new road scheme that will bypass the section of the A890 between Ardnarff and Attadale to permanently reduce the risk of ongoing rock falls. The scheme is at the route optioneering stage, with the preferred option being the construction of a new road through Gleann Udalain to Attadale.

THC should carefully consider whether the ongoing risk posed by rock falls whilst the current road remains in use is acceptable, considering the potential for injury to road users and the potential disruption due to road closures following a rock fall. Consideration should also be given to the period of time that the current road will remain in use and that road users will continue to be exposed to the risk of rock falls.

Taking cognisance of the above, AECOM recommends that THC continues to carry out scheduled remedial works on at least a biennial basis in addition to the monthly and annual inspections, to reduce the risk of rock falls while the current road remains in use.

Recommendations for remedial works are given in the rock slope assessment table in Appendix D.

The recommended remedial works have been split in to three categories as described below:

- **Category 1 – Ongoing maintenance:** Recommended maintenance work is recommended to maintain the current condition of the rock faces and existing rock fall protection installations. Examples of required maintenance include repair of damaged or corroded netting, clearing of existing ditches and ongoing removal of loose rock and/or vegetation. Undertaking the maintenance work will not necessarily reduce the risk posed by the rock faces, but instead aims to prevent existing protection measures from deteriorating further and the risk increasing. Some of these works can be undertaken directly by THC (e.g. clearing out ditches – see Section 5.3), whilst others will require specialist contractors (e.g. replacing damaged or corroded elements or coppicing trees). These works are generally of low to moderate cost.
- **Category 2 – Localised targeted rock fall protection works:** Targeted rock fall protection works are recommended to address the risk posed by individual hazards that have been identified during the inspections in the longer term. Examples of these works include dowelling/strapping/netting or removal of a small number of individual blocks. These works will reduce the risk associated with the specific hazard but may not reduce the risk posed by the rock face as a whole due to the presence of other hazards that have not been addressed. These works will involve specialist contractors and are generally of moderate cost.
- **Category 3: Large scale rock fall protection works:** These are recommended to address the rock fall hazard posed by the entire rock face in the long term. Examples of these works include installing new rock fall barriers (catch fences), rock fall netting systems and associated spot dowels, cable strapping and areas of high strength netting. These works are generally high cost and will involve specialist contractors, but they would offer a significant level of risk reduction. Additional detailed inspection of the individual rock faces may be required to enable detailed design and pricing of Category 3 works.

It is recognised that THC has a limited budget for remedial works and to achieve the maximum level of risk reduction it is recommended that works are prioritised to address the highest risk rock faces and hazards in the first instance (typically Category 2 and 3 works). Where the budget allows, lower priority works focussing on upgrading and maintaining existing rock fall protection installations (typically Category 1 and 2 works) should be undertaken. On occasion, the prioritisation of Category 1 works may be appropriate to ensure existing remedial systems remain functional and offer the desired level of risk reduction.

AECOM is in regular discussions with THC in relation to the budget and timing of planned remedial works such that an appropriate scope of remedial work can be selected.

### 5.3 Maintenance of Roadside Rock Traps / Drainage Ditches

Roadside rock trap ditches are present along the toe of many of the slopes and these must remain clear of significant debris accumulations to offer a continued level of risk reduction to the road and road users from small to moderate scale rock falls originating from the slopes above. During the 2022 inspection debris was noted in the roadside ditches at several locations and it is recommended that these be cleared to re-establish their original capacity at the earliest opportunity. These are non-specialist works and can be undertaken from road level by THC or a standard civil engineering contractor. Blocked drainage gullies were also identified and these will also require to be cleared to maintain drainage beneath the road.

The build-up of debris within the roadside ditches should be monitored during THC's monthly inspections and clearance works undertaken as required to maintain their capacity. As a guide, THC should allow for annual clearance works.

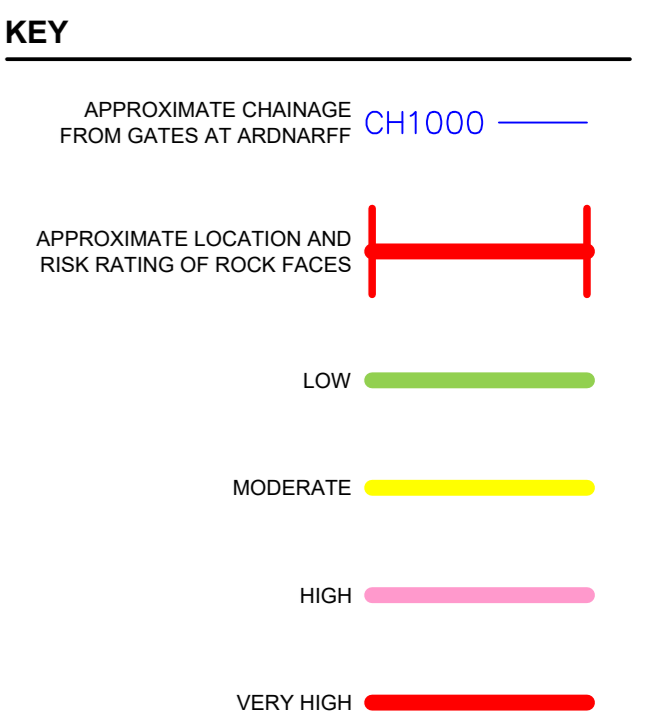
### 5.4 Additional Recommendations

During inspections of the slopes, both in 2022 and in previous years, AECOM has identified several additional hazards that are not directly related to the condition of the rock slopes. Considerations should be given to addressing these issues, which are summarised below:

- Trees on upper slopes - A plantation of mature coniferous trees is present on the steep hillside above slopes AA12 to AA22A. The superficial deposits on the slope are thin and the trees are consequently poorly anchored and prone to falling in high winds. A large percentage of the trees have already fallen and remain on the slope. These have generally come to rest against the remaining live trees or dead tree stumps. Numerous boulders dislodged when the trees fell have come to rest against these fallen trees which are acting as a natural catch feature. It is, however, known that boulders originating from the root balls of uprooted trees have occasionally rolled downslope and reached the road. The live trees that remain on the slope will continue to fall and there is a risk that dislodged boulders could roll downslope and reach the road or railway. Photographic drone surveys of the site were carried out in 2019 and 2020, allowing for a comparison to be undertaken to better quantify the risk associated with tree falls. A reduction in the number of standing trees of ca. 3% was identified between the 2019 and 2020 surveys, suggesting a relatively low rate of tree fall, however, it should be recognised that such events will be largely weather dependant and a single storm event could fell many trees. It is recommended that a repeat photographic drone survey of the slopes to the east of Frenchman's Burn be carried out in March / April 2023, when vegetation cover is at a minimum, to allow further quantification of the rate of tree falls and the pros / cons of felling to be further considered.
- Many drainage channels leading to the road from the upper slopes were noted to contain debris (rock and trees). Clearance of these should be undertaken to prevent alteration to the hydrological regime.
- The Armco barrier between the road and the railway was noted to be broken and in very poor condition at several locations (notable opposite slopes AA1, AA3 and AA7). It is understood that THC has replacement works programmed for Autumn 2022.
- Culverts – the inspection of culverts crossing beneath the road and railway was outside AECOM's inspection scope, however, localised blockages were noted. Periodic inspection of the culverts by THC is recommended, along with clearance of accumulated debris when required to maintain the flow capacity of culverts.
- Many of the chainage markers installed in 2017 were either obscured by vegetation or had been damaged by grass cutting equipment. It is recommended that the chainage markers be replaced with markers on higher posts prior to the 2023 inspection.



# Appendix A Drawings



ISSUE/REVISION

Rev	Date	Description	Drawn/Checked

Key Plan

Purpose of Issue

FOR INFORMATION

Project Number

60685712

Sheet Title

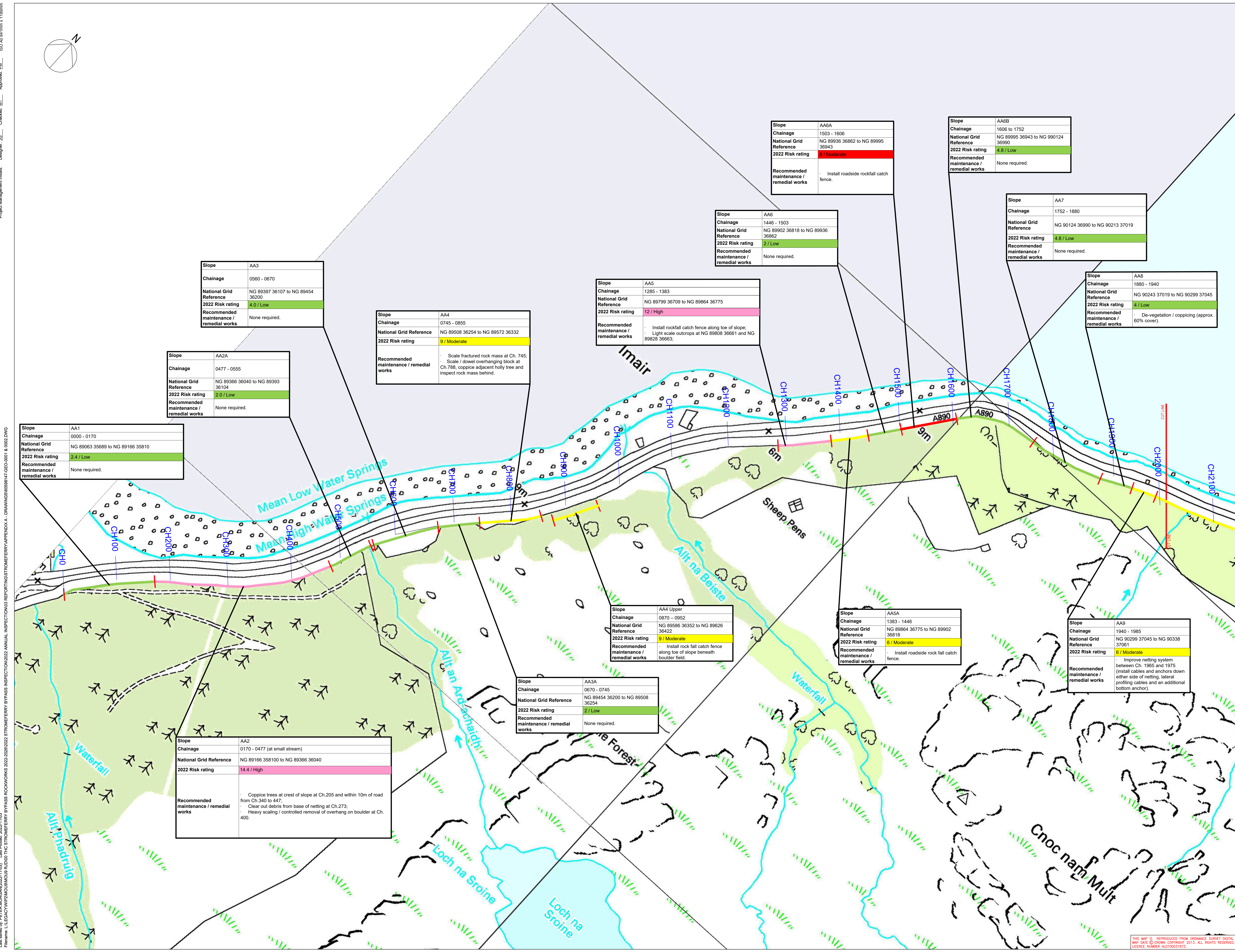
STROME FERRY  
2022 INSPECTION  
SHEET 1 OF 2

Sheet Number

60685712-0001

Scale: @AO

Rev:



Designer: JG, Checked: MT, Approved: PM, ISO A0 841mm x 1189mm  
 Project Management Initials: \_\_\_\_\_  
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Slope	AA6A
Chainage	1503 - 1606
National Grid Reference	NG 89036 36862 to NG 89995 36943
2022 Risk rating	8 / Moderate
Recommended maintenance / remedial works	Install roadside rockfall catch fence.

Slope	AA6B
Chainage	1606 to 1752
National Grid Reference	NG 89995 36943 to NG 90124 36990
2022 Risk rating	4.8 / Low
Recommended maintenance / remedial works	None required.

Slope	AA7
Chainage	1752 - 1880
National Grid Reference	NG 90124 36990 to NG 90213 37019
2022 Risk rating	4.8 / Low
Recommended maintenance / remedial works	None required.

Slope	AA8
Chainage	1880 - 1940
National Grid Reference	NG 90243 37019 to NG 90299 37045
2022 Risk rating	4 / Low
Recommended maintenance / remedial works	De-vegetation / coppicing (approx. 60% cover).

Slope	AA6
Chainage	1446 - 1503
National Grid Reference	NG 89902 36818 to NG 89936 36862
2022 Risk rating	2 / Low
Recommended maintenance / remedial works	None required.

Slope	AA5
Chainage	1285 - 1383
National Grid Reference	NG 89799 36709 to NG 89864 36775
2022 Risk rating	12 / High
Recommended maintenance / remedial works	Install rockfall catch fence along toe of slope; Light scale outcrops at NG 89808 36661 and NG 89828 36663.

Slope	AA4
Chainage	0745 - 0855
National Grid Reference	NG 89508 36254 to NG 89572 36332
2022 Risk rating	9 / Moderate
Recommended maintenance / remedial works	Scale fractured rock mass at Ch. 745; Scale / dowel overhanging block at Ch.788, coppice adjacent holly tree and inspect rock mass behind.

Slope	AA3
Chainage	0560 - 0670
National Grid Reference	NG 89397 36107 to NG 89454 36200
2022 Risk rating	4.0 / Low
Recommended maintenance / remedial works	None required.

Slope	AA2A
Chainage	0477 - 0555
National Grid Reference	NG 89366 36040 to NG 89393 36104
2022 Risk rating	2.0 / Low
Recommended maintenance / remedial works	None required.

Slope	AA1
Chainage	0000 - 0170
National Grid Reference	NG 89063 35689 to NG 89166 35810
2022 Risk rating	2.4 / Low
Recommended maintenance / remedial works	None required.

Slope	AA4 Upper
Chainage	0970 - 0952
National Grid Reference	NG 89586 36352 to NG 89626 36422
2022 Risk rating	9 / Moderate
Recommended maintenance / remedial works	Install rock fall catch fence along toe of slope beneath boulder field.

Slope	AA5A
Chainage	1383 - 1446
National Grid Reference	NG 89864 36775 to NG 89902 36818
2022 Risk rating	6 / Moderate
Recommended maintenance / remedial works	Install roadside rock fall catch fence.

Slope	AA9
Chainage	1940 - 1985
National Grid Reference	NG 90299 37045 to NG 90338 37061
2022 Risk rating	6 / Moderate
Recommended maintenance / remedial works	Improve netting system between Ch. 1965 and 1975 (install cables and anchors down either side of netting, lateral profiling cables and an additional bottom anchor).

Slope	AA3A
Chainage	0670 - 0745
National Grid Reference	NG 89454 36200 to NG 89508 36254
2022 Risk rating	2 / Low
Recommended maintenance / remedial works	None required.

Slope	AA2
Chainage	0170 - 0477 (at small stream)
National Grid Reference	NG 89166 35810 to NG 89366 36040
2022 Risk rating	14.4 / High
Recommended maintenance / remedial works	Coppice trees at crest of slope at Ch.205 and within 10m of road from Ch.340 to 447; Clear out debris from base of netting at Ch.273; Heavy scaling / controlled removal of overhang on boulder at Ch. 400.



# Appendix B Emergency Inspection Report, May 2022

<b>Client:</b>	The Highland Council	
<b>Project title:</b>	A890 “Stromeferry Bypass”	
<b>Project Number:</b>	TBC	
<b>Department:</b>	Ground Engineering	
<b>Site Personnel:</b>	Peter Morgan (PLM), Associate, AECOM Martha Taylor (MT), Principal Engineering Geologist, AECOM 2 x Geo-rope personnel; 2 x Alba Traffic Management personnel.	
<b>Report No:</b>	1	
<b>Date Of Inspection:</b>	27/05/22	
<b>Timing</b>	<b>Arrival:</b>	1200
	<b>Departure:</b>	1700
<b>Weather:</b>	Cloud with sunny intervals	

<b>1</b>	<b>GENERAL</b>
	<p>On the evening of Wednesday 25<sup>th</sup> May 2022 a rock fall occurred at approximate site chainage 3065 measured between the ‘snow gates’ at Ardnarff to Attadale (slope reference AA18-19). OS NG 91183 37673. Several blocks of rock landed on the road carriageway (reportedly up to 0.3m in size), with two blocks of rock landing within the boundary of the adjacent railway (observed to be up to 0.4 x 0.2 x 0.2m).</p> <p>Andrew Bone of The Highland Council (THC) attended site shortly after the incident and has indicated that the rock debris had been removed from the carriageway by members of the public by the time of his arrival. He understands that a passing vehicle was struck by a small block, causing minor damage to the wing of the van. The police attended, as did Network Rail who applied a temporary speed restriction to the railway line.</p> <p>AECOM was made aware of the rock fall on the morning of 26<sup>th</sup> May 2022 and mobilised a rope access inspection team to carry out an inspection of the failure source area on 27<sup>th</sup> May 2022. Rope access support and traffic management was provided by Geo-rope Ltd. The site visit involved the inspection of the failure area from road level, followed by a targeted rope access inspection of the failure source area.</p> <p>A debris flow type failure previously occurred at AA18-19 in October 2014, originating from the slope below the natural rock crags. Following this failure the lower slope was subject to emergency remedial works involving the installation of a drape netting system and the enlargement of a debris catch basin at the toe. The upper crags have also been subject to targeted remedial works in the past (most recently in 2015 during the Phase 8 remedial works programme), including scaling and the removal of trees.</p> <p>Weather conditions prior to the failure were reported by Andrew Bone to have been poor with “several days of heavy rain” (since Sunday 22<sup>nd</sup> May). Publicly available rainfall data<sup>1</sup> from a SEPA rainfall gauge located at New Kelso, Strathcarron, 6km to the northeast indicates that 66mm of rain had fallen in the week preceding the failure. Additionally since the 1<sup>st</sup> May, 186.4mm of rain had been recorded, which is 71% more than the indicated mean for the whole month of May of 108.9mm.</p> <p>Appendix A contains copies of the report and photographs relating to the recent failure that were submitted to AECOM by THC.</p>

<sup>1</sup> <https://www2.sepa.org.uk/rainfall/#234289>

**2 SITE CONDITIONS**

The failure event of the 25<sup>th</sup> May 2022 originated from the natural rock crags located above a shallower set back slope associated with a watercourse flowing downslope between two roadside rock cuttings. This section of the site is known as AA18-AA19 in the slope nomenclature of roadside rock slopes regularly inspected by THC between Ardnarff and Attadale.

The steep slope adjacent to the road rises for ca. 90m before shallowing above (hillside slope above is 10-30°). The lower 40m of the slope is up to 50° and formed of weather rock and scree. This slope is partially vegetated and has a drape netting system installed across it. Above this at a height of ca. 40m there is a break in slope of ca. 3m slope length at ca. 20° to 30°, before the rock crags above rise steeply at between 50 and 80°. The rock crags extend over a height of ca. 40m i.e. total height of 80-90m.

Between the toe of the slope and edge of the road there is a lower area associated with the watercourse which acts as a rock-trap feature (photos 2 and 3). This lower area measures approximately 2 to 5m wide, 10m long and 0.5 to 1.0m deep. This catch pit was partially constructed using scaled boulders generated from adjacent rock slope remedial works in 2012.



**Photo 1: Slope at AA18-AA19 with failure source area circled.**

The failure resulted in ca. 2m<sup>3</sup> of predominantly rock debris (but with some soil and vegetation) reaching the toe of the slope with the vast majority observed to be retained in the catch pit. Observed block sizes at the toe of the slope ranged from 0.1 x 0.1 x 0.1m to 1.0 x 0.5 x 0.5m, but more typically 0.2 x 0.2 x 0.2m. Debris was present over a ca. 15m verge length at road level, with the furthest travelled block observed in the northern cess of the railway ca. 15m to 20m from the toe of the slope.



**Photo 2: Debris catch pit between toe of slope and road with recent debris accumulation.**



**Photo 3: Edge of debris catch pit between toe of slope and road. Recent debris visible on both side of 'bund' formed of boulders sourced from previous scaling works from adjacent rock cuttings.**



**Photo 4: Block located in railway cess is highlighted above. Broken fence wire indicates it struck fence at ca. 0.7m height. Location of small impact mark on rail line also shown.**



**Photo 5: Block located in railway cess on far side of railway. This block is thought to have originated from the recent failure.**

The failure originated from the lower and middle levels of the rock crags, ca. 60-70m above road level. The failure area is ca. 3-4m wide and 2-3m high with a vertical back scar formed of fractured and weathered rock. Scree typically comprising blocks ca. 0.1 to 0.2m diameter was observed on the ledge below the failure source area (ca. 40m height) and this appears to have accumulated over several years with some material overlying the top of the drape netting installed in 2014. The



scree is present across an area ca. 3m wide and 2m high (slope length). A small fallen tree was also present to one side of the scree.



**Photo 6: Failure source area circled.**



**Photo 7: Scree accumulation on break of slope below upper crags.**



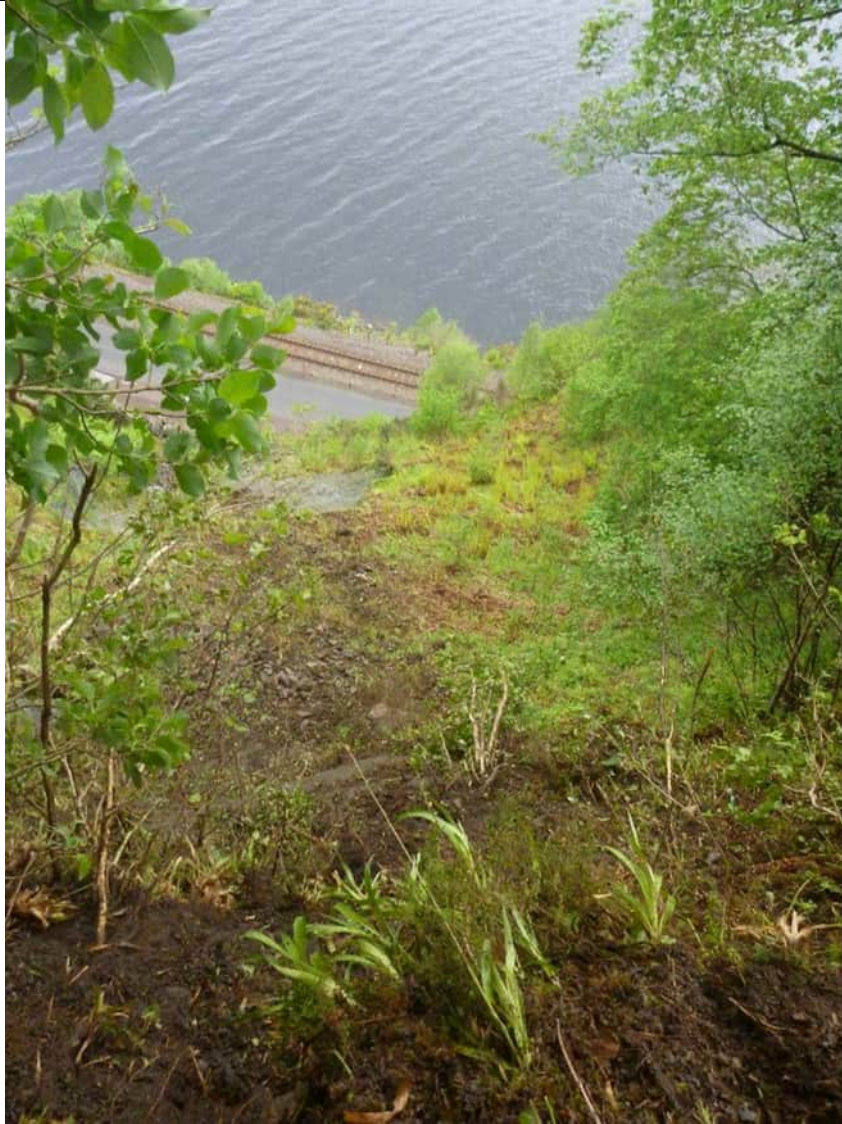
**Photo 8: Scree accumulation on break of slope below upper crags.**



**Photo 9: View downslope of failure source area from upper crags.**



**Photo 10: Weathered rock mass at failure source at mid to lower portion of upper crags.**



**Photo 11: view downslope from immediately below failure source. Failure/debris flow scar visible downslope to top of mesh.**

As the debris passed over the drape netting system it caused minor damage, with several tears up to 0.2m observed. Given the nature of the netted slope, the presence of these tears is not considered to pose a significantly increased risk to its function.



**Photo 12: Small tears visible in drape netting system caused by recent failure.**

<b>3</b>	<p><b>DISCUSSION</b></p> <p>The event appears to have been initiated by the failure of a weathered rock mass which became saturated from rainfall and overland seepage and fell onto the slope below, which then dislodged further vegetation, scree and soil forming a combination of small debris flow and scree failures which reached the toe of the slope. Whilst the majority of the material came to rest in the debris catch pit at the base of the gully, several blocks were observed in the roadside verge (some of which will have come to rest here and others which came to rest in the road and were subsequently moved) and two blocks were observed in the railway cess (one in the southern cess and one in the northern cess).</p> <p>The rock mass at and around the source area of the failure is weathered with some loose soil and rock still present on the slope. Some of the failure material also remains on the slope (scree) immediately beneath the failure source area and on the mid-slope area at the top of the netting.</p> <p>Whilst no imminent risk of further failure was observed, there is potential of future failure from the ongoing weathering and degradation of the material, particularly during and/or following periods of inclement weather.</p>
<b>4</b>	<p><b>RECOMMENDATIONS</b></p> <p>Given the recent failure, history of failures in this area and the uncertainty of contributory factors such as weather, it is recommended that the following actions are undertaken at the earliest opportunity to reduce the risk from further failures:</p> <ol style="list-style-type: none"> <li>1. Clean out catch pit area: remove debris to maximise capacity;</li> <li>2. Raise level of catch pit roadside edge by increasing the height of bund using site-won material to improve capacity and rock catch height;</li> <li>3. Undertake light scaling (by hand / hand tools) of failure source and area between failure source and top of netting to remove weathered and loose rock, scree, soil and vegetation.</li> </ol> <p>Given the slope geometry and site constraints it is envisaged that scaling works will require no road or rail traffic. Working methodologies and timing of the works will have to be agreed with Network Rail.</p>

<b>5</b>	<b>ATTACHMENTS / APPENDICES</b>
	Appendix A – THC inspection records

Martha Taylor, 30/05/22

Signature:

Peter Morgan, 30/05/22

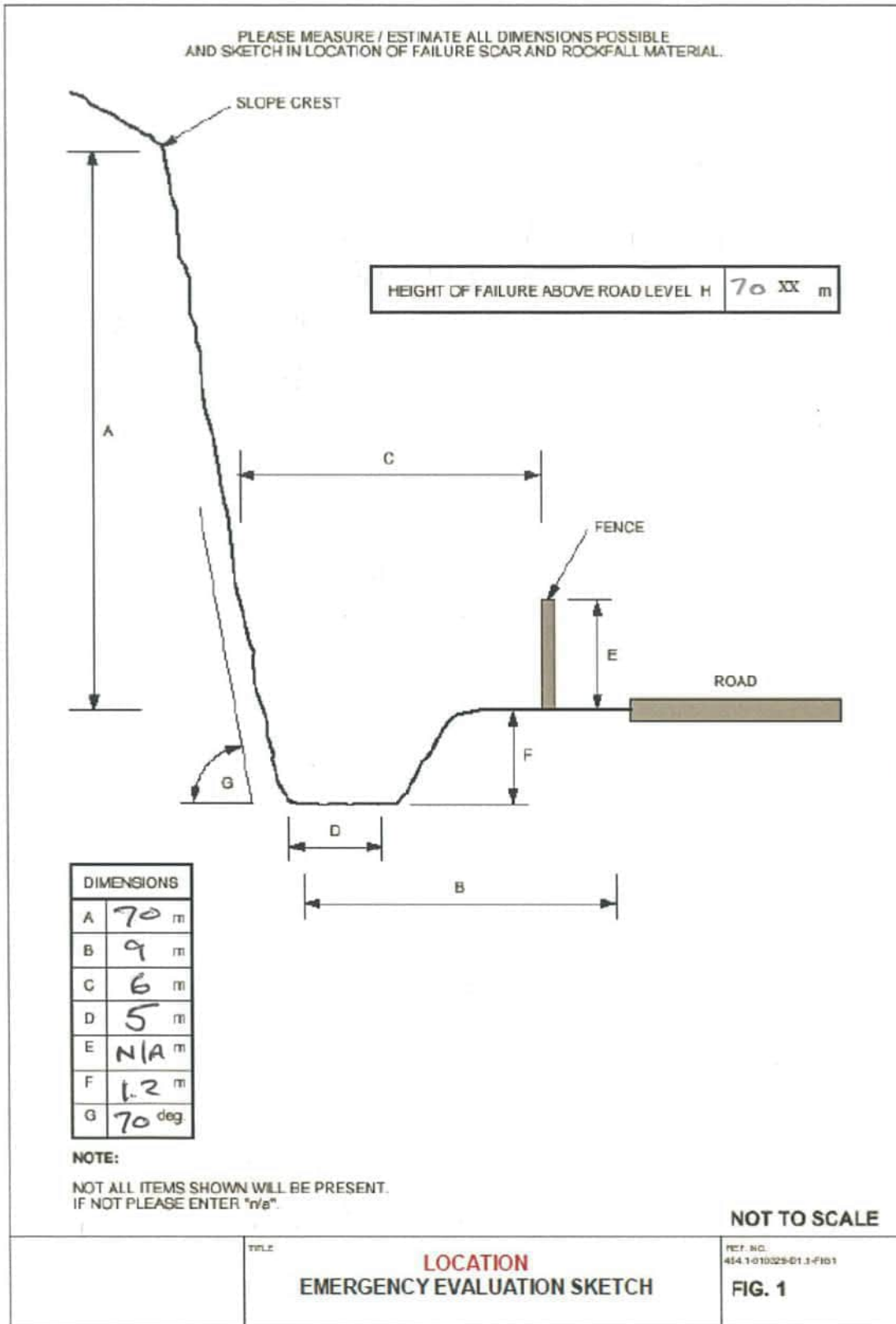
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On behalf of AECOM

## **Appendix A THC Inspection Record 26-05-2022**

















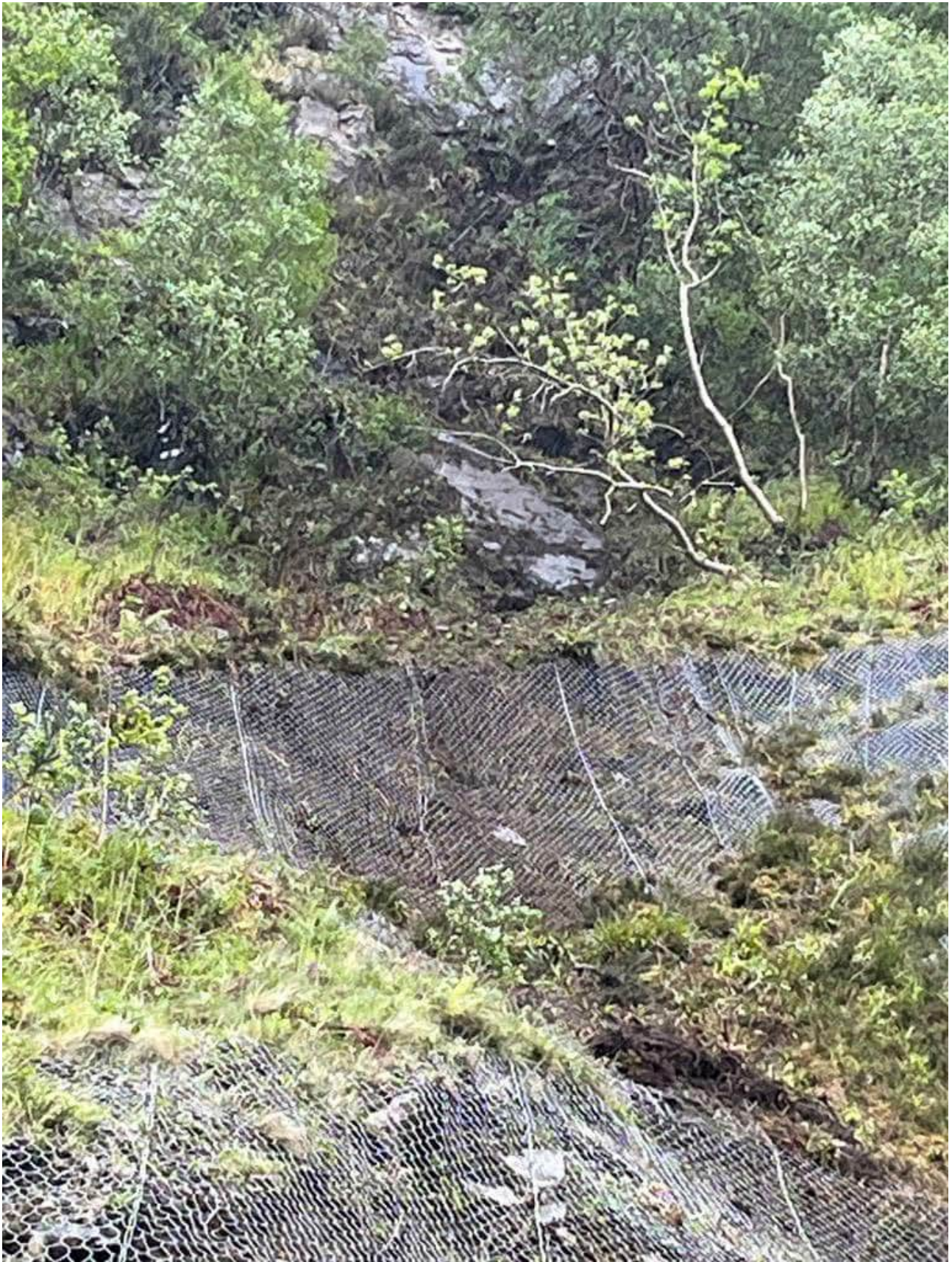
















# Appendix C Inspection Record Sheet



Slope No.	Change and National Grid Reference		Significant observations from previous inspections & record of remedial works								2022 Inspection Comments				2022 Risk Assessment					Recommended Maintenance / Remedial Works												
			2012	2013	2014	2016	2017	2018	2019	2020 (Interim road level inspection)	2021	Failures/Degradation since 2021 inspection		New potential hazards observed	Additional Comments	Amendments to 2021 Risk Register	Hazard Rating	Pathway Rating	Receptor Rating	Risk Rating	Relative Risk Level Low = 1-5 Medium = 6-10 High = 11-15 Very High = 16	Large Scale Rock Fall Protection Works (Category 3)	Localised Targeted Rock Fall Protection Works (Category 2)	Ongoing Maintenance (Category 1)	Volume / area / length to be treated	Unit						
												Observed by THC during monthly inspections	Observed by AECOM during 2021 inspection																			
AA3A	0670 (NG 89494 3620)	0745 (NG 89508 36254)	Not assessed.	Not assessed.	Not assessed.	Not assessed.	Not assessed.	Not assessed.	Not assessed.	Slope assessed for first time. Ch. 690 - accumulation of small blocks was noted on the upslope side of the deer fence.  Area between AA3 and AA4 first assessed in 2019. Comprises a fully vegetated (grass and trees) slope with no obvious rock outcrops. During the 2019 inspection an accumulation of small blocks was noted on the upslope side of the deer fence at Ch. 690. Fence post has fallen down here but appears to have rotted rather than been struck by a block. Debris not recent but screen present upslope with an isolated rock outcrop ~30m above road level. Failed blocks typically ca. 0.1m x 0.1m x 0.1m. Outcrop inspected to be flat bedded with fissures a consequence of swelling associated with ongoing root jacking. Evidence of road side deer fence effectively arresting small blocks, however, potential for blocks to reach verge/edge of road exists. Slope AA3A to be included in monthly and annual inspections and debris build up to be monitored.	No significant changes observed.	No significant changes observed.	None.	None.	None.	None.	None.	1	2	1	2	Low										
AA4	0745 (NG 89508 36254)	0855 (NG 89572 36332)	Ch. 725 - Potential hazard: fall of slope crest (2.0m x 1.5m x 1.5m). 2 No. dowsels installed during Phase 8 works (2015).  Potential block fall at Ch. 725. 2 No. dowsels installed during Phase 8 works (2015).	No new hazards observed.	No new hazards observed.	Ch. 725 - Potential fall rock-jacking. Potential for multiple blocks to fall onto vehicle approx. 6m <sup>2</sup> . Slope profile means blocks unlikely to reach road.  Ch. 802 - Further block noted at crest of slope with potential failure pathway to road. Photo AA4-1. Inspection completed during 2019 annual inspection - see notes.  Ch. 745 - Root jacking and fractured rock mass observed around fin above road level with a potential failure volume of ca. 1m <sup>3</sup> . Although most debris would rest on slope or in ditch there is potential for a small volume to reach the road. Scaling recommended to minimise risk.  Vegetation is quite well established (60-70%) and trees which were previously coppiced are growing again. <u>See under observation during future inspections re root jacking risk becoming an issue.</u>  <b>THC Monthly Inspections:</b> June 2018: Ch. 830 - new stone in drain x2. August 2018: Ch. 760 - more stone in ditch from same location.	Ch. 765 - Evidence of minor raveling with debris in ditch Ca. 0.1m <sup>3</sup> (max block size 0.2m x 0.2m x 0.1m).  Ch. 802 - Further block noted at crest of slope with potential failure pathway to road. Photo AA4-1. Inspection completed during 2019 annual inspection - see notes.  Ch. 745 - Root jacking and fractured rock mass observed around fin above road level with a potential failure volume of ca. 1m <sup>3</sup> . Although most debris would rest on slope or in ditch there is potential for a small volume to reach the road. Scaling recommended to minimise risk.  Vegetation is quite well established (60-70%) and trees which were previously coppiced are growing again. <u>See under observation during future inspections re root jacking risk becoming an issue.</u>  <b>THC Monthly Inspections:</b> June 2018: Ch. 830 - new stone in drain x2. August 2018: Ch. 760 - more stone in ditch from same location.	No new hazards observed.  Minor raveling / root jacking potential. Ditch generally considered to be effective although occasional small block may reach edge of carriageway. Vegetation cover 60 to 70%. Photo AA4-1.  Ch. 802 - Following up on observation from the 2018 inspection, a rope access inspection concluded there is not a block at crest of slope at this location. The feature observed from road level was a cut birch tree stump that has started to regrow. Overhanging portion was very rotten and was removed during the inspection. No immediate risk remains. Photo AA4-2.	No significant changes observed.  Root jacking remains an issue. Slope 80% obscured by vegetation. Trees previously coppiced have regrown significantly so root jacking risk will continue to increase.	None.	No significant changes observed.	None.	Works completed since 2021 inspection: Scaling of block at Ch. 764 completed and no longer a significant hazard. [AA4-1]	None.					3	3	1	9	Moderate		Scale / dowel overhanging block at Ch. 788, coppice adjacent holly tree and inspect rock mass behind.		N/A	SUM				
AA4 Upper	0870 (NG 89586 36352) (at roadside)	0952 (NG 89626 36422) (at roadside)	Not assessed.	NG 89631-36342 - Large boulder (2.4m x 1.5m x 1.5m) - observed on 40-45 degree slope - crest of the boulder was resting on the ground surface and was leaning against a 3.5m high tree. Further tree was leaning on top of the boulder. Evidence of recent failure in the vicinity. Boulder removed during Phase 7 works (2013).	No new hazards observed.	NG 89640 36335 - boulder 3.2m high x 1.6m wide x 1.3m deep sitting partially embedded in slope. No sign of movement, reported but should be monitored during future inspections.  Series of sub-parallel curved tension cracks in upper slope. Considered to represent tension cracks - prior to road construction. Cracks vary from 1m to 2m wide and 1m to 2m deep and are located in a wide long slope length of approximately 30m to 40m. NE end terminates in area of historic failure - (re-inspected last time above NG 89482 36354. Identified as being above AA3 during 2019 inspection and as such not relating to hazard moved.	AA4 Upper not inspected in 2017.	A few small (0.1m x 0.1m x 0.1m) blocks roadside ditch.  Boulder field above baseline inspected for first time. Approx. 75m wide and 200m high. Slope angles up to approx. 40 degrees. Numerous angular boulders, including some stacked boulders, of varying size (max. 2m <sup>3</sup> ) and with isolated trees. Vast majority have a good covering of moss / lichen suggesting they have been in situ for hundreds of years. However, occasional fresher blocks were noted. Currently at angle of repose but should destabilising mechanism (e.g. deer, additional rock falls, root jacking) occur there is a risk of boulders impacting the road.  Crag above boulder field also inspected. Shaded joints and evidence of root jacking from sporadic trees. Spalling of small blocks from toe of crags was observed. No immediate risk of failure but inspection recommended by end-2020 - re-inspected in April 2021 - see comments.  Boulder at NG 89640 36335 re-inspected. No sign of recent movement or increased risk.	No new hazards observed.  Ch. 952 - boulder ca. 0.5m x 0.3m x 0.3m against base of deer fence. 2m wide verge plus 2m wide x 1m deep ditch between road and fence.  NE of Ch. 925 steep slope is well set back from road. 6m increasing to 20m. Steeper slope back to deer fence at large stream at Ch. 1039 but no observed hazards.	None.	None.	None.	None.	None.	None.	None.	None.	None.	None.	None.	None.	None.	None.	None.	None.	None.	None.	None.	None.	None.	75	m
AA4 Upper	0870 (NG 89586 36352) (at roadside)	0952 (NG 89626 36422) (at roadside)	Not assessed.	NG 89631-36342 - Large boulder (2.4m x 1.5m x 1.5m) - observed on 40-45 degree slope - crest of the boulder was resting on the ground surface and was leaning against a 3.5m high tree. Further tree was leaning on top of the boulder. Evidence of recent failure in the vicinity. Boulder removed during Phase 7 works (2013).	No new hazards observed.	NG 89640 36335 - boulder 3.2m high x 1.6m wide x 1.3m deep sitting partially embedded in slope. No sign of movement, reported but should be monitored during future inspections.  Series of sub-parallel curved tension cracks in upper slope. Considered to represent tension cracks - prior to road construction. Cracks vary from 1m to 2m wide and 1m to 2m deep and are located in a wide long slope length of approximately 30m to 40m. NE end terminates in area of historic failure - (re-inspected last time above NG 89482 36354. Identified as being above AA3 during 2019 inspection and as such not relating to hazard moved.	AA4 Upper not inspected in 2017.	A few small (0.1m x 0.1m x 0.1m) blocks roadside ditch.  Boulder field above baseline inspected for first time. Approx. 75m wide and 200m high. Slope angles up to approx. 40 degrees. Numerous angular boulders, including some stacked boulders, of varying size (max. 2m <sup>3</sup> ) and with isolated trees. Vast majority have a good covering of moss / lichen suggesting they have been in situ for hundreds of years. However, occasional fresher blocks were noted. Currently at angle of repose but should destabilising mechanism (e.g. deer, additional rock falls, root jacking) occur there is a risk of boulders impacting the road.  Crag above boulder field also inspected. Shaded joints and evidence of root jacking from sporadic trees. Spalling of small blocks from toe of crags was observed. No immediate risk of failure but inspection recommended by end-2020 - re-inspected in April 2021 - see comments.  Boulder at NG 89640 36335 re-inspected. No sign of recent movement or increased risk.	No new hazards observed.  Ch. 952 - boulder ca. 0.5m x 0.3m x 0.3m against base of deer fence. 2m wide verge plus 2m wide x 1m deep ditch between road and fence.  NE of Ch. 925 steep slope is well set back from road. 6m increasing to 20m. Steeper slope back to deer fence at large stream at Ch. 1039 but no observed hazards.	None.	None.	None.	None.	None.	None.	None.	None.	None.	None.	None.	None.	None.	None.	None.	None.	None.	None.	None.	None.	None.	75	m

NOTES:  
 1. Observations from previous inspections that no longer pose a significant hazard (e.g. following remedial works or re-assessment) are indicated with a strikethrough (e.g. ~~strikethrough~~), whilst those that remain are shown in bold (e.g. **bold**).  
 2. The level of risk assigned to each slope related to the conditions observed during the inspection carried out in April 2019. All risk ratings are relative and it should be noted that a 'low' rating does not mean that a slope will not fail, but that the likelihood and/or consequence of a failure is lower than at other locations. For further details of the risk assessment methodology refer to the AECOM report 'A890 Strome Ferry Bypass – Annual Slope Inspection Report 2019'.





Slope No.	Chainage and National Grid Reference		Significant observations from previous inspections & record of remedial works										2022 Inspection Comments				2022 Risk Assessment					Recommended Maintenance / Remedial Works				
			2012	2013	2014	2016	2017	2018	2019	2020 (Interim road level inspection)	2021	Failures/Degradation since 2021 inspection		New potential hazards observed	Additional Comments	Amendments to 2021 Risk Register	Hazard Rating	Pathway Rating	Receptor Rating	Risk Rating	Relative Risk Level Low = +5 Medium = +3 to +10 High = +10 - +15 Very High = +15	Large Scale Rock Fall Protection Works (Category 3)	Localised Targeted Rock Fall Protection Works (Category 2)	Ongoing Maintenance (Category 1)	Volume / area / length to be treated	Unit
												Observed by THC during monthly inspections	Observed by AECOM during 2021 inspection													
AA8	1880 (NG 90243 37019)	1940 (NG 90299 37045)	NG 90243-37019 (Ch. 1880) - large pile of debris (approx. 10m <sup>3</sup> ) at base of slope. Tree coppicing and light scaling carried out during Phase 8 works (2015). The ditch at the toe of the slope was also cleared and a roadside bund created.	Potential for re-vegetation from non-remediated debris on rock face. Tree coppicing and light scaling carried out during Phase 8 works (2015).	No new hazards observed.	No new hazards observed.	Ch. 1930 - Build up of debris behind bund/ditch where blocks have fallen from crest. Clearance not currently required but further debris build up to be monitored during monthly inspections.	Ch. 1930 - Debris behind bund/ditch remains. Photo AA8-1.	Ch. 1880 to 1895 - Note that there is root jacking potential here but that the large ditch below serves as an appropriate risk reduction measure.	Vegetation has become fairly well established - increased risk of root jacking and obscures rock face preventing inspection. De-vegetation would be beneficial.	Ch. 1880 - Minor accumulations of gravel sized rock at base of gully but still plenty of capacity in ditch.	None.	None.	None.	None.	2	2	1	4	Low			De-vegetation / coppicing (approx. 60% cover).	TBC	m <sup>2</sup>	
			Bottom anchor spacing 7m - potential for failed material to reach road.																							
AA9	1940 (NG 90299 37045)	1965 (NG 90338 37061)		No new hazards observed.	No new hazards observed.	Ch. 1965 - 1975 - Netting installed on upper section of rock face inspected for first time. Top cable and anchors were in good condition, with only slight corrosion noted. However, the sides and bottom of the netting were gaping. Potential failures up to 6.5m <sup>2</sup> were identified and these could fall out of the netting at either side or through the bottom, which is only secured with two end anchors and one intermediate anchor.	No new hazards observed.	No new hazards observed.	No significant changes since 2019.	Ch. 1975 - overhanging square blocks near crest with dilated joint at rear observed. <del>Estimated volume of rock is approximately 10m<sup>3</sup>. Rope access inspection carried out in 2021. See notes.</del>	Ch. 1975 - Overhanging block ca. 2m x 1m x 0.5m with buff coloured, fresher surfaces at base. No debris at ditch at toe or evidence of recent failures suggesting fresher surfaces could be due to past scaling works. Dilated fracture at right hand-side base of fracture.	None.	Bottom cable showing early signs of corrosion.	None.	2	3	1	6	Moderate			Improve netting system between Ch. 1965 and 1975. - Install vertical cables down either side of netting (25m each side) with additional anchors installed to secure in place (6 No. each side). - Install 2 No. lateral cables to profile netting (10m long). - Install 1 No. additional bottom anchor.	N/A	SUM		
AA10	1985 (NG 90338 37061)	2297 (NG 90610 37260)	Ch. 2000 - large pile of debris (approx. 10m <sup>3</sup> ) at base of slope. Re-inspected 2019 - see notes for details.	Recent failure (1804/13) - falling tree dislodged soil and rock with isolated block landing in road.	Source of April 2013 failure identified - no significant hazard identified.	Ch. 2033 - 2188 - slope noted to be well vegetated with shrubs and trees. Root jacking evident and several trees were noted to have been uprooted. Potential for blocks to be dislodged and some of these may reach road. Specific hazards identified at Ch. 2066 and Ch. 2130.	Ch. 2030 - 0.125m <sup>3</sup> block of rock noted to be resting against deer fence. No point suggesting failure was recent. Unable to determine source of block due to vegetation cover.	Ch. 2130 - Potential wedge failure ca. 15m above road level was inspected via rope access. It comprises a clear wedge failure with a large block 2m high x 2m wide x 1m deep with dilated fractures. Scaling was deemed feasible. The trajectory of a potential failure is difficult to predict, with the probable pathway to the left of the roadside ledging. The potential failure volume is large enough to burst through the deer fence and may either come to rest in the ditch or at the edge of the road.	Ch. 1997 - Potential root jacking of column of rock ca. 5 to 6m above toe. However, there is a 3-4m wide verge here so risk to road is low.	Ch. 2000 - Note that wedge identified in 2012 is ca. 10m wide x 10m high feature at the crest of the rock slope. No evidence of dilated fractures here and mass failure considered unlikely.	Ch. 2130 - Wedge re-inspected. No significant change noted.	None.	Ch. 2130 - Tree down ca. 6m above road level. Roof ball has soil and rock weathering out but well back from road so unlikely to pose a significant risk.	Ch. 2240: at crest of slope there are a number of trees leaning towards the road. If these were to fall there is potential for the root balls to dislodge loose blocks, however, these would be unlikely to impact the road due to the set-back distance of the slope. (Photo Ref. AA10-2)	None.	3	3	1	9	Moderate	Install targeted combination of roadside rock fall catch fences and netting.		Targeted coppicing of trees growing in rock exposures and light leading of broken/unstable rock.	TBC	TBC	
French man's Burn (Allt na Fhrangaich)	2315 (NGR 90613 37210)	N/A	N/A	N/A	N/A	None	Upper and lower basin noted to be free from significant debris.	Upper basin is at around 50% capacity and lower basin is at around 80% capacity. It is worth considering clearing debris to maintain full capacity.	No new hazards observed.	Top basin 90% full. Lower basin 25% full (High water).	Water levels are low. Both the lower and upper catch pits have good capacity. It is understood clearance of the catch pits was undertaken by THC in late 2020.	None.	Works completed since 2021 inspection include: - THC cleared debris from catch basins in summer 2021.	None.	N/A	N/A	N/A	N/A	N/A			Clear debris from basins as required to maintain capacity.	N/A	SUM		
AA11	2360 (NG 90657 37232)	2369 (NG 90696 37260)	NG 90657-37232 - Potential wedge failure. 10.5m x 0.5m x 1.5m approx. - recent inspection of netting system identified the following faults: - Feature amended during 2018 inspection. See note for Ch. 2364.	No new hazards observed.	No new hazards observed.	Potential wedge failure at NG 90656-37232. To be assessed in future inspections to determine if remedial works are required. Inspection completed in 2018.	Ch. 2364 - Previous wedge failure identified, possibly the same as that noted in 2012. Comprises an overhanging column of rock ca. 6m above road level. Wedge of rock below has previously failed, possibly during construction but joints are light and overhang is not at imminent risk of failure.	No new hazards observed.	No change other than vegetation is more established.	None.	Ch. 2366 - damaged intermediate bottom anchor. Mesh has caught and ripped anchor out by grass cutter (anchor 1m long and corroded - may be indicative of condition of other anchors).	Ch. 2399 to Ch. 2411: Vegetation well established on slope without netting (ca. 40% gorse cover). Potential for root jacking to cause small scale raveling.	None.	None.	2	2	1.2	4.8	Low			Install bimetallic corrosion protection between existing galvanised cable and stainless steel eye nuts.	5	No.		
AA12	2399 (NG 90698 37260)	2467 (NG 90740 37326)	Potential planar failure. NG 90740-37326 (Ch. 2440) - NG 90740-37326 (Ch. 2445) and NG 90740-37326 (Ch. 2424) - 7 No. blocks installed during Phase 8 works (2015).	No new hazards observed.	No new hazards observed.	Ch. 2422 - wedge of rock approx. 1.5m above road level acting as a key to a slab of rock above with open fracture to rear. Potential failure volume approx. 10m <sup>3</sup> . Not at imminent risk of failure, but there is no vegetation so failure would reach road.	Ch. 2422 - Potential wedge failure identified approx. 7m above road level and requires inspection and attention to be given further. Ch. 2422 - inspection of the upper portion of the rock face was noted to be heavily damaged, with dilated fractures and numerous overhangs noted. Potential failure up to 6m identified. Some blocks could be removed by scaling, but this adequately reduce risk an active netting system is required to protect the road.	Ch. 2422 - Large slab of rock 8-12m above road level identified. Potential failure volume approx. 10m <sup>3</sup> . Not at imminent risk of failure, but there is no vegetation so failure would reach road.	Ch. 2422 - Potential wedge failure identified approx. 7m above road level and requires inspection and attention to be given further. Ch. 2422 - inspection of the upper portion of the rock face was noted to be heavily damaged, with dilated fractures and numerous overhangs noted. Potential failure up to 6m identified. Some blocks could be removed by scaling, but this adequately reduce risk an active netting system is required to protect the road.	Ch. 2399 to Ch. 2411: Vegetation well established on slope without netting (ca. 40% gorse cover). Potential for root jacking to cause small scale raveling.	Ch. 2411 to Ch. 2427: TECCO netting system is generally in good condition. No visible sign of corrosion to any components.	Ch. 2427: SPIDER netting system appears in good condition from road level.	None.	None.	1	2	1	2	Low			Replace bottom cable and install additional bottom anchors.	2	No. (anchors)		

NOTES:  
 1. Observations from previous inspections that no longer pose a significant hazard (e.g. following remedial works or re-assessment) are indicated with a strikethrough (e.g. ~~strikethrough~~), whilst those that remain are shown in bold (e.g. **bold**).  
 2. The level of risk assigned to each slope related to the conditions observed during the inspection carried out in April 2019. All risk ratings are relative and it should be noted that a 'low' rating does not mean that a slope will not fail, but that the likelihood and/or consequence of a failure is lower than at other locations. For further details of the risk assessment methodology refer to the AECOM report 'A890 Stromeferry Bypass – Annual Slope Inspection Report 2019'.











# Appendix D Photographs





Photograph AA2-1

Debris at base of netting that is recommended to be cleared out at Ch. 273.



Photograph AA2-2

Controlled removal / heavy scaling of large overhanging boulder positioned 5m above road level at Ch. 400 is recommended.



Photograph AA4-1

Column of fractured rock removed by light scaling 6-8m above road at Ch.0764 during Ph.12 works in 2021.



Photograph AA6A-1	Location of new catch fence installed during the 2021 works. (Not clear in photo due to the dense vegetation)
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Photograph AA6B-1

Fallen tree at Ch. 1654 posing no risk to the road.



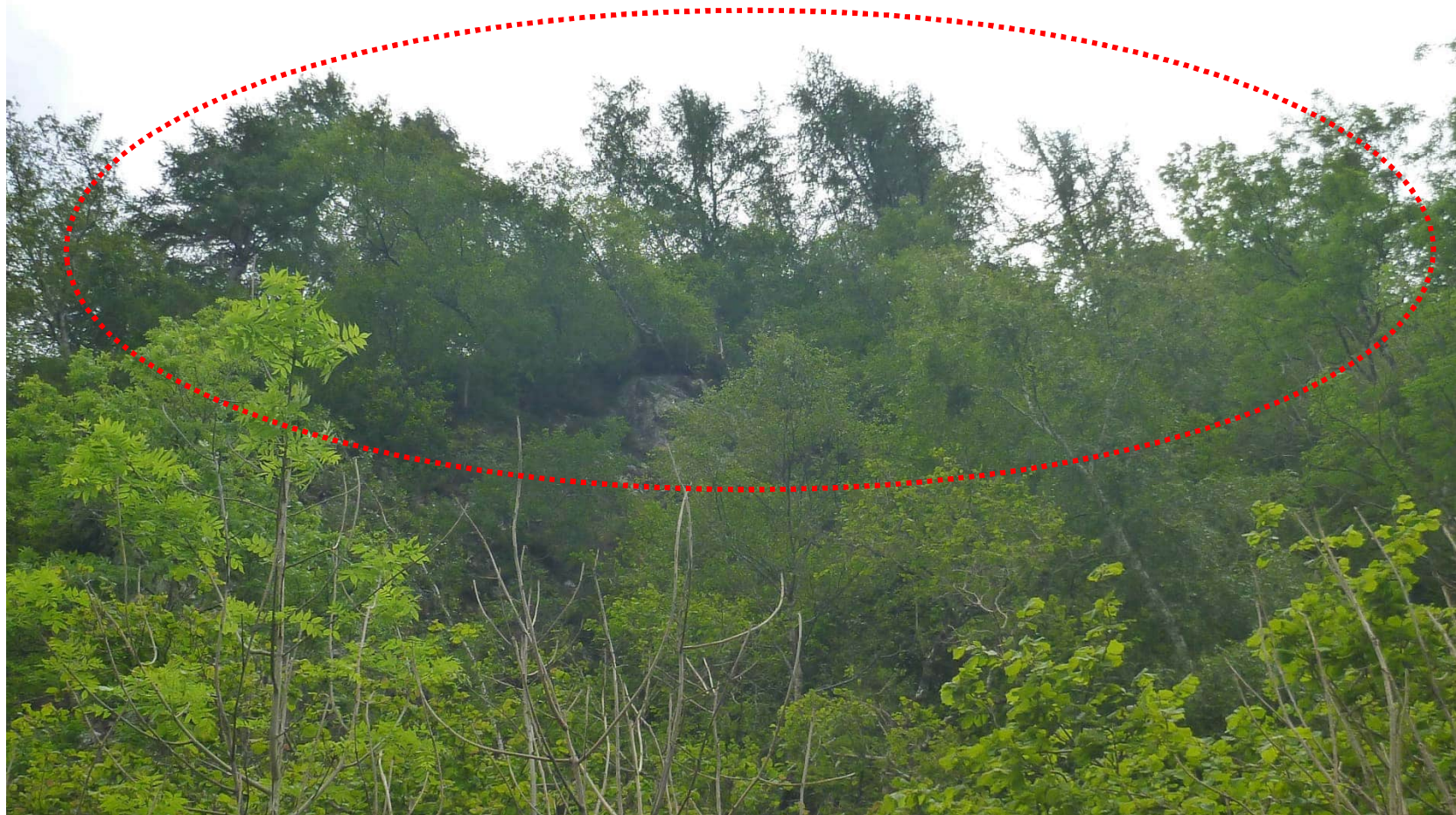
Photographs AA8-1a and 1b

Soil slip/wash out originating c.8m above ground level at Ch. 1892 to 1896. Large ditch with plenty of capacity. Recommend keeping ditch under observation and cleared where required to maintain its capacity.



Photograph AA10-1

Wedge of rock with dilated joints 15m above road level at Ch. 2130. Potential for failure due to root-jacking. Potential failure volume is large enough to burst through the deer fence and may either come to rest in the ditch or at the edge of the road.



Photograph AA10-2

At approx. Ch. 2240, at the crest of the slope there are a number of trees leaning towards the road. If these were to fall they could dislodge loose rock, but unlikely to impact road due to set back distance of the slope.





Photographs FB-1 and FB-2

Top: Upper catch pit; Bottom: Lower catch pit  
Both the upper and lower catch pits have good capacity.



Photograph AA13-1

Netting has been torn at Ch. 2518. This was potentially caused by a grass cutter.



Photograph  
AA18\_19\_19U-1

Location of recent rockfall which impacted the road and railway. Block originated c.70m upslope. Debris caused minor damage to netting system as it passed over it.



Photograph AA19-1

Example of some of the cable clamps on the bottom cable are starting to corrode at Ch. 3100.



Photograph AA20-1

Block that rotated out during the drilling of a temporary catch fence anchor and landed on flat area above retaining wall at Ch. 3185. Not at risk of further downslope movement.



Photograph AA20U-1

Catch fence installed during the Phase 12 2021 works



Photograph AA22A-1

Ditch has been re-instated between Ch. 3412 to 3425.



Photograph AA22B-1

Bottom cable and cable clamps on lateral and vertical reinforcing cables are corroded between Ch. 3462 and 3519.





Photograph AA22B-2

Block fall originating c.5m above toe of slope at Ch.3454. Block is c.0.3m x 0.2m x 0.2m and is being held by netting at c.2m above ground level.



Photograph AA23N-1

Block fall (c.0.4m x 0.4m x 0.3m) has landed in ditch. Block looks to have originated c.2m above the toe of slope.



Photograph AA23S-1

Block fall (c.0.25m<sup>3</sup>) landed in ditch during Phase 12 works and has since been cleared. Block originated c.7m above the toe of slope.

# Appendix E Roadside Geotechnical Assessment Sheets

**GEOTECHNICAL ASSESSMENT SHEET**

<b>Site:</b> A890 Stromeferry Bypass	<b>Slope Ref:</b> AA1	<b>Chainage:</b> 0000 - 0170	<b>Start Grid Ref:</b> NG 89063 35689	<b>End Grid Ref:</b> NG 89166 35810	<b>Elevation:</b> 17 m AOD
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**Rock Slope Characteristics:**

Dip: 85	Azimuth: 302	Height (m): 7	Length (m): 170	Vegetation Cover: Ch. 0 to Ch. 100: 50-90% Ch. 100 to Ch. 146: 30-50% Ch. 146 to Ch. 163: 10% Ch. 163 to Ch. 170: 90%  Grass, moss, saplings and ferns.	Ditch Details:  Typically 0.5-1m deep, 1m wide. Reduces to 0.15m deep, 0.3m wide from Ch. 60 to 65	Roughness (Profile): Rough	Verge Width: 1.5
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**Engineering Description of Rock:**

Very strong thinly foliated dark bluish grey fine to medium grained micaceous SCHIST (PSAMMITE)

Existing Netting Details or other remedial work details:							
<ul style="list-style-type: none"> <li>- TECCO mesh installed between Ch. 146 to 163 during phase 7 works (2013). Generally in good condition, although following defects were observed: 1.5m wide x 8m high area of netting within waterfall is discoloured; boundary cables locally exhibit surface corrosion (most evident at base of waterfall); 3 No. spike plates in waterfall exhibit surface corrosion.</li> <li>- 2 No. dowels installed at Ch. 50 during phase 8 works (2015)</li> <li>- Tree stump removed at failure area during Phase 8 works (2015)</li> <li>- Ditch and bund improved during phase 8 works (2015)</li> </ul>							
Hazards Observed:							
Location		Comments					
Throughout AA1		On-going ravelling across slope.					
SUMMARY			Comments				
Overall Hazard Rating =	1		Small scale ravelling only. Targeted remedial works were undertaken within AA1 in 2013 and 2015. Hazard rating reduced accordingly.				
Pathway Rating =	2		1.5m verge, with ditch and bund along length of section. Most blocks not expected to reach the road.				
Receptor Rating =	1.2						
Risk Value =	<b>2.4</b>						
Risk Level =	<b>Low</b>						
Recommended Remedial Works / Actions							
<ul style="list-style-type: none"> <li>- Monitor build-up of debris in ditch during monthly and annual inspections and undertake clearance works when required to maintain its capacity.</li> <li>- Monitor condition of dowels and netting system during annual inspections.</li> </ul>							
Assessed in field by:	PLM/JG	Date:	21/06/2022	Reviewed by:	Martha Taylor	Date:	06/09/2022

**GEOTECHNICAL ASSESSMENT SHEET**

<b>Site:</b> A890 Stromeferry Bypass	<b>Slope Ref:</b> AA2	<b>Chainage:</b> 0170 – 0477 (at small stream)	<b>Start Grid Ref:</b> NG 89166 358100	<b>End Grid Ref:</b> NG 89366 36040	<b>Elevation:</b> 9 mAOD
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**Rock Slope Characteristics:**

Dip: 74	Azimuth: 319	Height (m): 20	Length (m): 307	Vegetation Cover: Ranges between 10-100% across the slope comprising of moss, heather and occasional fern. Small saplings becoming established. Trees along crest.	Ditch Details: 0.5m to 1.0m wide, 0.4m deep	Roughness (Profile): Rough	Verge width: 0.8m
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**Engineering Description of Rock:**

Very strong thinly foliated dark grey fine to medium grained SCHIST (PSAMMITE)

Existing Netting Details or other remedial work details:									
Netting Type	Top cable	Typical anchor spacing (m)	Anchor Type	Cable-Anchor connection	No. of cable clamps	Netting lap connections	Laps on anchors	Vertical Reinforcing	Notes
PVC coated double twist	16mm galvanised	5m	25mm galvanised bars	Galvanised eye nuts	4	Spenax rings	No	None	Netting system present between Ch. 170 and Ch. 202 and Ch. 230 and 292.
<ul style="list-style-type: none"> <li>- Damaged section of mesh repaired with double twist Maccaferri netting during Phase 8 works (2015)</li> <li>- Slight surface corrosion of bottom cable identified at Ch. 273 identified during 2022 annual inspection.</li> </ul>									
Hazards Observed:									
Location		Comments							
Ch. 205		Trees at eastern edge of gully at crest of rock face are overhanging and at risk of falling and dislodging blocks.							
Ch. 335		Culvert requires clearance (was cleared in 2020 but has filled up again; c.8cm clear at top of culvert, remainder filled with gravel).							
Ch. 340-447		Potential for root jacking identified.							
Ch. 400		Large boulder 5m above road level. Overhanging portion at risk of falling (ca. 4.5m <sup>3</sup> ). Passing place beneath potential rock fall.							
Ch. 360		Root jacking in crags ca. 25m above road level with the potential for dislodging of blocks.							
Ch. 205-230		No remedial measures over rock face in this area. Almost 70% vegetation cover including small coniferous saplings. Root jacking may become an issue.							
SUMMARY									
Overall Hazard Rating =		3		Increased from 2 in 2016 due to identification of potential 4.5m <sup>3</sup> failure at Ch. 400. Elsewhere within AA2 the hazard rating is lower.					
Pathway Rating =		4		Pathway rating increased from 3 in 2017 due to presence of passing place beneath potential failure at Ch. 400. Elsewhere within AA2 the pathway rating is lower.					
Receptor Rating =		1.2							
Risk Value =		<b>14.4</b>							
Risk Level =		<b>High</b>							
Recommended Remedial Works / Actions									
<ul style="list-style-type: none"> <li>- Coppice trees at crest of slope at Ch. 205 and within 10m of road between Ch. 340 and Ch. 447;</li> <li>- Clear out debris from base of netting at Ch. 273; and</li> <li>- Controlled removal / heavy scaling of large overhang at Ch.400. Stitch drilling and blasting likely to be best solution.</li> </ul>									
Assessed in field by:	PLM/JG	Date:	21/06/2022	Reviewed by:	Martha Taylor	Date:	06/09/2022		



**GEOTECHNICAL ASSESSMENT SHEET**

<b>Site:</b> A890 Stromeferry Bypass	<b>Slope Ref:</b> AA2A	<b>Chainage:</b> 0477-0555	<b>Start Grid Ref:</b> NG 89366 36040	<b>End Grid Ref:</b> NG 89393 36104	<b>Elevation:</b> 9 mAOD
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**Rock Slope Characteristics:**

Dip: 84	Azimuth: 300	Height (m): 12	Length (m): 78	Vegetation Cover: c.95% cover. Generally comprises moss, grass, saplings and bushes. Many tree stumps.	Ditch Details: 1.5m wide, 0.5 - 1 m deep	Roughness (Profile): Rough	Verge Details: 3.5m
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**Engineering Description of Rock:**

Strong thinly foliated dark grey fine to medium grained SCHIST (PSAMMITE).

**Existing Netting Details or other remedial work details:**

- No remedial installations.
- Ditch and bund at toe of rock slope were improved during Phase 8 works (2015).

**Hazards Observed:**

Location	Comments
Throughout AA2A	Potential for small scale ravelling/blockfalls up to 0.125m <sup>3</sup> .

**SUMMARY**

Overall Hazard Rating =	2	Comments
Pathway Rating =	1	Pathway rating reduced following improvements to rock trap ditch during Phase 8 works.
Receptor Rating =	N/A	Receptor rating only applicable when pathway rating is ≥2.
Risk Value =	<b>2.0</b>	<b>Re-assessed during the 2022 inspection following changes to receptor rating. Risk value reduced from 2.4.</b>
Risk Level =	<b>Low</b>	

**Recommended Remedial Works / Actions**

- The build up of debris within ditch should be monitored during monthly and annual inspections and clearance works undertaken as required to maintain its capacity.

<b>Assessed in field by:</b> PLM/JG	<b>Date:</b> 21/06/2022	<b>Reviewed by:</b> Martha Taylor	<b>Date:</b> 06/09/2022
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**GEOTECHNICAL ASSESSMENT SHEET**

<b>Site:</b> A890 Strome ferry Bypass	<b>Slope Ref:</b> AA3	<b>Chainage:</b> 0560 - 0670	<b>Start Grid Ref:</b> NG 89397 39107	<b>End Grid Ref:</b> NG 89454 36200	<b>Elevation:</b> 14 mAOD
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**Rock Slope Characteristics:**

Dip: 80	Azimuth: 317	Height (m): 16	Length (m): 110	Vegetation Cover: 20-30% cover. Moss and ground cover with occasional trees. Trees on ditch edge forming barrier. Some trees overhanging at crest.	Ditch Details: Ch. 605 to Ch. 670: 2.2m wide, 1.2m deep	Roughness (Profile): Smooth	Verge Details: Ch. 560 to Ch. 605 = 3.5m Ch. 605 to Ch. 670 = 13m
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**Engineering Description of Rock:**

Medium strong thinly to narrowly foliated light pinkish grey schist (PSAMMITE).

**Existing Netting Details or other remedial work details:**

No remedial installations.  
Large rock trap ditch below majority of rock face.

**Hazards Observed:**

Location	Comments
Ch. 560-605	Potential for toppling/blockfall up to 2m <sup>3</sup> originating from 5-8m above road level. 3.5m verge at this location, however, and blocks unlikely to reach road.
Ch. 605-670	Potential for very large toppling/blockfall failures although presence of large ditch and very mean these do not pose a risk to the road.
NG 89467 36164 (Ch. 612)	Series of sub-parallel tension cracks were recorded on the upper slope. Cracks vary from 1-3m deep. No evidence of recent movement.

**SUMMARY**

	Comments
Overall Hazard Rating =	4
Pathway Rating =	1
Receptor Rating =	N/A
Risk Value =	<b>4.0</b>
Risk Level =	<b>Low</b>

**Recommended Remedial Works / Actions**

- Build-up of debris in rock trap ditch should be monitored during monthly and annual inspections and clearance works undertaken as required to maintain its capacity.
- Tension cracks on slope above rock face at Ch. 612 to be kept under observation during annual inspections.

<b>Assessed in field by:</b> PLM/JG	<b>Date:</b> 21/06/2022	<b>Reviewed by:</b> Martha Taylor	<b>Date:</b> 06/09/2022
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**GEOTECHNICAL ASSESSMENT SHEET**

<b>Site:</b> A890 Strome ferry Bypass	<b>Slope Ref:</b> AA3A	<b>Chainage:</b> 0670 - 0745	<b>Start Grid Ref:</b> NG 89454 36200	<b>End Grid Ref:</b> NG 89508 36254	<b>Elevation:</b> 14 mAOD
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**Rock Slope Characteristics:**

Dip: 35 to 45	Azimuth: 315	Height (m): N/A (vegetated slope with isolated rock outcrops)	Length (m): 75	Vegetation Cover: 100%. Fully vegetated slopes (trees, grass and moss ground cover).	Ditch Details: 0.5m wide, 0.3m deep.	Roughness (Profile): Smooth	Verge Details: 0m
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**Engineering Description of Rock:**

Medium strong thinly to narrowly foliated light pinkish grey schist (PSAMMITE).

**Existing Netting Details or other remedial work details:**

No remedial installations.

Hazards Observed:			
Location	Comments		
Ch.690	Isolated rock outcrop ca. 30m above road level with ongoing ravelling / root jacking. Some blocks have reached deer fence 1-2m above road level.		
SUMMARY		Comments	
Overall Hazard Rating =	1	Small scale ravelling / root jacking from isolated outcrops.	
Pathway Rating =	2	Most of the failure debris is expected to come to rest on the slope between the outcrop and the road but there is potential for occasional blocks to reach road level.	
Receptor Rating =	1		
Risk Value =	<b>2.0</b>		
Risk Level =	<b>Low</b>		
Recommended Remedial Works / Actions			
<ul style="list-style-type: none"> <li>- Slope AA3A to be included in monthly and annual inspections and build up of debris at deer fence to be monitored.</li> </ul>			
Assessed in field by:	PLM/JG	Date: 21/06/2022	Reviewed by: Martha Taylor Date: 06/09/2022

**GEOTECHNICAL ASSESSMENT SHEET**

<b>Site:</b> A890 Stromeferry Bypass	<b>Slope Ref:</b> AA4	<b>Chainage:</b> 0745–0855	<b>Start Grid Ref:</b> NG 89508 36254	<b>End Grid Ref:</b> NG 89572 36332	<b>Elevation:</b> 21 mAOD
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**Rock Slope Characteristics:**

Dip: 80	Azimuth: 310	Height (m): 20	Length (m): 110	Vegetation Cover: 75-80% cover. Lots of ivy, grass/small shrubs and small saplings.	Ditch Details: 1.0m wide, 0.6m deep	Roughness (Profile): Rough	Verge Details: 1.0m
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**Engineering Description of Rock:**

Very strong thinly foliated grey fine grained schist (PSAMMITE).

**Existing Netting Details or other remedial work details:**

- No netting present.
- 4 No. rock dowels installed during Phase 8 (2015) works.
- Removal of large boulder during phase 7 works (2013)

**Hazards Observed:**

Location	Comments
Ch. 788	Overhanging block at crest of slope with release joint and only partial overlap keying block in place. Holly bush immediately to the left obscuring rock mass.
Ch. 745	Root jacking and fractured rock mass 8m above road level. Potential failure volume 1m <sup>3</sup> .
Ch. 808	Soil wedge slipped and landed in roadside ditch in May 2021, leaving slight overhang of vegetation at crest of failure that could fail in future.
Whole slope	Minor ravelling potential throughout AA4.

SUMMARY		Comments
Overall Hazard Rating =	3	
Pathway Rating =	3	
Receptor Rating =	1	
Risk Value =	<b>9</b>	
Risk Level =	<b>Moderate</b>	

**Recommended Remedial Works / Actions**

- Build up of debris in ditch should be monitored during monthly and annual inspections with ditch cleared as required to maintain its capacity.
- Scale overhanging block at Ch. 788 and coppice holly bush to reduce risk of root jacking and allow rock mass behind to be inspected.
- Scale fractured rock mass at Ch. 745.

<b>Assessed in field by:</b> PLM/JG	<b>Date:</b> 21/06/2022	<b>Reviewed by:</b> Martha Taylor	<b>Date:</b> 06/09/2022
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**GEOTECHNICAL ASSESSMENT SHEET**

<b>Site:</b> A890 Strome ferry Bypass	<b>Slope Ref:</b> AA5	<b>Chainage:</b> 1285–1383	<b>Start Grid Ref:</b> NG 89799 36709	<b>End Grid Ref:</b> NG 89864 36775	<b>Elevation:</b> 19 mAOD
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**Rock Slope Characteristics:**

Dip: 70	Azimuth: 320	Height (m): 70	Length (m): 98	Vegetation Cover: 90% cover lower slope, 60% cover upper slope. Moss and bracken. Moss is up to 0.15 to 2.0m thick. Numerous deciduous trees upslope with large saplings down slope.	Ditch Details: 1m wide, 0.5m deep	Roughness (Profile): Rough	Verge Details: 2.0m
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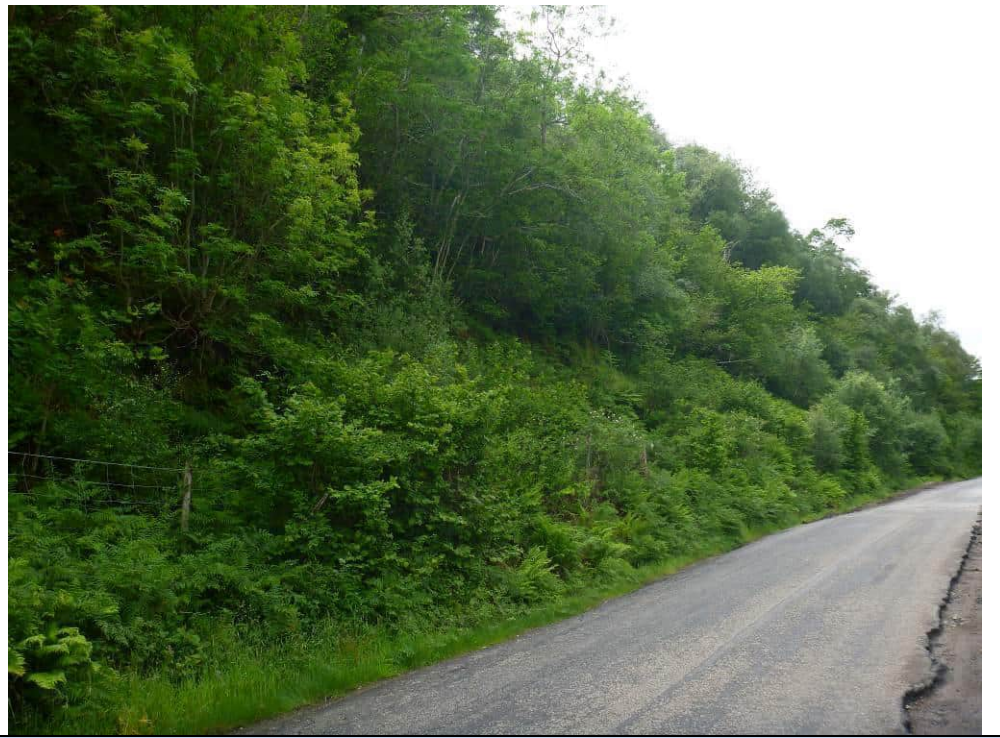
**Engineering Description of Rock:**

Strong to very strong thinly foliated pinkish grey medium grained schist (PSAMMITE).

Existing Netting Details or other remedial work details:				
None				
Hazards Observed:				
Location	Comments			
Ch.1287	Blocks c.1.6m x 1.6m x 0.3m passed deer fence and in roadside ditch.			
Ch.1333	Blocks in roadside ditch and at fence line.			
Ch. 1360	Small accumulation of blocks behind deer fence originating from outcrop 5-6m above road level. Seepage and root jacking noted on rock slope with small blocks being washed out.			
Ch. 1328	Outcrop ca. 50m above road level. Possible debris flow type failure.			
NG 89808 36663	Outcrop of fractured rock approximately 40m above road level			
NG 89828 36663	Outcrop with detached block (~1m <sup>3</sup> ) with potential for additional blocks to fail.			
Throughout section	Presence of trees on/adjacent to isolated rock outcrops may lead to root jacking.			
SUMMARY		Comments		
Overall Hazard Rating =	3	Reduced from 4 in 2018 following re-assessment of potential failure size.		
Pathway Rating =	4	Increased from 2 in 2018 to reflect probability of a failure impacting the road.		
Receptor Rating =	1			
Risk Value =	<b>12</b>			
Risk Level =	<b>High</b>			
Recommended Remedial Works / Actions				
<ul style="list-style-type: none"> <li>- Install rockfall catch fence along toe of slope / light scaling fractured outcrops.</li> <li>- Light scale outcrops at NG 89808 36663 and NG 89828 36663 (only required if catch fence not installed).</li> </ul>				
Assessed in field by:	PLM/JG	Date: 21/06/2022	Reviewed by: Martha Taylor	Date: 06/09/2022

**GEOTECHNICAL ASSESSMENT SHEET**

<b>Site:</b> A890 Stromeferry Bypass	<b>Slope Ref:</b> AA5A	<b>Chainage:</b> 1383 - 1446	<b>Start Grid Ref:</b> NG 89864 36775	<b>End Grid Ref:</b> NG 89902 36818	<b>Elevation:</b> 19m
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**Rock Slope Characteristics:**

Dip: 70	Azimuth: 320	Height (m): 70 – almost completely vegetated slope with isolated outcrops.	Length (m): 83	Vegetation Cover: 90% cover lower slope, 70% cover upper slope. Moss and bracken. Numerous deciduous trees upslope with large saplings down slope.	Ditch Details: 0.5m wide, 0.3 deep	Roughness (Profile): Rough	Verge Details: 0.8m
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**Engineering Description of Rock:**

Strong to very strong thinly foliated pinkish grey medium grained schist (PSAMMITE).

**Existing Netting Details or other remedial work details:**

No remedial installations.

Hazards Observed:							
Location	Comments						
Across slope	Numerous fallen and leaning silver birch trees with lots of dilated root-jacked rocks on slope.						
Ch. 1432	Fractured rock in upper section of slope with potential root jacking.						
Ch. 1440	Fractured rock with potential root jacking 20m above road level.						
SUMMARY			Comments				
Overall Hazard Rating =	3						
Pathway Rating =	2						
Receptor Rating =	1						
Risk Value =	6						
Risk Level =	Moderate						
Recommended Remedial Works / Actions							
<ul style="list-style-type: none"> <li>- Install roadside rock fall catch fence.</li> </ul>							
<b>Assessed in field by:</b>	PLM/JG	<b>Date:</b>	21/06/2022	<b>Reviewed by:</b>	Martha Taylor	<b>Date:</b>	06/09/2022

**GEOTECHNICAL ASSESSMENT SHEET**

<b>Site:</b> A890 Stromeferry Bypass	<b>Slope Ref:</b> AA6	<b>Chainage:</b> 1446 – 1503	<b>Start Grid Ref:</b> NG 89902 36818	<b>End Grid Ref:</b> NG 89936 36862	<b>Elevation:</b> 10 mAOD
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**Rock Slope Characteristics:**

Dip: 71	Azimuth: 310	Height (m): 35	Length (m): 57	Vegetation Cover: Ranges between 40-100%. Generally comprises ground cover and saplings.	Ditch Details: Widest section 0.8m deep, 2.3m wide (no ditch where rock slope close to road).	Roughness (Profile): Rough	Verge Details: 0.8 – 1.5m
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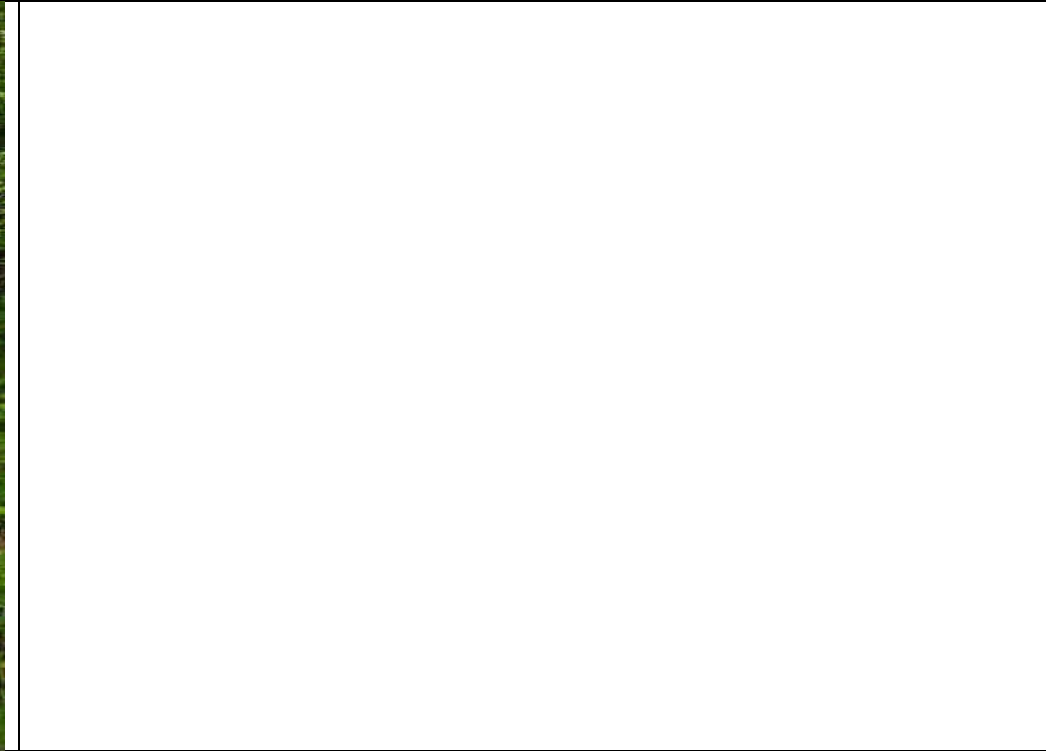
**Engineering Description of Rock:**

Very strong thinly foliated dark grey fine to medium grained schist (PSAMMITE).

Existing Netting Details or other remedial work details:									
Netting Type	Top cable	Typical anchor spacing (m)	Anchor Type	Cable-Anchor connection	No. of cable clamps	Netting lap connections	Laps on anchors	Vertical Reinforcing	Notes
Double twist netting	16mm galvanised	5m	25mm galvanized bars	Galvanised eye nuts	3	Spenax rings	No	None	Partial coverage only. Additional bottom anchors installed during phase 8 works (2015).
- Netting was inspected during 2022 annual inspection and was in good condition.									
Hazards Observed:									
Location	Comments								
Entire slope	No significant hazards observed. Potential failures limited to minor raveling / root jacking. e.g. in May 2021 a small failure was observed at Ch. 1502, with debris in roadside ditch.								
Ch. 1470 – 1500	Potential for Planar failure and root jacking. Targeted inspection at height recommended.								
SUMMARY			Comments						
Overall Hazard Rating =	1								
Pathway Rating =	2		Pathway rating reduced in 2019 following reassessment of potential failure pathways.						
Receptor Rating =	1								
Risk Value =	2.0								
Risk Level =	Low								
Recommended Remedial Works / Actions									
- The build-up of debris in ditch should be monitored during monthly and annual inspections and clearance works undertaken as required to maintain its capacity.									
<b>Assessed in field by:</b>	PLM/JG	<b>Date:</b>	21/06/2022	<b>Reviewed by:</b>	Martha Taylor	<b>Date:</b>	06/09/2022		

**GEOTECHNICAL ASSESSMENT SHEET**

<b>Site:</b> A890 Stromeferry Bypass	<b>Slope Ref:</b> AA6A	<b>Chainage:</b> 1503 – 1606	<b>Start Grid Ref:</b> NG 89936 36862	<b>End Grid Ref:</b> NG 89995 36943	<b>Elevation:</b> 76 mAOD
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**Rock Slope Characteristics:**

Dip: 70	Azimuth: 300	Height (m): 35	Length (m): 103	Vegetation Cover: Fully vegetated slope (trees and ground cover) with occasional rock outcrops.	Ditch Details: Ch.1503-1530 0.8m wide, 0.3m deep. Ch. 1530-1606 2m wide, 0.75m deep with bund 1m wide, 0.45m high	Roughness (Profile): Rough	Verge Details: Ch. 1503-1530 0.5m wide Ch.1530-1606 0.8m wide
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**Engineering Description of Rock:**

Strong very narrowly banded dark grey crystalline medium grained schist (PSAMMITE/SCHIST). Well defined foliation with schistosity.

**Existing Netting Details or other remedial work details:**

Ch. 1511: Three small catch fences in gully (boundary between AA6 and AA6A).  
 Ch.1503 to 1526: New rock fall catch fence installed in gully. The older catch fences were left in place below the new fence. (completed during the 2021 works)

**Hazards Observed:**

Location	Comments
NG 89983 36824 (upper crags)	Large buttress with large dilated fracture behind. The rock is thinly bedded and lightly folded with beds also dilated. To the left of this is a broken, dilated, rock mass sitting on a daylighting discontinuity, which is only keyed in at left hand side of the base. Down slope from this there is another large buttress which has moved historically, where the key stone in the rock mass is observed to have been pushed out. Potential for significant failure, with buttress breaking up and falling down gully. New catch fence installed in 2021 to mitigate risk.

**SUMMARY**

SUMMARY	Comments
Overall Hazard Rating =	4 Increased from 2 in 2018 due to identification of buttresses which have the potential to break out and fall down gully.
Pathway Rating =	2 Decreased from 4.5 in 2022 due to construction of catch fence in gully.
Receptor Rating =	1 Reduce from 1.2 in 2018 following confirmation of sightline beneath potential failures.
Risk Value =	<b>8</b>
Risk Level =	<b>Moderate</b>

**Recommended Remedial Works / Actions**

- Install roadside rock fall catch fence.

<b>Assessed in field by:</b> PLM/JG	<b>Date:</b> 21/06/2022	<b>Reviewed by:</b> Martha Taylor	<b>Date:</b> 06/09/2022
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**GEOTECHNICAL ASSESSMENT SHEET**

<b>Site:</b> A890 Stromeferry Bypass	<b>Slope Ref:</b> AA6B	<b>Chainage:</b> 1606-1752	<b>Start Grid Ref:</b> NG 89995 36943	<b>End Grid Ref:</b> 90124 36990	<b>Elevation:</b> 100 mAOD
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**Rock Slope Characteristics:**

Dip: 70	Azimuth: 300	Height (m): 35	Length (m): 146	Vegetation Cover: 100% - No rock outcrops noted and slope is covered in vegetation	Ditch Details: N/A	Roughness (Profile): N/A	Verge Width: N/A
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**Engineering Description of Rock:**

Isolated outcrops only. Very strong thinly foliated dark grey schist (PSAMMITE).

Existing Netting Details or other remedial work details:							
None							
Hazards Observed:							
Location		Comments					
Whole slope		No significant hazards observed. Boulders present on slope and in drainage gully. No destabilising mechanism identified but likely to be from upturned root balls.					
Ch. 1654		Fallen tree. Does not present risk to road.					
Ch. 1708		Two trees down c.10m upslope. Loose rock behind root ball on slope but not posing risk to road.					
SUMMARY		Comments					
Overall Hazard Rating =	2	Increased from 1 in 2018 following identification of failed blocks at roadside.					
Pathway Rating =	2						
Receptor Rating =	1.2						
Risk Value =	4.8						
Risk Level =	Low						
Recommended Remedial Works / Actions							
- No recommended remedial works.							
Assessed in field by:	PLM/JG	Date:	21/06/2022	Reviewed by:	Martha Taylor	Date:	06/09/2022

**GEOTECHNICAL ASSESSMENT SHEET**

<b>Site:</b> A890 Strome ferry Bypass	<b>Slope Ref:</b> AA7	<b>Chainage:</b> 1752 - 1880	<b>Start Grid Ref:</b> NG 90124 36990	<b>End Grid Ref:</b> NG 90213 37019	<b>Elevation:</b> 13 mAOD
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**Rock Slope Characteristics:**

Dip: 75 - 80	Azimuth: 336	Height (m): 30	Length (m): 128	Vegetation Cover: 60-70% cover. Lots of saplings established on slope.	Ditch Details: 1m wide, 0.75 deep. Bund 0.6m wide, 0.3m high	Roughness (Profile): Rough	Verge Details: None
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**Engineering Description of Rock:**

Very strong thinly foliated dark grey schist (PSAMMITE).

**Existing Netting Details or other remedial work details:**

Scaling carried out during Phase 8 (2015) works. Ditch at toe of slope also improved during these works.

Hazards Observed			
Location	Comments		
Ch. 1770	Dilated block noted in crag 30m above road level. Inspected by rope access and noted to be keyed in.		
Ch. 1803	Dilated fractures observed but no obvious fractures at base of block and chances of reaching road level if it does failure are low due to large ditch.		
Ch. 1826	Fractured rock on right hand side of previous failure, low risk due to verge and ditch.		
General comment	Vegetation has increased and obscures much of the rock slope.		
SUMMARY		Comments	
Overall Hazard Rating =	2	Increased from 1 in 2018 to reflect potential failure volume.	
Pathway Rating =	2	Reduced from 3 in 2018 due to likelihood of failure reaching road.	
Receptor Rating =	1.2		
Risk Value =	<b>4.8</b>		
Risk Level =	<b>Low</b>		
Recommended Remedial Works / Actions			
<ul style="list-style-type: none"> <li>- The build up of debris within ditch should be monitored during monthly and annual inspections and clearance works undertaken as required to maintain its capacity.</li> </ul>			
Assessed in field by:	PLM/JG	Date:	21/06/2022
		Reviewed by:	Martha Taylor
		Date:	06/09/2022

**GEOTECHNICAL ASSESSMENT SHEET**

<b>Site:</b> A890 Stromeferry Bypass	<b>Slope Ref:</b> AA8	<b>Chainage:</b> 1880-1940	<b>Start Grid Ref:</b> NG 90243 37019	<b>End Grid Ref:</b> NG 90299 37045	<b>Elevation:</b> 20 mAOD
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**Rock Slope Characteristics:**

Dip: 75 – 80	Azimuth: 326	Height (m): 25 – 30	Length (m): 63	Vegetation Cover: Up to 60% cover comprising lots of ivy, grass and small saplings.	Ditch Details: 0.5-1m deep; 2-5m wide Bund: 0.5m high, 0-4m wide	Roughness (Profile): Rough	Verge Details: 0-1m
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**Engineering Description of Rock:**

Very strong thinly foliated dark grey schist. Contains occasional thin quartz foliations (PSAMMITE).

Existing Netting Details or other remedial work details:									
Netting Type	Top cable	Typical anchor spacing (m)	Anchor Type	Cable-Anchor connection	No. of cable clamps	Netting lap connections	Laps on anchors	Vertical Reinforcing	Notes
PVC coated double twist	16mm galvanised	7	Bottom anchors are stainless steel	Stainless steel eye nuts and shackles at bottom.	?	Spenax rings	No	None	Partial coverage. Present between Ch. 1895 and 1932. Bimetallic corrosion protection present at bottom anchors but not in full contact.
- Pillar of rock removed through heaving scaling and tree coppicing carried out during Phase 8 works (2015)									
Hazards Observed:									
Location	Comments								
Ch. 1930	Ongoing failure of small blocks from crest. Debris successfully contained by rock trap ditch/bund. Area should be kept under observation in future inspections.								
Ch. 1880 to 1895	No netting. Vegetated. Root jacking potential but large ditch below.								
Ch. 1892 to 1896	Soil slip/wash-out from 8m above ground level. There is a large ditch below with sufficient capacity.								
Ch.1895 to Ch.1932	Vegetation well established and obscuring parts of the slope.								
SUMMARY		Comments							
Overall Hazard Rating =	2								
Pathway Rating =	2								
Receptor Rating =	1								
Risk Value =	4								
Risk Level =	Low								
Recommended Remedial Works / Actions									
<ul style="list-style-type: none"> <li>- The build-up of debris within ditch should be monitored and clearance works undertaken as required to maintain its capacity.</li> <li>- Potential for bimetallic corrosion of bottom cable at anchor points – keep under observation during annual inspections.</li> <li>- De-vegetation / coppicing of entire slope.</li> </ul>									
Assessed in field by:	PLM/JG	Date:	21/06/2022	Reviewed by:	Martha Taylor	Date:	06/09/2022		

**GEOTECHNICAL ASSESSMENT SHEET**

<b>Site:</b> A890 Stromeferry Bypass	<b>Slope Ref:</b> AA9	<b>Chainage:</b> 1940-1985	<b>Start Grid Ref:</b> NG 90299 37045	<b>End Grid Ref:</b> NG 90338 37061	<b>Elevation:</b> 12 mAOD
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**Rock Slope Characteristics:**

Dip: 82	Azimuth: 350	Height (m): 30	Length (m): 45	Vegetation Cover: 30-40% and locally >75% cover. Generally comprises grass and saplings.	Ditch Details: None	Roughness (Profile): Rough	Verge Details: 1.4m
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**Engineering Description of Rock:**

Strong thinly foliated dark grey medium schist. Some foliations are mica rich. Small 'z' folds were noted. (PSAMMITE).

Existing Netting Details or other remedial work details:									
Netting Type	Top cable	Typical anchor spacing (m)	Anchor Type	Cable-Anchor connection	No. of cable clamps	Netting lap connections	Laps on anchors	Vertical Reinforcing	Notes
PVC coated double twist	16mm galvanised	5?	25mm stainless steel bars	Stainless steel eye nuts	3?	Spenax rings	No	None	Only present between Ch. 1965 and Ch. 1975. No netting on lower 15m of slope. 0.2 – 0.3m gap between bottom cable and rock face.
<ul style="list-style-type: none"> <li>- It has been noted that sides and bottom of netting are gapping between Ch. 1965 and Ch. 1975</li> <li>- Bottom cable showing early signs of corrosion – noted during the 2022 annual inspection</li> </ul>									
Developing Hazards Observed (Considered likely to fail with the next 5 years):									
Location	Comments								
Ch. 1965-1975	Netting noted to be gapping at sides and bottom. Potential for blocks up to 0.5m <sup>3</sup> to fall out either side or bottom and onto road below.								
Ch.1978	Overhanging block at crest with buff coloured, fresher surfaces at base (possibly representative of past scaling). Block c.2m x 1m x 0.5m and appears to have dilated fracture at right hand side. Overall appears keyed in but vegetation growth around block could lead to root jacking.								
SUMMARY		Comments							
Overall Hazard Rating =	2								
Pathway Rating =	3								
Receptor Rating =	1								
Risk Value =	6								
Risk Level =	Moderate								
Recommended Remedial Works / Actions									
<ul style="list-style-type: none"> <li>- Improve netting system at Ch. 1965-1975: installation of vertical cables and side anchors down either side of netting and additional bottom anchors to secure netting at base. Installation of lateral cables to profile netting also recommended.</li> <li>- Future rope access inspection recommended to inspect the overhanging block at Ch.1978.</li> </ul>									
Assessed in field by:	PLM/JG	Date:	21/06/2022	Reviewed by:	Martha Taylor	Date:	06/09/2022		



**GEOTECHNICAL ASSESSMENT SHEET**

<b>Site:</b> A890 Strome ferry Bypass	<b>Slope Ref:</b> AA10	<b>Chainage:</b> 1985-2297	<b>Start Grid Ref:</b> NG 90338 37061	<b>End Grid Ref:</b> NG 90610 37206	<b>Elevation:</b> 15 mAOD
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**Rock Slope Characteristics:**

Dip: 85	Azimuth: 332	Height (m): 40	Length (m): 312	Vegetation Cover: 70% cover. Generally comprises grass and small to medium sized trees, with occasional large trees.	Ditch Details: Ch. 1985-2010 only. Width 1.7, Depth 0.4	Roughness (Profile): Rough	Verge Details: Generally 10m, but 1m minimum.
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**Engineering Description of Rock:**

Very strong thinly foliated dark grey and white fine to medium schist. Contains thin laminations of quartz. (PSAMMITE)

**Existing Netting Details or other remedial work details:**

No remedial installations.

**Hazards Observed:**

Location	Comments
Ch. 2033-2188	Noted that slope is well vegetated in this area with uprooted trees. Root jacking evident, with potential to dislodge blocks. Recent failures evident.
Ch. 2075	Potential wedge failure with root jacking identified.
Ch.2110	Tree down c.8m above road level. Root ball has soil and rock weathering out but unlikely to be a risk to the road.
Ch. 2130	Wedge failure observed ~15m above road level. Potential for root jacking and release joints observed. The trajectory of a potential failure is difficult to predict, with the probable pathway to the left of the roadside outcrop. Potential failure volume is large enough to burst through the deer fence and may either come to rest in the ditch or at the edge of the road.
Ch. 2240	At crest of slope there are a number of trees leaning towards the road. If these fall there is potential for root balls to dislodge blocks, however, these are unlikely to impact the road as slope is set-back from road.
Ch. 1997	Potential root jacking of column of rock ca. 5 to 8m above toe. 3-4m verge so low risk.

SUMMARY		Comments
Overall Hazard Rating =	3	Reduced from 4 in 2018 due to detailed rope access inspection of wedge failure and accurate determination of potential failure volume.
Pathway Rating =	3	Increased from 2 in 2018 due to inspection of failure trajectory.
Receptor Rating =	1	
Risk Value =	<b>9</b>	
Risk Level =	<b>Moderate</b>	

**Recommended Remedial Works / Actions**

- Installation of catch fence at toe of slope and targeted rockfall netting.
- Coppice trees growing on rock exposure (if catch fence/netting not installed).
- Scale potential wedge failure at Ch. 2130.

<b>Assessed in field by:</b> PLM/JG	<b>Date:</b> 21/06/2022	<b>Reviewed by:</b> Martha Taylor	<b>Date:</b> 06/09/2022
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## GEOTECHNICAL ASSESSMENT SHEET

<b>Site:</b> A890 Stromeferry Bypass	<b>Slope Ref:</b> AA11	<b>Chainage:</b> 2360-2399	<b>Start Grid Ref:</b> NG 90657 37232	<b>End Grid Ref:</b> NG 90698 37266	<b>Elevation:</b> 10 mAOD
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### Rock Slope Characteristics:

Dip:	80	Azimuth:	322	Height (m):	20	Length (m):	39	Vegetation Cover:	0 to 60% cover comprising heather, grass and some sapling trees.	Ditch Details:	0.4m deep, 0.6-1m wide	Roughness (Profile):	Rough	Verge Width:	0-0.3m
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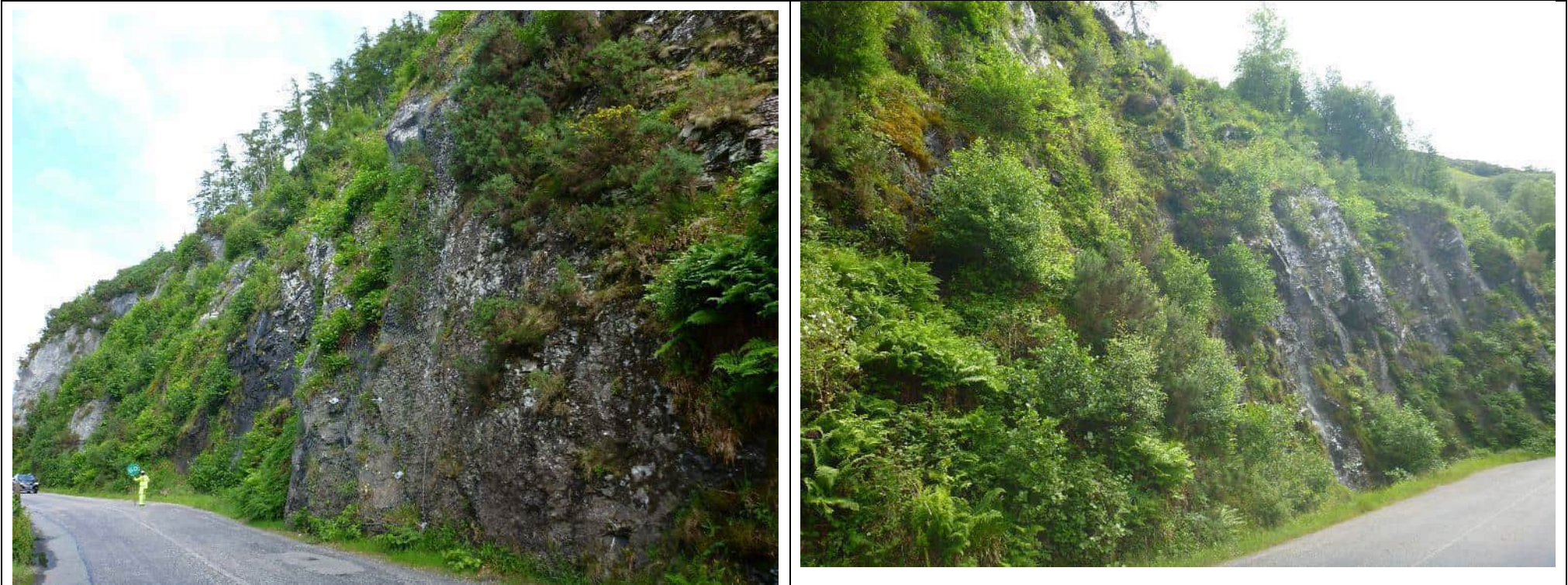
### Engineering Description of Rock:

Extremely strong thinly foliated dark grey and white SCHIST. Foliations comprise quartz. Approximately the same quantity of dark grey and white foliations. (PSAMMITE)

Existing Netting Details or other remedial work details:									
Netting Type	Top cable	Typical anchor spacing (m)	Anchor Type	Cable-Anchor connection	No. of cable clamps	Netting lap connections	Laps on anchors	Vertical Reinforcing	Notes
PVC coated double twist netting	16mm galvanised	5 – 6m but bottom anchors up to 11m apart	25mm stainless bars (2 No. platypus anchors)	Stainless eye nuts (M20 thread)	4 No.	2 staggered rows of spenax rings every aperture	No	None	No bimetallic corrosion protection between cable and eye nuts. Bottom cable corroded. Top cable secured with combination of direct anchors and corroded dropper cables attached to platypus anchors.
<b>Hazards Observed:</b>									
<b>Location</b>		<b>Comments</b>							
Ch. 2364		Previous wedge failure identified, comprising an overhanging column of rock ca. 6-8m above road level. Wedge of rock below has previously failed, possibly during construction but joints are tight and overhang. Not at imminent risk of failure.							
Ch. 2377		Overhang noted ca. 8m above road level at up chainage end of buttress. Overhang ca. 1m. Dilated fractures and potential for small blocks to free fall ca. 2-3m before impacting mesh. Maximum block size ca. 0.4m x 0.4m x 0.4m so likely to be retained by existing netting.							
Ch. 2386		Damaged intermediate bottom anchor (mesh caught and torn by grass cutter, pulling <1m long corroded anchor from face).							
<b>SUMMARY</b>				<b>Comments</b>					
Overall Hazard Rating =		2							
Pathway Rating =		2							
Receptor Rating =		1.4							
Risk Value =		4.8							
Risk Level =		Low							
<b>Recommended Remedial Works / Actions</b>									
<ul style="list-style-type: none"> <li>- Install bimetallic corrosion between galvanised cables and stainless steel eye nuts.</li> <li>- Replace bottom cable and install additional bottom anchors</li> <li>- Replace dropper cables and install additional anchors.</li> </ul>									
<b>Assessed in field by:</b>	PLM/JG	<b>Date:</b>	21/06/2022	<b>Reviewed by:</b>	Martha Taylor	<b>Date:</b>	06/09/2022		

**GEOTECHNICAL ASSESSMENT SHEET**

<b>Site:</b> A890 Stromeferry Bypass	<b>Slope Ref:</b> AA12	<b>Chainage:</b> 2399 - 2467	<b>Start Grid Ref:</b> NG 90698 37266	<b>End Grid Ref:</b> NG 90740 37326	<b>Elevation:</b> 20 mAOD
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**Rock Slope Characteristics:**

Dip: 80	Azimuth: 306	Height (m): 20	Length (m): 98	Vegetation Cover: 20-60% ground cover (gorse, heather, ferns) and small to medium trees.	Ditch Details: None in part, otherwise: 1.1m deep, 2.8m wide	Roughness (Profile): Rough	Verge Width: 0m
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**Engineering Description of Rock:**

Very strong dark to light grey very narrowly banded crystalline coarse to medium grained SCHIST.



Existing Netting Details or other remedial work details:							
7 No. dowels installed during Phase 8 (2015) works.							
Tecco netting system installed during Phase 9 (2017) works between Ch. 2411 and 2427. In good condition, no defects.							
Spider netting system installed during Phase 9 (2017) works at Ch. 2462. In good condition, no defects.							
Hazards Observed:							
Location		Comments					
NG 90790 37253		Large gully ca. 15m wide and 4m deep with watercourse above boundary between AA12/AA13. There is watercourse at risk of being washed out below.					
SUMMARY			Comments				
Overall Hazard Rating =	1						
Pathway Rating =	2		Pathway rating increased from 1 in 2019 following re-assessment.				
Receptor Rating =	1						
Risk Value =	2						
Risk Level =	Low						
Recommended Remedial Works / Actions							
- None.							
Assessed in field by:	PLM/JG	Date:	21/06/2022	Reviewed by:	Martha Taylor	Date:	06/09/2022

**GEOTECHNICAL ASSESSMENT SHEET**

<b>Site:</b> A890 Strome ferry Bypass	<b>Slope Ref:</b> AA13	<b>Chainage:</b> 2467- 2562	<b>Start Grid Ref:</b> NG 90740 37326	<b>End Grid Ref:</b> NG 90796 37399	<b>Elevation:</b> 12 mAOD
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**Rock Slope Characteristics:**

Dip: 70 to 80	Azimuth: 301	Height (m): 25 to 30	Length (m): 95	Vegetation Cover: 40-50% cover comprising a lot of gorse and saplings.	Ditch Details: Locally no ditch. Where present 0.5m deep, 1.5m wide. Bund half way along.	Roughness (Profile): Rough	Verge Width: 0-4m
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**Engineering Description of Rock:**

Very strong thickly foliated GNEISS with quartz rich bands

Existing Netting Details or other remedial work details:									
Netting Type	Top cable	Typical anchor spacing (m)	Anchor Type	Cable-Anchor connection	No. of cable clamps	Netting lap connections	Laps on anchors	Vertical Reinforcing	Notes
PVC coated double twist	12mm galvanised	5.5	25mm stainless steel bars	Stainless steel eye nuts	3	3 rows of spenax rings every third aperture.	No	8mm cable at 1m centres	Not all of the face netted. The following faults have been identified with the netting system: small scale puncturing of mesh; wide spacing of spenax rings joining vertical reinforcing cables; slack cables; and corroded cable clamps.
<ul style="list-style-type: none"> <li>- Coppicing of trees, light scaling, installation of dowel, cables and anchors, and, repairing of existing Macaferri drape netting system during Phase 9 (2017) works.</li> <li>- Netting has been torn by grass cutter at Ch. 2518 (observed during the 2022 annual inspection)</li> </ul>									
Hazards Observed:									
Location		Comments							
		No significant hazards observed.							
Ch. 2535		Overhanging area c.12 to 15m above toe with gaping mesh below. Potentially some dilated fractures around base of overhang. Large verge and ditch at toe mean low risk to road.							
Ch. 2560		Ongoing washing out of debris from gully.							
SUMMARY			Comments						
Overall Hazard Rating =		1							
Pathway Rating =		2	Pathway rating increased in 2019 following re-assessment.						
Receptor Rating =		1.2							
Risk Value =		2.4							
Risk Level =		Low							
Recommended Remedial Works / Actions									
<ul style="list-style-type: none"> <li>- Replace corroded cable clamps, re-tension and install additional spenax rings on vertical reinforcing cables between Ch. 2513 and 2528.</li> </ul>									
Assessed in field by:	PLM/JG	Date:	21/06/2022	Reviewed by:	Martha Taylor	Date:	06/09/2022		



**GEOTECHNICAL ASSESSMENT SHEET**

<b>Site:</b> A890 Stromeferry Bypass	<b>Slope Ref:</b> AA14E	<b>Chainage:</b> 2630 - 2664	<b>Start Grid Ref:</b> NG 90846 37438	<b>End Grid Ref:</b> NG 90871 37455	<b>Elevation:</b> 11 mAOD
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**Rock Slope Characteristics:**

Dip: 86	Azimuth: 347	Height (m): 30	Length (m): 33	Vegetation Cover: Rock slope ca. 10 – 20% cover. Some grass with occasional sapling and gorse at crest of rock slope.	Ditch Details: Width 1.0-1.2 Depth 0.8	Roughness (Profile): Rough	Verge Details: 0-0.8m at roadside 20m to toe of rock slope
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**Engineering Description of Rock:**

Strong thinly foliated dark grey fine to medium grained SCHIST. Contains occasional thin foliations of quartz. Some laminations were noted to be mica rich. (PSAMMITE)

**Existing Netting Details or other remedial work details:**

Mid-slope catch fence 1.5m high, posts at 6m centres (140mm diameter, 8mm thick steel tubes). Fence constructed from double twist netting with 16mm horizontal stainless steel reinforcing cables at 0.4m vertical spacing. No brake rings.

**Hazards Observed:**

Location	Comments
Crest of slope	Large overhang with dilated joints and potential for failures to exceed catch fence capacity/height.

**SUMMARY**

Overall Hazard Rating =	3	Comments
Pathway Rating =	3	
Receptor Rating =	1.4	
Risk Value =	<b>12.6</b>	
Risk Level =	<b>High</b>	

**Recommended Remedial Works / Actions**

- Install TECCO netting with face pattern bolts on upper half of slope with TECCO drape over lower half. Alternatively an appropriately designed catch fence could be considered;
- Accumulation of debris behind existing catch fence to be monitored during monthly and annual inspections and clearance works undertaken in the event of a failure.

<b>Assessed in field by:</b> PLM/JG	<b>Date:</b> 21/06/2022	<b>Reviewed by:</b> Martha Taylor	<b>Date:</b> 06/09/2022
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**GEOTECHNICAL ASSESSMENT SHEET**

<b>Site:</b> A890 Stromeferry Bypass	<b>Slope Ref:</b> AA14W	<b>Chainage:</b> 2562- 2630	<b>Start Grid Ref:</b> NG 90796 37399	<b>End Grid Ref:</b> NG 90846 37438	<b>Elevation:</b> 12 mAOD
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**Rock Slope Characteristics:**

Dip: 75	Azimuth: 324	Height (m): 15	Length (m): 85	Vegetation Cover: 100% on upper half of slope in places; c.10% on remaining slope. Predominantly comprising gorse bushes.	Ditch Details: Width 1.0 Depth 0.3	Roughness (Profile): Rough	Verge Details: 0.4m
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**Engineering Description of Rock:**

Extremely strong to very strong grey and pink medium banded crystalline coarse grained GNEISS.

Existing Netting Details or other remedial work details:									
Netting Type	Top cable	Typical anchor spacing (m)	Anchor Type	Cable-Anchor connection	No. of cable clamps	Netting lap connections	Laps on anchors	Vertical Reinforcing	Notes
PVC coated double twist	12mm galvanised	Up to 15m	Older 15mm bars and recently installed (2013) 25mm GEWI bars.	D shackle (connected with locking nuts on one side only) / Threaded eye nuts	3 / 4	2 rows of cable twist connections every fourth aperture	No	None	New top cable and anchors installed during Phase 7 works (2013). Present between Ch. 2566 and 2576 and Ch. 2622 and 2627.
Active Tecco netting system between Ch. 2576 and 2633. Installed during Phase 11 works (2019) to replace Maccaferri drape. In good condition. Minor defect of slightly corroded cut bar ends.									
Hazards Observed:									
Location	Comments								
SUMMARY			Comments						
Overall Hazard Rating =	2								
Pathway Rating =	1								
Receptor Rating =	N/A		Receptor rating only applicable when pathway rating is $\geq 2$ .						
Risk Value =	2		- Formerly very high risk. Re-assessed following Phase 11 works and hazard and pathway ratings reduced. - Re-assessed during the 2022 inspection following changes to receptor rating. Risk value reduced from 2.4.						
Risk Level =	Low								
Recommended Remedial Works / Actions									
None.									
Assessed in field by:	PLM/JG	Date:	21/06/2022	Reviewed by:	Martha Taylor	Date:	06/09/2022		

**GEOTECHNICAL ASSESSMENT SHEET**

<b>Site:</b> A890 Stromeferry Bypass	<b>Slope Ref:</b> AA15	<b>Chainage:</b> 2664- 2851	<b>Start Grid Ref:</b> NG 90871 37455	<b>End Grid Ref:</b> NG 91005 37551	<b>Elevation:</b> 18 mAOD
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**Rock Slope Characteristics:**

Dip: 75	Azimuth: 335	Height (m): 25 - 30	Length (m): 171	Vegetation Cover: 50-60% cover; up to 75% locally: a lot of saplings, gorse bushes and heather.	Ditch Details: Ch. 2690-2698: No Ditch Ch. 2695-2705: 2m wide, 0.3m deep Ch2705-2800: 2m wide, 0.5m deep.	Roughness (Profile): Rough	Verge Details: 0.5 – 2.0m
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**Engineering Description of Rock:**

Very strong thickly foliated dark GNEISS with pinkish quartz bands.

Existing Netting Details or other remedial work details:									
Netting Type	Top cable	Typical anchor spacing (m)	Anchor Type	Cable-Anchor connection	No. of cable clamps	Netting lap connections	Laps on anchors	Vertical Reinforcing	Notes
PVC coated double twist	12mm galvanised	4 – 7m at crest but only terminal anchors at toe	25mm? stainless bars and occasional platypus anchors (6mm stainless cable)	Stainless eye nuts (bar machined to M20 thread) and 150mm stainless faceplates	3	2 rows of spenax rings	No	8mm cable at 1m spacing (3 cable clamps)	- Passive netting extended during Phase 8 works (2015). Netting present between Ch. 2664 and 2783.
- Active high strength netting (SPIDER mesh) installed over potential failure at Ch.2680 during Phase 8 works (2015).									
Hazards Observed									
Location		Comments							
Ch. 2790		Root jacking recorded beyond end of netting approximately 10m above road level and may have associated hazards.							
Ch. 2807-2810		Numerous blocks in roadside ditch originating from failure ca. 4-5m above road level, the largest is 0.5 x 0.4 x 0.2m. Total failure volume of ca. 0.5-0.75m <sup>3</sup> . Root jacking is evident as the cause. Dilated fracture observed to left hand side of failure scar with the potential for similar size failures to occur in the future but the 2m wide x 0.3m deep ditch/verge should contain these failures. No remedial measures determined to be required.							
Netted Section		Vegetation (particularly gorse) becoming well established on rock slope obscuring rock mass and introducing potential for root jacking.							
SUMMARY			Comments						
Overall Hazard Rating =		3	Increased from 2 in 2021 to reflect increased root jacking risk,						
Pathway Rating =		2	Reduced from 3 in 2018 following re-assessment of potential for failures to reach road.						
Receptor Rating =		1.2							
Risk Value =		<b>7.2</b>							
Risk Level =		<b>Moderate</b>							
Recommended Remedial Works / Actions									
<ul style="list-style-type: none"> <li>- Coppice trees towards crest of slope outwith netting system and de-vegetate rock face within netting system;</li> <li>- Install additional top and bottom anchors (max. 5m spacing) and replace top cable.</li> </ul>									
Assessed in field by:		PLM/JG	Date:	21/06/2022	Reviewed by:	Martha Taylor	Date:	06/09/2022	

**GEOTECHNICAL ASSESSMENT SHEET**

<b>Site:</b> A890 Stromeferry Bypass	<b>Slope Ref:</b> AA16	<b>Chainage:</b> 2851- 2923	<b>Start Grid Ref:</b> NG 91005 37551	<b>End Grid Ref:</b> NG 91069 37601	<b>Elevation:</b> 18 mAOD
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**Rock Slope Characteristics:**

Dip: 60 – 75	Azimuth: 322	Height (m): 15 - 20m	Length (m): 72	Vegetation Cover: 60 to 70% cover. Generally comprised ground gorse, grass, etc.	Ditch Details: Only between Ch. 2890-2920. 2m wide, 1m deep.	Roughness (Profile): Rough	Verge Details: 1m
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**Engineering Description of Rock:**

Very strong thinly foliated dark grey schist. (PSAMMITE)

Existing Netting Details or other remedial work details:									
Netting Type	Top cable	Typical anchor spacing (m)	Anchor Type	Cable-Anchor connection	No. of cable clamps	Netting lap connections	Laps on anchors	Vertical Reinforcing	Notes
PVC coated double twist	16mm galvanised	4 - 5	25mm galvanized bars	Galvanised eye nuts	3	3 rows of galvanised spenax rings	No	None?	Netting present between Ch. 2872 and 2899. At each top anchor on the top cable an additional dowel is located approximately 2m above and connected to the main cable with a 16mm dropper cable.
<b>Hazards Observed:</b>									
<b>Location</b>		<b>Comments</b>							
Ch. 2888		Broken rock mass 5-10m above road level. Block size ~0.1m <sup>3</sup> but total potential volume (2-3m <sup>3</sup> ) may exceed netting capacity. Tree causing root jacking.							
Ch. 2910		Overhang noted at the crest of the slope, however, rope access inspection indicated generally keyed in with no obvious dilation of joints. Area to be kept under observation in future inspections for signs of deterioration.							
General		Vegetation well established.							
<b>SUMMARY</b>					<b>Comments</b>				
Overall Hazard Rating =		3		Increased form 2 in 2021 to reflect increased root jacking risk.					
Pathway Rating =		2							
Receptor Rating =		1							
Risk Value =		6							
Risk Level =		Moderate							
<b>Recommended Remedial Works / Actions</b>									
<ul style="list-style-type: none"> <li>- Coppice tree at Ch.2888</li> <li>- Vegetation clearance / tree coppicing across slope</li> <li>- Build-up of debris in ditch should be monitored during monthly and annual inspections and clearance works undertaken as required to maintain its capacity.</li> </ul>									
<b>Assessed in field by:</b>		PLM/JG		<b>Date:</b> 21/06/2022		<b>Reviewed by:</b> Martha Taylor		<b>Date:</b> 06/09/2022	



**GEOTECHNICAL ASSESSMENT SHEET**

<b>Site:</b> A890 Stromeferry Bypass	<b>Slope Ref:</b> AA17	<b>Chainage:</b> 2923- 2987	<b>Start Grid Ref:</b> NG 91069 37601	<b>End Grid Ref:</b> NG 91123 37630	<b>Elevation:</b> 11 mAOD
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**Rock Slope Characteristics:**

Dip: 80	Azimuth: 322	Height (m): 20	Length (m): 64	Vegetation Cover: 20% cover: moss, ferns, heather, gorse and saplings.	Ditch Details: No Ditch	Roughness (Profile): Rough	Verge Details: 1 – 3m
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**Engineering Description of Rock:**

Extremely strong to very strong dark grey narrowly banded crystalline medium grained GNEISS.

Existing Netting Details or other remedial work details:										
Netting Type	Top cable	Typical anchor spacing (m)	Anchor Type	Cable-Anchor connection	No. of cable clamps	Netting lap connections	Laps on anchors	Vertical Reinforcing	Notes	
PVC coated double twist	16-20mm galvanised	2.5m at crest but up to 12m at toe	25mm galvanized bars	None	2	Netting joined with cable twists and lacing wire, with additional Spenax rings installed in 2015	No	None but numerous lateral/diagonal reinforcing cables (note that many of the anchors for these appear corroded).	New top cable and anchors and additional spenax jointing installed during Phase 8 works (2015).  Bottom cable has some localised corrosion (first observed during the 2022 annual inspection)	
<b>Hazards Observed:</b>										
<b>Ref</b>		<b>Comments</b>								
Ch. 2933-2946		Large area of blast damaged rock mass with potential to exceed capacity of mesh in event of failure.								
Ch. 2965		Large wedge approximately 10m above road level, with smaller wedge above. Rope access inspection confirmed blocks are currently keyed in but condition should be monitored during future inspections.								
Ch. 2923-2935		Wide spacing of bottom anchors (up to 12m) with partially buried mesh and corroded eyelets observed.								
<b>SUMMARY</b>				<b>Comments</b>						
Overall Hazard Rating =		3								
Pathway Rating =		3								
Receptor Rating =		1.2								
Risk Value =		<b>10.8</b>								
Risk Level =		<b>High</b>								
<b>Recommended Remedial Works / Actions</b>										
<ul style="list-style-type: none"> <li>- Ch. 2933-2946: Open up Macafferri netting and carry out scaling before re-assessing. Netting to be reinstated on completion.</li> <li>- Replace corroded anchor points on reinforcing cables.</li> </ul>										
<b>Assessed in field by:</b>		PLM/JG		<b>Date:</b>		21/06/2022		<b>Reviewed by:</b>		<b>Date:</b>

**GEOTECHNICAL ASSESSMENT SHEET**

<b>Site:</b> A890 Stromeferry Bypass	<b>Slope Ref:</b> AA18	<b>Chainage:</b> 2987- 3059	<b>Start Grid Ref:</b> NG 91123 37630	<b>End Grid Ref:</b> NG 91186 37649	<b>Elevation:</b> 10 mAOD
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**Rock Slope Characteristics:**

Dip: 76	Azimuth: 346	Height (m): 15	Length (m): 72	Vegetation Cover: 10%-15% cover. Generally comprised grass, moss and heather	Ditch Details: No ditch	Roughness (Profile): Rough	Verge Details: 1.2m
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**Engineering Description of Rock:**

Extremely strong thinly foliated dark grey SCHIST. Contains occasional thin foliations of quartz.

**Existing Netting Details or other remedial work details:**

Maccaferri drape netting removed and replaced by active Tecco netting system in 2018 (Phase 10 works). De-vegetation and scaling also carried out at this time and a sprayed concrete buttress installed. Netting system in good condition but installation of incorrect spike plate / nut combination has not been resolved.

Ch.3032: Potential corrosion of netting mid-slope and bottom cable observed during the 2022 annual inspection. To be inspected at height in 2023.

**Hazards Observed:**

Location	Comments
	No significant hazards.
Ch.2995	Some loose blocks behind netting near crest. One block c.0.15m x 0.15m x 0.15m caught behind netting and pulling netting out slightly from slope.
Ch.3012	A few small blocks sitting on ledge of rock face c.7m from toe. Not straining or deforming mesh so removal not required.

**SUMMARY**

	Comments
Overall Hazard Rating =	1
Pathway Rating =	1
Receptor Rating =	N/A
Risk Value =	1
Risk Level =	Low

**Recommended Remedial Works / Actions**

- None

<b>Assessed in field by:</b> PLM/JG	<b>Date:</b> 21/06/2022	<b>Reviewed by:</b> Martha Taylor	<b>Date:</b> 06/09/2022
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**GEOTECHNICAL ASSESSMENT SHEET**

<b>Site:</b> A890 Stromeferry Bypass	<b>Slope Ref:</b> AA18/AA19	<b>Chainage:</b> 3059-3070	<b>Start Grid Ref:</b> NG 91186 37649	<b>End Grid Ref:</b> NG 91199 37660	<b>Elevation:</b> 10 mAOD
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**Rock Slope Characteristics:**

Dip: 76	Azimuth: 346	Height (m): 15	Length (m): 11	Vegetation Cover: 60% cover. Generally comprised grass.	Ditch Details: Bund: 2-3m wide, 0.5-1.5m high on road side; Ditch: 1-6m wide, 1.5-2m deep on slope side.	Roughness (Profile): Rough	Verge Details: 2-4m
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**Engineering Description of Rock:**

Strong thinly foliated dark grey SCHIST.

Existing Netting Details or other remedial work details:									
Netting Type	Top cable	Typical anchor spacing (m)	Anchor Type	Cable-Anchor connection	No. of cable clamps	Netting lap connections	Laps on anchors	Vertical Reinforcing	Notes
PVC coated Maccaferri double twist	16mm galvanised	2m top and bottom	25mm GEWI	Galvanised eye nuts	4 No.	3 rows Spenax rings	No	No	Installed as emergency works in 2014 following failure. Cable clamps on boundary ropes all noted as being corroded.
Hazards Observed:									
Location		Comments							
Ch.3052		No significant hazards. Slope continues to weather and ravel but debris retained by mesh. There is a rock 0.75m x 0.5m x 0.2m in the waterfall. Source not clear.							
SUMMARY			Comments						
Overall Hazard Rating =	1								
Pathway Rating =	1								
Receptor Rating =	N/A		Receptor rating only applicable when pathway rating is $\geq 2$ .						
Risk Value =	1								
Risk Level =	Low								
Recommended Remedial Works / Actions									
<ul style="list-style-type: none"> <li>- Replace corroded component of netting system (~80 clamps) with appropriate, suitably galvanised replacements</li> <li>- Debris from May 2021 rock fall from AA19 Upper to be cleared and catch ditch capacity to be improved.</li> </ul>									
Assessed in field by:	PLM/JG	Date:	21/06/2022	Reviewed by:	Martha Taylor	Date:	06/09/2022		

## GEOTECHNICAL ASSESSMENT SHEET

<b>Site:</b> A890 Stromeferry Bypass	<b>Slope Ref:</b> AA19	<b>Chainage:</b> 3070 – 3157	<b>Start Grid Ref:</b> NG 91199 37660	<b>End Grid Ref:</b> NG 91274 37698	<b>Elevation:</b> 10 mAOD
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### Rock Slope Characteristics:

Dip: 74	Azimuth: 341	Height (m): 25	Length (m): 87	Vegetation Cover: 10 to 20% cover. Grass, gorse, etc.	Ditch Details: Width 0.9m Depth 0.4m (clear with some standing water)	Roughness (Profile): Rough	Verge Details: 0m
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### Engineering Description of Rock:

Very strong thinly foliated dark grey fine to medium grained SCHIST. Contains occasional thin foliations of quartz. (PSAMMITE).

Existing Netting Details or other remedial work details:									
Netting Type	Top cable	Typical anchor spacing (m)	Anchor Type	Cable-Anchor connection	No. of cable clamps	Netting lap connections	Laps on anchors	Vertical Reinforcing	Notes
Tecco	12mm galvanised	2.5-3.5m	25/28mm solid galvanised and 32mm hollow bar galvanised	Eye nuts	4	T3 clips	No	Vertical and diagonal reinforcing/profiling cables (12mm galvanised)	Installed in 2012 as emergency works following failure. 37 No. dowels also installed at this time.
Some of the cable clamps on the bottom cable are showing early signs of corrosion. Otherwise netting is in good condition. (Observed during the 2022 annual inspection)									
Hazards Observed:									
Location		Comments							
		No significant hazards observed.							
Ch.3100		0.25m <sup>3</sup> failure retained by netting system 6-8m above road.							
SUMMARY			Comments						
Overall Hazard Rating =	2		Increased from 1 in 2018 following observed failure being retained by mesh.						
Pathway Rating =	1								
Receptor Rating =	N/A		Receptor rating only applicable when pathway rating is ≥2.						
Risk Value =	2								
Risk Level =	Low								
Recommended Remedial Works / Actions									
- None.									
Assessed in field by:	PLM/JG	Date:	22/06/2022	Reviewed by:	Martha Taylor	Date:	06/09/2022		



**GEOTECHNICAL ASSESSMENT SHEET**

<b>Site:</b> A890 Stromeferry Bypass	<b>Slope Ref:</b> AA20	<b>Chainage:</b> 3157-3215	<b>Start Grid Ref:</b> NG 91274 37698	<b>End Grid Ref:</b> NG 91322 37727	<b>Elevation:</b> 13 mAOD
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**Rock Slope Characteristics:**

<b>Dip:</b> 80 (rock slope)	<b>Azimuth:</b> 326	<b>Height (m):</b> 10m	<b>Length (m):</b> 58	<b>Vegetation Cover:</b> 80% ground cover, trees above 20m up the slope	<b>Ditch Details:</b> None	<b>Roughness (Profile):</b> Rough	<b>Verge Details:</b> 0-1.5m
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**Engineering Description of Rock:**

Lower slope adjacent to the road - very strong to strong dark grey mottled pink narrowly banded crystalline coarse grained GNEISS.

**Existing Netting Details or other remedial work details:**

- 4 No. rock dowels adjacent to the avalanche shelter. Bar approx. 20mm diameter, 150mm\*150mm face plate. Bar length etc. unknown
- Concrete and steel retaining wall/debris trap between Ch.3157 & Ch.3160, 3.4m high 33m long. 'I' beams noted to be corroded.
- Concrete block with 10No, ground anchors on upper slope, details unknown. Below this is temporary works that have been left in place and consist of a catch fence of Maccaferri double twist netting between 2 tall tree stumps supported by cable to nearby rock outcrop and a catch fence of railway sleepers between 2 tree stumps.
- Rock dowel (4m long, 25mm GEWI bar) installed during Phase 8 (2015) works.
- Ch. 3205 Rock dowel (originally a test anchor) installed during Phase 11 (2019) works.

**Hazards Observed:**

Location	Comments
Ch. 3175 (above retaining wall)	4m above road level several blocks are noted with dilated joints (0.1m <sup>3</sup> -0.5m <sup>3</sup> ). Although outcrop is set back from top of wall by 1.5m, the ground is sloping and blocks have potential to reach road.
Ch. 3185	In September 2021, a blocks rotated out during drilling of an anchor for the temporary catch fence installed during the Phase 12 works. The block came to rest on a flat area above the retaining wall and is not at risk of moving further down slope.
Ch. 3195	Root jacking observed. Potential for occasional small block fall. Limited verge width so may land on road.
Ch. 3205 (between wall and avalanche shelter)	Large wedge failure located approximately 1.5m above road level.
Ch.3200 to 3205 (between wall and avalanche shelter)	Ongoing ravelling occurring in this section with potential for small blocks to reach road as there is a narrow verge and no ditch.

SUMMARY	Comments
Overall Hazard Rating =	2
Pathway Rating =	3
Receptor Rating =	1.2
Risk Value =	<b>7.2</b>
Risk Level =	<b>Moderate</b>

**Recommended Remedial Works / Actions**

- Light scale and dowel blocks above retaining wall.
- Install passive rock netting system where ravelling and potential wedge failure poses a risk to road.

<b>Assessed in field by:</b> PLM/JG	<b>Date:</b> 22/06/2022	<b>Reviewed by:</b> Martha Taylor	<b>Date:</b> 06/09/2022
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**GEOTECHNICAL ASSESSMENT SHEET**

<b>Site:</b> A890 Stromeferry Bypass	<b>Slope Ref:</b> AA21	<b>Chainage:</b> 3280-3386	<b>Start Grid Ref:</b> NG 91381 37761	<b>End Grid Ref:</b> NG 91451 37842	<b>Elevation:</b> 18 mAOD
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**Rock Slope Characteristics:**

Dip: 75	Azimuth: 320	Height (m): 15	Length (m): 106	Vegetation Cover: c.10% cover: saplings and shrubs.	Ditch Details: Typically none, although 1m wide, 0.5m deep towards end of section	Roughness (Profile): Rough	Verge Details: 0.5m
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**Engineering Description of Rock:**

Very strong thinly foliated dark grey GNEISS with white quartz banding.

Existing Netting Details or other remedial work details:									
Netting Type	Top cable	Typical anchor spacing (m)	Anchor Type	Cable-Anchor connection	No. of cable clamps	Netting lap connections	Laps on anchors	Vertical Reinforcing	Notes
PVC coated double twist	16mm galvanised	5 – 5.5m	25mm? galvanized bars	Stainless steel eye nuts (bar machined to M20 thread)	4	2 rows of staggered spenax rings	Yes, every fourth anchor. 2 cable clamps on each side	8mm cable at 1m spacing (2 cable clamps)	Several faults noted within netting system, which is generally in poor condition -PVC coating is brittle and cracked in places, corrosion of wire noted. - lateral reinforcing cables are very slack with rare spenax jointing to netting. - cable clamps are corroded.
Scaling undertaken, with dowels installed in unstable blocks, at north-eastern end of section (outside netting) during Phase 8 works (2015). Additional bottom anchors were also installed within the netted area at this time.									
Hazards Observed:									
Location		Comments							
Ch. 3305		Large wedge at crest of rock slope (2m x 5m x 5-6m high). Rock mass blast damaged and dilated discontinuities present. Big gap between drape mesh and rockface would allow failure to gain energy and potentially exceed capacity of netting, impacting road below.							
Ch. 3310		Root jacking recorded approximately 3m above road level.							
Ch. 3322		Potential wedge failure approximately 5m above road level. Multiple blocks, total volume 1.5m <sup>3</sup> .							
Ch. 3363		Broken rock mass at crest with root jacking also an issue. Several blocks with potential to fail.							
Ch. 3350		Rock mass at crest with dilated release plane. Numerous dowels, but only in one block, and a cable present. Ca. 15m above road level. 3m x 2m x 1.5m.							
Ch. 3371		Some dilated fractures on face of rock slope in area of water flow; freeze-thaw could lead to deterioration of some blocks.							
SUMMARY			Comments						
Overall Hazard Rating =		3							
Pathway Rating =		3							
Receptor Rating =		1							
Risk Value =		9							
Risk Level =		Moderate							
Recommended Remedial Works / Actions									
<ul style="list-style-type: none"> <li>- Ch.3305: Open up drape mesh and install panel of active netting (e.g. TECCO) over wedge of blast damaged rock. Re-join drape on completion;</li> <li>- Ch.3322: install dowels in potential failure;</li> <li>- Coppice trees at Ch.3310 (3m above road level) and Ch.3366 (crest of slope). Light scale broken rock mass at Ch.3366;</li> <li>- Remove 3-4 cut logs trapped under top cable;</li> <li>- Ch. 3311 remove block from behind netting (3m below crest);</li> <li>- Replace corroded cable clamps, re-tension and re-attach reinforcing cables to drape netting.</li> </ul>									
Assessed in field by:	PLM/JG	Date:	22/06/2022	Reviewed by:	Martha Taylor	Date:	06/09/2022		

**GEOTECHNICAL ASSESSMENT SHEET**

<b>Site:</b> A890 Stromeferry Bypass	<b>Slope Ref:</b> AA22A	<b>Chainage:</b> 3386-3415	<b>Start Grid Ref:</b> NG 91451 37842	<b>End Grid Ref:</b> NG 91483 37882	<b>Elevation:</b> 17 mAOD
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**Rock Slope Characteristics:**

Dip: 75 - 80	Azimuth: 310	Height (m): 30	Length (m): 29	Vegetation Cover: c.60% cover comprising heather and saplings.	Ditch Details: Width 1.0m, Depth 0.3m	Roughness (Profile): Rough	Verge Details: 1m
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**Engineering Description of Rock:**

Very strong thinly to thickly foliated dark grey GNEISS with thin pink and white quartz bands.

Existing Netting Details or other remedial work details:									
Netting Type	Top cable	Typical anchor spacing (m)	Anchor Type	Cable-Anchor connection	No. of cable clamps	Netting lap connections	Laps on anchors	Vertical Reinforcing	Notes
PVC coated double twist	12mm galvanised	5.5 – 10.0	25mm? stainless bars and occasional old 18mm machine threaded bars	Stainless steel eye nuts (bar machined to M20 thread)	3	2 rows of cable twists every fourth aperture	No	8mm cable at 1m spacing (3 cable clamps) in some areas	Faults noted passive netting system including wide spacing of bottom anchors at 10m apart and bottom cable is corroded where there is water flow.
<ul style="list-style-type: none"> <li>- 11 No. dowels installed within two areas during Phase 8 works (2015)</li> <li>- Western terminal anchor at crest replaced during Phase 8 works (2015)</li> </ul>									
Developing Hazards Observed (Considered likely to fail with the next 5 years):									
Location		Comments							
Ch. 3390		Overhanging blocks noted within blast damaged area at crest (~8m wide, 1m deep, and 2-3m high). Large gap between mesh and rock slope at this location.							
Across section		Vegetation growth obscures areas of rock slope locally.							
SUMMARY		Comments							
Overall Hazard Rating =		3							
Pathway Rating =		2							
Receptor Rating =		1							
Risk Value =		6							
Risk Level =		Moderate							
Recommended Remedial Works / Actions									
<ul style="list-style-type: none"> <li>- Install dowels in blast damaged rock mass at Ch. 3390;</li> <li>- De-vegetation/coppicing to allow for inspection of obscured rock mass;</li> <li>- Install additional bottom anchors;</li> <li>- Clear out ditch between Ch. 3385 to 3412.</li> </ul>									
Assessed in field by:	PLM/JG	Date:	22/06/2022	Reviewed by:	Martha Taylor	Date:	06/09/2022		

**GEOTECHNICAL ASSESSMENT SHEET**

<b>Site:</b> A890 Stromeferry Bypass	<b>Slope Ref:</b> AA22B	<b>Chainage:</b> 3415-3592	<b>Start Grid Ref:</b> NG 91483 37882	<b>End Grid Ref:</b> NG 91561 38016	<b>Elevation:</b> 11 mAOD
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**Rock Slope Characteristics:**

Dip:	85	Azimuth:	296	Height (m):	20	Length (m):	177	Vegetation Cover:	20% on main cutting face; 60% on upper third of slope. Comprising of heather and saplings.	Ditch Details:	None but Armco barrier creates rock trap.	Roughness (Profile):	Rough	Verge Details:	Ch. 3415-3445 1.5m verge. 1m verge from 3445 (start of Armco)
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**Engineering Description of Rock:**

Extremely strong dark grey and white irregular narrow banding crystalline coarse grained GNEISS. Particularly massive along this section of road.

Existing Netting Details or other remedial work details:										
Chainage	Netting Type	Top cable	Typical anchor spacing (m)	Anchor Type	Cable-Anchor connection	No. of cable clamps	Netting lap connections	Laps on anchors	Vertical Reinforcing	Notes
3415–3542	PVC coated double twist	8 mm galvanised, later reinforced with a 12mm galvanised cable connected with cable clamps every 1 – 2m	5.5	25mm? stainless bars and occasional old 18mm machine threaded bars	Stainless eye nuts(bar machines to M20 thread)	3	2 rows of cable twists ever fourth aperture	No	8 mm cable at 1m spacing (3 cable clamps) in some areas	Netting systems noted to be in poor condition: PVC coating cracked and brittle; limited number of bottom anchors; reinforcing cables slack, poorly attached and with corroded clamps; bottom cable corroded.
3543 – 3497 and Ch. 3515 – 3567	PVC coated double twist	12mm galvanised	8	18mm machine threaded bars	D shackle (connected with locking nuts on one side only)	2	2 rows of cable twists every fourth aperture	No	None	

Phase 11 works (2019):

- Heavy scaling of overhanging rock mass at Ch. 3465;
- Replacement of Maccaferri drape netting with active Tecco netting system between Ch. 3497 and 3515.

Cut end of bars as part of the Tecco netting system are corroded (observed in the 2022 annual inspection).

**Developing Hazards Observed (Considered likely to fail with the next 5 years):**

Location	Comments
Ch.3425	Failure in 2021 originating c.6m above road level where blocks (c.0.25m <sup>3</sup> ) have slid along a steep release plane and have come to rest at toe of slope behind netting. Water seepage in the area gives potential for further rock fall. It is likely that this would be a volume of c.0.4m <sup>3</sup> and a maximum block size of c.0.3m x 0.3m x 0.3m.
Ch. 3454	Block (c.0.3m x 0.2mx 0.2m) positioned approx. 2m above ground level is being held by netting. Has fallen 5m to current position.
Ch.3475	Overhanging fractured rock mass ~15m above road level. No dilated joints at present. Minor rockfall from base of overhang observed in May 2021. Keep under observation.
Ch.3530	Possible detached block behind netting c.1m below crest. Some dilated fractures in the area are noted.

**SUMMARY**

	Comments
Overall Hazard Rating =	3
Pathway Rating =	2
Receptor Rating =	1
Risk Value =	6
Risk Level =	Moderate
	Re-assessed following completion of Phase 11 works and risk level reduced from high.

**Recommended Remedial Works / Actions**

- Replace corroded bottom anchors and install additional anchors to achieve maximum spacing of 5m;
- Replace bottom cable between Ch. 3462 and Ch. 3519;
- Replace corroded cable clamps on lateral and vertical reinforcing cables. Re-tensioning and installation of additional spenax rings should also be carried out.
- Rope access inspection required at Ch.3530 to determine if there is a detached block behind netting.
- Apply anti-corrosion paint on cut end bars as part of the TECCO netting system to prevent further corrosion.

Assessed in field by:	PLM/JG	Date:	22/06/2022	Reviewed by:	Martha Taylor	Date:	06/09/2022
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**GEOTECHNICAL ASSESSMENT SHEET**

<b>Site:</b> A890 Stromeferry Bypass	<b>Slope Ref:</b> AA23N	<b>Chainage:</b> 3640-3690	<b>Start Grid Ref:</b> NG 91589 38050	<b>End Grid Ref:</b> NG 91626 38084	<b>Elevation:</b> 26 mAOD
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Rock Slope Characteristics:															
Dip:	60	Azimuth:	230	Height (m):	6	Length (m):	50	Vegetation Cover:	c.50% cover: predominantly gorse	Ditch Details:	1m wide, 0.2m deep	Roughness (Profile):	Rough	Verge Details:	0.5m

**Engineering Description of Rock:**  
 Very strong very thinly banded grey and white GNEISS.

**Existing Netting Details or other remedial work details:**  
 No remedial installations.

Hazards Observed:			
Location		Comments	
Northern end of slope		Localised root jacking (see photos above), however, small blocks will be retained by ditch.	
Ch. 3669		Block fall c.0.4m x 0.4m x 0.3m has landed in the ditch. Block originated c.2m up rock slope. (Observed during the 2022 annual inspection)	
SUMMARY		Comments	
Overall Hazard Rating =	1		
Pathway Rating =	2		
Receptor Rating =	1.2		
Risk Value =	<b>2.4</b>		
Risk Level =	<b>Low</b>		
Recommended Remedial Works / Actions			
<ul style="list-style-type: none"> <li>- Build-up of debris within ditch should be monitored and clearance works undertaken as required to maintain its capacity.</li> </ul>			
Assessed in field by:	PLM/JG	Date:	22/06/2022
		Reviewed by:	Martha Taylor
		Date:	06/09/2022

**GEOTECHNICAL ASSESSMENT SHEET**

<b>Site:</b> A890 Stromeferry Bypass	<b>Slope Ref:</b> AA23S	<b>Chainage:</b> 3630-3708	<b>Start Grid Ref:</b> NG 91586 38039	<b>End Grid Ref:</b> NG 91643 38087	<b>Elevation:</b> 23 mAOD
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**Rock Slope Characteristics:**

Dip:	70	Azimuth:	324	Height (m):	8	Length (m):	78	Vegetation Cover:	30-40% cover. Grass, gorse, saplings.	Ditch Details:	Width 1.0m Depth 0.5m	Roughness (Profile):	Rough	Verge Details:	1m
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**Engineering Description of Rock:**

Extremely strong very thinly banded grey and white GNEISS.

**Existing Netting Details or other remedial work details:**

No remedial installations.

Hazards Observed:			
Location	Comments		
Ch. 3665-3687	Rock mass is very broken with potential for small blocks to fail due to raveling / root jacking.		
Ch. 3671	In October 2021, there was a block fall of approx. size 0.25m <sup>3</sup> . It originated c.7m above the toe of slope. It split into several pieces on landing in the ditch. The debris was cleared during the Phase 12 works.		
Ch. 3680	Boulders and cobbles weathering out of exposed soil slope and landing in ditch below.		
Whole section	Presence of trees immediately above rock face may lead to root jacking / failures associated with uprooted trees.		
SUMMARY		Comments	
Overall Hazard Rating =	2		
Pathway Rating =	3		
Receptor Rating =	1.2		
Risk Value =	<b>7.2</b>		
Risk Level =	<b>Low</b>		
Recommended Remedial Works / Actions			
<ul style="list-style-type: none"> <li>- Install fence/barrier on verge between Ch. 3665-3687. If not possible, netting should be considered for this section.</li> <li>- De-vegetate and light scale rock face.</li> <li>- Coppice trees within 5m of crest of slope.</li> <li>- Build-up of debris in ditch should be monitored and clearance works undertaken as required to maintain its capacity.</li> </ul>			
<b>Assessed in field by:</b>	PLM/JG	<b>Date:</b>	22/06/2022
		<b>Reviewed by:</b>	Martha Taylor
		<b>Date:</b>	06/09/2022

**GEOTECHNICAL ASSESSMENT SHEET**

<b>Site:</b> A890 Stromeferry Bypass	<b>Slope Ref:</b> AA24	<b>Chainage:</b> 3708-3892	<b>Start Grid Ref:</b> NG 91643 38087	<b>End Grid Ref:</b> NG 91807 38166	<b>Elevation:</b> 32 mAOD
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**Rock Slope Characteristics:**

Dip:	80	Azimuth:	340	Height (m):	12	Length (m):	18 4	Vegetation Cover:	30% cover over highest rock slope, increasing to 80% cover towards N of section. Generally comprised grass, ferns and gorse.	Ditch Details:	Typical width 0.5m, depth 0.3m From Ch.3790 2m wide, 0.6m deep.	Roughness (Profile):	Rough	Verge Details:	Typically 0.5m. From Ch.3790 1.5m
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Engineering Description of Rock:									
Very strong very thinly banded grey and white GNEISS with occasional quartz foliation.									
Existing Netting Details or other remedial work details:									
Netting Type	Top cable	Typical anchor spacing (m)	Anchor Type	Cable-Anchor connection	No. of cable clamps	Netting lap connections	Laps on anchors	Vertical Reinforcing	Notes
PVC coated double twist	8mm galvanised	5m	18mm machine threaded bars (top anchors visibly corroded)	D shackle (connected on one side only)	3	Cable twists	No	None	Netting only present across highest area of the rock slope.
- Chainlink netting is locally present on slope above Maccaferri netting and is broken in places.									
Hazards Observed:									
Location	Comments								
Ch.3740 to 3745	Several blocks with dilated fractures and / or root jacking potential have been identified that are likely to fail in the future but should be contained by the Maccaferri netting.								
Ch. 3748	Small accumulation of debris at toe of slope behind netting c.1m x 0.4m x 0.2m. Source c.4m above toe. Material not loading net. Keep under observation.								
Ch. 3783 - 3792	Exposed soil slope 4m above road level with boulders in back scar of previous failure which could weather out and reach road. Slumping is also noted upslope from back scar.								
Ch. 3762-3800	Trees at crest of slope could cause block fall associated with root jacking/ uprooted trees.								
Ch. 3783 to 3892	Potential for ravelling of small blocks, however, ditch below sufficiently wide/deep to retain.								
Ch. 3870	Potential planar failure 3m above road. Small tabular blocks likely to be contained by ditch below.								
SUMMARY		Comments							
Overall Hazard Rating =	3								
Pathway Rating =	2								
Receptor Rating =	1.2								
Risk Value =	7.2								
Risk Level =	Moderate								
Recommended Remedial Works / Actions									
<ul style="list-style-type: none"> <li>- Ch. 3783: Re-profile vertical soil slope and install erosion control matting;</li> <li>- Ch. 3762-3800: Coppice trees within 5m of crest of rock slope;</li> <li>- Build-up of debris within ditch should be monitored and clearance works undertaken as required to maintain its capacity.</li> </ul>									
Assessed in field by:	PLM/JG	Date:	22/06/2022	Reviewed by:	Martha Taylor	Date:	06/09/2022		

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