Stirling-Alloa-Kincardine Railway (Route Re-opening) and Linked Improvements (Scotland) Bill

ENVIRONMENTAL STATEMENT

VOLUME 3

SUPPORTING INFORMATION

FEBRUARY 2003

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CLACKMANNANSHIRE COUNCIL

STIRLING - ALLOA - KINCARDINE RAILWAY (ROUTE RE-OPENING) AND LINKED IMPROVEMENTS (SCOTLAND) BILL

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Scott Wilson (Scotland) Ltd
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1. INTRODUCTION

1.1 Background

This document relates to the Stirling–Alloa–Kincardine Railway (Route Re-opening) and Linked Improvements (Scotland) Bill introduced in the Scottish Parliament on 27 March 2003 (to be confirmed). It has been prepared by Scott Wilson Scotland Limited on behalf of Clackmannanshire Council to satisfy Rule 9A.2.3(c)(iii) of the Parliament's Standing Orders. The contents are entirely the responsibility of the promoter and have not been endorsed by the Parliament.

1.2 Purpose and Structure of Volume 3

This document is Volume 3 (Supporting Information) of the Environmental Statement, which contains supporting information for a number of the specialist topics in Volume 2, references and a glossary of terms and abbreviations used. Volume 1 (Main Report) presents the Scheme proposals and provides a summary of the significant environmental effects. Volume 2 (Topic Specific Reports) presents the findings of the environmental studies undertaken for each topic. In addition, a separate Non-Technical Summary has also been prepared, which provides a brief summary of the Scheme and the principal findings of the environmental assessment in non-technical language.

This document provides supporting information for the following specialist topics included in Volume 2:

- Cultural Heritage
- Air Quality
- Landscape and Visual Effects
- Ecology
- Noise and Vibration
- Water Resources

1.3 Reference Sources

Appendix 1A of this chapter is a list of environmental and planning legislation, guidelines, standards and best practice that has been taken into account in the environmental assessment of the Scheme.

1.4 Consultation

Copies of the consultation bodies letters and responses received are given in Appendix 1B of this chapter.

1.5 Glossary and Abbreviations

A glossary of the main terms and an explanation of the key abbreviations used in this Environmental Statement is given in Appendix 1C of this chapter.

APPENDIX 1A: INFORMATION SOURCES

- 2nd Stage Review & Assessment, Fife Council, January 2001
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APPENDIX 1B: CONSULTATION BODIES LETTERS AND RESPONSES

e01 – Scottish Natural Heritage

e02 – Historic Scotland

e03 – PlanningDept, Clackmannanshire Council

e04 – PlanningDept, Stirling Council

e05 – PlanningDept, Falkirk Council

e06 – Scottish Water

e07 – Scottish Environment Protection Agency

e08 – Scottish Executive Development Department

e09 – Health and Safety Executive

e10 – PlanningDept, Fife Council

e11 – Scottish Natural Heritage

e26 – Scottish Natural Heritage

e27 - Historic Scotland

e28 – PlanningDept, Clackmannanshire Council

e29 – Health and Safety Executive

e30 – Scottish Executive Development Department

e31 – Scottish Water

e32 – Scottish Environment Protection Agency

Area Manager (Argyll and Stirling),
Scottish Natural Heritage
The Beta Centre
Innovation Park
University of Stirling
Stirling FK9 4NF

B109401ENV1/e01

2 July 2002

Dear Sir,

Stirling-Alloa-Kincardine Route Re-opening

You may be aware that Scott Wilson has been appointed by Clackmannanshire Council to prepare a preliminary design and a Parliamentary submission to re-open the Stirling-Alloa-Kincardine Railway. As part of this work, Scott Wilson is required to undertake an environmental impact assessment leading to the preparation of an Environmental Statement (ES) to support the Parliamentary submission. The Stirling-Alloa-Kincardine Railway route lies within the Clackmannnanshire Council, Fife Council and Stirling Council areas. The re-opening would involve the upgrading the existing railway route between Stirling Station and Longannet Power Station. The section of the route from Stirling to Alloa would be re-opened to passenger and freight trains, with a freight only connection through to Kincardine and on to Longannet Power Station.

At this stage you will also be aware of the Scottish Transport Appraisal Guidance (STAG) Part 1 and Part 2 appraisals which were prepared in support of the Stirling-Alloa-Kincardine Rail Line Reopening Benefit Study, February 2002 prepared by MVA which included an environmental appraisal of the re-opening options. For your information, we have attached an extract of this study comprising Chapter 9: Environmental Appraisal (P. 47-79, Appendix E AST Tables Part 1/Part 1a/1b/Part 2). You should note that Option E is the scheme that is now being developed.

The environmental impact assessment would be prepared in accordance with the Environmental Impact Assessment (Scotland) Regulations 1999 and the intention would be to submit the ES in support of the submission to the Scottish Parliament to promote a Scottish Private Bill to enable the railway line to be re-opened.

It is important that the relevant environmental issues are taken into account in assessing the environmental implications of re-opening the railway. We are therefore trying to collate the relevant data in an effort to identify and assess the likely environmental impacts of the re-opening, and any potential mitigation measures that may be required.

We are therefore writing to you as a statutory consultee

- To identify any information you may hold which would be relevant
- To identify any concerns that you may have about the re-opening
- To identify any issues that you would like to see included in the Environmental Statement at this stage

We would be particularly interested to hear of any existing or proposed statutory designations, the landscape character of the area, details of your woodland inventory and protected species or other natural heritage issues that may affect the scheme. We would also be pleased if you could advise of any other parties or organisations who may hold relevant information. In addition, you should note that we will be undertaking a Phase 1 survey of the study area. A plan is enclosed to show the route of the railway to be re-opened (see attached Babtie Drawing No. BTR202443/G/01). For your information, a similar letter to this one has also been sent to the SNH Forth and Borders area office at Dalkeith to seek information from the Area Manager.

It is hoped to submit the Environmental Statement by the end of October, 2002 in support of the Parliamentary submission, and for this reason it would be helpful if all comments could be received as soon as possible but by no later than Friday 26 July 2002. If you wish to discuss the proposals further, or seek clarification about the information requested, please do not hesitate to contact us. It would be helpful if you could direct enquiries to the consultants who are assisting Clackmannanshire Council in preparation of the necessary documents, either Fraser Maxwell or Nigel Hackett of Scott Wilson on 0131 225 1230.

Yours faithfully

Nigel Hackett

Encl.

cc Alex Deans, Transportation, Clackmannanshire Council
Tara Whitworth, Project Manager, Babties
Gail Jeffrey, Scott Wilson Railways, Glasgow

Historic Scotland
Longmore House
Salisbury Place
Edinburgh
EH9 1SH

B109401ENV1/eo2

2 July 2002

Dear Sir,

Stirling-Alloa-Kincardine Route Re-opening

You may be aware that Scott Wilson has been appointed by Clackmannanshire Council to prepare a preliminary design and a Parliamentary submission to re-open the Stirling-Alloa-Kincardine Railway. As part of this work, Scott Wilson is required to undertake an environmental impact assessment leading to the preparation of an Environmental Statement (ES) to support the Parliamentary submission. The Stirling-Alloa-Kincardine Railway route lies within the Clackmannnanshire Council, Fife Council and Stirling Council areas. The re-opening would involve the upgrading the existing railway route between Stirling Station and Longannet Power Station. The section of the route from Stirling to Alloa would be re-opened to passenger and freight trains, with a freight only connection through to Kincardine and on to Longannet Power Station.

At this stage you will also be aware of the Scottish Transport Appraisal Guidance (STAG) Part 1 and Part 2 appraisals which were prepared in support of the Stirling-Alloa-Kincardine Rail Line Reopening Benefit Study, February 2002 prepared by MVA which included an environmental appraisal of the re-opening options. For your information, we have attached an extract of this study comprising Chapter 9: Environmental Appraisal (P. 47-79, Appendix E AST Tables Part 1/Part 1a/1b/Part 2). You should note that Option E is the scheme that is now being developed.

The environmental impact assessment would be prepared in accordance with the Environmental Impact Assessment (Scotland) Regulations 1999 and the intention would be to submit the ES in support of the submission to the Scottish Parliament to promote a Scottish Private Bill to enable the railway line to be re-opened.

It is important that the relevant environmental issues are taken into account in assessing the environmental implications of re-opening the railway. We are therefore trying to collate the relevant data in an effort to identify and assess the likely environmental impacts of the re-opening, and any potential mitigation measures that may be required.

We are therefore writing to you as a statutory consultee

- To identify any information you may hold which would be relevant
- To identify any concerns that you may have about the re-opening
- To identify any issues that you would like to see included in the Environmental Statement at this stage

We would be particularly interested to hear of any known scheduled ancient monuments, monuments on the non-statutory list, or listed buildings that may be found in the area. A plan is enclosed to show the route of the railway to be re-opened (see attached Babtie Drawing No. BTR202443/G/01). We would also be grateful if you could make sure that this letter is copied to your Ancient Monuments Inspectorate (for Scheduled Ancient Monuments) and the Architectural Section (for Listed Buildings) within Historic Scotland.

It is hoped to submit the Environmental Statement by the end of October, 2002 in support of the Parliamentary submission, and for this reason it would be helpful if all comments could be received as soon as possible but by no later than Friday 26 July 2002. If you wish to discuss the proposals further, or seek clarification about the information requested, please do not hesitate to contact us. It would be helpful if you could direct enquiries to the consultants who are assisting Clackmannanshire Council in preparation of the necessary documents, either Fraser Maxwell or Nigel Hackett of Scott Wilson on 0131 225 1230.

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Nigel Hackett

Encl.

cc Alex Deans, Transportation, Clackmannanshire Council
Tara Whitworth, Project Manager, Babties
Gail Jeffrey, Scott Wilson Railways, Glasgow

Development and Environmental Services
Clackmannanshire Council
Greenfield B109401ENV1/e03
Alloa
FK10 2AD 2 July 2002

Dear Sirs,

Stirling-Alloa-Kincardine Route Re-opening

You will be aware that Scott Wilson has been appointed by Clackmannanshire Council to prepare a preliminary design and a Parliamentary submission to re-open the Stirling-Alloa-Kincardine Railway. As part of this work, Scott Wilson is required to undertake an environmental impact assessment leading to the preparation of an Environmental Statement (ES) to support the Parliamentary submission. The Stirling-Alloa-Kincardine Railway route lies within the Clackmannnanshire Council, Fife Council and Stirling Council areas. The re-opening would involve the upgrading the existing railway route between Stirling Station and Longannet Power Station. The section of the route from Stirling to Alloa would be re-opened to passenger and freight trains, with a freight only connection through to Kincardine and on to Longannet Power Station.

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The environmental impact assessment would be prepared in accordance with the Environmental Impact Assessment (Scotland) Regulations 1999 and the intention would be to submit the ES in support of the submission to the Scottish Parliament to promote a Scottish Private Bill to enable the railway line to be re-opened.

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We would be particularly interested to hear of any land use or planning proposals or issues that may affect the scheme. A plan is enclosed to show the route of the railway to be re-opened (see attached Babtie Drawing No. BTR202443/G/01). We would also be grateful if you could make sure that this letter is copied to other relevant sections within Clackmannashire Council including those with an interest in biodiversity and archaeology.

It is hoped to submit the Environmental Statement by the end of October, 2002 in support of the Parliamentary submission, and for this reason it would be helpful if all comments could be received as soon as possible but by no later than Friday 26 July 2002. If you wish to discuss the proposals further, or seek clarification about the information requested, please do not hesitate to contact us. It would be helpful if you could direct enquiries to the consultants who are assisting Clackmannanshire Council in preparation of the necessary documents, either Fraser Maxwell or Nigel Hackett of Scott Wilson on 0131 225 1230.

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Tara Whitworth, Project Manager, Babties
Gail Jeffrey, Scott Wilson Railways, Glasgow

Director of Environmental Services
Stirling Council
Viewforth
Stirling
FK8 2ET

B109401ENV1/e04

2 July 2002

Dear Sirs,

Stirling-Alloa-Kincardine Route Re-opening

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It is hoped to submit the Environmental Statement by the end of October, 2002 in support of the Parliamentary submission, and for this reason it would be helpful if all comments could be received as soon as possible but by no later than Friday 26 July 2002. If you wish to discuss the proposals further, or seek clarification about the information requested, please do not hesitate to contact us. It would be helpful if you could direct enquiries to the consultants who are assisting Clackmannanshire Council in preparation of the necessary documents, either Fraser Maxwell or Nigel Hackett of Scott Wilson on 0131 225 1230.

Yours faithfully

Nigel Hackett

Encl.

cc Alex Deans, Transportation, Clackmannanshire Council
Tara Whitworth, Project Manager, Babties
Gail Jeffrey, Scott Wilson Railways, Glasgow

Development Services
Falkirk Council
Abbotsford House
David's Loan
Bainsford,
Falkirk
FK3 4HQ

B109401ENV1/e05

2 July 2002

Dear Sirs,

Stirling-Alloa-Kincardine Route Re-opening

As an adjoining planning authority where development is likely to affect your area, you will be aware that Scott Wilson has been appointed by Clackmannanshire Council to prepare a preliminary design and a Parliamentary submission to re-open the Stirling-Alloa-Kincardine Railway. As part of this work, Scott Wilson is required to undertake an environmental impact assessment leading to the preparation of an Environmental Statement (ES) to support the Parliamentary submission. The Stirling-Alloa-Kincardine Railway route lies within the Clackmannnanshire Council, Fife Council and Stirling Council areas. The re-opening would involve the upgrading the existing railway route between Stirling Station and Longannet Power Station. The section of the route from Stirling to Alloa would be re-opened to passenger and freight trains, with a freight only connection through to Kincardine and on to Longannet Power Station.

At this stage you will also be aware of the Scottish Transport Appraisal Guidance (STAG) Part 1 and Part 2 appraisals which were prepared in support of the Stirling-Alloa-Kincardine Rail Line Reopening Benefit Study, February 2002 prepared by MVA which included an environmental appraisal of the re-opening options. For your information, we have attached an extract of this study comprising Chapter 9: Environmental Appraisal (P. 47-79, Appendix E AST Tables Part 1/Part 1a/1b/Part 2). You should note that Option E is the scheme that is now being developed.

The environmental impact assessment would be prepared in accordance with the Environmental Impact Assessment (Scotland) Regulations 1999 and the intention would be to submit the ES in support of the submission to the Scottish Parliament to promote a Scottish Private Bill to enable the railway line to be re-opened.

It is important that the relevant environmental issues are taken into account in assessing the environmental implications of re-opening the railway. We are therefore trying to collate the relevant data in an effort to identify and assess the likely environmental impacts of the re-opening, and any potential mitigation measures that may be required.

We are therefore writing to you as a statutory consultee

- To identify any information you may hold which would be relevant
- To identify any concerns that you may have about the re-opening
- To identify any issues that you would like to see included in the Environmental Statement at this stage

We would be particularly interested to hear of any land use or planning proposals or issues that may affect the scheme. A plan is enclosed to show the route of the railway to be re-opened (see attached Babtie Drawing No. BTR202443/G/01). We would also be grateful if you could make sure that this letter is copied to other relevant sections within Falkirk Council including those with an interest in biodiversity and archaeology.

It is hoped to submit the Environmental Statement by the end of October, 2002 in support of the Parliamentary submission, and for this reason it would be helpful if all comments could be received as soon as possible but by no later than Friday 26 July 2002. If you wish to discuss the proposals further, or seek clarification about the information requested, please do not hesitate to contact us. It would be helpful if you could direct enquiries to the consultants who are assisting Clackmannanshire Council in preparation of the necessary documents, either Fraser Maxwell or Nigel Hackett of Scott Wilson on 0131 225 1230.

Yours faithfully

Nigel Hackett

Encl.

cc Alex Deans, Transportation, Clackmannanshire Council
Tara Whitworth, Project Manager, Babties
Gail Jeffrey, Scott Wilson Railways, Glasgow

Scottish Water
Woodlands
St Ninians Road
STIRLING
FK8 2HB

B109401ENV1/e06

2 July 2002

Attention : Mr Douglas Cooper

Dear Sirs,

Stirling-Alloa-Kincardine Route Re-opening

You may be aware that Scott Wilson has been appointed by Clackmannanshire Council to prepare a preliminary design and a Parliamentary submission to re-open the Stirling-Alloa-Kincardine Railway. As part of this work, Scott Wilson is required to undertake an environmental impact assessment leading to the preparation of an Environmental Statement (ES) to support the Parliamentary submission. The Stirling-Alloa-Kincardine Railway route lies within the Clackmannnanshire Council, Fife Council and Stirling Council areas. The re-opening would involve the upgrading the existing railway route between Stirling Station and Longannet Power Station. The section of the route from Stirling to Alloa would be re-opened to passenger and freight trains, with a freight only connection through to Kincardine and on to Longannet Power Station.

At this stage you will also be aware of the Scottish Transport Appraisal Guidance (STAG) Part 1 and Part 2 appraisals which were prepared in support of the Stirling-Alloa-Kincardine Rail Line Reopening Benefit Study, February 2002 prepared by MVA which included an environmental appraisal of the re-opening options. For your information, we have attached an extract of this study comprising Chapter 9: Environmental Appraisal (P. 47-79, Appendix E AST Tables Part 1/Part 1a/1b/Part 2). You should note that Option E is the scheme that is now being developed.

The environmental impact assessment would be prepared in accordance with the Environmental Impact Assessment (Scotland) Regulations 1999 and the intention would be to submit the ES in support of the submission to the Scottish Parliament to promote a Scottish Private Bill to enable the railway line to be re-opened.

It is important that the relevant environmental issues are taken into account in assessing the environmental implications of re-opening the railway. We are therefore trying to collate the relevant data in an effort to identify and assess the likely environmental impacts of the re-opening, and any potential mitigation measures that may be required.

We are therefore writing to you as a statutory consultee

- To identify any information you may hold which would be relevant
- To identify any concerns that you may have about the re-opening
- To identify any issues that you would like to see included in the Environmental Statement at this stage

We would be particularly interested to hear if this proposal would interfere with any existing water and sewerage functions. A plan is enclosed to show the route of the railway to be re-opened (see attached Babtie Drawing No. BTR202443/G/01).

It is hoped to submit the Environmental Statement by the end of October, 2002 in support of the Parliamentary submission, and for this reason it would be helpful if all comments could be received as soon as possible but by no later than Friday 26 July 2002. If you wish to discuss the proposals further, or seek clarification about the information requested, please do not hesitate to contact us. It would be helpful if you could direct enquiries to the consultants who are assisting Clackmannanshire Council in preparation of the necessary documents, either Fraser Maxwell or Nigel Hackett of Scott Wilson on 0131 225 1230.

Yours faithfully

Nigel Hackett

Encl.

cc Alex Deans, Transportation, Clackmannanshire Council
Tara Whitworth, Project Manager, Babties
Gail Jeffrey, Scott Wilson Railways, Glasgow

Scottish Environment Protection Agency
Erskine Court
The Castle Business Park
Stirling
FK9 4TX

B109401ENV1/e07

2 July 2002

Attention : Mr Francis Hayes, Environment Protection Officer

Dear Sirs,

Stirling-Alloa-Kincardine Route Re-opening

You may be aware that Scott Wilson has been appointed by Clackmannanshire Council to prepare a preliminary design and a Parliamentary submission to re-open the Stirling-Alloa-Kincardine Railway. As part of this work, Scott Wilson is required to undertake an environmental impact assessment leading to the preparation of an Environmental Statement (ES) to support the Parliamentary submission. The Stirling-Alloa-Kincardine Railway route lies within the Clackmannnanshire Council, Fife Council and Stirling Council areas. The re-opening would involve the upgrading the existing railway route between Stirling Station and Longannet Power Station. The section of the route from Stirling to Alloa would be re-opened to passenger and freight trains, with a freight only connection through to Kincardine and on to Longannet Power Station.

At this stage you will also be aware of the Scottish Transport Appraisal Guidance (STAG) Part 1 and Part 2 appraisals which were prepared in support of the Stirling-Alloa-Kincardine Rail Line Reopening Benefit Study, February 2002 prepared by MVA which included an environmental appraisal of the re-opening options. For your information, we have attached an extract of this study comprising Chapter 9: Environmental Appraisal (P. 47-79, Appendix E AST Tables Part 1/Part 1a/1b/Part 2). You should note that Option E is the scheme that is now being developed.

The environmental impact assessment would be prepared in accordance with the Environmental Impact Assessment (Scotland) Regulations 1999 and the intention would be to submit the ES in support of the submission to the Scottish Parliament to promote a Scottish Private Bill to enable the railway line to be re-opened.

It is important that the relevant environmental issues are taken into account in assessing the environmental implications of re-opening the railway. We are therefore trying to collate the relevant data in an effort to identify and assess the likely environmental impacts of the re-opening, and any potential mitigation measures that may be required.

We are therefore writing to you as a statutory consultee

- To identify any information you may hold which would be relevant
- To identify any concerns that you may have about the re-opening
- To identify any issues that you would like to see included in the Environmental Statement at this stage

We would be particularly interested to hear if this proposal would interfere with any existing pollution control, waste management or flood prevention activities. A plan is enclosed to show the route of the railway to be re-opened (see attached Babtie Drawing No. BTR202443/G/01).

It is hoped to submit the Environmental Statement by the end of October, 2002 in support of the Parliamentary submission, and for this reason it would be helpful if all comments could be received as soon as possible but by no later than Friday 26 July 2002. If you wish to discuss the proposals further, or seek clarification about the information requested, please do not hesitate to contact us. It would be helpful if you could direct enquiries to the consultants who are assisting Clackmannanshire Council in preparation of the necessary documents, either Fraser Maxwell or Nigel Hackett of Scott Wilson on 0131 225 1230.

Yours faithfully

Nigel Hackett

Encl.

cc Alex Deans, Transportation, Clackmannanshire Council
Tara Whitworth, Project Manager, Babties
Gail Jeffrey, Scott Wilson Railways, Glasgow

Scottish Executive Development Department
Planning Division
Victoria Quay
Edinburgh
EH6 6QQ

B109401ENV1/e08

2 July 2002

Dear Sirs,

Stirling-Alloa-Kincardine Route Re-opening

You may be aware that Scott Wilson has been appointed by Clackmannanshire Council to prepare a preliminary design and a Parliamentary submission to re-open the Stirling-Alloa-Kincardine Railway. As part of this work, Scott Wilson is required to undertake an environmental impact assessment leading to the preparation of an Environmental Statement (ES) to support the Parliamentary submission. The Stirling-Alloa-Kincardine Railway route lies within the Clackmannnanshire Council, Fife Council and Stirling Council areas. The re-opening would involve the upgrading the existing railway route between Stirling Station and Longannet Power Station. The section of the route from Stirling to Alloa would be re-opened to passenger and freight trains, with a freight only connection through to Kincardine and on to Longannet Power Station.

At this stage you will also be aware of the Scottish Transport Appraisal Guidance (STAG) Part 1 and Part 2 appraisals which were prepared in support of the Stirling-Alloa-Kincardine Rail Line Reopening Benefit Study, February 2002 prepared by MVA which included an environmental appraisal of the re-opening options. For your information, we have attached an extract of this study comprising Chapter 9: Environmental Appraisal (P. 47-79, Appendix E AST Tables Part 1/Part 1a/1b/Part 2). You should note that Option E is the scheme that is now being developed.

The environmental impact assessment would be prepared in accordance with the Environmental Impact Assessment (Scotland) Regulations 1999 and the intention would be to submit the ES in support of the submission to the Scottish Parliament to promote a Scottish Private Bill to enable the railway line to be re-opened.

It is important that the relevant environmental issues are taken into account in assessing the environmental implications of re-opening the railway. We are therefore trying to collate the relevant data in an effort to identify and assess the likely environmental impacts of the re-opening, and any potential mitigation measures that may be required.

We are therefore writing to you as a statutory consultee

- To identify any information you may hold which would be relevant
- To identify any concerns that you may have about the re-opening
- To identify any issues that you would like to see included in the Environmental Statement at this stage

We would be particularly interested to hear of any planning or transport, air, water or waste interests, agricultural land, countryside and natural heritage, and fisheries issues that may be affected by the proposed scheme. I confirm that as we understand you act as a clearing house for all Scottish Executive departments who should be consulted, we have contacted no other departments as we assume you will do this. A plan is enclosed to show the route of the railway to be re-opened (see attached Babtie Drawing No. BTR202443/G/01).

It is hoped to submit the Environmental Statement by the end of October, 2002 in support of the Parliamentary submission, and for this reason it would be helpful if all comments could be received as soon as possible but by no later than Friday 26 July 2002. If you wish to discuss the proposals further, or seek clarification about the information requested, please do not hesitate to contact us. It would be helpful if you could direct enquiries to the consultants who are assisting Clackmannanshire Council in preparation of the necessary documents, either Fraser Maxwell or Nigel Hackett of Scott Wilson on 0131 225 1230.

Yours faithfully

Nigel Hackett

Encl.

cc Alex Deans, Transportation, Clackmannanshire Council
Tara Whitworth, Project Manager, Babties
Gail Jeffrey, Scott Wilson Railways, Glasgow

Health and Safety Executive
Belford House
59 Belford Road
Edinburgh
EH4 3UE

B109401ENV1/e09

2 July 2002

Dear Sirs,

Stirling-Alloa-Kincardine Route Re-opening

You may be aware that Scott Wilson has been appointed by Clackmannanshire Council to prepare a preliminary design and a Parliamentary submission to re-open the Stirling-Alloa-Kincardine Railway. As part of this work, Scott Wilson is required to undertake an environmental impact assessment leading to the preparation of an Environmental Statement (ES) to support the Parliamentary submission. The Stirling-Alloa-Kincardine Railway route lies within the Clackmannnanshire Council, Fife Council and Stirling Council areas. The re-opening would involve the upgrading the existing railway route between Stirling Station and Longannet Power Station. The section of the route from Stirling to Alloa would be re-opened to passenger and freight trains, with a freight only connection through to Kincardine and on to Longannet Power Station.

At this stage you will also be aware of the Scottish Transport Appraisal Guidance (STAG) Part 1 and Part 2 appraisals which were prepared in support of the Stirling-Alloa-Kincardine Rail Line Reopening Benefit Study, February 2002 prepared by MVA which included an environmental appraisal of the re-opening options. For your information, we have attached an extract of this study comprising Chapter 9: Environmental Appraisal (P. 47-79, Appendix E AST Tables Part 1/Part 1a/1b/Part 2). You should note that Option E is the scheme that is now being developed.

The environmental impact assessment would be prepared in accordance with the Environmental Impact Assessment (Scotland) Regulations 1999 and the intention would be to submit the ES in support of the submission to the Scottish Parliament to promote a Scottish Private Bill to enable the railway line to be re-opened.

It is important that the relevant environmental issues are taken into account in assessing the environmental implications of re-opening the railway. We are therefore trying to collate the relevant data in an effort to identify and assess the likely environmental impacts of the re-opening, and any potential mitigation measures that may be required.

We are therefore writing to you as a statutory consultee

- To identify any information you may hold which would be relevant
- To identify any concerns that you may have about the re-opening
- To identify any issues that you would like to see included in the Environmental Statement at this stage

We would be particularly interested to hear if this proposal would result in any health and safety issues which may need to be taken into account. A plan is enclosed to show the route of the railway to be re-opened (see attached Babtie Drawing No. BTR202443/G/01).

It is hoped to submit the Environmental Statement by the end of October, 2002 in support of the Parliamentary submission, and for this reason it would be helpful if all comments could be received as soon as possible but by no later than Friday 26 July 2002. If you wish to discuss the proposals further, or seek clarification about the information requested, please do not hesitate to contact us. It would be helpful if you could direct enquiries to the consultants who are assisting Clackmannanshire Council in preparation of the necessary documents, either Fraser Maxwell or Nigel Hackett of Scott Wilson on 0131 225 1230.

Yours faithfully

Nigel Hackett

Encl.

cc Alex Deans, Transportation, Clackmannanshire Council
Tara Whitworth, Project Manager, Babties
Gail Jeffrey, Scott Wilson Railways, Glasgow

Head of Planning and Building Control
Fife Council
North Street
Glenrothes
KY7 5LT

B109401ENV1/e10

2 July 2002

Dear Sir,

Stirling-Alloa-Kincardine Route Re-opening

You will be aware that Scott Wilson has been appointed by Clackmannanshire Council to prepare a preliminary design and a Parliamentary submission to re-open the Stirling-Alloa-Kincardine Railway. As part of this work, Scott Wilson is required to undertake an environmental impact assessment leading to the preparation of an Environmental Statement (ES) to support the Parliamentary submission. The Stirling-Alloa-Kincardine Railway route lies within the Clackmannnanshire Council, Fife Council and Stirling Council areas. The re-opening would involve the upgrading the existing railway route between Stirling Station and Longannet Power Station. The section of the route from Stirling to Alloa would be re-opened to passenger and freight trains, with a freight only connection through to Kincardine and on to Longannet Power Station.

At this stage you will also be aware of the Scottish Transport Appraisal Guidance (STAG) Part 1 and Part 2 appraisals which were prepared in support of the Stirling-Alloa-Kincardine Rail Line Reopening Benefit Study, February 2002 prepared by MVA which included an environmental appraisal of the re-opening options. For your information, we have attached an extract of this study comprising Chapter 9: Environmental Appraisal (P. 47-79, Appendix E AST Tables Part 1/Part 1a/1b/Part 2). You should note that Option E is the scheme that is now being developed.

The environmental impact assessment would be prepared in accordance with the Environmental Impact Assessment (Scotland) Regulations 1999 and the intention would be to submit the ES in support of the submission to the Scottish Parliament to promote a Scottish Private Bill to enable the railway line to be re-opened.

It is important that the relevant environmental issues are taken into account in assessing the environmental implications of re-opening the railway. We are therefore trying to collate the relevant data in an effort to identify and assess the likely environmental impacts of the re-opening, and any potential mitigation measures that may be required.

We are therefore writing to you as a statutory consultee

- To identify any information you may hold which would be relevant
- To identify any concerns that you may have about the re-opening
- To identify any issues that you would like to see included in the Environmental Statement at this stage

We would be particularly interested to hear of any land use or planning proposals or issues that may affect the scheme. A plan is enclosed to show the route of the railway to be re-opened (see attached Babtie Drawing No. BTR202443/G/01). We would also be grateful if you could make sure that this letter is copied to other relevant sections within Fife Council including those with an interest in biodiversity and archaeology.

It is hoped to submit the Environmental Statement by the end of October, 2002 in support of the Parliamentary submission, and for this reason it would be helpful if all comments could be received as soon as possible but by no later than Friday 26 July 2002. If you wish to discuss the proposals further, or seek clarification about the information requested, please do not hesitate to contact us. It would be helpful if you could direct enquiries to the consultants who are assisting Clackmannanshire Council in preparation of the necessary documents, either Fraser Maxwell or Nigel Hackett of Scott Wilson on 0131 225 1230.

Yours faithfully

Nigel Hackett

Encl.

cc Alex Deans, Transportation, Clackmannanshire Council
Tara Whitworth, Project Manager, Babties
Gail Jeffrey, Scott Wilson Railways, Glasgow

Ruth Briggs
Area Manager (Forth and Borders),
Scottish Natural Heritage
Laundry House
Dalkeith Country House
Dalkeith
EH22 2NA

B109401ENV1/e11

2 July 2002

Dear Mrs Briggs,

Stirling-Alloa-Kincardine Route Re-opening

You may be aware that Scott Wilson has been appointed by Clackmannanshire Council to prepare a preliminary design and a Parliamentary submission to re-open the Stirling-Alloa-Kincardine Railway. As part of this work, Scott Wilson is required to undertake an environmental impact assessment leading to the preparation of an Environmental Statement (ES) to support the Parliamentary submission. The Stirling-Alloa-Kincardine Railway route lies within the Clackmannnanshire Council, Fife Council and Stirling Council areas. The re-opening would involve the upgrading the existing railway route between Stirling Station and Longannet Power Station. The section of the route from Stirling to Alloa would be re-opened to passenger and freight trains, with a freight only connection through to Kincardine and on to Longannet Power Station.

At this stage you will also be aware of the Scottish Transport Appraisal Guidance (STAG) Part 1 and Part 2 appraisals which were prepared in support of the Stirling-Alloa-Kincardine Rail Line Reopening Benefit Study, February 2002 prepared by MVA which included an environmental appraisal of the re-opening options. For your information, we have attached an extract of this study comprising Chapter 9: Environmental Appraisal (P. 47-79, Appendix E AST Tables Part 1/Part 1a/1b/Part 2). You should note that Option E is the scheme that is now being developed.

The environmental impact assessment would be prepared in accordance with the Environmental Impact Assessment (Scotland) Regulations 1999 and the intention would be to submit the ES in support of the submission to the Scottish Parliament to promote a Scottish Private Bill to enable the railway line to be re-opened.

It is important that the relevant environmental issues are taken into account in assessing the environmental implications of re-opening the railway. We are therefore trying to collate the relevant data in an effort to identify and assess the likely environmental impacts of the re-opening, and any potential mitigation measures that may be required.

We are therefore writing to you as a statutory consultee

- To identify any information you may hold which would be relevant
- To identify any concerns that you may have about the re-opening
- To identify any issues that you would like to see included in the Environmental Statement at this stage

We would be particularly interested to hear of any existing or proposed statutory designations, the landscape character of the area, details of your woodland inventory and protected species or other natural heritage issues that may affect the scheme. We would also be pleased if you could advise of any other parties or organisations who may hold relevant information. In addition, you should note that we will be undertaking a Phase 1 survey of the study area. A plan is enclosed to show the route of the railway to be re-opened (see attached Babtie Drawing No. BTR202443/G/01). For your information, a similar letter to this one has also been sent to the SNH Argyll and Stirling area office at Stirling to seek information from the Area Manager.

It is hoped to submit the Environmental Statement by the end of October, 2002 in support of the Parliamentary submission, and for this reason it would be helpful if all comments could be received as soon as possible but by no later than Friday 26 July 2002. If you wish to discuss the proposals further, or seek clarification about the information requested, please do not hesitate to contact us. It would be helpful if you could direct enquiries to the consultants who are assisting Clackmannanshire Council in preparation of the necessary documents, either Fraser Maxwell or Nigel Hackett of Scott Wilson on 0131 225 1230.

Yours sincerely

Nigel Hackett

Encl.

cc Alex Deans, Transportation, Clackmannanshire Council
Tara Whitworth, Project Manager, Babties
Gail Jeffrey, Scott Wilson Railways, Glasgow

Mr Mike Taylor
Area Officer
Scottish Natural Heritage
(Tayside and Clackmannanshire)
Battleby
Redgorton
Perth, PH1 3EW

B109401ENV1/e26

18 September 2002

Dear Mike,

Stirling-Alloa-Kincardine Route Re-opening

Thank you for your letter dated the 8th August 2002 giving the response from SNH (Tayside and Clackmannanshire) to our letter of consultation regarding the above project, dated the 2nd July 2002. The information you provided was most helpful, and has been duly taken into account.

As you are aware, Scott Wilson is undertaking an environmental impact assessment leading to the preparation of an Environmental Statement (ES) to support the Parliamentary submission. The environmental impact assessment is being prepared in accordance with the Environmental Impact Assessment (Scotland) Regulations 1999 and the intention is to submit the ES in support of the submission to the Scottish Parliament to promote a Scottish Private Bill to enable the railway line to be re-opened.

However, it is now the intention to include the proposed Alloa Eastern Link Road (the Link Road) in the forthcoming Parliamentary submission, as this road proposal is essential to enable the railway to be re-opened. The Link Road has been proposed in the Clackmannanshire Draft Local Plan, and would accommodate the closure of Hilton Road Level Crossing and Hilton Manor Farm Level Crossing. A plan is enclosed to show the proposed route of the scheme (see attached Clackmannanshire Council drawing, no. 1798/004/A).

The proposed Link Road is approximately 1 km in length and will be made up of a single carriageway 7.3 m wide with 2.5 m wide verges each side. The Link Road will extend from an enlarged roundabout at the junction of Carsebridge Road / Whins Road / Hilton Road south east to a new roundabout on the A907 east of Alloa. The road will be mainly at grade or on embankment, rising up over the Stirling - Alloa - Kincardine railway line on a single span structure.

The Link Road will pass through industrial and agricultural land, and will require the demolition of three warehouses. Two sections of the A907 will also require to be diverted to accommodate the raised alignment in the vicinity of the Stirling - Alloa - Kincardine railway bridge, and a short length of farm track.

It is important that the relevant environmental issues are taken into account in assessing the environmental implications of the Link Road. We are therefore trying to collate the relevant data in an effort to identify and assess the likely environmental impacts of the proposal, and any potential mitigation measures that may be required.

We are therefore writing to you as a statutory consultee

- To identify any information you may hold which would be relevant
- To identify any concerns that you may have about the Link Road
- To identify any issues that you would like to see included in the Environmental Statement at this stage

We would be particularly interested to hear of any existing or proposed statutory designations, the landscape character of the area, details of your woodland inventory and protected species or other natural heritage issues that may affect the Link Road. We would also be pleased if you could advise of any other parties or organisations who may hold relevant information. In addition, you should note that we will be undertaking a Phase 1 survey of the Link Road study area.

It is hoped to submit the Environmental Statement by the end of October 2002 in support of the Parliamentary submission, and in view of this tight timetable it would be helpful if all comments could be received as soon as possible but by no later than Wednesday 2 October 2002 If you wish to discuss the proposals further, or seek clarification about the information requested, please do not hesitate to contact either Steven Harding or Nigel Hackett of Scott Wilson on 0131 225 1230.

Yours faithfully

Nigel Hackett

Encl.

cc Alex Deans, Transportation, Clackmannanshire Council
Tara Whitworth, Project Manager, Babties
Gail Jeffrey, Scott Wilson Railways, Glasgow

Development and Environmental Services
Clackmannanshire Council
Greenfield
Alloa
FK10 2AD

B109401ENV1/e28

17 September 2002

Dear Sirs,

Stirling-Alloa-Kincardine Route Re-opening

Thank you for your email dated the 13th September 2002 giving the response from Clackmannanshire Council to our letter of consultation regarding the above project, dated the 2nd July 2002. The information you provided was most helpful, and has been duly taken into account.

As you are aware, Scott Wilson is undertaking an environmental impact assessment leading to the preparation of an Environmental Statement (ES) to support the Parliamentary submission. The environmental impact assessment is being prepared in accordance with the Environmental Impact Assessment (Scotland) Regulations 1999 and the intention is to submit the ES in support of the submission to the Scottish Parliament to promote a Scottish Private Bill to enable the railway line to be re-opened.

However, it is now the intention to include the proposed Alloa Eastern Link Road (the Link Road) in the forthcoming Parliamentary submission, as this road proposal is essential to enable the railway to be re-opened. The Link Road has been proposed in the Clackmannanshire Draft Local Plan, and would accommodate the closure of Hilton Road Level Crossing and Hilton Manor Farm Level Crossing. A plan is enclosed to show the proposed route of the scheme (see attached Clackmannanshire Council drawing, no. 1798/004/A).

The proposed Link Road is approximately 1 km in length and will be made up of a single carriageway 7.3 m wide with 2.5 m wide verges each side. The Link Road will extend from an enlarged roundabout at the junction of Carsebridge Road / Whins Road / Hilton Road south east to a new roundabout on the A907 east of Alloa. The road will be mainly at grade or on embankment, rising up over the Stirling - Alloa - Kincardine railway line on a single span structure.

The Link Road will pass through industrial and agricultural land, and will require the demolition of three warehouses. Two sections of the A907 will also require to be diverted to accommodate the raised alignment in the vicinity of the Stirling - Alloa - Kincardine railway bridge, and a short length of farm track.

It is important that the relevant environmental issues are taken into account in assessing the environmental implications of the Link Road. We are therefore trying to collate the relevant data in an effort to identify and assess the likely environmental impacts of the proposal, and any potential mitigation measures that may be required.

We are therefore writing to you as a statutory consultee

- To identify any information you may hold which would be relevant
- To identify any concerns that you may have about the Link Road
- To identify any issues that you would like to see included in the Environmental Statement at this stage

We would be particularly interested to hear of any land use or planning proposals or issues that may affect the scheme. We would also be grateful if you could make sure that this letter is copied to other relevant sections within Clackmannanshire Council including those with an interest in biodiversity and archaeology.

It is hoped to submit the Environmental Statement by the end of October 2002 in support of the Parliamentary submission, and in view of this tight timetable it would be helpful if all comments could be received as soon as possible but by no later than Wednesday 2 October 2002. If you wish to discuss the proposals further, or seek clarification about the information requested, please do not hesitate to contact either Steven Harding or Nigel Hackett of Scott Wilson on 0131 225 1230.

Yours faithfully

Nigel Hackett

Encl.

cc Alex Deans, Transportation, Clackmannanshire Council
Tara Whitworth, Project Manager, Babtie Group Ltd
Gail Jeffrey, Scott Wilson Railways, Glasgow

Mrs J. Edmond
Historic Scotland
Langmore House
Salisbury Place
Edinburgh
EH9 1SH

B109401ENV1/e27

18 September 2002

Dear Mrs Edmond,

Stirling-Alloa-Kincardine Route Re-opening

Thank you for your letter dated the 14th August 2002 giving the response from Historic Scotland to our letter of consultation regarding the above project, dated the 2nd July 2002. The information you provided was most helpful, and has been duly taken into account.

As you are aware, Scott Wilson is undertaking an environmental impact assessment leading to the preparation of an Environmental Statement (ES) to support the Parliamentary submission. The environmental impact assessment is being prepared in accordance with the Environmental Impact Assessment (Scotland) Regulations 1999 and the intention is to submit the ES in support of the submission to the Scottish Parliament to promote a Scottish Private Bill to enable the railway line to be re-opened.

However, it is now the intention to include the proposed Alloa Eastern Link Road (the Link Road) in the forthcoming Parliamentary submission, as this road proposal is essential to enable the railway to be re-opened. The Link Road has been proposed in the Clackmannanshire Draft Local Plan, and would accommodate the closure of Hilton Road Level Crossing and Hilton Manor Farm Level Crossing. A plan is enclosed to show the proposed route of the scheme (see attached Clackmannanshire Council drawing, no. 1798/004/A).

The proposed Link Road is approximately 1 km in length and will be made up of a single carriageway 7.3 m wide with 2.5 m wide verges each side. The Link Road will extend from an enlarged roundabout at the junction of Carsebridge Road / Whins Road / Hilton Road south east to a new roundabout on the A907 east of Alloa. The road will be mainly at grade or on embankment, rising up over the Stirling - Alloa - Kincardine railway line on a single span structure.

The Link Road will pass through industrial and agricultural land, and will require the demolition of three warehouses. Two sections of the A907 will also require to be diverted to accommodate the raised alignment in the vicinity of the Stirling - Alloa - Kincardine railway bridge, and a short length of farm track.

It is important that the relevant environmental issues are taken into account in assessing the environmental implications of the Link Road. We are therefore trying to collate the relevant data in an effort to identify and assess the likely environmental impacts of the proposal, and any potential mitigation measures that may be required.

We are therefore writing to you as a statutory consultee

- To identify any information you may hold which would be relevant
- To identify any concerns that you may have about the Link Road
- To identify any issues that you would like to see included in the Environmental Statement at this stage

We would be particularly interested to hear of any known scheduled ancient monuments, monuments on the non-statutory list, or listed buildings that may be found in the area. We would also be grateful if you could make sure that this letter is copied to your Ancient Monuments Inspectorate (for Scheduled Ancient Monuments) and the Architectural Section (for Listed Buildings) within Historic Scotland.

It is hoped to submit the Environmental Statement by the end of October 2002 in support of the Parliamentary submission, and in view of this tight timetable it would be helpful if all comments could be received as soon as possible but by no later than Wednesday 2 October 2002. If you wish to discuss the proposals further, or seek clarification about the information requested, please do not hesitate to contact either Steven Harding or Nigel Hackett of Scott Wilson on 0131 225 1230.

Yours faithfully

Nigel Hackett

Encl.

cc Alex Deans, Transportation, Clackmannanshire Council
Tara Whitworth, Project Manager, Babtie Group Ltd
Gail Jeffrey, Scott Wilson Railways, Glasgow

Dr. G A Cook
Health and Safety Executive
Belford House
59 Belford Road
Edinburgh
EH4 3UE

B109401ENV1/e29

18 September 2002

Dear Dr Cook,

Stirling-Alloa-Kincardine Route Re-opening

Thank you for your letter dated the 8th July 2002 giving the response from the Health and Safety Executive to our letter of consultation regarding the above project, dated the 2nd July 2002. The information you provided was most helpful, and has been duly taken into account.

As you are aware, Scott Wilson is undertaking an environmental impact assessment leading to the preparation of an Environmental Statement (ES) to support the Parliamentary submission. The environmental impact assessment is being prepared in accordance with the Environmental Impact Assessment (Scotland) Regulations 1999 and the intention is to submit the ES in support of the submission to the Scottish Parliament to promote a Scottish Private Bill to enable the railway line to be re-opened.

However, it is now the intention to include the proposed Alloa Eastern Link Road (the Link Road) in the forthcoming Parliamentary submission, as this road proposal is essential to enable the railway to be re-opened. The Link Road has been proposed in the Clackmannanshire Draft Local Plan, and would accommodate the closure of Hilton Road Level Crossing and Hilton Manor Farm Level Crossing. A plan is enclosed to show the proposed route of the scheme (see attached Clackmannanshire Council drawing, no. 1798/004/A).

The proposed Link Road is approximately 1 km in length and will be made up of a single carriageway 7.3 m wide with 2.5 m wide verges each side. The Link Road will extend from an enlarged roundabout at the junction of Carsebridge Road / Whins Road / Hilton Road south east to a new roundabout on the A907 east of Alloa. The road will be mainly at grade or on embankment, rising up over the Stirling - Alloa - Kincardine railway line on a single span structure.

The Link Road will pass through industrial and agricultural land, and will require the demolition of three warehouses. Two sections of the A907 will also require to be diverted to accommodate the raised alignment in the vicinity of the Stirling - Alloa - Kincardine railway bridge, and a short length of farm track.

It is important that the relevant environmental issues are taken into account in assessing the environmental implications of the Link Road. We are therefore trying to collate the relevant data in an effort to identify and assess the likely environmental impacts of the proposal, and any potential mitigation measures that may be required.

We are therefore writing to you as a statutory consultee

- To identify any information you may hold which would be relevant
- To identify any concerns that you may have about the Link Road
- To identify any issues that you would like to see included in the Environmental Statement at this stage

We would be particularly interested to hear if this proposal would result in any health and safety issues that may need to be taken into account.

It is hoped to submit the Environmental Statement by the end of October 2002 in support of the Parliamentary submission, and in view of this tight timetable it would be helpful if all comments could be received as soon as possible but by no later than Wednesday 2 October 2002. If you wish to discuss the proposals further, or seek clarification about the information requested, please do not hesitate to contact either Steven Harding or Nigel Hackett of Scott Wilson on 0131 225 1230.

Yours faithfully

Nigel Hackett

Encl.

cc Alex Deans, Transportation, Clackmannanshire Council
Tara Whitworth, Project Manager, Babtie Group Ltd
Gail Jeffrey, Scott Wilson Railways, Glasgow

Mr. J Brown
Scottish Executive Development Department
Planning Division
Victoria Quay
Edinburgh
EH6 6QQ

B109401ENV1/e30

18 September 2002

Dear John,

Stirling-Alloa-Kincardine Route Re-opening

Thank you for your letter dated the 8th July 2002 giving the response from the Scottish Executive Development Department Planning Division to our letter of consultation regarding the above project, dated the 2nd July 2002. The information you provided was most helpful, and has been duly taken into account.

As you are aware, Scott Wilson is undertaking an environmental impact assessment leading to the preparation of an Environmental Statement (ES) to support the Parliamentary submission. The environmental impact assessment is being prepared in accordance with the Environmental Impact Assessment (Scotland) Regulations 1999 and the intention is to submit the ES in support of the submission to the Scottish Parliament to promote a Scottish Private Bill to enable the railway line to be re-opened.

However, it is now the intention to include the proposed Alloa Eastern Link Road (the Link Road) in the forthcoming Parliamentary submission, as this road proposal is essential to enable the railway to be re-opened. The Link Road has been proposed in the Clackmannanshire Draft Local Plan, and would accommodate the closure of Hilton Road Level Crossing and Hilton Manor Farm Level Crossing. A plan is enclosed to show the proposed route of the scheme (see attached Clackmannanshire Council drawing, no. 1798/004/A).

The proposed Link Road is approximately 1 km in length and will be made up of a single carriageway 7.3 m wide with 2.5 m wide verges each side. The Link Road will extend from an enlarged roundabout at the junction of Carsebridge Road / Whins Road / Hilton Road south east to a new roundabout on the A907 east of Alloa. The road will be mainly at grade or on embankment, rising up over the Stirling - Alloa - Kincardine railway line on a single span structure.

The Link Road will pass through industrial and agricultural land, and will require the demolition of three warehouses. Two sections of the A907 will also require to be diverted to accommodate the raised alignment in the vicinity of the Stirling - Alloa - Kincardine railway bridge, and a short length of farm track.

It is important that the relevant environmental issues are taken into account in assessing the environmental implications of the Link Road. We are therefore trying to collate the relevant data in an effort to identify and assess the likely environmental impacts of the proposal, and any potential mitigation measures that may be required.

We are therefore writing to you as a statutory consultee

- To identify any information you may hold which would be relevant
- To identify any concerns that you may have about the Link Road
- To identify any issues that you would like to see included in the Environmental Statement at this stage

We would be particularly interested to hear of any planning or transport, air, water or waste interests, agricultural land, countryside and natural heritage, and fisheries issues that may be affected by the proposed scheme. I confirm that as we understand you act as a clearing house for all Scottish Executive departments who should be consulted, we have contacted no other departments as we assume you will do this.

It is hoped to submit the Environmental Statement by the end of October 2002 in support of the Parliamentary submission, and in view of this tight timetable it would be helpful if all comments could be received as soon as possible but by no later than Wednesday 2 October 2002. If you wish to discuss the proposals further, or seek clarification about the information requested, please do not hesitate to contact either Steven Harding or Nigel Hackett of Scott Wilson on 0131 225 1230.

Yours faithfully

Nigel Hackett

Encl.

cc Alex Deans, Transportation, Clackmannanshire Council
Tara Whitworth, Project Manager, Babtie Group Ltd
Gail Jeffrey, Scott Wilson Railways, Glasgow

Douglas Cooper
Scottish Water
Woodlands
St Ninians Road
STIRLING
FK8 2HB

B109401ENV1/e31

18 September 2002

Dear Douglas,

Stirling-Alloa-Kincardine Route Re-opening

Thank you for your letter dated the 11th July 2002 giving the response from Scottish Water to our letter of consultation regarding the above project, dated the 2nd July 2002. The information you provided was most helpful, and has been duly taken into account.

As you are aware, Scott Wilson is undertaking an environmental impact assessment leading to the preparation of an Environmental Statement (ES) to support the Parliamentary submission. The environmental impact assessment is being prepared in accordance with the Environmental Impact Assessment (Scotland) Regulations 1999 and the intention is to submit the ES in support of the submission to the Scottish Parliament to promote a Scottish Private Bill to enable the railway line to be re-opened.

However, it is now the intention to include the proposed Alloa Eastern Link Road (the Link Road) in the forthcoming Parliamentary submission, as this road proposal is essential to enable the railway to be re-opened. The Link Road has been proposed in the Clackmannanshire Draft Local Plan, and would accommodate the closure of Hilton Road Level Crossing and Hilton Manor Farm Level Crossing. A plan is enclosed to show the proposed route of the scheme (see attached Clackmannanshire Council drawing, no. 1798/004/A).

The proposed Link Road is approximately 1 km in length and will be made up of a single carriageway 7.3 m wide with 2.5 m wide verges each side. The Link Road will extend from an enlarged roundabout at the junction of Carsebridge Road / Whins Road / Hilton Road south east to a new roundabout on the A907 east of Alloa. The road will be mainly at grade or on embankment, rising up over the Stirling - Alloa - Kincardine railway line on a single span structure.

The Link Road will pass through industrial and agricultural land, and will require the demolition of three warehouses. Two sections of the A907 will also require to be diverted to accommodate the raised alignment in the vicinity of the Stirling - Alloa - Kincardine railway bridge, and a short length of farm track.

It is important that the relevant environmental issues are taken into account in assessing the environmental implications of the Link Road. We are therefore trying to collate the relevant data in an effort to identify and assess the likely environmental impacts of the proposal, and any potential mitigation measures that may be required.

We are therefore writing to you as a statutory consultee

- To identify any information you may hold which would be relevant
- To identify any concerns that you may have about the Link Road
- To identify any issues that you would like to see included in the Environmental Statement at this stage

We would be particularly interested to hear if this proposal would interfere with any existing water and sewerage functions.

It is hoped to submit the Environmental Statement by the end of October 2002 in support of the Parliamentary submission, and in view of this tight timetable it would be helpful if all comments could be received as soon as possible but by no later than Wednesday 2 October 2002. If you wish to discuss the proposals further, or seek clarification about the information requested, please do not hesitate to contact either Steven Harding or Nigel Hackett of Scott Wilson on 0131 225 1230.

Yours faithfully

Nigel Hackett

Encl.

cc Alex Deans, Transportation, Clackmannanshire Council
Tara Whitworth, Project Manager, Babtie Group Ltd
Gail Jeffrey, Scott Wilson Railways, Glasgow

Francis Hayes
Scottish Environment Protection Agency
Erskine Court
The Castle Business Park
Stirling
FK9 4TX

B109401ENV1/e32

18 September 2002

Dear Francis,

Stirling-Alloa-Kincardine Route Re-opening

Thank you for your letter dated the 9th[th] July 2002 giving the response from SEPA to our letter of consultation regarding the above project, dated the 2[nd] July 2002. The information you provided was most helpful, and has been duly taken into account.

As you are aware, Scott Wilson is undertaking an environmental impact assessment leading to the preparation of an Environmental Statement (ES) to support the Parliamentary submission. The environmental impact assessment is being prepared in accordance with the Environmental Impact Assessment (Scotland) Regulations 1999 and the intention is to submit the ES in support of the submission to the Scottish Parliament to promote a Scottish Private Bill to enable the railway line to be re-opened.

However, it is now the intention to include the proposed Alloa Eastern Link Road (the Link Road) in the forthcoming Parliamentary submission, as this road proposal is essential to enable the railway to be re-opened. The Link Road has been proposed in the Clackmannanshire Draft Local Plan, and would accommodate the closure of Hilton Road Level Crossing and Hilton Manor Farm Level Crossing. A plan is enclosed to show the proposed route of the scheme (see attached Clackmannanshire Council drawing, no. 1798/004/A).

The proposed Link Road is approximately 1 km in length and will be made up of a single carriageway 7.3 m wide with 2.5 m wide verges each side. The Link Road will extend from an enlarged roundabout at the junction of Carsebridge Road / Whins Road / Hilton Road south east to a new roundabout on the A907 east of Alloa. The road will be mainly at grade or on embankment, rising up over the Stirling - Alloa - Kincardine railway line on a single span structure.

The Link Road will pass through industrial and agricultural land, and will require the demolition of three warehouses. Two sections of the A907 will also require to be diverted to accommodate the raised alignment in the vicinity of the Stirling - Alloa - Kincardine railway bridge, and a short length of farm track.

It is important that the relevant environmental issues are taken into account in assessing the environmental implications of the Link Road. We are therefore trying to collate the relevant data in an effort to identify and assess the likely environmental impacts of the proposal, and any potential mitigation measures that may be required.

We are therefore writing to you as a statutory consultee

- To identify any information you may hold which would be relevant
- To identify any concerns that you may have about the Link Road
- To identify any issues that you would like to see included in the Environmental Statement at this stage

We would be particularly interested to hear if this proposal would interfere with any existing pollution control, waste management or flood prevention activities.

It is hoped to submit the Environmental Statement by the end of October 2002 in support of the Parliamentary submission, and in view of this tight timetable it would be helpful if all comments could be received as soon as possible but by no later than Wednesday 2 October 2002. If you wish to discuss the proposals further, or seek clarification about the information requested, please do not hesitate to contact either Steven Harding or Nigel Hackett of Scott Wilson on 0131 225 1230.

Yours faithfully

Nigel Hackett

Encl.

cc Alex Deans, Transportation, Clackmannanshire Council
Tara Whitworth, Project Manager, Babtie Group Ltd
Gail Jeffrey, Scott Wilson Railways, Glasgow

HISTORIC SCOTLAND
Tel: 0131 668 8762 Fax: 0131 668 8765

B10940 ENV1

Mr Nigel Hackett
Scott Wilson Scotland Ltd
23 Chester Street
EDINBURGH
EH3 7ET

Your Ref: B10940IENV1/eo2

Our Ref: AMN/16/CC

14 August 2002

cc. HOC
AM/GT.

Dear Sir

ENVIRONMENTAL IMPACT ASSESSMENT (SCOTLAND) REGULATIONS 1999 OPTION 'E' FOR STIRLING-ALLOA-KINCARDINE RAIL LINE REOPENING (SCOPING)

I refer to your letter dated 2 July 2002 requesting Historic Scotland's comments on the above proposal.

For Historic Scotland's archaeological interests, we would offer the following comments.

We would agree the statement in the Benefits Study Final Report that no scheduled ancient monuments exist along the railway line. However, there are scheduled ancient monuments in the vicinity of the railway line and you should note that the list of monuments given in the Benefit Study Final Report is not complete. There are, in fact, 11 scheduled ancient monuments within 500m of the railway. I enclose details of these and maps.

We have been provided with minimal information about the works involved with reopening the line, except that a new station will be built in Alloa. However, based on the information given in the Appraisal of Options Section, we have no reason to believe there will be significant extra negative effects on the settings of these scheduled sites. We therefore have no concerns about the re-opening based on the information we have been sent at this stage. However, for any developments which may have effects on the settings of scheduled sites we would refer you to the documents that set out the Government's position on this. These are listed below.

As you are aware, Historic Scotland's remit extends only to the provision of information and advice on sites that are statutorily protected at the national level. These are monuments scheduled under the Ancient Monuments and Archaeological Areas Act 1979. Responsibility for information and advice on other sites, those protected through planning policy at the regional and local level, lies with the relevant Council Archaeologist. Unfortunately, Midlothian Council does not employ the services of an archaeologist for advice on archaeological monuments. Information on unscheduled sites could therefore be obtained from the National Monuments Record of Scotland, John Sinclair House, 16 Bernard Terrace, Edinburgh EH8 9NX, their switchboard number is 0131 662 1456. For the Fife Council area, you should seek this information from Douglas Speirs at the Archaeology Unit, Planning Service, Fife Council, Fife House, North Street, Glenrothes KY7 5LT. For the Stirling Council area, you should contact Lorna Main, Environmental Services, Stirling Council, Viewforth, Stirling FK8 2ET, telephone 0178 442752 who is responsible for the Council Archaeological Service in this area. The NMRS and regional archaeologists may make a charge for this service.

For Historic Scotland's listed buildings and designed landscapes interests we have no comments of offer.

We also recommend that you seek detailed information on conservation areas from the local planning authorities.

In terms of policy implications, we would refer you to the following documents which set out the framework of Government policy for the protection of Scotland's built heritage:

- National Planning Policy Guideline 5 (NPPG 5): Archaeology and Planning (Scottish Office Development Department, 1994)
- Planning Advice Note 42 (PAN 42): Archaeology, the Planning Process and Scheduled Monument Procedures (Scottish Office Development Department, 1994)

Yours faithfully

Jacqueline D Edmond

MRS J D EDMOND

cc: Mr John Browne, SE-DD, Planning Victoria Quay
Mr Douglas Speirs, Fife Council Archaeologist
Ms Lorna Main, Stirling Council Archaeologist

HISTORIC SCOTLAND
Tel: 0131 668 8762 Fax: 0131 668 8765

Mr Nigel Hackett
ScottWilson Scotland Ltd
23 Chester Street
Edinburgh
EH3 7ET

Your Ref: B109401ENV1/e30

Our Ref: AMN/16/CC

15 November 2002

B109401ENV1.

cc. L Thomson/HOC.
H McCracken/SWR - Glasgow.

Dear Sir

STIRLING - ALLOA - KINCARDINE ROUTE RE-OPENING

I refer to your letter of 18 September 2002 for our views on any built heritage issues that should be addressed in an Environmental Assessment for this proposed scheme. It might be helpful if, at the outset, I were to clarify Historic Scotland's remit in the provision of information and advice on the protection of the built heritage.

For archaeological issues, Historic Scotland's remit extends only to the provision of information and advice on sites that are statutorily protected at the national level. These are monuments scheduled under the Ancient Monuments and Archaeological Areas Act 1979. Responsibility for information and advice on other sites, those protected through planning policy at the regional and local level, lies with the relevant Council Archaeologist. You should seek this information from Lorna Main, Environmental Services, Stirling Council, Viewforth, Stirling FK8 2ET, telephone 01786 442752 who is responsible for the Council Archaeological Service in this area. You should however be aware that a fee may be charged for the time taken to provide this information. Lorna Main will be able to clarify the scale of charges for work of this nature.

Historic Scotland, in conjunction with Scottish Natural Heritage, is responsible for the identification of historic gardens and designed landscapes and for the provision of advice on their maintenance and preservation. We will therefore provide information, where appropriate, on any affected historic gardens or designed landscapes within the area of search.

Listed buildings present a more difficult problem, given the very large number of individual entries that may exist within the area of search. If the applicants require this level of information, the statutory lists are in the public domain and can be consulted here, at Longmore House; at the Royal Commission on the Ancient and Historic Monuments of Scotland, 16 Bernard Terrace, Edinburgh EH8 9NX or at Clackmannanshire Council.

Longmore House, Salisbury Place, Edinburgh EH9 1SH Telephone 0131 668 8600

We also recommend that the applicants seek detailed information on conservation areas from the council.

Thus, on this basis, I have checked the map enclosed with your letter.

I can confirm that there are no designed landscapes or scheduled ancient monuments on the route of the proposed link road. However there is a scheduled ancient monument in close proximity to the southernmost roundabout called AMH/3016, Parkmill, cross slab 460m N of. I enclose a map of the location of the scheduled area. Your assessment should therefore look at the effects the development will have on the setting of this monument in accordance with government guidance as referenced below and the relevant policies in the Council's development plans.

In terms of policy implications, we would refer you to the following four documents which set out the framework of Government policy for the protection of Scotland's built heritage:

- National Planning Policy Guideline 5 (NPPG 5): Archaeology and Planning (Scottish Office Development Department, 1994)
- Planning Advice Note 42 (PAN 42): Archaeology, the Planning Process and Scheduled Monument Procedures (Scottish Office Development Department, 1994
- National Planning Policy Guideline 18 (NPPG 18): Planning and the Historic Environment (Scottish Office Development Department, 1999)
- Memorandum of Guidance on Listed Buildings and Conservation Areas (Historic Scotland, 1998)

Yours faithfully

Jacqueline D. Edmond

MRS J D EDMOND

cc: Ms Lorna Main, Local Authority Archaeologist
Mr J. Browne, SEDD, Planning, Victoria Quay

MGT00215.112

HISTORIC SCOTLAND

Email: sabina.strachan@scotland.gsi.gov.uk Tel: 0131 668 8934 Fax: 0131 668 8765

Dr Lindsey J Thomson
AOC Archaeology Group
Edgefield Industrial Estate
Edgefield Road
Loanhead
EH20 9SY

28 NOV 2002

Our ref: AMH/3016/10

27th November 2002

Dear Dr Thomson,

PARKMILL, CROSS SLAB 500yds N of

Thank you for your letter dated 31st October address to my colleague, Ms Deirdre Cameron. As the above Scheduled Ancient Monument (SAM) to which your enquiry relates is Medieval in date, Ms Cameron kindly passed on your letter to me as Area Inspector for Standing Buildings in Clackmannanshire.

Please find enclosed a copy of the scheduling document and annotated map dated 4th December 1970. A scale is included and the description locates the SAM as being 500 yards north of Parkmill. Thank you for enclosing the paper copy and CD-Rom version of the route of the proposed link road. The location of the SAM and extent of the scheduled area is as described and illustrated upon the actual scheduling document. The maps used are the 1:10,000 Ordnance Survey mapsheets, NS89SE and NS99SW. I also enclose the scheduled area delinated using GIS Arcview 3.2 based on the current OS Landline data at scales of 1:2,500 and 1:10,000. These should only be used as tools to be compared with your computer-generated layout as it is the scheduling document that should be relied upon.

It would seem that, allowing for changes in the surroundings of the SAM since its scheduling, the proposed roundabout would impinge upon the north edge of the scheduled area. Works necessary to create the banking indicated upon your layout would inevitably fall within the scheduled area. I would therefore advise that the location of the proposed roundabout be revised to take this into account and provide a reasonable buffer around the SAM and consider ways in which the affect upon the setting of the SAM can be minimised.

I look forward to viewing your revised layout.

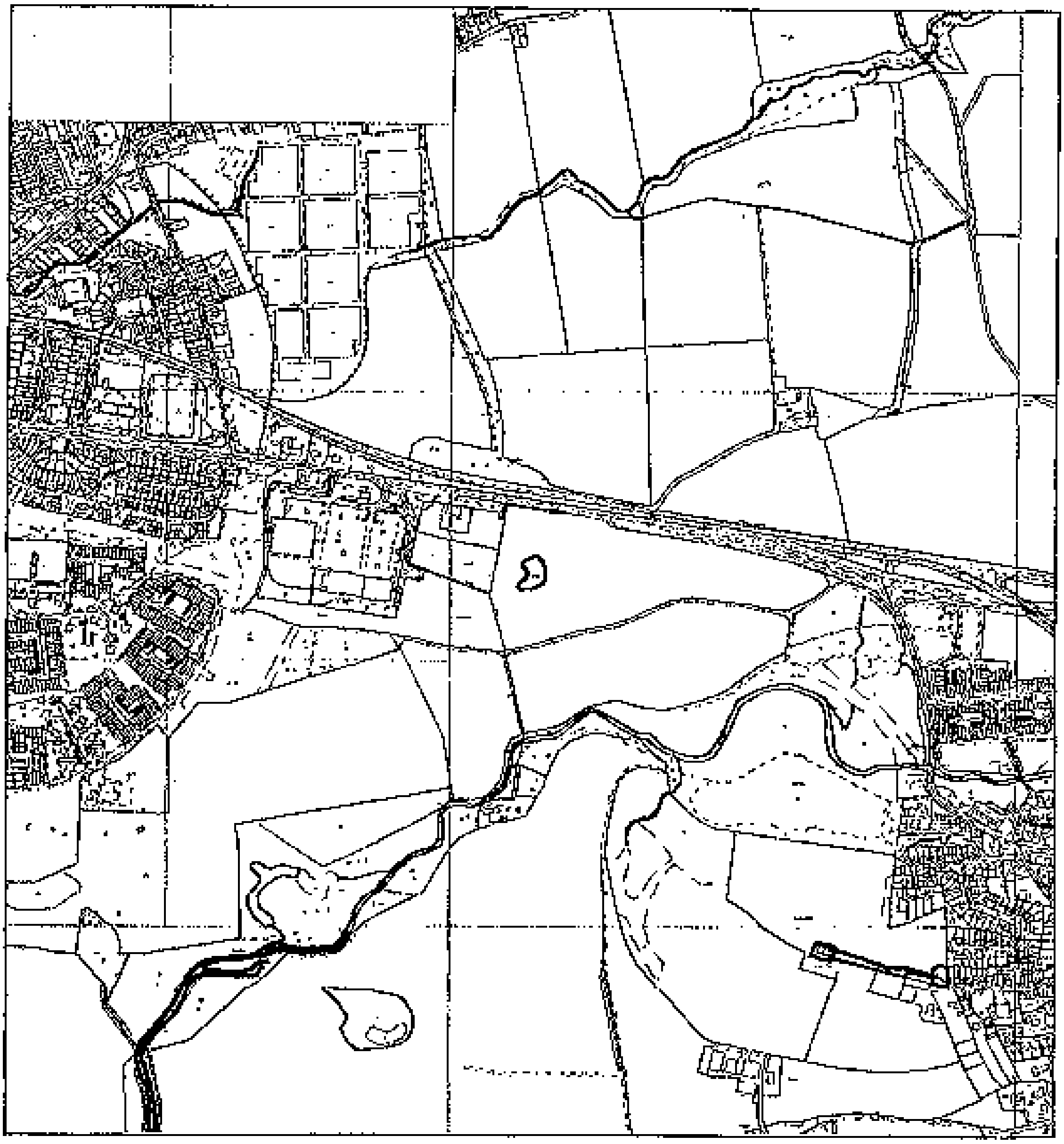
Yours sincerely,

Sabina Strachan
Assistant Inspector of Ancient Monuments

Encs.

28-NOV-2002 10:06 FROM:AOC ARCHAEOLOGY GROU 0131 440 3422

Parkmill, cross slab 500yds N of



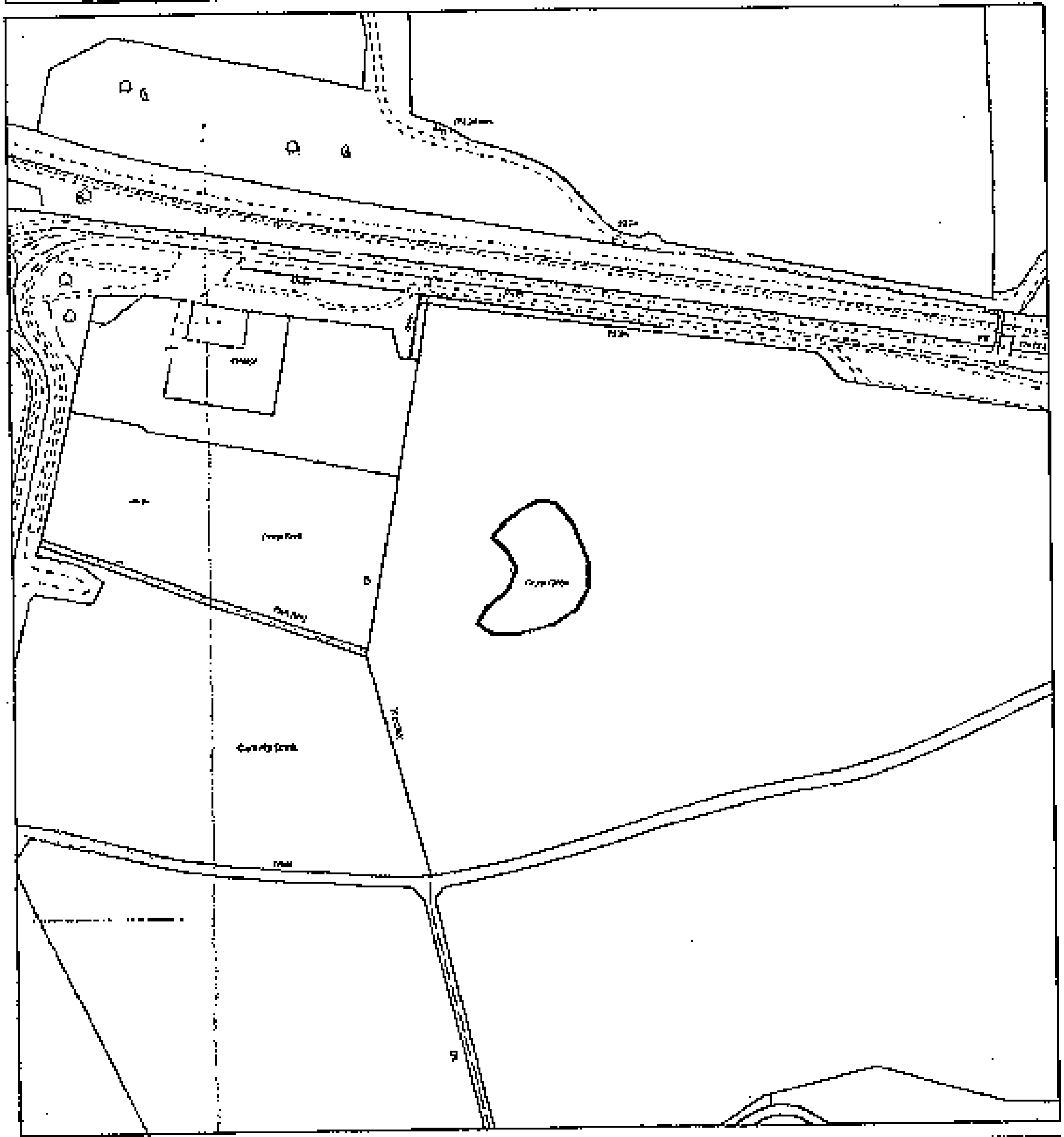
N

Scale 1:10,000

100 0 100 200 300 400 600 Meters

scheduled area

Parkmill, cross slab 500yds N of



scheduled area

N

Scale 1:2,500

30 0 30 60 90 120 Meters

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SCOTTISH NATURAL HERITAGE

TAYSIDE & CLACKMANNANSHIRE

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e-mail addresses: mike.shepherd@snh.gov.uk
tayside@snh.gov.uk

Battleby
Redgorton
Perth
PH1 3EW

Telephone: 01738 444177
Fax: 01738 458611
Centre Fax: 01738 458612
e-mail: forename.surname@snh.gov.uk

Mr Nigel Hackett
Scott Wilson Scotland Ltd
23 Chester Street
EDINBURGH
EH3 7ET

Our ref: CNS2002-03/6257
Your ref: B109401ENV1/c01

11 July 2002

Dear Mr Hackett

Stirling – Alloa – Kincardine Route Re-opening

Thank you for your letter of 2 July 2002, sent to our Stirling Office, this has now been sent to Battleby for me to deal with..

I will be liaising with my colleagues in the 3 Areas concerned. I will then prepare a response on behalf of Scottish Natural Heritage.

B109401ENV1

Yours sincerely

Michael Shepherd
Area Officer
Tayside and Clackmannanshire

SWSL EDINBURGH
RECEIVED
16 JUL 2002

SCOTTISH NATURAL HERITAGE

TAYSIDE & CLACKMANNANSHIRE

Tel: 01738 458593(direct line)
Fax: 01738 458616
e-mail address: mike.taylor@snh.gov.uk

Battleby
Redgorton
Perth
PH1 3EW

Telephone: 01738 444177
Fax: 01738 458611
Centre Fax: 01738 458612
e-mail: forename.surname@snh.gov.uk

B109401BNV

Mr Nigel Hackett
Scott Wilson Scotland Ltd
23 Chester Street
EDINBURGH
EH3 7ET

Our ref: CNS/DC/7524
Your ref: B109401BNV

SWSL EDINBURGH
RECEIVED
- 4 OCT 2002

3 October 2002

Dear Mr Hackett

Stirling – Alloa – Kincardine Route Re-opening

I refer to your letter of 18 September 2002 concerning the proposed Alloa Eastern Link Road which is essential to enable the railway to be re-opened.

The 1km route does not cross any area of natural heritage interest and therefore we have no concerns or specific issues to raise which would be relevant to your Environmental Statement. I mentioned in my previous letter that Phase 1 survey information may be available from Clackmannanshire Council and again this may be an option for this study area.

I hope that this answers the points you raised. Should you wish to discuss anything further then please contact me at the above address.

Yours sincerely

Mike Taylor
Area Officer
Tayside and Clackmannanshire

SCOTTISH NATURAL HERITAGE

TAYSIDE & CLACKMANNANSHIRE

Battleby
Redgorton
Perth
PH1 3EW

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Fax: 01738 458616
e-mail address: mike.taylor@snh.gov.uk

Telephone: 01738 444177
Fax: 01738 458611
Centre Fax: 01738 458612
e-mail: forename.surname@snh.gov.uk

3

SWSL EDINBURGH
RECEIVED
12 AUG 2002

Mr Nigel Hackett
Scott Wilson Scotland Ltd
23 Chester Street
EDINBURGH
EH3 7ET

Our ref: CNS2002-03/6257
Your ref: BI09401ENV1/e01

BI09401ENV1.

N.B Incomplete map of SPA – May need to obtain this ##.

8 August 2002

Dear Mr Hackett

(Back to SH)

file. cc. HM, A. Baker (encl. endorses)

Stirling – Alloa – Kincardine Route Re-opening

I refer to your letter of 2 July 2002 and our interim response of 11 July concerning the above proposal. I have liased with colleagues in the 3 Areas concerned and now respond on behalf of Scottish Natural Heritage. I believe that a colleague in our Stirling Office has also responded to a request for information from a Colin Sloan of the Environmental section of Scott Wilson.

The route does not form part of any designated or proposed site within SNH jurisdiction, although one site very close to the proposed route, Abbey Craig (OS grid ref NS810995) is a site of Special Scientific Interest (SSSI). However, it does not appear that the proposal will have any adverse impact on the SSSI, but I enclose a copy of the citation and map of the site for your information.

With regard to undertaking a Phase 1 survey of the study area, it may be worthwhile checking with both Clackmannanshire and Stirling Councils as to whether they already hold this information. I believe that Clackmannanshire Council do have digitised Phase 1 information for their area.

The survey results may identify areas of semi-natural woodland and unimproved neutral grassland along the embankment. If this is the case we would be happy to advise on these areas of interest should the proposal progress.

SNH would also be concerned that any redevelopment of the route should not have a negative affect on any rights of way or footpath access. The Devon Way is one such path which crosses the line route in central Alloa, but we would hope that any locally used routes would be accommodated and perhaps enhanced as part of such a scheme.

A copy of the information provided to Colin Sloan is also enclosed. It does not appear to be the case, but should any work require to be done on the railway bridge crossing the River Forth at Stirling then SNH would provide you with information regarding the River Teith candidate Special Area of Conservation.

I hope that this answers the points you raised. Should you wish to discuss anything further then please contact me at the above address.

Yours sincerely

Mike Taylor
Area Officer
Tayside and Clackmannanshire

From: Gail Jeffrey
Sent: 11 February 2003 17:32
To: Steven Harding
Subject: FW: Response to Statutory Consultation

-----Original Message-----
From: jhamilton@clacks.gov.uk [mailto:jhamilton@clacks.gov.uk]
Sent: 13 September 2002 15:09
To: mwest@clacks.gov.uk
Cc: Gail Jeffrey
Subject: Re: Response to Statutory Consultation

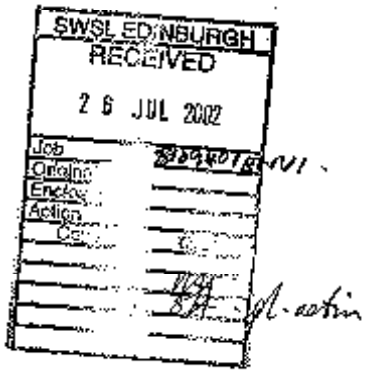
Gail,
My apologies for not responding more promptly.

I understand that Niall Urquhart met with you to discuss the relevant planning issues relating to the proposed reopening of the Rail Line.

You will appreciate our enthusiasm for the proposed reopening. Support for it has been in the Local Plan for over a decade, from safeguarding the route from any development which would preclude reopening to the more recent proposal status. From the perspective of our Planning authority,and from the wider Council perspective, the repening and its numerous benefits is very much supported.

24 July 2002

Stirling Council



Scott Wilson Scotland Ltd
23 Chester Street
Edinburgh
EH3 7ET

Environmental Services
Planning & Environmental Strategy
Stirling Council
Viewforth Stirling FK8 2ET
www.stirling.gov.uk
Tel. 01786 442635
Fax. 01786 443003
email: thorogoodd@stirling.gov.uk
Head of Service: Mick Stewart

Our reference: DPP/11/1/DT/TO

Your reference: B109401ENV1/e04

Dear Sir

Stirling - Alloa - Kincardine Route Re-opening

I refer to your letter of 2nd July and attached papers. The following response covers Planning matters. Colleagues in Environmental Health and Technical Services (Transportation) may wish to comment on other issues, but your deadline is a short one in this holiday period and these responses will follow as soon as possible.

I understand that MVA were supplied with extensive planning constraints information to assist with their study, and this seems to be largely reflected in the Report extract forwarded by you. Some updating is now required:

- The Clackmannanshire & Stirling Structure Plan is now approved, with Modifications. I assume that Clackmannan officials will have passed these Modifications to you.
- Stirling Council has just placed on deposit a draft Alteration to the Stirling Council Local Plan. Environmental policies are largely unchanged except for Flood risk, SUDS and Contaminated land policies (Extract enclosed). Laurencecroft (see below) is the only new development allocation proposed for the vicinity of the route.
- The River Forth, from its confluence with the River Teith down to Stirling Road Bridge, is now a candidate Special Area of Conservation, and the Alloa Inches SSSI is part of the Firth of Forth proposed Special Protection Area; both designations deriving from European conservation Directives. As you will be aware there are some planning implications for operations and activities outwith the actual confines of these designated areas. The Inches SSSI is also included in the proposed Firth of Forth RAMSAR site. (Incidentally, the MVA reference to Alloa Inches on p.54 puts it 75m. south of the railway. It is nearer 6 – 700m.).

Water Quality:

It is noted that water quality is only referred to in relation to freshwater streams. With the imminent incorporation of the European Water Framework Directive into Scots law, estuarial waters will also have quality standards.

Contaminated Land:

The Council has not reached the stage of creating Registers relative to the Environmental Protection Act Part 2A. Our main source of information at present is the "Landmark" dataset derived from historic map analysis, which routinely identifies railway land as potentially contaminated. The areas outlined in brown on the enclosed plans are those adjacent to the rail line which are included in the "Landmark" data. The narrow triangular site alongside Causewayhead Road is former railway land, currently occupied by a restaurant. The commitment (MVA para. 9.19.70) to remediation of current railway land found to have been contaminated in the past is noted and welcomed.

Safety:

While it is noted that "Safety" appears in the MVA "Appraisal Summary Tables", it does not seem to feature in the groupings of topics for consideration in the EIA. It is an important environmental issue in the broad sense, both in relation to land use alongside the rail line, and for the re-opened level crossing sites. It relates also to "Community Severance".

There is a claimed pedestrian right of way across the line about 40m. west of the A91 overbridge. I understand that your office is already in contact with the Council's Access Officer, who will supply further details of this and other rights of way issues.

Visual Amenity and Landscape:

It is noted that the rail line is characterised, for the purposes of the Stirling Council area, as an established landscape feature, and that an assumption is made for the purposes of the MVA study that the recommissioning will not involve works outwith the current railway boundary. Clearly the railway *is* an established feature but its visual impact could be significantly changed by the clearance of trackside vegetation, and possibly also by renewal of fencing, installation of additional signalling, lighting, etc..

Should you require further information or discussion on planning matters please contact myself.

Yours faithfully

D. Thorogood

David Thorogood
Planning Officer

HSE
Health & Safety Executive
Hazardous Installations Directorate
Land Division

Head of Unit: J L Sumner

Scott Wilson Scotland Ltd
23 Chester Street
Edinburgh
EH3 7ET

Our ref: GAC/ Blackford

Your ref: B109401/ENV/12636

22 October 2002

For the attention of Steven Harding

Dear Sirs

STIRLING – ALLOA – KINCARDINE RAIL ROUTE

Thank you for your letter dated 17 October 2002 on the above.

The Control of Major Accident Hazards Regulations 1999 (SI 1999 No.743) apply to the site and place duties on the operator, the emergency planning authority (Clackmannanshire Council) and the Competent Authority (HSE and SEPA). The issues you have raised, are best answered by the operator and Clackmannanshire Council. The contact for Diageo is Harry Fox, 01259 722093 and for Clackmannanshire Council is Bill Gault, emergency planner, 01259 452546

The site stores up to 320,000 tonnes of flammable liquid in a series of warehouses, which are distributed over the site and adjacent to the original track bed. The operator should have an on-site emergency plan to deal with any major accident scenarios, while the emergency planners will have drawn up an off-site emergency plan on the same basis. Clearly your concerns on emergency vehicle access and evacuation procedures should be included in these plans and the effect of re-opening the line on these emergency plans will need to be considered.

As I understand it, operation of the line would be curtailed in the event of a major accident on site to protect passengers and railway staff, so that operation would not adversely affect emergency access or evacuation in theory. You should contact Railtrack or their successor on this matter.

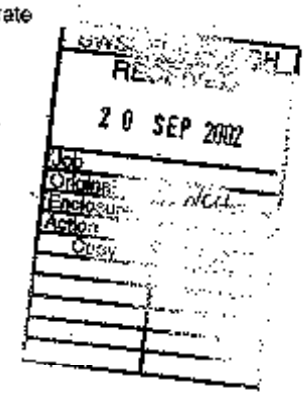
I hope this is helpful.

Yours faithfully

Dr G A Cook
HM Principal Inspector of Health and Safety

Belford House, 59 Belford Road, Edinburgh EH4 3UE
Tel: 0131 247 2000 Fax: 0131 247 2041
Reducing risks - protecting people

HSE
Health & Safety Executive
Hazardous Installations Directorate
Land Division



Head of Unit – Mr J L Sumner

Scott Wilson Scotland Ltd
23 Chester Street
Edinburgh
EH3 7ET
UK

Your Ref: B109401ENV1/c29
Our Ref:

19 September 2002

Dear Sirs

STIRLING-ALLOA-KINCARDINE ROUTE RE-OPENING

Thank you for your letter dated 18 September 2002. The advice given in the previous letter dated 8 July 2002 stands for the Eastern Link Road.

Yours faithfully.

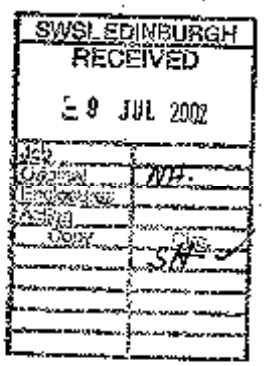
Dr G A Cook
HM Principal Inspector of Health & Safety

Belford House, 59 Belford Road, Edinburgh EH4 3UE
Tel: 0131 247 2000 Fax: 0131 247 2041
Reducing risks - protecting people

HSE
Health & Safety Executive
Hazardous Installations Directorate
Land Division

Head of Unit :
Mr J L Sumner

B109401/ENV1



Scott Wilson Scotland Ltd
23 Chester Street
Edinburgh
EH3 7ET

Date: 8th July 2002

Your Ref: B109401ENV1

Dear Sir

Thank you for your letter of 2nd July 2002 concerning:

ENVIRONMENTAL ASSESSMENT FOR PROPOSED DEVELOPMENT AT STIRLING-ALLOA-KINCARDINE ROUTE RE-OPENING,

asking HSE to make available any information which may be relevant to the preparation of this development.

Environmental Impact Assessments are concerned with projects which are likely to have significant effects on the environment. HSE's principal concerns are the health and safety of people affected by work activities. HSE would like to advise that the proposed development is within the vicinity of a COMAH Top Tier whisky site (Diageo Scotland Ltd, Blackgrange/Cambus Bond).

You should note that your environmental statement should not include measures which would conflict with the requirements of the Health and Safety at Work etc Act 1974 and it's relevant statutory provisions.

Yours faithfully

Dr G A Cook
HM Principal Inspector of Health and Safety

Belford House, 59 Belford Road, Edinburgh EH4 3UE
Tel: 0131 247 2000 Fax: 0131 247 2041
Reducing risks - protecting people

Fife COUNCIL

PLANNING & BUILDING CONTROL SERVICE

FIRST CLASS
Nigel Hackett
Scott Wilson Scotland Ltd
23 Chester Street
Edinburgh
EH3 7ET

Direct Line: **Andrew Kelly (01592) 416336**

Our Ref: AK/847/dm

Date: 26th July 2002

Dear Mr Hackett,

STIRLING – ALLOA- KINCARDINE ROUTE RE-OPENING

Thank you for your letter dated 2 July 2002 with enclosures to the Head of Planning and Building Control Service regarding the above subject. I have been asked to co-ordinate a response to you in terms of the Council's interests as a statutory consultee and enclose relevant observations. These include details of appropriate officials who may be contacted for further information/ clarification on the aspects covered should you so wish.

I should be pleased to clarify any points arising from the response as a whole.

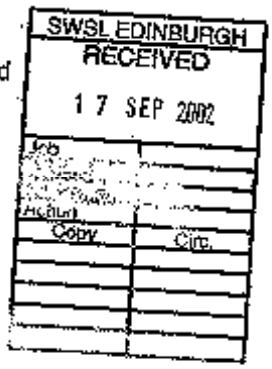
Yours sincerely,

Andrew Kelly
Principal Planner (Specialist Services)

Fife Council

PLANNING & BUILDING CONTROL SERVICE

Steven Harding
Scott Wilson Scotland Ltd
23 Chester Street
Edinburgh
EH3 7ET



Direct Line: Andrew Kelly
(01592) 416336

Our Ref: AK/855/lm
B25/ D15

Date: 12th September 2002

Dear Mr Harding,

STIRLING-ALLOA-KINCARDINE ROUTE RE-OPENING

Thank you for your e-mail of 28th August 2002 regarding the above subject and requesting information on the Longannet and Kincardine Power Station sites identified as brownfield land for business and employment development opportunities in the West Villages Local Plan. (I enclose an extract from the latest version – West Villages Local Plan (finalised Draft, February 2000, as amended 2002) for your information.)

I have not chosen to complete the table attached to your e-mail since, having investigated the position regarding development interest and planning status with our West Area office and the Council's Economic Development Service, I have established that there has been no developer interest or any history of planning applications at either site to date. (Please note that the area of site PR18- Longannet Power Station is 4.45ha (S2 to the west) and 3.9ha (s3 to the east) – total 8.35ha.)

I am advised by our West Area office that land within the Kincardine Power Station site (PR19) may be required for construction of the new Forth crossing at Kincardine. The Local Plan as amended shows two alternative routes and the text in the Transport chapter has been changed accordingly (extract attached), it being unknown as yet which option the Scottish Executive will select.

I am further advised by our West Area office that in January of this year, consultants WS Atkins had been engaged by the DTI and in this connection were seeking information on a portion of the land of Local Plan site S14- the Longannet Ash lagoons (site plan attached), to assess its suitability for a particular activity. No further clarification was provided by them and it was generally emphasised by this Service that the Local Plan's policies relating to the site are for continuing ash deposition leading to ultimate restoration as grassland to enhance nature conservation and provide for public recreation.

Fife Council Fife House North Street Glenrothes Fife KY7 5LT

DAVID RAE Head of Planning & Building Control Service

TELEPHONE 01592 414141
FACSIMILE 01592 416300
E-MAIL pbchq@fife.gov.uk

A change of use of the site would be of particular concern, especially if the new use did not relate to the energy industry. No further communication has since been received from WS Atkins on this matter.

I trust that the above information is helpful but should be pleased to clarify any points arising.

Yours sincerely,

Andrew Kelly
Principal Planner (Specialist Services)

Enc

SEPA
Scottish Environment
Protection Agency

SWSL EDINBURGH
RECEIVED
11 JUL 2002

Our Ref: 24/03/000/0000
Your Ref:

Mr Nigel Hackett
Scott Wilson Scotland Ltd
23 Chester Street
Edinburgh
EH3 7ET

9 July 2002

Dear Mr Hackett

STIRLING-ALLOA-KINCARDINE RAIL LINK
GENERAL COMMENTS

Thank you for your letter dated the 2 July 2002. The benefit study appears to cover the main issues of interest for SEPA. I will detail here how they may relate to our regulatory function.

Construction Phase
The construction phase of development includes a number of pollution risks e.g. from spillages of materials employed such as oil stores etc. I enclose guidance note PPG6 on "Working at Construction and Demolition Sites" which you may find useful in terms of the controls expected during development.

River Crossings
The route will involve a number of river crossings. Work to strengthen or replace bridges should be highlighted as a sensitive aspect of the development. Guidance document PPG5 "Works in, near or liable to affect watercourses" should be adhered to. Obviously the priority is to keep building materials, chemicals and machinery outwith watercourses wherever possible.

Surface Water Drainage
I am not sure what scale of surface water drainage will be necessary for the route, but I would advise you to consider Sustainable Urban Drainage if any of the options are suitable for a railway. The CIRIA design manual on sustainable urban drainage systems, "SUDS Design Manual for Scotland and Northern Ireland (CIRIA C521)" will provide you with more detailed information on this subject. The address for CIRIA can be found in the SUDS booklet enclosed. The principle is to employ attenuation or infiltration measures to help treat and control surface water from new developments, e.g. filter drains, retention ponds etc.

If the drainage from the rail link is expected to contain contaminating matter other than surface water, then it may be necessary to apply for a SEPA consent for any discharges to a watercourse. This matter can be discussed in more detail with the SEPA Stirling office when you have details of where drainage is likely to be needed.

Stirling Office
Erskine Court, Castle Business Park, Stirling FK9 4TX
tel 01786 461407 fax 01786 461425
www.sepa.org.uk

Flood Defences
Flood prevention works are the responsibility of the local authority and I advise you to contact Clackmannanshire Council on this issue.

Waste Management Issues
Should it be necessary to remove gravels or other substrate from the existing rail system it may prove necessary to undertake analysis for contaminants, such as the level of hydrocarbons in gravels. The type and quality of any wastes produced from the existing system may have a bearing on their destination for disposal or re-use.

I hope these comments are useful.

Yours sincerely

Francis Hayes
Environment Protection Officer
Stirling Team

SEPA
Scottish Environment Protection Agency

Our Ref: 44/00/073/0065/JJ/MC
Your Ref:

Scott Wilson Scotland Ltd
23 Chester Street
Edinburgh
EH3 7ET

3 December 2002

Dear Mr Hackett

ALLOA EASTERN LINK ROAD
STIRLING – ALLOA – KINCARDINE ROUTE

In response to your enquiry regarding the above proposed development I can confirm that SEPA has a number of sites that it regulates in the vicinity of the new road.

Air sites
Safeway Petrol station has a Petrol Vehicle Recovery authorisation.

Waste sites
Alloa Auto Breakers and Alloa Auto Dismantlers are both exempt scrapyards close to the proposed new roundabout. There is also an area around the new road that is a regular fly-tipping spot.

COMAH sites
We have one COMAH (Control of Major Accident Hazards) site at the bonded warehouses.

The water quality of the Brothie Burn downstream of Ind Coope is unclassified by SEPA.

The hydrology department noted that there has been flooding upstream of NS 8960 9335 in the past although the specific location is not known. However downstream of this point is clear of flooding problems.

There are no known contaminated land issues in the locality.

SEPA provides guidance on construction sites and working in or near watercourses in the form of guidance notes PPG 5 and PPG 6. I have enclosed a copy of both for reference.

Please feel free to contact me if you have any further queries.

Yours sincerely

J. Johnstone

Julie Johnstone
Environmental Protection Officer
Stirling Team

SWSL EDINBURGH RECEIVED 05 DEC 2002
Job | Original | Enclosures | Action | Copy

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MA
SH
OW.

ISO 9001 UKAS

Chief Executive
Ken Collins

Stirling Office
Bremner House, Castle Business Park, Stirling FK9 4TF
tel 01786 452595 fax 01786 461425
www.sepa.org.uk

SCOTTISH EXECUTIVE

Environment Group

Air, Climate & Engineering Unit
Victoria Quay
Edinburgh EH6 6QQ

Telephone: 0131-244 0196
Fax: 0131-244 0211
guy.winter@scotland.gov.uk

Your ref: B109401ENV1/e30
Our ref: EDV/1/28 part 7

Date: 26 September 2002

Mr Nigel Hackett
Scott Wilson Scotland Ltd
23 Chester Street
EDINBURGH
EH3 7ET

Dear Mr Hackett

ENVIRONMENTAL IMPACT ASSESSMENT (SCOTLAND) REGULATIONS 1999
SCOPING STUDY – STIRLING-ALLOA-KINCARDINE ROUTE RE-OPENING

I refer to your recent consultation with the Scottish Ministers about the above case under the above Regulations.

This response relates to the Scottish Ministers responsibilities for water supply, water protection, sewerage, flood prevention, coastal protection, waste disposal, air quality and countryside and natural heritage. Consideration is being given to the other responsibilities of the Scottish Ministers, and you may expect separate responses on these aspects.

In relation to the above case, on the basis of the information available and without prejudice to any further consideration the Scottish Ministers may be required to give, we have no specific comments to offer on the Scoping Study of the Environmental Assessment, although we would mention that potential noise and air quality issues should be considered. Also, the hydrological and hydrological conditions at the site should be considered and the developer should ensure that there are no adverse impacts on groundwater and water quality of any water courses during construction and operation. It would be good practice for the Sustainable Urban Drainage Systems (SUDS) to be taken into account – SEPA can advise if necessary.

Yours sincerely

GUY WINTER

SCOTTISH EXECUTIVE

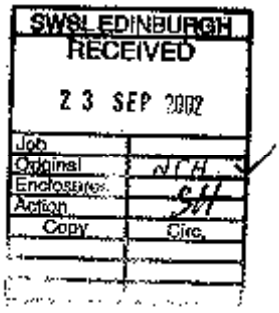
Development Department
Planning Division: Room 2-G85

Victoria Quay
Edinburgh EH6 6QQ

Telephone: 0131-244 7071
Fax: 0131-244 7083

FAO : Nigel Hackett

Scott Wilson Scotland Ltd
23 Chester Street
EDINBURGH
EH3 7ET



Your ref: B109401ENV1/c30

Our ref: P/EA/96/CC/08/1

19 September 2002

Dear Mr Hackett

ENVIRONMENTAL IMPACT ASSESSMENT (SCOTLAND) REGULATIONS 1999 - STIRLING-ALLOA-KINCARDINE ROUTE RE-OPENING

I am writing to acknowledge receipt of your letter of 18 September 2002 giving further details of the above development, as a follow-on from an earlier scoping consultation about Option 'B'.

These latest papers are now being circulated to interested parties within the Executive, who have been asked to send responses direct. Their attention has also been drawn to the deadline (2 October) mentioned in your letter. However, if any of these parties have queries, or require additional time to reply, they have been advised to contact you or Steven Harding to negotiate, by agreement, a revised deadline, etc.

Yours sincerely

John Browne

JOHN BROWNE

5

SCOTTISH EXECUTIVE

Development Department
Road Network Management &
Maintenance Division

Victoria Quay
Edinburgh EH6 6QQ

Telephone: 0131-244 0448
Fax: 0131-244 0156
Mark.wilkie@scotland.gsi.gov.uk
http://www.scotland.gov.uk

SWSL EDINBURGH
RECEIVED
20 AUG 2002

Nigel Hackett
Scott Wilson Scotland Ltd
23 Chester Street
EDINBURGH B109401ENV1
EH3 7ET

cc. A McCracken
D. Webster

Your ref: B109401ENV1/e08
Our ref: ZZA 5/11 pt. 3
Date: 19 August, 2002

Dear Nigel

STIRLING-ALLOA-KINCARDINE RAILWAY REOPENING
ENVIRONMENTAL ASSESSMENT SCOPING DOCUMENT

I refer to your letter of 31 July, enclosing a plan of the preferred route for the above project. I can now advise you that ongoing consultation will be required on the following trunk road issues:

- the crossing of the existing A876(T) in Kincardine, to the east of Kincardine Bridge (Contact - Mike Dobson, SEDD-RNMMD-4, Area 1-D, Victoria Quay. Tel. No. 0131 244 40488);
- the potential conflict with the proposed Upper Forth Crossing at Kincardine (Contact - Roy Brannan, SEDD-Trunk Roads Design and Construction Division, Area 2-D, Victoria Quay. Tel. No. 0131 244 7207);
- Potential traffic impact issues relating to the location and use of freight terminals, in the first stage of the project. The subsequent creation of passenger terminals should have an overall beneficial impact on trunk road traffic, but consultation on the proposed locations, and accesses to the trunk road network would also be required (Contact – Mark Wilkie).

I trust that this is helpful.

Yours sincerely

Mark Wilkie

Mark Wilkie
RNMMD-7
Area 1-D
Victoria Quay

Cc:- John Browne, DD Planning Division
Mike Dobson, DD-RNMMD-4
Roy Brannan, DD-TRDCD-2

SCOTTISH EXECUTIVE

Development Department
Road Network Management &
Maintenance Division

Victoria Quay
Edinburgh EH6 6QQ

Nigel Hackett
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http://www.scotland.gov.uk

Your ref: B109401ENV1/e08
Our ref: ZZA 5/11 pt. 3
Date: 26 July, 2002

Dear Nigel

STIRLING-ALLOA-KINCARDINE RAILWAY REOPENING
ENVIRONMENTAL ASSESSMENT SCOPING DOCUMENT

I refer to your letter of 2 July, addressed to the Planning Division, containing the above document.

I note that it refers at par.9.17.2 to the A907 trunk road. No section of the A907 is trunked. The nearest trunk roads to the rail project are as follows:

- the A977(T) between Kincardine and Gartarry;
- the A876(T) in Kincardine, to the east of Kincardine Bridge;
- the A985(T) to the east of the A876(T)/A77(T)/A985(T) mini-roundabout in Kincardine.

It would be helpful if you could supply a copy of drawing number BTR202443/G/01, so that I can review the potential impact of the railway re-opening on the above trunk roads.

Yours sincerely

Mark Wilkie
RNMMD-7
Area 1-D
Victoria Quay

Cc:- John Browne, DD Planning Division

SCOTTISH EXECUTIVE

Environment Group

Air, Climate & Engineering Unit
Victoria Quay
Edinburgh EH6 6QQ

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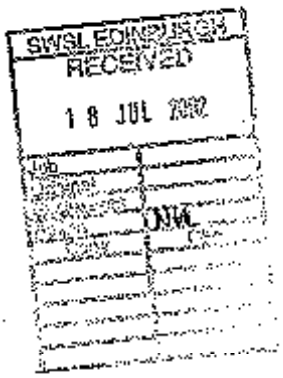

Nigel Hackett
Scott Wilson Scotland Ltd
23 Chester Street
EDINBURGH
EH3 7ET

Your ref: B109401ENV1/e08
Our ref: EDV/1/28: Part 06

Date: 16 July 2002

Dear Mr Hackett

ENVIRONMENTAL IMPACT ASSESSMENT (SCOTLAND) REGULATIONS 1999 OPTION'E' FOR STIRLING-ALLOA-KINCARDINE RAIL LINE RE-OPENING (SCOPING)

I refer to your recent consultation under the 1999 Regulations with the Scottish Ministers about the proposed development named above.

The above Regulations provide that, among others, Scottish Ministers must make available to the applicant any information they consider relevant to the preparation of an Environmental Statement. This response relates to Scottish Ministers' responsibilities for water supply, water protection, sewerage, flood prevention, coastal protection, waste disposal, air quality and countryside and natural heritage. Consideration is being given to certain other responsibilities of Scottish Ministers, and you may expect separate responses on these aspects.

In relation to the above development, without prejudice to any further consideration Scottish Ministers may be required to give to the application, we do not consider that we have any information relevant to the preparation of an Environmental Statement.

Yours sincerely

G WINTER

SCOTTISH EXECUTIVE

Development Department
Planning Division: Room 2-G85

Victoria Quay
Edinburgh EH6 6QQ

Telephone: 0131-244 7071
Fax: 0131-244 7083

FAO : Nigel Hackett

Messrs Scott Wilson Scotland Ltd
23 Chester Street
EDINBURGH
EH3 7ET

Your ref: B 109401ENV1/e08

Our ref: P/EA/96/CC/8/1

8 July 2002

Dear Mr Hackett

ENVIRONMENTAL IMPACT ASSESSMENT (SCOTLAND) REGULATIONS 1999 - OPTION 'E' FOR STIRLING-ALLOA-KINCARDINE RAIL LINE RE-OPENING (SCOPING)

I am writing to acknowledge receipt of your letter of 2 July 2002 and enclosure, concerning a scoping opinion related to Option 'E', which is now the preferred choice for the above development.

The various papers are now being circulated to interested parties within the Executive, who have been asked to send any responses direct to you. Their attention has also been drawn to the deadline mentioned in your letter of 2 July. However, if any of these parties have queries, or require additional time to reply, they have been advised to contact either yourself or Fraser Maxwell, to negotiate, by agreement, a revised timescale, etc.

Yours sincerely

John Browne

JOHN BROWNE

11 July 2002

SCOTTISH WATER

SCOTTISH WATER

Woodlands
St Ninians Road
Stirling
FK8 2HB

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Scott Wilson Scotland Ltd
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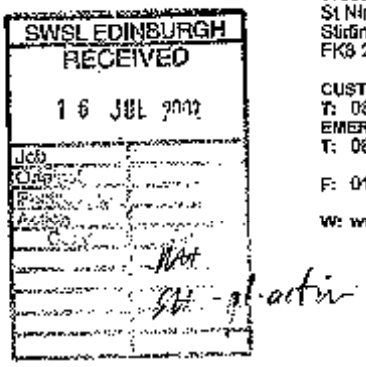
FAO Mr Nigel Hackett



Dear Mr Hackett

Your Ref: B109401 ENV1/e05
Our Ref: DC/LAD/10707 0241463714

Stirling – Alloa – Kincardine Route Re-opening

Thank you for your enquiry of 02 July 2002, enclosing details of the proposals for the above project.

I enclose plans indicating sewers and water mains in the vicinity of the railway line, and I feel that the best way forward would be a meeting to discuss potential implications for our infrastructure, where affected.

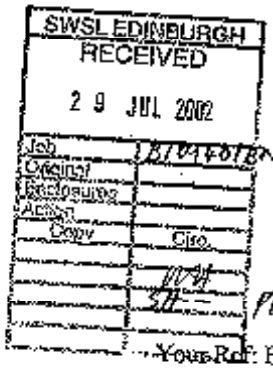
If you are in agreement, could you please contact me on 01786 458742.

Yours sincerely

Douglas Cooper
Team Leader Asset Management
douglas.cooper@scottishwater.co.uk

FORTH DISTRICT SALMON FISHERY BOARD.

Clerk: TOM McKENZIE. 12, CHARLES STREET, DUNBLANE. FK15 9BY
Telephone/Fax 01786 825544.
E-mail forthdsfb@tesco.net



Scott Wilson Scotland Ltd.
23, Chester Street,
Edinburgh
EH3 7ET.

22nd July 2002

Your Ref: B109401/NAW/621

Dear Sir,

Stirling – Alloa- Kincardine Route Reopening.

Thank you for your consultation documentation regarding the above project.

The proposal, as has been indicated in the appraisal, will impinge in some way on the two major water systems along the route, the Black Devon and the River Devon Of these The River Devon is a designated salmon river and the Black Devon at the crossing point on the proposed route has a healthy population of brown trout and various coarse fish species. It is also likely however that a number of smaller streams will to some extent be affected and this should be borne in mind as all will have fish populations of some sort.

With regard to how the proposal might affect these streams and their fish stocks it is not possible to say without detailed plans. However if any engineering work is required to protect or strengthen existing crossings or to culvert or divert streams, this will impact on the streams in some way and we would wish to be advised of any proposals. If no work is required at crossings there is unlikely to be any environmental impact.

I would draw your attention to your comment that the Board has been consulted as a non statutory body. This is incorrect. The Board is in fact a statutory body formed under the 1986 Salmon Act with a remit to protect and improve salmon stocks and as such we would request that we be placed on your list of statutory consultees for those parts of the project where water courses are affected. If you wish further clarification on this please do not hesitate to contact me.

Yours sincerely,

Tom McKenzie
Clerk to the Board.

APPENDIX 1C: GLOSSARY AND ABBREVIATIONS

Given below is an explanation of some of the key terms used in this Environmental Statement:

Environmental Assessment Process	
Baseline	The environmental conditions against which potential impacts/effects are identified.
Baseline Study / Survey	The process of research and fieldwork by which the baseline conditions are established.
Construction	Any activities, which take place during the construction phase, including temporary landtake.
Effect	The result of an impact on a particular resource or receptor.
Environmental Impact Assessment (EIA)	A process for identifying and evaluating the likely effect of a proposed development on the environment. EIA normally forms part of the consent procedure.
Environmental Statement	A document or series of documents which reports the findings of the EIA
Impact	A physical or measurable change to the environment attributable to the Scheme.
Infrastructure	The facilities, services and businesses in a defined area.
Magnitude of impact	The actual change taking place to the environment, for example, the extent of landtake or predicted change in noise levels.
Operation	Any activities forming part of or associated with the operation of the Scheme.
Permanent Landtake	The permanent occupation of land by Scheme infrastructure, including physical features such as buildings.
Receptor	A component of the natural, created or built environment such as a human being, water, air, a building or a plant that is affected by an impact
Resources	Physical or qualitative features of the environment which are capable of identification and evaluation, and which are often the subject of some form of protective planning designation.
Scope	The extent of coverage of EA.
Significance of impact	The product of an impact's magnitude and the sensitivity, importance or value of the relevant receptor or resource
Sources of Impact	The Scheme activities or components, which give rise to environmental impact, as, defined below.

Types of Effect	
Cumulative Effect	An effect resulting from the accumulation of a number of effects. A cumulative effect may result from: • The combination of different effects at a particular location; • The recurrence of effects of the same type at different locations; • The interaction of different effects over time or • The interaction between the Scheme and other projects.
Direct Effect	An effect arising from an impact attributable to a project component or activity.
Environmental Effect	Identification of the possible range and location of potential impact, the words impact and effect have been used interchangeably
Indirect Effect	An effect arising from additional development works which are as a result of the Scheme.
Non-significant Effect	An effect, which is unlikely to have an influence on the decision-making process.
Permanent Effect	An effect, which is irreversible or likely to persist for the foreseeable life of the Scheme.
Residual Effect	An effect, which is likely to remain after the application of mitigation measures.
Secondary Effect	An effect, which may arise as a consequence of a primary effect, particularly between different environmental topics (e.g. reduced amenity of a community facility due to noise and disturbance).
Significant Effect	An effect, which, in isolation or in combination with other effects, is likely – in the opinion of the EA team – to have an influence on the decision-making process.
Temporary Effect	An effect which is of limited duration, due to either the cessation of the impact giving rise to it or the ability of the environment to accommodate or recover from it.
Unavoidable Effect	An effect which is an inevitable consequence of the Scheme and which cannot be removed or rendered insignificant by mitigation.
Mitigation	Measures adopted to reduce, ameliorate or avoid significant effects.

Delineation of Landtake	
Limits of Deviation (LoD)	Maximum extent of landtake which may be compulsorily acquired for the proposed infrastructure and ancillary works.
Limits of Land to be Acquired or Used (LLAU)	The Limits of Land to be Acquired or Used are shown on the Bill plans. They define the extent of land that may be required either permanently or temporarily for a specified ancillary purpose including: • Land for construction sites; • Land for construction access; • Land for service diversions; and • Land for off route mitigation. The land required temporarily may be returned to its original use once the infrastructure is constructed.
Construction sites	Land temporarily required for construction.

Railway and Engineering Terms	
At Grade	Junction where all lines are at the same elevation
Ballast	Graded stone, used for supporting track and providing drainage
Construction Compound	A defined area (usually fenced off) where construction activity takes place
Crossover	A length of rail that enables a train to cross from one line to another
Loop	Section of track, connected to the line at both ends, to enable trains to be overtaken
Junction	Two or more lines converging from different directions
Overbridge	A structure carrying a road (generally) over the railway
Permanent Landtake	A requirement for land that will be needed as part of the operation phase of the Scheme
Possession	A section of line under the control of an engineer, with no trains allowed to enter except those specifically run by the engineer (e.g. for maintenance or construction purposes)
Relocatable Equipment Building	Modular equipment room, which contains electrical/electronic equipment necessary for the functioning of signaling and other electrical railway equipment.
Solum	Railway corridor
Switches and Crossings	Items of track enabling trains to change tracks
Temporary Landtake	A requirement for land that will be needed during the construction phase of the Scheme only, and can be returned to other use afterwards
Underbridge	A structure carrying the railway over a feature (e.g. road or river)

The following is an explanation of some of the abbreviations used in this Environmental Statement:

- **AELR** - Alloa Eastern Link Road
- **CO** - Carbon monoxide
- **CO_2** - Carbon dioxide
- **CRN** - Calculation of Railway Noise
- **CRTN** - Calculation of Road Traffic Noise
- **DMRB** - Design Manual for Roads and Bridges
- **GoMMMS** - Guidance On The Methodology For Multi Modal Studies
- **HDV's** - Heavy Duty Vehicles
- **$L_{A90,T}$** - Sound pressure level exceeded for 90% of the time T
- **$L_{Aeq,T}$** - Equivalent continuous A-weighted sound pressure level normalized to the time T
- **$L_{AMAX,fast}$** - Maximum sound pressure level, with the meter on "fast" response
- **NMHC** - Non methane hydrocarbons
- **NO_2** - Nitrogen dioxide
- **NO_x** - Oxides of Nitrogen
- **PAN** - Planning Advice Note
- **PM_{10}** - Fine particles (less than 10 µm in diameter)
- **Ppv** - Peak Particle Velocity
- **SEL** - Sound Exposure Level. Equivalent continuous A-weighted sound pressure level normalized to a time of one second
- **SEPA** - Scottish Environment Protection Agency
- **SO_2** - Sulphur dioxide
- **VDV** - Vibration Dose Value
- **WHO** - World Health Organization

2. CULTURAL HERITAGE

APPENDIX 2A: METHODOLOGY

Data procurement methods and sources

A desk-based survey was undertaken to review the information held within readily accessible public archives. This information allowed the compilation of a catalogue of known archaeological sites within and around the development area, and the reconstruction of the recent history of land use in the area. The public archives consulted include:

- The Royal Commission on the Ancient and Historical Monuments of Scotland (for the National Monuments Record of Scotland, the Ordnance Survey Name Book, the Aerial Photographic Collection, architectural and archaeological photographs, and various publications);
- The National Map Library: for early Ordnance Survey maps and early cartographic records;
- The Scottish Record Office: for Old and New Statistical Accounts;
- Historic Scotland: for information on scheduled areas, listed buildings and designed landscapes designations;
- Stirling Council (for Stirling and Clackmannanshire Sites & Monuments Record (SMR) data;
- Fife Council Archaeological Unit (for Fife Sites & Monuments Record (SMR) data.

The sources consulted during this assessment were examined for an area covering a minimum margin of 200 m beyond the limit of the proposed development. This was done to evaluate the immediate vicinity and so allow an assessment of the potential for unidentified archaeological sites to be present within the proposed development area. The catchment area of the assessment was increased to 1 km of the railway in the case of scheduled ancient monuments to assess potential visual impacts.

Aerial photographs held at the Aerial Photography Unit at the RCAHMS were consulted. These depicted the railway at scales of 1:10,000 and 1:24,000, in the years 1946, 1955, and 1971.

Sites and monuments considered to be of archaeological interest within this defined study area have each been assigned a Site No. unique to this assessment. The Site Gazetteer in Appendix 2C lists these in numerical order, along with other basic data about their location and status, with some descriptive information. All sites recorded in the National Monuments Record of Scotland (NMRS), in the local authority Sites & Monuments Records (SMR), in the scheduled ancient monuments database (SAM) and in the listed buildings record located within the study area have automatically been assigned a Site No. in this assessment, however a number of other sites were also identified from consulting historical maps and aerial photographs.

Buildings and structures located in the assessment area that have statutory protection as listed buildings or scheduled ancient monuments are identified as such in the Site Gazetteer in Appendix 2C.

This corpus of sites represents the known archaeological and historical remains within the development area. However, as in most areas proposed for development, there exists the potential for buried remains to survive that have never entered the aerial photographic,

documentary or cartographic record. Such remains would only be found during ground-breaking works.

Method of assessing sensitivity

The criteria used to rate the sensitivity of the archaeological features in the study area have been adapted from those used by Historic Scotland for assigning protective categories to Listed Buildings and Scheduled Ancient Monuments. These protective designations are generally assigned based upon factors such as age, rarity, condition, site context, architectural design and historical associations. Note that in some cases a monument which does not have a protective designation assigned to it could nonetheless still be rated as having the same sensitivity as another monument which is protected. This is because the selection of items for listing by Historic Scotland is an ongoing activity. Generally, the criteria for judging archaeological sensitivity are gradually evolving, with an increasing trend towards including more recent types of structures. In some cases, important buildings or monuments may have been accidentally overlooked during Listing, or could now be judged worthy of Listing, whereas they were not previously. The criteria used to rate archaeological sensitivity in the current assessment are presented in Table 2A; over.

TABLE 2A

Criteria For Rating Archaeological & Cultural Heritage Sensitivity	
SENSITIVITY	**CRITERIA**
Very High	Scheduled Ancient Monuments; *or* Category A Listed Buildings; *or* Archaeological sites of national or international importance, either architectural or historic, or fine, little-altered examples of some particular period, style or type.
High	Category B Listed Buildings; *or* Archaeological sites of regional or more than local importance, or major examples of some period, style or type, which may have been altered *or* Historic designed landscapes
Moderate	Category C Listed Buildings; *or* Archaeological sites of local importance, lesser examples of any period, style or type, as originally constructed or altered, and simple, traditional sites, which group well with categories A and B, or are part of a planned group such as an estate or an industrial complex *or* Cropmarks/remains of indeterminate date and significance
Low	Non-protected archaeological remains of local importance.

Method of assessing impacts

The magnitude of the physical impact upon monuments caused by the development has been rated using the classifications and criteria outlined in Table 2B below.

TABLE 2B

Criteria For Classifying Magnitude Of Adverse Impact	
Adverse physical impact	**Criteria**
Severe	Landtake or physical damage would result in the loss of an area, features or evidence fundamental to the historic character and integrity of the site. Severance would result in the complete loss of physical integrity.
Moderate	Land take or physical damage would result in the loss of an important part of the site or some important features and evidence, but not areas or features fundamental to its historic character and integrity. Severance, which may be at a secondary or peripheral level, would affect the integrity of the site. Key physical relationships would not be lost
Slight	Land take, severance or physical damage would be peripheral and/or secondary and would not affect the key features of the site. The historic integrity of the site would not be significantly affected.
Negligible	Land take, severance or physical damage confined to a relatively small, peripheral and/or unimportant part of the cultural feature, and would not affect its historic integrity, or the quality of the surviving evidence.

The predicted significance of impact upon each site of archaeological/cultural heritage interest was then determined by appraising the magnitude of the physical impact with the archaeological or cultural heritage sensitivity of each site or monument. The method of deriving the overall significance of impact in indicated in Table 2C below.

TABLE 2C

Method Of Rating Significance Of Adverse Impact				
	Archaeological/Cultural Heritage Sensitivity			
Magnitude of impact	**Low**	**Moderate**	**High**	**Very High**
Severe	Moderate	Moderate-to-Major	Major	Extreme
Moderate	Low-to-moderate	Moderate	Moderate-to-Major	Major
Slight	Low	Low-to-moderate	Moderate	Moderate-to-Major
Negligible	Negligible	Low	Low-to-moderate	Moderate
No impact	None	None	None	None

APPENDIX 2B: ARCHAEOLOGICAL REFERENCES

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Cartographic references

The maps consulted during the assessment are listed below in chronological order:

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- 1865 (surveyed 1861) Ordnance Survey. Stirlingshire sheets X.15 and X.16, scale 1:10,560.
- 1866 (surveyed 1863) Ordnance Survey. Perth & Clackmannanshire sheets CXXXIX.2-4, scale 1:10,560.
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- 1899 Ordnance Survey. Stirlingshire sheets XVII.NE and X.SE, scale 1:10,560.
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- 540/RAF/1645, frames F22: 0258-0262, F22: 0257-9, F21: 0367-0369, F22: 0368-0371, date 17.6.1955, scale 1:10,000, NMRS library code B415.
- Meridian 114/71, frames 125-131, 088-089, 062-064, date 10.7.1971, scale 1:24,000, NMRS library code C306.

APPENDIX 2C: SITE GAZETTEER

A gazetteer below lists the sites located during the archive consultation, numbered consecutively from west to east along the railway route. An individual entry for each monument is laid out below in the following fashion:

i) Unique monument number
ii) Site name and locale
iii) Protective designation (if any)
iv) Type of site
v) National Monuments Record No.
vi) Ordnance Survey National Grid Reference
vii) Estimated archaeological/cultural heritage sensitivity
viii)Description
ix) References

Site No 1
Name: Stirling Middle Signal Box
Local Authority:Stirling
Status: Listed building category A
Type of site: Standing building
NMRS number: None
Map reference: NS 7996 9333
Sensitivity:Very High
Description: Located about 300m south-east of Stirling Station building, on the east side of the tracks. Long, brick, timber and glass signal box, with level frames and associated equipment. In reference to the railway at Stirling, C McKean (1985) has highlighted the 'rare survival of a large signal box, its long upper-glazed storey cantilevered from its brick plinth'. Built around 1900. Similar to Stirling North Signal box, but longer and with more original levers in-situ.Unlike Stirling North Box, it has no internal partition. A computer has already been installed at the north end of the lever frame. Modifications were recently made for installing the TPWS system - a tube carrying the cables can been seen arching overhead inside the building. Many of the levers in this signal box are out of use (painted white). The wiring in the wall-mounted disconnection cabinet is relatively rare in Scotland due to its age. The boards to the rear of the base of the levers gives access to trays in which levers inerlock. (Information recorded during a site visit made by AOC Archaeology in Oct 2002).

Site No 2
Name: Gasworks, Goosecroft Road, Stirling
Local Authority:Stirling
Status: None
Type of site: Site of Gasworks
NMRS number: NS79SE 155
Map reference: NS 798 933
Sensitivity:Low
Description: The NMRS holds photos of the gasworks dating from 1949 and 1956, as well as two undated site plans. However, no descriptive information about the site or its former structures is recorded in the NMRS. It is now demolished.

Site No. 3
Name:Port Street Bastion, Stirling Town Wall
Local Authority:Stirling
Status:SAM; Listed building category C(s)
Type of Site: Bastion
NMRS number: NS79SE 35.03 7973 9327.
Map reference: (NS 7973 9327)
Sensitivity: Very High
Description: The Port Street bastion in Stirling Town Wall is a rubble-built structure of one storey, roughly circular on plan externally but rectangular within. The upper storey is of much later date. Near the SE re-entrant angle of Town Wall and bastion, the latter contains a splayed gun-loop. The circular outline of the external wall of the bastion ends on the N in a rocky outcrop which may have carried the wall in a northerly direction as indicated on Laye's plan of 1725. The W wall of the bastion has been disturbed and partly rebuilt; the E wall is 4'3" thick. The structure is roofed with a barrel-vault of rubble. Internally, there is a chamber, 12' x 7', below

ground level. The provision of what appears to be a crudely formed garderobe, with a drain, in the N wall suggests that the chamber was used as a prison. RCAHMS 1963, visited 1955 As described. Visited by OS (JP) 6 December 1973.

Site No 4
Name: Site of signal box, Stirling Station
Local Authority:Stirling
Status: None
Type of site: Site of signal box
NMRS number: None
Map reference: NS 7989 9349
Sensitivity: Low
Description: Site of signal box located about 100m south-east of Stirling Station building, next to sidings that branched off to the east of the station. Shown on OS maps in 1958 and 1966, but no longer standing.

Site No 5
Name: Site of Goods Shed, Stirling Station
Local Authority:Stirling
Status: (Formerly Listed Building Category A)
Type of site: Site of railway building
NMRS number: NS79SE 162.01
Map reference: NS 7980 9350
Sensitivity: Low
Description: Goods Station and Office shown here on the OS map in 1860, and again (un-named) in 1899 and 1958. Located just south of the Station building. It was a large rectangular structure, almost as long as the Station building. Although it was a listed building, it was demolished some time after 1966, and is now overlain by the Station car park. Its site is therefore of low Sensitivity.

Site No 6
Name: Semaphore Signals, Stirling Station
Local Authority:Stirling
Status: Listed building category A
Type of site: Railway signal posts
NMRS number: None
Map reference: NS 7976 9358
Sensitivity: Very High
Description: Semaphore signal posts, located north and south of Stirling station. Shown on the 1899 OS map.

Site No 7
Name: Stirling Station
Local Authority:Stirling
Status: Listed Building Category A
Type of site: Standing building, Railway Station
NMRS number: NS79SE 162.00
Map reference: NS 7976 9358
Sensitivity: Very High
Description: Built in 1913-1915, designed by James Miller (Glasgow). Scots manner, symmetrical single-storey crowstepped 3-gable front with linking crenellated sections, central gable taller with iron and glass porch (recently shortened) and clock. The interior has a horse-shoe plan concourse and veranda platforms (W A Paterson of the Caedonian Railway, engineer-in-chief) (information from listed building record) The structures protected by the listing at the station include the station building, with north and middle signal boxes and associated semaphore signals. C McKean (1985) has described the station as *'one of the loveliest of surviving Scottish railway stations, the platforms retaining an Edwardian charm that is all but lost elsewhere'.*

Site No 8
Name: Bastion, Stirling Town Wall
Local Authority:Stirling
Status: SAM;
Type of site: Standing structure
NMRS number: NS79SE 35.01
Map reference: NS 7943 9342
Sensitivity: Very High
Description: This bastion in the Town Wall of Stirling is circular on plan and the portion projecting S of the Wall contains three gun-loops. The interior, 13'5" in diameter, is entered from the NE. The structure has been altered, as the floor is now more than 2' above the sill-level of the gun-loops, the interior is brick-lined, and there is a

domed roof of rubble with a circular opening in the crown of the vault. This suggests that the bastion has been converted for use as a dovecot at some stage, and it is uncertain how much of the structure that projects N of the Wall is original. RCAHMS 1963, visited 1955. As described. Visited by OS (JP) 6 December 1973.

Site No 9
Name: Town wall, Stirling
Local Authority:Stirling
Status:SAM (35.05); Listed Building Category ? (35.01)
Type of site: Standing structure
NMRS number: NS79SE 35
Map reference: NS 79 93
Sensitivity: Very High
Description: NS79SE 35 is the general NMRS number assigned to the remaining components of the town wall. These comprise the following:
NS79SE 35.01 NS 7943 9342 Bastion (see Site No.8, listed building);
NS79SE 35.02 NS 7966 9321 Gateway;
NS79SE 35.03 NS 7973 9327 Bastion (See Site No.3);
NS79SE 35.04 NS 7971 9333 Gateway;
NS79SE 35.05 NS 7962 9359 Gateway – (see Site No.13, SAM).
Both documentary and architectural evidence suggests that the portions of the Town Wall visible today were erected in the 16th century. The line of the wall is shown by Laye in 1725. Laye does not show a North Wall, and it may be assumed that the rear enclosure walls of the outer tenements were considered to give sufficient protection on this side. Laye's plan indicates that the wall began at the SE angle of the castle, however this can be debated. Only fragments of the wall are still standing, other parts have not been preserved, and some stretches have been rebuilt. Between Cowane's Hospital and the Military Prison (at NS 7920 9360) the footings of the original wall may perhaps survive, but the upper portion has been rebuilt. The stretch now forming the rear wall of the Prison seems to have been completely rebuilt, but SE of this point there is a well-preserved section which runs as far as Academy Road (NS 7932 9351). The wall rises to a height of 23' and its thickness at the base, where measured, was 5'. The lower portion has a noticeable batter and the uppermost few feet, with the crenelles, are comparatively recent. Crudely formed gun-loops may be seen at intervals. The wall is broken at Academy Road and although the rear wall of the High School no doubt follows the old alignment, little of the original structure survives. SE of the High School the wall curves inwards, and at least its lower portion is original. It runs towards a bastion (NS79SE 35.1), then on towards the Council Offices (NS 7947 9340). It reappears E of the Public Library (NS 7952 9336) and runs to NS 7960 9327. The maximum height of this sector is 16'6", and where measured, it was 6'3" thick. There are no remains between NS 7960 9327 and the Barras-Yett (NS79SE 35.2). Of the section of wall that ran from the Barras-Yett to the Port Street bastion (NS79SE 35.3) only the last 30' or so survives, incorporated in a building within the yard of the Kinross Company Carriage Works. No remains of the wall were found N of this bastion, and the point at which it ended is uncertain. In general, the Town Wall is roughly built of random rubble, the gun-loops are rectangular, and the height at which some are placed suggests that some sort of timber walk must have been necessary. The wall was founded on outcrops of natural rock wherever possible. The many blocked-up doorways now seen in the Wall formed no part of the original structure. RCAHMS 1963, visited 1955.

Site No 10
Name: Dominican Friary, Stirling
Local Authority:Stirling
Status: None
Type of site: Site of monastery
NMRS number: NS79SE 40
Map reference: NS 7967 9358
Sensitivity: Low
Description: Located about 100m west of Stirling Station. Friary dedicated to St Laurence or, according to Brockie, St Kentigern. It was founded in 1233 by Alexander II. It was destroyed in 1559 by Reformers, and Stirling burgh acquired the Friars' lands in 1652. There are no upstanding traces of the Friary. However, its site was pointed out in 1858 by the R C priest and Town Clerk, as "situated on the E side of Murray Place and Maxwell Place, now occupied as a house and gardens, where great quantities of human bones have often been found." Name Book 1858; D E Easson 1957. During demolition of the Saracen's Head Inn in 1835, it was clear from finds made that the bank garden was formerly used as a burial ground (Trans Stirling Natur Hist Antiq Soc 1890).

In demolishing 58 & 60 Murray Place in 1899, an old wall was discovered. It was 46' long, 5' broad, with four buttresses 12' apart, each projecting 5' from the main wall. It is believed to have been the S wall of the Blackfriars Church. An abundance of human remains were also found. Nimmo (1880) notes that for over 250 years, the Church was the chief place of worship in Stirling, with the burial ground adjacent. Ronald records that the Blackfriars' lands were bounded by a stone wall, whose S boundary is said locally to have been located at

Thistle Street. (J Ronald 1899; Trans Stirling Natur Hist Antiq Soc 1903). Reappraisal of the records in Central Region Archives have confirmed this location for the Friary wall (NS 7969 9355). A further section of the wall base was subsequently excavated in 1994. It was of very solid construction, having survived the post-Reformation robbing out. Mortar and rubble debris also indicated the line of the wall eastwards. The ground had been greatly disturbed, by stone-robbing and by the cultivation of gardens since before 1858. Many human bone fragments were found. The excavated evidence suggested that the eastern end of the church was older and of simpler construction. The end of the church was apsidal, probably round, or conceivably polygonal. The width of the church was 6.5m internally, with walls 1.5m thick, making overall width 9.5m, and the known length is now calculated at 27.5m. (E R Page and C Page 1994).

Site No 11
Name: Royal Bank of Scotland, 79 Murray Place, Stirling
Local Authority:Stirling
Status: Listed Building category B
Type of site: Site of bank building
NMRS number: NS79SE 263
Map reference: NS 7963 9354
Sensitivity: High
Description: No descriptive information is recorded about this building in the NMRS. Marked as 'Bank' on the 1966 OS map.

Site No 12
Name: Royal Bank of Scotland, 80-82 Murray Place, Stirling
Local Authority:Stirling
Status: Listed Building category B
Type of site: Site of bank building
NMRS number: NS79SE 233
Map reference: NS 7965 9357
Sensitivity: High
Description: The NMRS holds plans, sections and elevation drawings dating from 1854. Otherwise, there is no descriptive information recorded about this building in the NMRS. The 1966 OS map shows the building as 'General Post Office'.

Site No 13
Name: Friars Wynd Port, Stirling
Local Authority:Stirling
Status: SAM
Type of site: Site of medieval town gate
NMRS number: NS79SE 35.5
Map reference: NS 7962 9359
Sensitivity: Very High
Description: Friars' Wynd Port, one of the town wall gateways, seems to have been of similar construction to the Mary Wynd Port (see NS79SE 63). So many alterations have taken place here that it is difficult to point out the exact site. It probably stood at the foot of Maxwell Place between the Blackfriars' Wall and the North Wall. It was still in existence in 1745. J Ronald 1899. There are no longer any upstanding traces visible. RCAHMS 1963, visited 1955

Site No 14
Name: Site of railway buildings, Stirling North
Local Authority:Stirling
Status: None
Type of site: Site of railway buildings
NMRS number: None
Map reference: NS 7974 9371
Sensitivity: Low
Description: Two (un-named) railway buildings were shown here on OS maps in 1865, located about 100m north of the Station building. Both were long buildings, accessed from the two railway lines by sidings. They were demolished in the second half of the 1800s, as they were not shown on the 1899 OS map.

Site No 15
Name: Sheriff Court, Viewfield Place, Stirling
Local Authority:Stirling
Status: None
Type of site: Standing building
NMRS number: NS79SE 142

Map reference: NS 796 937
Sensitivity: Low
Description: Architect: Thomas Brown (Brown & Wardrop) 1874-6

Site No 16
Name: 5 Princes Street, Stirling
Local Authority:Stirling
Status:Listed Building Category C(s)
Type of site: Standing building
Map reference: NS 7950 9370
Sensitivity:Moderate
Description: No.'s 5 & 9-17 Princes Street are category C(s) listed buildings. The Drill Hall is a category B listed building.

Site No 17
Name:Market Cross, Broad Street, Stirling
Local Authority: Stirling
Status: SAM
Type of site: Standing structure
NMRS number: NS79SE 25
Map reference: NS 7932 9370
Sensitivity: Very High
Description: Stirling Mercat Cross was restored and re-erected in its original position in 1891, but only the unicorn finial formed part of the original monument. The animal, in a sitting position, wears a collar from which a chain carries round the body. In front of the breast is a shield bearing the Royal Arms of Scotland, surrounded by the collar of the Order of the Thistle. Ronald states that there are good grounds for believing that it dates from the 12th century. The jougs which were attached to the market cross are in the Smith Institute, Stirling (Acc No: OA 2). RCAHMS 1963, visited 1954; J Ronald 1899; Smith Institute 1934. The earliest part may be most likely to date from the early 1600's.

Site No 18
Name: Bothwell House, Stirling
Local Authority:Stirling
Status: SAM
Type of site: Standing building
NMRS number: NS79SE 66
Map reference: NS 7925 9368
Sensitivity: Very High
Description: Bruce of Auchenbowie's House measures 45'8" by 21', a wheel-stair projecting 4'10" into the street; it stands three storeys and an attic high. Above the ground floor, which consists of two barrel-vaulted cellars separated by a through passage, the fabric has been extensively restored; the roof has been re-slated; the stair-tower now has a penthouse type roof; the windows have been enlarged or restored. The house was originally built in the 16th century. It is traditionally associated with the family of Bruce of Auchenbowie. RCAHMS 1963, visited 1954. This house is as described. It is in the care of DoE and is known as Bothwell House. Visited by OS(JP) 6 December 1973.

Site No 19
Name: King's Knot, Stirling Castle
Local Authority:Stirling
Status: SAM
Type of site: Landscaped garden
NMRS number: NS79SE 7
Map reference: NS 7889 9364
Sensitivity: Very High
Description: Remains of a landscaped, formal garden, surviving as earthworks, on lower ground south-west of Stirling Castle Rock. Part of the King's Park, which appears to have been Crown property since at least the end of the 12th century, when William the Lion began to enlarge the area of the original park by taking in more ground to the S, the earlier and later enclosures becoming known as the Old Park and the New Park. These "parks" were primarily hunting grounds, and references to the King's deer are found as late as the 17th century. From about the beginning of the 16th century onwards, the NE corner of the Old Park seems to have been set aside as a garden. An extensive system of alterations and reconstructions was carried out about 1627-8; it is to this period that the extant remains have their origin. Today, there may be seen a parterre, to the SE of which is an octagonal, stepped mound known as the King's Knot. The mound, a characteristic feature of gardens of the 16th and 17th centuries, is 9' high and 22' across the top. It stands within a double-ditched enclosure measuring 420' x

425' over all. The S angle and part of SW side have been encroached upon by the Dumbarton road. No doubt the outlines of the walks and of the Knot became indistinct after the gardens fell out of use (before the beginning of the 18th century) for a "thorough restoration and renewal" was carried out in 1867. A comparison of the site as it is today with an 18th century War Office plan in the Public Record Office, London (WO 78/1562), suggests that in the course of restoration the "mount" was considerably altered, while it also seems possible that the orientation of the entire enclosure was slightly changed. On the SE side of the King's Knot, a ditch can be seen running from the E corner of the Park to the Dumbarton road, a distance of about 140 yds. According to the 6" OS map, there was a bank on the N side of the ditch, but this has now been obliterated. This linear earthwork may be an early boundary designed to keep deer and livestock out of the Royal garden. The present boundary wall of the Park on the NE is built on the line of a similar bank and ditch. RCAHMS 1963, visited 1959.

Site No 20
Name: Site of railway building, Stirling North
Local Authority:Stirling
Status: None
Type of site: Site of railway building
NMRS number: None
Map reference: NS 7972 9376
Sensitivity: Low
Description: A small, un-named railway building is shown here between the two railway lines on OS maps in 1865 and 1899. It had been removed by the time of the 1958 OS map.

Site No 21
Name: Forth Place, Stirling
Local Authority:Stirling
Status: Listed Building Category B
Type of site: Standing buildings
Map reference: NS 7980 9400 (centred at)
Sensitivity: High
Description: 1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 21, 23, 25, 27 Forth Place are all Category B listed buildings.

Site No 22
Name: Allan's Hospital, Stirling
Local Authority:Stirling
Status: None
Type of site: Standing remains, building wall
NMRS number: NS79SE 32
Map reference: NS 7950 9375
Sensitivity: Low
Description: Spittals or Nether Hospital was founded by Robert Spittal, tailor to James VI in 1725. The exact site has been ascertained as being on the S side of Irvine Place. The Nether Hospital was sited to the remains at this position by ex-Provost Gourlay from a town map of Stirling dated 1824. He has visited the site and believes it may be that of the Hospital. The remains now only comprise the walls, standing to a height of 4.0m. They have every appearance of considerable age. The site was in use as a builders' yard in 1950. The character of the fabric of the walls would agree with an early 18th century date. The building comprised a main block, of which only the N wall remains, and a wing, extending from its W end, which survived as the shell of a two storeyed house in 1954 (RCAHMS 1963). Only a short stretch of walling now survives. Visited by OS (JP) 6 December 1973.

Site No 23
Name: Mar's Wark, Stirling
Local Authority:Stirling
Status:SAM; Listed Building Category A
Type of site: Standing building
NMRS number: NS79SE 22
Map reference: NS 7923 9374
Sensitivity: Very High
Description: What remains of this large and important mansion stands as a roofless ruin in Mar Place. Only the facade now survives and this has been strengthened and patched where necessary by the DoE. The house as originally laid out must have covered a larger area than now appears at first sight, as traces of two contemporaray cellars at the S end and tusking at the N end of the existing block imply wings running W, the whole comprising three sides of a quadrangular courtyard. The builder was the Earl of Mar who became Regent of Scotland in 1571, and died in 1572. Two carved stones show that work was in progress during 1570-2. The legend that the building was never completed is probably true, as a town plan of 1725 shows only the main block and S wing. The existing frontage rises two storeys to a denuded wall-head, but the back wall has been trimmed off only a few courses above the level of the first floor and its outer face has been hidden up to this level by soil from the

Holy Rude graveyard. RCAHMS 1963, visited 1954. It was as described and in good condition when visited by OS (JP) 6 December 1973.

Site No 24
Name: Argyll's Lodging, Stirling
Local Authority:Stirling
Status: SAM;Listed Building Category A
Type of site: Standing building
NMRS number: NS79SE 21
Map reference: NS 7925 9381
Sensitivity: Very High
Description: Argyll's Lodging is the most important surviving town-house of its period in Scotland. The building is grouped round three sides of an irregular courtyard. Itis not all of the same date, rather, a house of moderate size has been altered and added to to produce the present mansion. The original house may be ascribed to the 16th century, and various additions were made in the 17th century. In 1666 the site was purchased by Archibald, 9th Earl of Argyll. It was sold by the 4th Duke of Argyll in 1764, and was used by the Crown as a military hospital in the 1950s, and subsequently as a youth hostel.

A watching brief was carried out at the building during renovation work in 1994. A trench 0.4m wide was opened under archaeological supervision, and several mid-20th century structures were recorded, along with some structures of indeterminate but possibly earlier date (not excavated). No finds were recovered. Sponsor: Historic Scotland.G Ewart and A Dunn 1995.

In 1995, prior to the installation of surfaces in parts of the N and E range ground floor chambers (Lower Hall, Corridor, Kitchen and Cellar), modern underfloor deposits and late medieval occupation debris were removed to an average depth of 350mm. Layers associated with the primary tower-house occupation (early 16th century) were identified. This soil horizon contained an abundance of 14th-15th century pottery. Evidence of timber joists for the 17th century floor and the contemporary staircase were also found, as well as evidence of a timber floor continuing from the Lower Hall, dating c1630 (pre-dating the present wall configuration). The kitchen floor comprised artificially levelled bedrock, and contained 2 rock-cut features of uncertain date, probably relating to the 16th century occupation of the site. Sponsor: Historic Scotland. G Ewart and P Sharman 1995.

Another excavation was undertaken in 1996 in the easternmost ground floor room in the 1674 part of the S range, along with a watching brief W of this room, in the area of the demolished S wing. Medieval and early post-medieval cultivated soil and evidence for the various uses of the room whilst the building was a military hospital. The external ground clearance uncovered the remains of the 1674 foundations of the N part of the S wing, although no occupation levels were disturbed by the work. Further archaeological monitoring was undertaken in 1996 during ground-breaking work in the gardens to the S and E, as well as in the street outside, to the W of the demolished S wing. A probable post-medieval garden soil was revealed along with a substantial E-W wall in the gardens, and evidence for the former W wall of the 1674 wing was uncovered, overlying a midden deposit containing leather offcuts. The latter was seen to overlay a possible earlier cobbled street surface. Features revealed during plaster removal in the house were also recorded. Sponsor: Historic Scotland G Ewart, P Sharman and D Murray, 1996.

Another archaeological watching brief was undertaken during the excavation of two small inspection holes being opened up at the S end of the E wall of the garden attached to the S side of Argyll's Lodging (Ewart, Sharman and Murray 1996). The core of the building is thought to be 16th century in date, with the bulk of it being built during the 17th century, with the late 17th-century S wing being demolished, apart from the street frontage, during the 1860s. The wall against which the trenches were excavated, which forms part of the terrace for a garden, was bulging at its base and it was hoped that these excavations might shed light on this problem. A 19th-century imported garden soil containing green-glazed pottery, but also some white china and clay pipe, overlay a deposit of mostly whin rubble and mortar, which was not bottomed. This seems most likely to derive from the 1860s demolition of the S wing of Argyll's Lodging, and had been cut by a trench running N-S against the E wall. This was shown to contain the upper part of this wall, which must be a rebuild on top of an earlier wall, and which bottomed some 800mm below the modern ground level. Beneath this the wall stepped in dramatically, and excavations were ceased. Sponsor: Historic Scotland. D Murray 1998
Used as a youth hostel.

Site No 25
Name: Stirling North Signal Box
Local Authority:Stirling
Status: Listed Building Category A
Type of site: Standing building
NMRS number: NS79SE 162.02
Map reference: NS 7990 9350

Sensitivity: Very High
Description: Long, brick, timber and glass signal box, with level frames and associated equipment. Built around 1900. Stirling North Signal Box is located about 250m north of Stirling Station, west of the line. The lever frame has been halved in length by the removal of around 60 of the former levers. A sub-division was put in following this. The existing block bench instruments are relatively old. A block switch is cased in a wooden box on the block bench. There is an auto-half barrier indicator for Cornton that is about 20 years old, also cased in another box on the block bench. The electronic equipment (shelf-type relays) in the cabinets mounted on the operating floor against the wall to the rear of the lever frame is minimal, since this was not part of the original design, this signal box being designed to operate the interlocking mechanically.

The shelves are arranged such that the wiring is contained between narrower shelves below each set of relay equipment. To the left of these two cabinets is another cupboard which contains the circuit arrangement. Some of the fuses are quite old and may even date back to the installation of the circuit arrangement. Some of the labels on the fuse wires still refer to pages of the drawings. On the front of the block bench are a row of dials, operated electrically, with hands to indicate when signals and points have been operated. There are also auto-barrier indicators. Wooden equipment cabinets are mounted on the operating floor up against the wall to the rear of the lever frame. Traditionally these housed the expensive and skilfully crafted electronic equipment (shelf-type relays) and circuitry. Some of the electronics here have been were hand-crafted by a variety of specialists including joiners, brass workers and electricians.

There are handles on the east interior wall for adjusting the taughtness of the cables during hotter periods - this is more of an issue for signals that are located further away. They area also usually adjusted seasonally. The basement contains mechanisms of all the levers. Points are operated by a system of rods, signals are operated by the chains. Brick-built building with brick floor at ground level. Steel horizontal rails on the floors exist to secure the timbers in place. A frame beam carved from a single timber runs along the whole length of the buildings down the centre. Note there is some evidence of timber rot to the floor timbers above that might call for shoring. There is also some water ingress at the south end of the ground floor. Half of the lever mechanisms have been removed, echoing the removal of half of the levers from the floor above. Built around 1901. (Information recorded during site visit by AOC Archaeology Group in Oct 2002).

Site No 26
Name: 4 Irvine Place, Stirling
Local Authority:Stirling
Status: None
Type of site: Standing building, residential
NMRS number: NS79SE 151
Map reference: NS 7949 9382
Sensitivity: Low

Site No 27
Name: Site of railway buildings, Stirling North
Local Authority:Stirling
Status: None
Type of site: Site of railway buildings
NMRS number: None
Map reference: NS 7984 9390
Sensitivity: Low
Description: Three railway buildings and a turning circle are shown here arranged along the east of the North British Railway track on OS maps in 1865, 1899, 1958 and 1966. These comprised (from north to south) a turntable, an Engine Shed (approx. 60m long), a Carriage Shed (approx 20m long), and a Joiners Shed (approx 30m long). In 1966 the Joiners Shed and the Carriage Shed were both marked as Goods Sheds. These buildings have all been demolished since 1966, and a large building now partly overlies the site.

Site No 28
Name:Stirling Castle, Castle Rock
Local Authority:Stirling
Status:SAM; Listed Building Category A
Type of site: Defence/Castle, Midden
NMRS number: NS79SE 6.00
Map reference: NS 7901 9403
Sensitivity: Very High
Description: It is thought that the Castle Rock has been continuously occupied since prehistoric times, and there are documentary references to it in the Early Medieval period. It was a royal stronghold from the 12th century, and the present Castle buildings date from the 1400s to the 1700s. It occupies a strategic, and naturally

defensible location, that was formerly the lowest bridging point of the Forth. It commanded both north-south and east-west routes through the area.
The castle comprises various elements, including:
NS79SE 6.01 7901 9403 Palace
NS79SE 6.02 7898 9409 Chapel Royal
NS79SE 6.03 7904 9402 Forework
NS79SE 6.04 7901 9406 Great Hall
NS79SE 6.05 7903 9409 Mint
NS79SE 6.06 7789 9407 The King's Old Buildings
NS79SE 6.07 7906 9401 Outer Defences
NS79SE 6.08 9889 9363 King's Knot
NS79SE 6.09 7905 9407 Kitchen Range
NS79SE 6.10 7914 9394 Esplanade
NS79SE 6.11 7905 9404 Governor's House.

Site No 29
Name: Site of Engine Shed, Forth & Clyde junction, Stirling
Local Authority:Stirling
Status: None
Type of site: Standing building
NMRS number: None
Map reference: NS 7973 9432
Sensitivity: Low
Description: Located a short distance east of Site No.30. Shown on the 1865 OS map, later demolished.

Site No 30
Name: Site of Engine Shed, Forth & Clyde junction, Stirling
Local Authority:Stirling
Status: None
Type of site: Standing building
NMRS number: NS79SE 230
Map reference: NS 7973 9432
Sensitivity: Low
Description: Shown on OS maps in 1865, 1899 and 1958. The NMRS also holds two photos of the building taken in 1966. No longer standing.

Site No 31
Name: Watching brief at Stirling Old Bridge
Local Authority:Stirling
Status: None
Type of site: Site of watching brief
NMRS number: S79SE 2.01
Map reference: NS 7975 9455
Sensitivity: Low
Description: A watching brief was undertaken in February 1997 during the cutting of cable trenches for floodlighting at the Old Bridge in Stirling. Operations were monitored in one trench on the S side of the bridge on the E bank and in two trenches on the N and S sides of the bridge on the W bank. A continuation of the revetting wall visible as a surface feature on the E bank was located immediately below the turf adjacent to the bridge. This wall appears to relate to the original construction of the 15th-century bridge, and was not affected by the works. No other features or deposits of archaeological Sensitivity were located, but the trenches excavated were too shallow to penetrate the topsoil or modern levelling layers. Sponsor: N G Bailey & Co Ltd on behalf of The Hawthorne Boyle Partnership. R Strachan 1997

Another watching brief was conducted for two days during the excavation of ten 0.65m square by 1m deep trenches for the erection of flag poles as part of the celebrations for the 700th anniversary of the Battle of Stirling Bridge. The trenches were located between Stirling Old Bridge and the current bridge. The ground between the two bridges appears to be partially made up and levelled, and the layer encountered immediately below the topsoil was clearly modern disturbance. A single sherd of green-glazed pottery recovered from this layer is most likely a residual find. The area examined between the two bridges does not appear, at least superficially, to have significant archaeological deposits. Aerial photographic evidence shows the area was the site of a farm until the mid-20th century and the presence of field drains and the density and wide range of finds would be consistent with this. Sponsor: Stirling Council Community Services. R Strachan 1997.

Site No 32
Name: North British Railway Bridge, Stirling
Local Authority:Stirling
Status: None
Type of site: Railway bridge
NMRS number: NS79SE 223
Map reference: NS 7983 9436
Sensitivity: Low
Description: This bridge carries the North British Railway line heading north-east from Stirling to Alloa across the River Forth. The NMRS hold photos of the bridge dating from 1981.

Site No 33
Name: Caledonian Railway Bridge, Stirling
Local Authority:Stirling
Status: None
Type of site: Railway bridge
NMRS number: NS79SE 186
Map reference: NS 7980 9432 to 7984 9444
Sensitivity: Low
Description: This bridge carries the Caledonian Railway line heading north-east from Stirling to Perth across the River Forth. Information from RCAHMS (RJCM), 30 September 1997. This bridge replaced an earlier wooden version that was built by the Scottish Central Railway Company and photographed by T Begbie c.1860. Information by RCAHMS (DE) August 2001. The NMRS hold photos of the bridge dating from 1981.

Site No 34
Name: New Bridge, Causewayhead Road, Stirling
Local Authority:Stirling
Status:Listed Building Category B
Type of site: Road bridge
NMRS number: NS79SE 185
Map reference: NS 7969 9444 to 7979 9449
Sensitivity: High
Description: New Bridge, built 1831, engineer Robert Stevenson. A five-span bridge of rustic ashlar construction with segmental arches and rounded cutwaters. The courses of the spandrels follow the lines of the voussoirs. J R Hume 1976. This bridge carries the A9 public road across the River Forth. Information from RCAHMS (RJCM), 30 September 1997.

Site No 35
Local Authority:Stirling
Status: SAM; Listed Building Category A
Type of site: Standing structure
NMRS number: NS79SE 2
Map reference: NS 7970 9456
Sensitivity: Very High
Description: Stirling Old Bridge is still standing and is thought to originate from the 1400's. For the predecessor and successor bridges, see Site No.36 and Site No. 34, respectively. Though Simpson states that the Old Bridge was built between 1410 and 1415, the RCAHMS consider its appearance suggests a date in the 15th or early 16th century for its erection. Built of squared rubble, it consists of four arches. References to the repair of the bridge in the 17th century are in the Burgh Council records. The southern arch was rebuilt in 1749, the original arch having been blown up in 1745 to prevent the Highland army entering Stirling. It was closed to wheeled traffic in 1831, when the new bridge was built (at NS 7973 9445). It was strengthened in 1912-20.

In good preservation, it is now under guardianship.

An excavation made in 1912 at the NE end of the bridge revealed three earlier causeways underlying the existing road; these no doubt represent attempts to ease the gradient of the access. RCAHMS 1963, visited 1955; W D Simpson and S Piggott 1970.

Site No 36
Name: Site of bridge, River Forth, Stirling
Local Authority:Stirling
Status: None
Type of site: Site of Medieval bridge
NMRS number: NS79SE 1
Map reference: NS 7972 9461

Sensitivity: High
Description: The foundations of two piers of a bridge, pre-dating the 15th century one at Site No.35, were discovered in 1905, located some 65 yards upstream from the later bridge. The piers were about 28' long by 14' broad; they were 25' apart, the centre of the NE one being about 25 and 30 yds from the right bank. The above details were confirmed during the drought of 1955.

The word "pons" appears on three mid-15th century maps, and a bridge is represented on the burgh seal of Stirling in 1296, one year earlier than Wallace's battle in which the breaking down the bridge is traditionally an episode. The tradition implies that the bridge was wooden, and the representation of a stone bridge on the seal is probably a convention. In 1304 an allusion to boats suggests no bridge was available; in 1305 a bridge, presumably of timber, was repaired. Between 1361 and 1391 a ferry replaced the bridge. In 1407 the bridge was said to be very ruinous. The work carried out then was evidently of some importance, and payments to the fabric are recorded in 1408 and 1415. This structure may again have been of wood, as the possibility of it being broken is mentioned by an English spy between 1424 and 1437 (see also NS79SE 2). RCAHMS 1963, visited 1955.

The two massive stone piers still remain in the bed of the River Forth, and have been accurately surveyed. The SW pier is covered by an extensive sand bank and was located by probing. It is marginally larger than the other pier, and its top is almost at the same level. These piers probably belong to the wooden bridge destroyed after the Battle of Stirling Bridge in 1297. R Page 1992. In September 1996 a sonar survey by the British Geological Survey indicated another possible pier near the W bank of the river, under a large sand bank. In April 1997 two members of Stirling University Sub-Aqua Club probed the sand bank with long iron rods, and confirmed the pier indicated by sonar, and located another, previously unknown. Accurate survey revealed that all four piers lie on the same straight line. The Common Seal of Stirling Burgh, recorded in 1296, shows eight piers. Assuming this is correct, the search continues for the remaining piers.

Excavations on the river banks to look for abutments or approach roads have so far been inconclusive, except that at NS 7966 9456 a group of large mortared stones were found in line with the piers in the river. Examination of Pier No 1 standing out of the river bed clear of the sand bank, by Dr Martin of the Scottish Institute of Maritime Studies of St Andrews University, indicated that some of the masonry appeared to consist of dressed stones. Sponsors: Historic Scotland, Stirling Ancient Bridge Trust, supported by Stirling Council, Argyll, the Isles, Loch Lomond, Stirling & Trossachs Tourist Board, Bank of Scotland, Glasgow Archaeological Society, Gordon Fraser Trust, Society of Antiquaries of Scotland, Mr G Dixon. R Page and L Main 1997.

Site No 37
Name: Military Road, Stirling to Crieff
Local Authority:Stirling
Status: None
Type of site: Line of Late Medieval road
NMRS number: NS89NW 91
Map reference: NS 8050 9550 to 7970 9335
Sensitivity: Low
Description: (The co-ordinates given above apply to where the road enters and leaves the assessment area only). The modern A9 appears to be on the line of the military road, initially heading NE, but performing a dogleg at NS 8057 9564, thereafter heading NNW. Information from RCAHMS (MW) 15 September 1999. This is one of a series of road sections built around the mid-1700's to open up the Highlands to more effective military control and administration. The operations were overseen by General Wade and were largely in response to the Jacobite uprising. The military road linked garrisons to each other, and linked the Highlands to the Lowlands, allowing easier movement of troops between these (Gordon 1988).

Site No 38
Name: Forth Mill, 7 Bridgehaugh Road, Stirling
Local Authority:Stirling
Status: None
Type of site: Industrial/ Textiles; Wool/ Woollen Mill
NMRS number: NS79SE 213
Map reference: NS 7981 9467
Sensitivity: Low
Description: The NMRS hold one photo of the mill dating from 1976, associated with a record card produced by industrial archaeologist John R Hume. No further information about the mill is recorded by the NMRS.

Site No 39
Name: Excavation at Stirling Ancient Bridge
Local Authority:Stirling
Status: None

Type of site: Site of Medieval bridge
NMRS number: NS79SE 198
Map reference: NS 978 9470
Sensitivity: Low
Description: The search for a northern approach road or abutment reported in Page and Main 1997 was continued by deeper excavations in 1998 and 1999. These excavations found evidence of river bank stabilisation or reclamation of 19th or 20th-century date. No convincing traces have as yet been found of approaches to the ancient bridge, although further investigation is required. Sponsor: Historic Scotland, via Stirling Ancient Bridge Trust. R Page and E Ross 1999.

Site No 40
Name: Site of Battle of Stirling Bridge
Local Authority:Stirling
Status: None
Type of site: Site of Medieval battle
NMRS number: NS89SW 1
Map reference: NS 800 946
Sensitivity: High
Description: In 1297 Sir William Wallace in the lowlands and Andrew of Moray in the north rebelled against the English rule recently imposed by Edward I; and the king's lieutenant John de Warrenne, Earl of Surrey, and Hugh de Cressingham, treasurer for Scotland, led an army against them while the king was in Flanders. Their march north was blocked at Stirling by the united forces of Wallace and Andrew of Moray established on the north bank of the Forth. The Battle of Stirling Bridge (sometimes called the Battle of Cambuskenneth) was fought on 11th September 1297 and resulted in the complete defeat of the English. Their vanguard (at the least) was allowed to pass over the narrow bridge, which was then closed by a body of Scots spearmen and the whole English force on the north side of the river was destroyed in marshy and restricted terrain where cavalry could not be properly employed.

The contemporary account of Walter de Hemingborough (H C Hamilton 1849) states that, before the battle, the Scots were stationed on what must have been the Abbey Craig ('in altera parte montis supra Monasterium de Skambskynel'(Cambuskenneth)) and that they had a strong tactical position ('nec fuit aptior locus in regne Scotiae ad concludendum Anglices in manus Scotorum et multos in manus paucerum'). It also mentions that Sir Richard Lundy, a Scots knight with the English, knew of a ford nearby ('vadum non longe abhinc') over which he offered to lead a force to take the Scots in the rear. The exact locality of the bridge, and therefore of the actual battle-ground, has been a matter of some conjecture. It has been widely supposed (Nimmo (1880); NSA (1845) and others) that it was at Kildean (NS 783 950) and it is this supposition, according to Ramsay (1908), which is responsible for the Ordnance Survey 6" map (1942-8) siting at NS 795 959. But the best modern authority for the siting is W B Cook (1906) whose arguments in favour of the bridge being actually in Stirling and of the fighting taking place in the horse-shoe bend centred at NS 800 946 are very convincing and are endorsed by Sir James Ramsay who, in turn, is quoted as the authority for the battle by Sir Maurice Powicke.

There was a bridge in Stirling in 1297, proved by an early 14th century charter authorising its repair and showing that it was approximately in the present position (at Site No.36) by reference to place-names still extant. As there was a bridge in Stirling it would be extravagant to suppose that there was also one at Kildean, especially as no references to such are known and no remains have been identified. Bridges usually replace ferries, not fords, and there was a ford at Kildean of which Cook had first-hand knowledge. The ford at Kildean could reasonably be that over which Sir Richard Lundy offered to lead an outflanking force. If it is not, then there is no known ford which could be described as 'non longe abhinc'. e. The north bank of the river at Kildean would allow cavalry to deploy almost immediately after crossing whereas opposite Stirling Bridge it is marshy and narrowing. Only at the latter position could infantry have successfully attacked cavalry, and therefore it is only there that the tactical situation described by Hemingborough exists. The Battle can therefore be sited with some certainty to the area NS 800 946. Information from OS Recorder (GL) 12 August 1958.

Site No 41
Name: Military Road, Crieff to Stirling
Local Authority:Stirling
Status: None
Type of site: Site of Medieval Road
NMRS number: NS89SW 82
Map reference: NS 8000 9380
Sensitivity: Low

Site No 42
Name: Limekiln, pier, Causewayhead
Local Authority:Stirling

Status: None
Type of site: Site of limekiln and pier
NMRS number: None
Map reference: NS 8043 9524
Sensitivity: Low
Description: A limekiln and a pier are shown here, on the north bank of the Forth, south of Causewayhead Station, on early OS maps.

Site No 43
Name: Site of Causewayhead Station
Local Authority:Stirling
Status: None
Type of site: Site of railway station
NMRS number: None
Map reference: NS 8039 9530
Sensitivity: Low
Description: Causewayhead Railway Station is shown here on OS maps in 1899 and 1958. The station building was on the north side of the track, west of the level crossing. A tram depot and chemical works were also located at Causewayhead in 1899.

Site No 44
Name: Abbey Craig Park House, Hillsfoot Road, Stirling
Local Authority:Stirling
Status: Listed Building Category B
Type of site: Standing building
Map reference: NS 807 958
Sensitivity: High

Site No 45
Name: Airthrey Castle Estate
Local Authority:Stirling
Status: Designated Historic Designed Landscape
Type of site: Historic designed landscape
NMRS number: NS89NW 29
Map reference: NS 8100 9650
Sensitivity: High
Description: Airthrey Castle (a category B listed building) is situated about 2 miles north of Stirling. The A9(T) and the B998 form the W and S boundaries of the estate, which now forms the setting for the campus of the University of Stirling. The polices extend across 158ha. The designed landscape dates from the late 1700s and early 1800s. Evidence of a designed landscape here can be gained from early maps (eg Roy c.1750, and OS maps from c.1870 and c.1900). A key feature of the designed landscape is the 23 acre loch, a component of the original design. Airthrey Castle was begun by Robert Adam in 1791.

After the estate was sold in 1796, additions were made to the designed landscape, and further changes were made to the House and grounds in the late 1800s (the house was extended in 1891). Some of the parkland trees survive as well as a planted avenue and a walled garden. Other features include screen walls cross the east entrance drive, and there is an icehouse and a ruined hermitage in the woods north of the House. There were various planted walks on the estate. Standing stones east of the House are thought to commemorate a battle between the Picts and the Scots in 839. Some of the former buildings have been demolished (the Lodge, Stables Gardener's Cottage and a footbridge over the loch). Other features that were shown on the early OS maps and no longer survive include pleasure grounds, a bowling green.

The House was used as a hospital in WWII and in the years following this. In 1966 it was gifted to the University of Stirling. Recently an area of 32 acres in the south of the park were leased and an Innovation Park was being developed at this site. The grounds are largely well-maintained, and the University has remained respectful of the historical features of the designed landscape. Views out from the estate are dominated by the Wallace Monument and Abbey Craig to the south, and views into the site from the surrounding roads are limited by the boundary wall and surrounding woodlands. However views down into the site can be gained from Hermitage Wood to the north and from the Wallace Monument to the south. Historic Scotland have classified the estate as 'Outstanding' as a work of art, with 'High' historical, horticultural, architectural, scenic and nature conservation value.

Site No 46
Name: Abbey Craig
Local Authority:Stirling
Status: SAM

Type of site: Fort
NMRS number: NS89NW 10
Map reference: NS 8094 9565
Sensitivity: Very High
Description: Fort, Abbey Craig: Near the N end of Abbey Craig there is a fort, which was damaged by the construction within it of the Wallace Monument. All that remains is a substantial turf-covered bank, crescentic on plan and 260ft in length, the ends of which lie close to the brink of the precipice that forms the W face of the hill. The bank stands to a maximum height of 5ft above the level of the interior and presumably represents a ruined timber-laced wall since numerous pieces of vitrified stones have been found on the slopes immediately below it. The entrance presumably lay between one end of the bank and the lip of the precipice, but both of the areas concerned have been disturbed by the construction of modern approaches.

The featureless interior of the fort measures about 175ft N-S by about 125ft. Nimmo's editor reports that 'eleven brazen spears' were discovered on Abbey Craig in 1784 (W Nimmo 1880). A partly polished dolerite axe, 3 by 1in, found on the top of Abbey Craig, was donated to the Smith Institute, Stirling, in 1888 (Acc No: AC 4). RCAHMS 1963, visited 1952; Smith Institute 1934. About 30m outside the main rampart of this fort on the E side of the hill are the remains of a second rampart. Running SE from the precipitous NW edge of the hill as a stony bank 3.5m thick and 0.9m high for 18m before being cut by a sunken path, it continues as a level terrace with a face 1.2m high round the E side of the hill for a distance of 75m, for the last 14m of which the rubble wall core is showing.

After this its course is obscured by modern debris but may continue on the N side of the approach road. Few vitrified rocks were noted in its fabric. N B Aitchison 1981.An archaeological watching brief was conducted in 2001 on ground-breaking works associated with the insertion of a new floodlighting system for the Wallace Monument. Much of this work was carried out within the Scheduled area around the remaining rampart of the Abbey Craig hillfort. Two phases of rampart building were identified, comprising the secondary building of an earth and stone rampart over a timber-laced rampart which had been vitrified. In addition, an upstanding stretch of vertically faced rampart was uncovered during the works. Sponsor: Stirling District Tourism Ltd. B Glendinning 2001.

Site No 47
Name: Wallace Monument, Abbey Craig, Stirling
Local Authority:Stirling
Status: Listed Building Category A
Type of site: Standing building
NMRS number: NS89NW 43
Map reference: NS 8090 9565
Sensitivity: Very High

Site No 48
Name: Ladyneuk
Local Authority:Stirling
Status: None
Type of site: Limekiln; pier
NMRS number: NS89NW 58
Map reference: NS 808 952 (centred on)
Sensitivity: Low
Description: A pier is marked on the 1st edition OS map, next to a lime kiln. The pier measures 4m by 3m and four courses of stone wall are visible above low tide level. It is disused and in a ruinous and overgrown condition (GUARD 1996).

Site No 49
Name: Pier, Cambuskenneth
Local Authority:Stirling
Status: None
Type of site: Pier
NMRS number: NS89NW 68
Map reference: NS 8089 9506
Sensitivity: Low
Description: 'This pier is marked on the 1st edition OS map at Ladyneuk. Three courses of stone wall are visible above low tide level. The pier measures 6m by 3m. It is now disused and in a ruinous and overgrown condition' (GUARD 1996). Site recorded during a rapid coastal survey undertaken by GUARD of the S shore of the Firth of Forth Sponsor: Historic Scotland.

Site No 50
Name: Site of Ladyneuk Farmstead
Local Authority:Stirling
Status: None
Type of site: Site of farmstead
NMRS number: NS89NW 57
Map reference: NS 8095 9504
Sensitivity: Low
Description: Ladyneuk farmstead, which comprises two roofed, L-shaped, ranges and a third roofed building to the S, is depicted and named on the 1st edition of the OS 6-inch map (Perth and Clackmannan 1866, sheet cxxxiii). Only one small roofed building was shown at this location on the 1979 OS 1:10000 map. Information from RCAHMS (PM) 27 August 1996.

Site No 51
Name: Manor Powis Colliery
Local Authority:Clackmannanshire
Status: None
Type of site: Coal mine
NMRS number: NS89SW 76
Map reference: NS 8290 9468
Sensitivity: Low
Description: Evidence from maps and aerial photographs show this colliery was opened some time in the first half of the 1900s (prior to 1946). It was linked to the railway line by sidings. Aerial photographs show it remained in use until at least the 1970s. The NMRS holds a photo of the colliery dating from the late 1940's, and there are two other images available from 1932 and 1933. No other information is recorded about the site in the NMRS.

Site No 52
Name: Site of dovecot, Manorneuk
Local Authority:Clackmannanshire
Status: None
Type of site: Site of dovecot
NMRS number: NS89SW 13
Map reference: NS 8261 9490
Sensitivity: Low
Description: This dovecot has now been reduced to a pile of debris. The foundations of a square structure with dressed quoins, measuring 15'4" a side can be made out. Doubtless, however, it belonged to Manor Castle (NS89SW 2), which stood about 100 yards to the E. RCAHMS 1963, visited 1953. By 1973 there was no longer any trace of the dovecot. Its site is now covered by a cattle shed. Visited by OS (JP) 11 December 1973

Site No 53
Name: Site of Manor Castle, Manor Neuk
Local Authority:Clackmannanshire
Status: None
Type of site: Site of castle
NMRS number: NS89SW 2
Map reference: NS 8271 9490
Sensitivity: Low
Description: Built in 1572. The last vestiges of Manor Castle can be seen some 70 yards N of the level crossing at Manor Powis colliery, but they are now too indistinct for measurement. From a sketch made in 1850, when the building was still entire, and some recorded details (J S Fleming 1902), it appears that the house consisted of a main block lying E-W and measuring 50' x 18', with a short wing projecting through the middle of the N side. The entrance was in the W wall of the wing, and had above it a heraldic panel, dated 1572, which is now preserved at 14 Abercromby Place, Stirling. RCAHMS 1963, visited 1952 and 1953. At the published site an amorphous mound of turf-covered rubble was noted in 1973 (Visited by OS (JP) 11 December 1973). Very little now remains and no earthwork in the vicinity of Manor Castle could not be located on the ground during the Forth Coastal Survey by GUARD in 1996.

Site No 54
Name: Site of signal box, Manorneuk
Local Authority:Stirling
Status: None
Type of site: Site of signal box
NMRS number: None
Map reference: NS 8282 9486

Sensitivity: Low
Description: A signal box was shown here on the 1958 OS map, north of the railway. It is not shown on current maps.

Site No 55
Name: Strathmore Distillery, Cambus
Local Authority: Clackmannanshire
Status: None
Type of site: Distillery
NMRS number: NS89SE 69
Map reference: NS 853 942
Sensitivity: Low
Description: Forth Brewery. The NMRS hold a photo dating from 1974. No more info is contained in the NMRS record. Aerial photographs show that the distillery expanded considerably to the west around 1950. They also show that the large area of bonded warehouses that currently flank the south side of the railway line were built following this expansion, sometime between 1955-1971. They were constructed on former arable land, and two farmsteads in their path were demolished at NS 8357 9475 and NS 8410 9460.

Site No 56
Name: Old Bridge, Tullibody
Local Authority:Clackmannanshire
Status: SAM; Listed Building Category A
Type of site: Road bridge
NMRS number: NS89NW 4
Map reference: NS 8465 9514
Sensitivity: Very High
Description: The old Bridge at Bridgend is no longer in use. It was constructed in three sections and measures about 442ft. The two arches spanning the river appear to have constituted the original early 16th century bridge. Before 1616 the bridge had been extended to the west and one arch survives from this period. The western end is of relatively late date. The bridge is said to have been built by Robert Sibbald, tailor to James IV but no authority is given for this attribution (RCAHMS 1933). The bridge is much restored, the whole of the parapet appearing modern. Fragments of old masonry are visible in the central portion. Visited by OS (JD) 10 June 1953.

Site No 57
Name: Dovecot, New Mills Crossing, Cambus
Local Authority: Clackmannanshire
Status: None
Type of site: Dovecot
NMRS number: NS89SE 14
Map reference: NS 85018 94647
Sensitivity: Low
Description: A rectangular dovecot of late date, with approximate dimensions 6.5m by 5.75m. It is built of harled rubble with one string-course and the flanks are crow-stepped. RCAHMS 1933, visited 1928. As described. Visited by OS (DWR) 9 February 1973.

Site No 58
Name: Cambus Distillery
Local Authority:Clackmannanshire
Status: None
Type of site: Distillery
NMRS number: NS89SE 67
Map reference: NS 8544 9407
Sensitivity: Low
Description: See Architecture. Cambus Distillery, founded 1806 by John Moubray. A very large group of buildings, mainly modern (aerial photography shows a significant expansion of the complex to the north around the 1960s). The most notable features are an early 19th-century cast-iron arch bridge (for which see Site No.59) at NS 853 940, recently restored, and a masonry water-tower with cast-iron sectional tank, dated 1866. J R Hume 1976. NMRS holds numerous photographs from 1993, and a few from 1974.

Site No 59
Name: Bridge, River Devon, Cambus
Local Authority: Clackmannanshire
Status: SAM; Listed Building Category A
Type of site: Cast iron bridge
NMRS number: NS89SE 52

Map reference: NS 8532 9407
Sensitivity: Very High
Description: Cast iron arch bridge over the River Devon, recently restored. Thought to date from around 1825. It is a cast iron, four ring, braced spandrel segmental arch bridge. It springs from masonry abutments and carries an old wagon road across the River Devon, a few wards upstream of the village of Cambus (Noble 1974; J R Hume 1976; RCAHMS 1978; NMRS Record Sheet CLR/3/1).

Site No 60
Name: Cottages, Station Road, Clackmannan
Local Authority:Clackmannanshire
Status: None
Type of site: Standing buildings, cottages
NMRS number: NS89SE 81
Map reference: NS 8556 9409
Sensitivity: Low
Description: The NMRS holds 3 photos dating from 1993, but no descriptive information about the cottages is recorded.

Site No 61
Name: Cambus Railway Station
Local Authority: Clackmannanshire
Status: None
Type of site: Railway Station
NMRS number: NS89SE 68
Map reference: NS 8555 9420
Sensitivity: Low
Description: Cambus Station, opened 1852 by the Stirling and Dunfermline Rly. JR Hume, a pioneering industrial archaeologist of the 1970's described Cambus Station as 'formerly a two-platform through station with the main offices in a two-storey masonry building on the up (Stirling) platform. This has been extended by a wooden shelter and there is a similar shelter on the down platform. There is an unusual iron-truss footbridge'. (J R Hume 1976). This intermediate station was opened by the Stirling and Dunfermline Rly on 1 July 1852, and closed to regular passenger traffic on 7 October 1968. R V J Butt 1995. Cambus Station (NBR) opened 1/7/1852, closed 1/11/1954. The NMRS hold photos from 1974, 1958 and 1962, plus a record card by Hume. The platforms are now overgrown.

Site No 62
Name: Stableblock, Arnsbrae House, Cambus
Local Authority:Clackmannanshire
Status: Listed Building Category C(s)
Type of site: Standing building
Map reference: NS 867 939
Sensitivity: Moderate
Description: Built in 1885, recently converted to housing (Swan 2001).

Site No 63
Name: Lodge, Arnsbrae House, Cambus
Local Authority:Clackmannanshire
Status: Listed Building Category C(s)
Type of site: Standing building
Map reference: NS 8675 9380
Sensitivity: Moderate
Description: T-plan with half-timbered gables and decorative ridges (Swan 2001).

Site No 64
Name: Arnsbrae, Cambus
Local Authority:Clackmannanshire
Status: Listed Building Category B
Type of site: Standing building
Map reference: NS 8685 9400
Sensitivity: High
Description: Built in 1885. Red rubble, gabled mansion, with gothic doorway, arched loggia and an elegant terrace (Swan 2001).

Site No 65
Name: Braehead, Alloa
Local Authority:Clackmannanshire
Status: None
Type of site: Prehistoric shell midden
NMRS number: NS89SE 90
Map reference: NS 8693 9370 (centred)
Sensitivity: Moderate
Description: A shell midden discovered by Mr W Neilson of Alloa on the edge of Braehead Golf Course close to the road from Cambus to Alloa. Information from Mr W Neilson, Alloa 1997 NS 8693 9370. The Braehead Midden site lies on the edge of Braehead Golf Course, four to five metres above the road from Cambus to Alloa, which here forms the northern boundary of frequently flooded flat fields to the N of the Forth. During small-scale borrow-pitting of soil for use on the golf course, at a piece of rough ground owned by the golf club a layer of shells and thick layers of soil were exposed some 40m N of the road. The midden is the most northerly and westerly known in the Forth Valley, and unlike most known sites Braehead lies to the N of the river. A bulk sample of the shell layer was collected and the possibility of further work is being considered.Sponsor: Historic Scotland. D Hall and P Ashmore 1997.

Site No 66
Name: South Lodge, Gean House, Tullibody Road
Local Authority: Clackmannanshire
Status: Listed Building Category C(s)
Type of site: Standing building; residential; gate lodge
Map reference: NS 8750 9371
Sensitivity: Moderate
Description: The NMRS holds 2 photos of the lodge dating from 1975-6.

Site No 67
Name: The Gean House, Tullibody Road & Claremont, Tullibody
Local Authority:Clackmannanshire
Status:Listed Building Category A
Type of site: Standing building
Map reference: NS 8745 9400
Sensitivity:Very High

Site No 68
Name: North Lodge, Gean House, Tullibody Road
Local Authority: Clackmannanshire
Status: Listed Building Category B
Type of site: Standing building; residential; gate lodge
Map reference: NS 8760 9412
Sensitivity: High

Site No 69
Name: Inglewood West Lodge & Gates, Tullibody
Local Authority:Clackmannanshire
Status: Listed Building Category B
Type of site: Standing building; residential; gate lodge
Map reference: NS 8793 9385
Sensitivity: High
Description: (The cited grid reference recorded by the NMRS may not be accurate).

Site No 70
Name: Inglewood, Tullibody Road
Local Authority:Clackmannanshire
Status: Listed Building Category A
Type of site: Standing building
Map reference: NS 8800 9390
Sensitivity: Very High
Description: The NMRS holds several photos dating from 1898, mostly showing the interior.

Site No 71
Name: Inglewood East Lodge & Garage Block, Tullibody
Local Authority:Clackmannanshire
Status: Listed Building Category B

Type of site: Standing building
Map reference: NS 8797 9380
Sensitivity: High

Site No 72
Name: Norwood, Alloa
Local Authority: Clackmannanshire
Status: None
Type of site: Site of house
NMRS number: NS89SE 179
Map reference: NS 8771 9329
Sensitivity: Low
Description: Now demolished, depicted on pre-1939 25" scale Ordnance Survey maps. No more info or refs in NMRS.

Site No 73
Name: Cowden Park, Alloa
Local Authority: Clackmannanshire
Status: Listed Building Category C(s)
Type of site: Residential;
NMRS number: NS89SE 32
Map reference: NS 8780 9322
Sensitivity: Moderate
Description: Built around 1850, designed by John Melvin. Tudor-Jacobean, 2-storey, near-symmetrical SW front with twin gables. Shouldered, lintel porch on NW elevation. Harled with margins, slated roof, octagonal shafted chimneys.

Site No 74
Name: Site of signal box, West Alloa
Local Authority: Clackmannanshire
Status: None
Type of site: Site of signal box
NMRS number: None
Map reference: NS 8783 9308
Sensitivity: Low
Description: A signal box was shown here on OS maps in 1860 and 1901.

Site No 75
Name: West End Park Gates
Local Authority: Clackmannanshire
Status: None
Type of site: Gates
NMRS number: NS89SE 65
Map reference: NS 8783 9302 to 8803 9275
Sensitivity: Low
Description: No more info or refs in NMRS.

Site No76
Name: Grange Road, Alloa
Local Authority: Clackmannanshire
Status: Listed Buildings, Category B and C(s)
Type of site: Standing buildings
Map reference: NS 879 928
Sensitivity: High
Description: Grange School, St John's Rectory and buildings at no.'s 1, 1a, 2, 3, 3a, 4, 5 and 13 on Grange Road are all category B listed buildings. No.'s 40 & 40a Grange Road are category C(s) listed buildings.

Site No 77
Name: Alloa Glassworks, Glasshouse Loan, Alloa
Local Authority: Clackmannanshire
Status: SAM; Listed Building Category A
Type of site: Industrial/ Glass Furnaces; Glass cone
NMRS number: NS89SE 49.1
Map reference: NS 8800 9241
Sensitivity: Very High

Description: Only one glass cone now remains of three, and it is the only surviving glass cone in Scotland. It is a conical brick structure built about 1825. It houses a modern glass furnace. J R Hume 1976; RCAHMS 1978; J B Stevenson 1985; G D Hay and G P Stell 1986; NMRS Record Sheet CLR/2/1. The NMRS holds photos from 1968, 1969, 1980 and 1986, and drawings from 1960, 1968, 1969 and 1984. There is also a detailed survey record sheet from 1968, and an engraved view dating from 1772.

Site No 78
Name: Claremont, Alloa
Local Authority: Clackmannanshire
Status: Listed Buildings, Category B and C(s)
Type of site: Standing buildings
Map reference: NS 881 932
Sensitivity: High & Moderate
Description: Claremont was the old road from Alloa to Stirling, a quiet rural road until it was developed for large villas after the railway bridge was built at Marshill in 1851 (Swan 2001). Alloa West Church, located on Claremont, is a category B listed building. Three other buildings on this street are category C(s) listed buildings: Claremont House, Craigmyle (35 Claremont), and 33 Claremont.

Site No 79
Name: War memorial, Alloa
Local Authority: Clackmannanshire
Status: Listed Building Category B
Type of site: War memorial
NMRS number: NS89SE 178
Map reference: NS 8831 9303
Sensitivity: High
Description: South African war memorial, built in 1904, designed by Robert Lorimer. Relocated into a memorial garden.

Site No 80
Name: Mars Hill, Alloa
Local Authority: Clackmannanshire
Status: None
Type of site: Site of cists, cinerary urn, armlets
NMRS number: NS89SE 9
Map reference: NS 8843 9297
Sensitivity: Moderate
Description: Two or more cists and twenty-two cinerary urns were found in March 1828 at Alloa in repairing the road on Mars Hill. According to one account the urns were inverted on pieces of flagstone. A further urn was found in 1850 (J Crawford 1874). Two Late Bronze Age gold armlets, one of Irish and the other of Covesea type (J M Coles 1962) are said to have been found on the cover of a cist here. The NSA (1845) states that they were found in a cist, and that another pair, exactly similar, were found in another cist.

Site No 81
Name: Marshill, Alloa
Local Authority: Clackmannanshire
Status: Listed Buildings, Category B
Type of site: Standing building
Map reference: NS 8840 9295
Sensitivity: High
Description: Alloa Town Hall, Ochil House, Marchill House and Marcelle (Regional Offices) on Marshill are all category B listed buildings.

Site No 82
Name: Findspot of Roman coin, Mars Hill, Alloa
Local Authority: Clackmannanshire
Status: None
Type of site: Findspot of Roman coin
NMRS number: NS89SE 8
Map reference: NS 884 929
Sensitivity: Low
Description: A Roman coin was excavated on Mars Hill about 1837. It was inscribed with the letters SC on one side, and the words AUGUSTUS TRIBUNIS on the other. Its present location is unknown. NSA 1845; T C Gordon 1937; A T Simpson and S Stevenson 1983.

Site No 83
Name: Alloa North Parish Church, Ludgate, Alloa
Local Authority: Clackmannanshire
Status:Listed Building Category B
Type of site: Standing building
Map reference: NS 8836 9319
Sensitivity: High
Description: Built in 1882, tall and gothic in style, with bold buttresses and deep splays on the window jambs (Swan 2001).

Site No 84
Name: Mar Place House, Mar Place, Alloa
Local Authority: Clackmannanshire
Status: Listed Building Category B
Type of site: Standing building
Map reference: NS 884 931
Sensitivity: High

Site No 85
Name: Site of Alloa Harbour Railway Branch
Local Authority: Clackmannanshire
Status: None
Type of site: Site of railway
NMRS number: None
Map reference: NS 8845 9308
Sensitivity: Low
Description: The 1865 OS maps show a former railway branching off from the main track in the centre of Alloa town at NS 8845 9308, and leading to Alloa Harbour to the south. Its route can still be traced in the lines of current property boundaries and roads in the town. The roundabout at NS 8832 9300 marks the position of the former railway tunnel on this line.

Site No 86
Name: Site of Alloa Station and signal box
Local Authority: Clackmannanshire
Status: None
Type of site: Site of railway station and signal box
NMRS number: None
Map reference: NS 8856 9306
Sensitivity: Low
Description: The former Alloa Railway station was opened in 1850. It was located south of the line, next to the Police Station. By the time of the 1901 OS map, it had moved to a new position east of the current sports centre, to a bigger station building. A signal box also stood at the site, shown in OS maps in 1901 and 1958.

Site No 87
Name: Mar Street, Alloa
Local Authority:Clackmannanshire
Status: None
Type of site: Waggonway bridge
NMRS number: NS89SE 72
Map reference: NS 8857 9293
Sensitivity: Low
Description: Referred to by Hume, J R (1976) in 'The industrial archaeology of Scotland, 1, Lowlands and Borders', London, 87. The Wagon Road was built in 1768 and carried coal, pulled by ponies in wagons or carts with cast-iron wheels, three at a time, along a wagon road from Sauchie Colliery to Alloa Harbour. It was later extended to the glassworks and as far as Devon Colliery as a tramway. Some parts survive in Alloa as a footpath , with brick arches under the streets (Swan 2001).

Site No 88
Name: Mar Street, Alloa
Local Authority: Clackmannanshire
Status: Listed Buildings, Category B
Type of site: Standing buildings
Map reference: NS 887 928
Sensitivity: High

Description: There are category B listed buildings at no.'s 6, 8, 10, 13, 15, 19 (YMCA building) and 21 Mar Street, and also on the corner at 31 Mill St /1, 3 Mar Street.

Site No 89
Name: Drysdale Street, Alloa
Local Authority: C lackmannanshire
Status: Listed Buildings, Category B
Type of site: Standing buildings
Map reference: NS 887 929
Sensitivity: High
Description: The County & Police Buildings, the Former County Offices (no.70), Moncrieff House (no.72), and Moncrieff UF Church on Drysdale Street are all category B listed buildings.

Site No 90
Name: Alloa Market Cross, Bank Street
Local Authority: Clackmannanshire
Status: Listed building category B
Type of site: Standing structure
Map reference: NS 8855 9268
Sensitivity: High
Description: Alloa burgh cross now stands before the municipal buildings. The base and top are modern but the shaft is original. It is octagonal in section and c.10' high. The capital is moulded and ornamented with scrolls. RCAHMS 1933, visited 1928. As described. Visited by OS (DWR) 8 February 1973.

Site No 91
Name: Old Parish Church, Kirkgate, Alloa
Local Authority: Clackmannanshire
Status:SAM; Listed Building Category B
Type of site: Church
NMRS number: NS89SE 6
Map reference: NS 8863 9258
Sensitivity: Very High
Description: The original parish kirk was in existence by 1401, and was repaired and enlarged in 1680 (by Tobias Bauchop) with the additional Mar Aisle to the north. The church was condemned as unsafe in 1816, and the stones were used in the construction of the new church (Bedford Place, St Mungo's Parish Church (Swan 2001). The remains are in the old churchyard. All that is left is the west gable with the bell-tower, the latter resembling the tower of the (17th century) Tolbooth at Clackmannan (NS99SW 2). It was oblong on plan with a N aisle. RCAHMS 1033, visited 1928.

Site No 92
Name: Thistle Brewery, East Vennel & Old Bridge Street, Alloa
Local Authority: Clackmannanshire
Status: Listed Building Category B
Type of site: Standing building
NMRS number: NS89SE 50
Map reference: NS 888 927
Sensitivity: High
Description: Thistle Brewery, founded 1830 by James Maclay, rebuilt late 19th century. A neat complex consisting of a two-storey and attic, 7-bay office block (1896); a two-storey, 5-bay malt store with a central hoist; a four-storey, 2-by-8-bay brewhouse with a tower, and various single-storey buildings. There is a single mash tun, two oil-fired coppers, a hop-back, ten wooden fermenting vats, and ancillary equipment. One of two surviving active small Scottish breweries. J R Hume 1976.

Site No 93
Name: Site of Alloa Station and signal box, Alloa
Local Authority: Clackmannanshire
Status: None
Type of site: Site of railway station and signal box
NMRS number: None
Map reference: NS 8872 9312
Sensitivity: Low
Description: Alloa Station was moved here in the late 1800s from its previous site at Site No.86. A signal box is also shown here on OS maps in 1901 and 1958, and there were also several sidings located here. The station was closed in 1968 (Butt).

Site No 94
Name: Site of railway building and turning circle, Alloa
Local Authority: Clackmannanshire
Status: None
Type of site: Site of railway building and turning circle
NMRS number: None
Map reference: NS 8882 9320
Sensitivity: Low
Description: An un-named railway building and turning circle were shown here on the 1860 OS map.

Site No 95
Name: Site of Alloa Brewery, Whins Road, Alloa
Local Authority: Clackmannanshire
Status: None
Type of site: Site of brewery
NMRS number: NS89SE 165
Map reference: NS 8890 9305
Sensitivity: Low
Description: A brewery developed on this site from 1810, the complex can be seen to expand considerably in successive OS maps from 1866 onwards. The brewery operated until recently, producing Skol Lager. Two annotated plans of the brewery dating from 1947 are held by the NMRS. Recently demolished.

Site No 96
Name: Alloa Tower, Alloa
Local Authority: Clackmannanshire
Status: Listed Building Category A
Type of site: Standing building
Map reference: NS 889 925
Sensitivity: Very High
Description: Large, 4-storey, oblong building, probably dating from the 1400s, and considerabley altered in the 1500s, 1600s and 1700s. Strategically sited between the lowest bridging point of the Forth and the Kincardine Ferry. The origins of the tower are unclear, although a manor is mentioned as its predecessor (Simpson & Stevenson 1983).

Site No 97
Name: Cairn, Hawkhill
Local Authority: Clackmannanshire
Status: SAM
Type of site: Cairn
NMRS number: NS89SE 10
Map reference: NS 8911 9282
Sensitivity: Very High
Description: The remains of a burial cairn of prehistoric date, surviving as a grass-covered mound. It lies in parkland with extensive views. It is built of stones, and has diameter 16.5m and height 1.5m. A concrete seat has recently been constructed on its summit. Excavations in the 1800's found the remains of a burial in a cist within the cairn. There are likely to be further burials in and around it. The scheduled area includes the cairn plus an area around it, forming an approximately semi-circular area with a maximum diameter of 40m (information from SAM record).

Site No 98
Name: Site of signal box and level crossing, Hilton Road, Alloa
Local Authority: Clackmannanshire
Status: None
Type of site: Site of signal box and level crossing
NMRS number: NS89SE 126
Map reference: NS 8959 9300
Sensitivity: Low
Description: Shown on the 1866, 1901 and 1958 OS maps, since demolished. The NMRS hold one photo dating from 1974 and a John R Hume Industrial/CBA card from 1974.

Site No 99
Name: Hallpark Distillery, East Alloa
Local Authority: Clackmannanshire
Status: None
Type of site: Distillery and bonded warehouses

NMRS number: NS89SE 70
Map reference: NS 8970 9330
Sensitivity: Low
Description: A distillery developed here north of Carsebridge Road from around 1799, formerly known as Carsebridge Distillery. The site no longer functions as a distillery and aerial photographs show that the complex of buildings has expanded to the south since 1946, now comprising a vast area of bonded warehouses.

Site No 100
Name: Site of signal box, Whinhill, Alloa
Local Authority: Clackmannanshire
Status: None
Type of site: Site of signal box
NMRS number: None
Map reference: NS 9006 9281
Sensitivity: Low
Description: A signal box was shown here on the 1901 OS map.

Site No 101
Name: Site of pits, east of Alloa
Local Authority: Clackmannanshire
Status: None
Type of site: Site of pits
NMRS number: None
Map reference: NS 9005 9295
Sensitivity: Low
Description: Vertical aerial photographs taken by the RAF in 1946 show pits covering areas here along the north and south of the railway line, possibly for extracting sand or gravel. By 1955 they had been filled in and the west part of the site had been levelled.

Site No 102
Name: Parkmill
Local Authority: Clackmannanshire
Status: SAM
Type of site: Cross-slab; cist
NMRS number: NS99SW 11
Map reference: NS 9013 9266
Sensitivity: Very High
Description: This slab known as the "Stone Cross" (New Statistical Account {NSA} 1845) is set up on a knoll 200 yards S of the main road between Alloa and Clackmannan. It is packed round the base with fairly large stones, and stands with its broad face E-W. A cross of Celtic form is incised on both sides. It stands 8' high and measures 2'7 1/2" x 9" at base. When the site was examined in 1829, many human bones were found close to the stone, and at about 9' N of its base was a stone cist which contained human bones, and was covered with a flagstone, at each end of which was incised a small cross of simple form. Long before 1829 the cross stood on the inside of a hedge-row and was situated about 160 paces from the old road between Alloa and Clackmannan, and a few paces W of it was an old parish road. The Statistical Account (OSA 1791) notes that old people used to speak of the figure of a man on horseback which they had seen on it. NSA (written by P Brotherston) 1845; P Miller 1889; RCAHMS 1933. This cross is as described. The incised crosses on either face can still be seen, although they are much weather-worn. Visited by OS (W M J) 7 July 1950.

Site No 103
Name: Site of signal box, Hilton, east of Alloa
Local Authority: Clackmannanshire
Status: None
Type of site: Site of signal box
NMRS number: None
Map reference: NS 9033 9275
Sensitivity: Low
Description: A signal box was shown here on the 1866 OS map.

Site No 104
Name: Site of signal box, Kincardine Junction
Local Authority: Clackmannanshire
Status: None
Type of site: Site of signal box
NMRS number: None

Map reference: NS 9096 9265
Sensitivity: Low
Description: A signal box was shown here at the fork of the junction, between the two railway lines, on OS maps in 1901 and 1958.

Site No 105
Name: Site of Paton & Baldwin's Mill, Clackmannan
Local Authority: Clackmannanshire
Status: None
Type of site: Site of mill Industrial/ Textiles; Wool/ Woollen Mill
NMRS number: NS99SW 36
Map reference: NS 9141 9230
Sensitivity: Low
Description: A woollen mill was established here in 1875 on the banks of the Black or Little Devon, on the site of a former distillery. It was built in the style of a typical Lancashire mill, a plain, square block of flats. The NMRS hold a photograph dating from 1974. Ref: Hume, J R (1976) The industrial archaeology of Scotland, 1, Lowlands and Borders, London, 91. It was recently demolished.

Site No 106
Name: Railway overbridge, Clackmannan
Local Authority: Clackmannanshire
Status: None
Type of site: Railway overbridge
NMRS number: NS99SW 43
Map reference: NS 9134 9208
Sensitivity: Low
Description: Road bridge crossing the railway off Alloa Road in Clackmannan. No no descriptive information about the bridge is recorded.

Site No 107
Name: Railway overbridge, Clackmannan
Local Authority: Clackmannanshire
Status: None
Type of site: Railway overbridge
NMRS number: NS99SW 42
Map reference: NS 9142 9202
Sensitivity: Low
Description: Road bridge crossing the railway at Clackmannan. Carries the road from Cattle Market and continues as the B910 to the north-east. No descriptive information about the bridge is recorded.

Site No 108
Name: Motte and bailey, Clackmannan Tower
Local Authority: Clackmannanshire
Status: None
Type of site: Motte-and-Bailey castle
NMRS number: NS99SW 13
Map reference: NS 906 919
Sensitivity: Moderate
Description: From a charter of Malcolm IV (c. 1141 - 1165) giving Dunfermline Abbey "the toft e croft in my town of Clacman" which has the words "apud Clacman" written on it, Gordon deduces that Malcolm IV had a residence at Clackmannan. He adds that it is possible to trace the area on the top of King's Seat Hill (name: NS 9060 9202) which was barricaded and strengthened to act as the royal castle of Clackmannan. The structure was wooden, of motte and bailey type. Clackmannan Castle is recorded in a charter of c. 1248 x 1264 (G Stell 1972). T C Gordon 1936; G Stell 1972; Information from Scottish Record office Register House Charters No. 54. There is nothing visible on the ground. The probable site is now occupied by the present castle (NS99SW 1). Visited by OS (D W R) 20 May 1974.

Site No 109
Name: Clackmannan Tower
Local Authority: Clackmannanshire
Status:SAM; Listed Building Category A
Type of site: Tower house
NMRS number: NS99SW 1
Map reference: NS 9065 9195
Sensitivity: Very High

Description: Clackmannan Tower is situated in the summit of a prominent ridge known as King's Seat Hill. The summit has been levelled, and probably at a later period, an area of about an acre has been enclosed as a garden by a wall which has now disappeared. On the southern side are traces of a garden terrace, while a short wide platform lying immediately south of the house, was probably a bowling green. The tower stands at the eastern end of this site. The oldest portion is the lower half of the north end which is part of an oblong tower dating probably from the late 14th century. A wing was added on the south side in the 15th century making the building L-shaped. This wing is five storeys high - one storey higher than the north tower which is surmounted by a cap-house. Alterations were made during the 16th and 17th century, and the entrance was transferred from the west wall of the wing to the east in the 17th century. De Cardonnel's view taken in 1788, represents the tower and the forecourt as standing on a mound, with a ditch in front; and slight traces of this ditch are still to be seen. The New Statistical Account (NSA 1845), stated that the tower was surrounded by a moat with drawbridge, while adjoining the tower stood the old mansion, the residence of the Bruce family from between 1365 and 1772. RCAHMS 1933.

A watching brief was maintained during the excavation of an electricity cable trench at Clackmannan Tower in December 1999. The trench, excavated by a small mechanical excavator, ran between an existing manhole immediately within the remains of a barmkin enclosure on the E side of the tower house. The trench was dug towards the E doorway and measured c 16m E-W, being up to 600mm deep. Two sherds of reduced post-medieval pottery (jug and handle sherds) were found along with the base of a glass bottle, probably dating from the 1600s. The findings from the excavation suggest that the present barmkin is the result of landscaping of the natural hill summit, with dumping of material directly over the clean clay horizon. There was no sign of a cobbled surface extant within the barmkin, although a shallow spread of loose stones and small rubble fragments may represent a damaged surface. Sponsor: Historic Scotland G Ewart 2000.

Site No 110
Name: Market Cross & King Robert's Stone, Main Street, Clackmannan
Local Authority: Clackmannanshire
Status: SAM; Listed Building Category B
Type of site: Standing structure
NMRS number: NS99SW 3 & 6
Map reference: NS 9110 9188
Sensitivity: Very High
Description: Clackmannan Market Cross stands in the main street beside the Tolbooth. Although the stepped base has been renewed, the shaft is original, dating from the 1600's. It is 9'6" in height, and is octagonal in section, measuring 11" in diameter. The capital is moulded and bears the Bruce arms. RCAHMS 1933, visited 1928. According to Dr Gordon (T C Gordon, The Manse, Clackmannan) the cross is correctly positioned as being on its original site. The Bruce arms on the head of the cross are still to be seen, but the steps are of recent origin. Visited by OS (W M J) 5 July 1950.

The Clackmannan Stone is situated next to the market cross. It is also known as King Robert's Stone, due to a tradition connecting it with Robert the Bruce. Because of this association it was kept, first in Clackmannan Tower, and later at the Cross (Name Book 1861). The stone is, according to Gordon, traditionally said to have originally come from nearby Lookabootye Brae (name: NS 9121 9125), probably from the foot of the brae. It is a whinstone boulder, 1 1/2" x 3 1/4" x 2 1/4". It has a deep cleft on its upper side, but there is nothing about it to indicate what it may have been originally (P Miller 1889). Early in the 19th century, a suitably shaped plinth was chosen from among the large boulders at the Abbey Craig at Causewayhead, and the stone, having been clamped together with iron bars, and a hole made in it for a flagstaff, was placed on top of it for better preservation. RCAHMS and Feachem create confusion by describing the plinth as the antiquity.

The Clackmannan Stone is regarded as that from which the county takes its name, which has been in use from the 13th century. Stone of Manau. Name Book 1861; P Miller 1889; W J Watson 1926; RCAHMS 1933; T C Gordon 1936; R W Feachem 1963. A plaque on the adjacent Tolbooth states that the stone was originally placed at Lookaboutye Brae (NS 912 911) and was sacred to the pre-Christian deity Mannan, and is a relic of pagan times. It was raised on its shaft in 1833. No further information. Visited by OS (D W R) 20 May 1974. Both stones are SAMs, and the market cross is also a category B listed building.

Site No 111
Name: Tolbooth, Main Street
Local Authority: Clackmannanshire
Status:SAM; Listed Building Category B
Type of site: Standing building remains
NMRS number: NS99SW 2
Map reference: NS 9119 9189
Sensitivity: Very High

Description: The remains of the Tolbooth, Clackmannan, which stands in the main street, consist of the west gable and bell-tower. The architectural detail is suggestive of the 17th century, and this is consistent with the fact that, prior to the passing of an Act of Parliament on 5th June 1592, Clackmannan had no Tolbooth, courts of justice being held at the Burgh Cross (RCAHMS 1933). It remained the County gaol for 200 years (T C Gordon 1936). By 1795 the Tolbooth had become'a heap of ruins', although the sheriff sometimes held his courts there. The tower and western gable of the Tolbooth are still standing in a good state of repair, having been recently renovated externally by order of the Town Council. Visited by OS (W M J) 5 July 1950. Acts Parl Scot 1814-75; OSA 1795; G Stell 1981.

Site No 112
Name: Watching brief, Town Hall, Main Street
Local Authority: Clackmannanshire
Status: None
Type of site: Watching brief
NMRS number: NS99SW 28
Map reference: NS 913 918
Sensitivity: Low
Description: Observations by SUAT of contractors foundation and service trenches located no archaeological deposits at this site. Sponsor: Clackmannan District Architects. D Hall 1993.

Site No 113
Name: Site of Clackmannan & Kennet Station
Local Authority: Clackmannanshire
Status: None
Type of site: Site of railway station
NMRS number: None
Map reference: NS 9157 9193
Sensitivity: Low
Description: The former railway station serving Clackmannan and Kennet opened in 1893 and closed in 1930, although the building was still shown on the 1958 OS map. Note that prior to 1893 Clackmannan was served by a station north-east of the town, which was renamed Clackmannan Road Station when Clackmannan Station opened in the town.

Site No 114
Name: Kennet House Lodge
Local Authority: Clackmannanshire
Status: Listed Building Category B
Type of site: Standing building
NMRS number: NS99SW 45.01
Map reference: NS 9195 9145
Sensitivity: High

Site No 115
Name: Site of colliery, Kennet
Local Authority: Clackmannanshire
Status: None
Type of site: Site of colliery
NMRS number: None
Map reference: NS 9268 9100
Sensitivity: Low
Description: Two disused coal pits shown here on OS maps in 1866. The pits here were presumably mined by the occupants of the Miners' Row at Kennet. They were disused by the time the railway was built in 1893. A colliery was later re established here, shown in aerial photographs in 1946, 1955 and 1971. It was accessed by a railtrack leading east off the Kincardine Branch Railway.

Site No 116
Name: Kincardine Branch, North British Railway
Local Authority: Fife
Status: None
Type of site: Site of railway
NMRS number: None (SMR no. FF9821)
Map reference: NT 093 865
Sensitivity: Low
Description: Originally planned as a through route to the newly enlarged harbour at Kincardine by North British Railway. Opened to Kincardine 18 December 1893. Opened through to Dunfermline 30 June 1906. Alloa -

Kincardine closes to passengers 7 July 1930. Re-opened in 1960 as a relief route for Kincardine Power Station coal traffic until its closure in 1988. (1) Ref: Unpublished document: Kincardine Crossing Archaeological Evaluation (Avoidance Phase) Volume 1, GUARD, 1994.

Site No 117
Name: 1-20 Miners' Houses, Kennet
Local Authority: Clackmannanshire
Status: Listed Buildings Category B
Type of site: Miners' houses
NMRS number: NS99SW 34 & 35
Map reference: NS 9268 9100 & NS 9276 9091
Sensitivity: High
Description: Terraced row of cottages, shown on the OS 1866 map, along with a school. At around 1950, three cottages west of the present row were demolished and the site cleared. A works building now stands at this end of the row. The rest of the cottages are still standing and occupied. The NMRS hold a photo dating from 1974 and an associated John R Hume Industrial/CBA card from 1974.

Site No 118
Name: Site of earthworks, Kilbagie
Local Authority: Fife
Status: None
Type of site: Earthworks
NMRS number: None
Map reference: NS 9300 9020
Sensitivity: Moderate
Description: Vertical aerial photographs taken by the RAF in 1946 show a series of earthworks in a field north of Kilbagie Mill. They include short linear features, like hollow-ways. They are of unknown date, but run towards a disused railway overbridge and could be associated with the early distillery or mill at Kilbagie.

Site No 119
Name: Kilbagie House & garden walls
Local Authority: Clackmannanshire
Status: Listed Building Category B
Type of site: Standing building
NMRS number: NS99SW 46
Map reference: NS 9282 9009
Sensitivity: High
Description: Built in the mid-1700s and later. Two-storey and attic (with single centre circular window), 3-window rubble with margins, architraved centre doorway, club skews. W addition with bow front and shaped W gable. Rusticated gatepiers.

Site No 120
Name: Kilbagie Mills
Local Authority: Clackmannanshire
Status: Listed Building Category C(s)
Type of site: Industrial/ Wood Working; Paper And Wood Pulp/ Paper Mill
NMRS number: NS98NW 58
Map reference: NS 928 899
Sensitivity: Moderate
Description: A threshing mill was noted at Kilbagie in 1795 at which time a distillery was also established on the site. The distillery was described in 1795 as 'substantial', covering 4 acres, surrounded by a high wall, with 4-storey malting barns and a small burn running through the middle of the site driving a threshing mill and grinding mills (*The Statistical Account of Scotland*). The distillerywas described in 1845 as *'a work of long standing and of great extent. There is a space of nearly seven acres covered by the various buildings etc, and the whole of said space in enclosed by a very high wall. There are byres for the feeding of 700 cattle, and about 850 acres of and have been cultivated in connection with the distillery'* (*The New Statistical Account of Scotland,* 1845). Marked as Chemical Manure Works on the 1866 OS map. It became a paper mill in 1875 and OS maps show it has expanded since this time. The earliest part of the complex dates from the mid-1700s, a 2-storey and attic 4-bay traditional house.

Site No 121
Name: Site of Kilbagie Railway Station
Local Authority: Fife
Status: None
Type of site: Site of Railway Station

NMRS number: NS98NW 246
Map reference: NS 9310 8995
Sensitivity: Low
Description: Site of Kilbagie Railway Station. Slight remains of the platform are incorporated into the garden of nearby Ambleside Cottage, itself possibly of railway company origin. Unpublished document: Kincardine Crossing Archaeological Evaluation (Avoidance Phase) Volume 1, GUARD, 1994, 27. SMR no.FF9974. Opened sometime in the late 1800s and shown on the 1901 OS map. Located east of Kilbagie Mill, on the east side of the track.

Site No 122
Name: Sidings, Kilbagie, Kincardine Railway
Local Authority: Fife
Status: None
Type of site: Sidings
NMRS number: None
Map reference: NS 9295 8980
Sensitivity: Low
Description:A branch of railway led off the main line to Kilbagie Mill, visible in aerial photographs in 1946, later dismantled. The sidings for Kilbagie Mill have been lifted and are mossed over. This was also the point to which the Kennetpans spur joined. Ref: Unpublished document: Kincardine Crossing Archaeological Evaluation (Avoidance Phase) Volume 1, GUARD, 1994, 27. SMR no.FF9973.

Site No 123
Name: Bridge, Kilbagie, Kincardine Railway
Local Authority: Fife
Status: None
Type of site: Bridge
NMRS number: None
Map reference: NS 9300 8975
Sensitivity: Low
Description: Railway bridge, 150m south-east of Kilbagie Mill. Ref: Unpublished document: Kincardine Crossing Archaeological Evaluation (Avoidance Phase) Volume 1, GUARD, 1994, 27. SMR no.FF9971.

Site No 124
Name: Bridge, Kilbagie, Kincardine Railway
Local Authority: Fife
Status: None
Type of site: Bridge
NMRS number: None
Map reference: NS 9286 8936
Sensitivity: Low
Description: Railway bridge, 500m south of Kilbagie Mill. Ref: Unpublished document: Kincardine Crossing Archaeological Evaluation (Avoidance Phase) Volume 1, GUARD, 1994, 27. SMR no.FF9972.

Site No 125
Name: Siding, Kincardine Railway Branch
Local Authority:Fife
Status:None
Type of site: Railway siding
NMRS number: None
Map reference: NS 9282 8934
Sensitivity:Low
Description: Demolished railway building and derelict sidings. Probably associated with mine complex to south. Unpublished document: Kincardine Crossing Archaeological Evaluation (Avoidance Phase) Volume 1, GUARD, 1994, 27. SMR no. FF9975.

Site No 127
Name: Site of Broomknowe Colliery
Local Authority: Fife
Status: None
Type of site: Site of coal mine
NMRS number: None
Map reference: NS 9280 8910
Sensitivity:Low

Description: Area of disused and backfilled coal pits with associated earthworks. Later brick buildings (in use) on the site associated with water movement. Ref: Unpublished document: Kincardine Crossing Archaeological Evaluation (Avoidance Phase) Volume 1, GUARD, 1994, 27. (Fife SMR FF9970). Aerial photographs show the colliery had become disused and overgrown by 1946.

Site No 128
Name: Culvert, on Kincardine Branch Railway
Local Authority: Fife
Status: None
Type of site: Culvert
NMRS number: None
Map reference: NS 9282 8898
Sensitivity: Low
Description: Stone culvert under railway. Original feature. Unpublished document: Kincardine Crossing Archaeological Evaluation (Avoidance Phase) Volume 1, GUARD, 1994, 27. SMR no.FF9976.

Site No 129
Name: Old Tulliallan Castle
Local Authority: Fife
Status: SAM; Listed Building Category A
Type of site: Defence; Residential/ Castle; Garden (Possible)
NMRS number: NS98NW 5
Map reference: NS 9268 8877
Sensitivity: Very High
Description: Tulliallan Castle, though ruinous, is one of the best surviving examples of a Scottish hall-house, probably built in the early 14th century within a broad ditch comparable to that at the Peel of Gargunnock or Peel of Gartfarren (homestead moats - see NS79NW and NS59NW). The upper storeys of the castle have been remodelled in the 15th century, and later additions have been made. J G Dunbar 1966; RCAHMS 1933; D MacGibbon and T Ross 1887-92.

The castle was shown on a map by General Roy (c.1750) with three fields enclosed by shelter planting. There was no associated designed landscape at this time. The foundations of Tulliallan Castle are built on a large natural rock outcrop. The causeway entrance over the ditch on the S is stone-packed, and the remains of a strong curtain wall exist in the SW corner. The base of the ditch varies from 4.0m to 5.0m in breadth and the outer upcast mound rises in places to a height of 1.5m above the bottom of the ditch. The whole site is so densely overgrown that approach is difficult except from the S. The remains are in poor condition. Visited by OS (M H) 13 July 1953. Possible 17th century garden. N Hynd 1984.

Site No 130
Name: Enclosure, Tulliallan
Local Authority: Fife
Status: None
Type of site: Site of enclosure
NMRS number: None
Map reference: NS 9300 8880
Sensitivity: Moderate
Description: Linear, angled cropmark about 1 m wide, in pasture. Unpublished document: Kincardine Crossing Archaeological Evaluation (Avoidance Phase) Volume 1, GUARD, 1994, 27. SMR no.FF9977.

Site No 131
Name: Tulliallan Estate
Local Authority: Fife
Status: Designated Historic Designed Landscape
Type of site: Historic designed landscape; Category A listed building
NMRS number: NS98NW 56
Map reference: NS 9350 8850
Sensitivity: High
Description: The new Tulliallan Castle was built at this site in 1815-1820, replacing the ruined castle to the west (Site No.129). It is a category A listed building, by William Atkinson. It is Gothic in style, with castellations and comprises a main 3-storey wing attached to two wings. A modern extension has been added to the north wing. The designed landscape developed from around 1820, and is shown on the 1855 OS map. Its extent remains similar today, although it has been somewhat fragmented by the sale of parts of the estate. The estate is bounded by the A977 to Alloa on its west side, and by the A985 on its south side.

To the north the parkland extended to the mausoleum, and a large area to the north and east of the estate was planted with forestry. There are about 93 ha in the designed landscape today. Tulliallan Castle was used by the headquarters of the Polish forces in Scotland in the 1940s. In 1949 the castle and policies were purchased by the Crown and used as a police training college. The castle and offices were modernised for this purpose, and some new college buildings have been added. A new heather garden was added in 1972, and training pitches and Skid Pan have also been constructed.

he former farm and stable buildings at Blackhall house the Traffic Division. Other original features include garages, estate cottages (dating from 1719), a dovecot (see Site No.132), laundry building (built 1820), boathouse, West Lodge and Gardens House (built 1918), mausoleum, two statues, several urns, Italian Garden (early 1800s), formal gardens, walled garden (possibly pre-dating the new castle), orchard and lawns. A former fountain west of the castle was probably removed at around 1949. Most of the woodlands were bought by the government during WWI and felled. Historic Scotland has classified the estate as 'Outstanding' both architecturally and as a work of art, and of 'High' historical and horticultural value. The estate also has some scenic and nature conservation value.

Site No 132
Name: Tulliallan Dovecot
Local Authority: Fife
Status: Listed Building Category B
Type of site: Standing building
Map reference: NS 93167 88392
Sensitivity: High
Description: Located in the grounds of Tulliallan Castle (Scottish Police Training College). Lectern-style construction. The NMRS holds photos of the dovecot dating from 1960 and 1986.

Site No 133
Name: Blackhall Lodge & Gateway, Tulliallan
Local Authority: Fife
Status: Listed Building Category B
Type of site: Standing building
Map reference: NS 9310 8825
Sensitivity: High
Description: Built in 1908 to the design of Watson & Salmon.

Site No 134
Name: Chapel Hill, Kincardine
Local Authority: Fife
Status: None
Type of site: Site of chapel
NMRS number: NS98NW 6
Map reference: NS 9294 8820
Sensitivity: Moderate
Description: Local informants, including the estate factor, state that a Roman Catholic chapel, of unknown dedication, which was destroyed at the Reformation, stood here. Name Book 1861. Situated on a natural rock outcrop are the faint traces of a rectangular building, 7.5m x 8.5m, and though earth-covered, the walls appear to have been about 1.0m thick and 0.2m high.

Visited by OS (M H) 13 July 1953. The Rev Meiklejohn (Kincardine Manse) states that there is no evidence for there ever having been a chapel here. The irregularity of the foundations tends to disprove that they are the remains of an ecclesiastical building; they are more probably those of an old farm building. (See also NS98NW 14.) Visited by OS (J L D) 17 October 1953. Excavations by the Kincardine Local History Group continued, exposing the complete outline of this lost medieval chapel. The single cell building measures approximately 10m by 7m, with walls surviving no higher than 0.6m. Opposed entrances at west end, each with large single threshold stone, well worn. Altar base exposed at east end. The floor was sealed in places by possible collapsed wall plaster. There was evidence of the structure having been destroyed by fire. Sponsor: Kincardine Local History Group. B Wolsey 1991.

Site No 135
Name: Chapelhill Street
Local Authority: Fife
Status: None
Type of site: Street, general
NMRS number: NS98NW 221
Map reference: NS 9290 8805

Sensitivity: Low

Site No 136
Name: Hawkhill Road, Kincardine
Local Authority: Fife
Status: Listed Building Category C(s)
Type of site: Cottages
NMRS number: NS98NW 45-47, 106-113, 115-125
Map reference: NS 9286 8803 (centred at)
Sensitivity: Moderate
Description: The SMR and NMRS have allocated numbers to all buildings in this street. No.'s 2-38 Hawkhill Road (even numbers only) are all category C(s) listed buildings. They are miners' cottages dating from the latter half of the 1700s. The NMRS holds a few photos dating from 1963 and 1975-6.

Site No 137
Name: Site of Kincardine Power Station & jetty
Local Authority: Fife
Status: None
Type of site: Site of Public Services/ Electricity Supply/ Power Station
NMRS number: NS98NW 61.00
Map reference: NS 9250 8810
Sensitivity: Low
Description: Built in the 1960s. Demolition commenced in Summer 2000. By November, little survived except the two tall brick-built chimney stacks. MKO, visited 08 Nov 2000. The NMRS holds 16 photos, dating from 1936 (gen view of site), 1960, 1987, 1988 and 1990, also some prints from the 1950's, 1960's and 1980's. See Gifford, McWilliam,and Walker, J, C.E., and D. (1988) 'Edinburgh', The buildings of Scotland series, London, 266; Matthew, R H (1957) 'Kincardine power station', Architectural Prospect, 1957, Winter 1957, 16-21; South of Scotland Electricity Board (1960), 'Kincardine Generating Station', [Glasgow]. South of Scotland Electricity Board (1971) 'Kincardine Power Station', [s.l.].

The jetty was built 1960, by Robert Matthew, Johnson-Marshall & Partners. J Gifford 1988. ARCHITECT: Robert H. Mathew, 1957. REFERENCE: Historic Scotland library. Prospect no.8 Winter 1957 - illustrated article.

Site No 138
Name: Tulliallan Old Parish Church
Local Authority: Fife
Status: Listed Building Category B
Type of site: Remains of former church
Map reference: NS 9338 8808
Sensitivity: High
Description: This church was built in 1675, the date inscribed over its doorway, as a successor to the old parish church (NS98NW 2) and was itself replaced about 1825 when a new church was built (at NS 9325 8789). Now roofless, it is rectangular, with a N transept and a square tower at the W end. RCAHMS 1933, Visited 1925. The remains of this church, as described, are in a fair state of preservation. Visited by OS (M H) 13 July 1953. A project to reinstate and re-establish fallen, buried and sunken tombstones at Tulliallan Kirkyard was carried out by William Wolsey and William Anderson of the Kincardine Local History Group. An illustrated record of stones, inscriptions and carvings is held in the NMRS. W E Wolsey 1997, NMRS MS/997/2.

NMRS holds photos showing some of the gravestones, dating from 1988, and other photos of the church and graveyard dating from 1885 and various subsequent dates.

Site No 139
Name: Tulliallan Parish Church, Kirk Street, Kincardine
Local Authority: Fife
Status: Listed Building Category B
Type of site: Standing building
Map reference: NS 9325 8790
Sensitivity: High
Description: The parish church was in existence from at least the early 15th century. A new church was built in 1675 to the south of the former one.

Site No 140
Name: Tulliallan Session House & 71, 73 Kirk Street, Kincardine
Local Authority: Fife

Status: Listed Building Category C(s)
Type of site: Standing building
Map reference: NS 9328 8787
Sensitivity: Moderate

Site No 141
Name: Kilbagie Street, Kincardine
Local Authority: Fife
Status: Listed Building Category B & C(s)
Type of site: Standing buildings
Map reference: NS 9295 8780 (centred at)
Sensitivity: High & Moderate
Description: Buildings at no.'s 24 ('The Orchard'), 36 ('Rosevale'), 38, 40, 42, 44, 60 ('Primrose Villa') Kilbagie Street are all category B listed buildings, and no.'s 63, and 65 Kilbagie Street are category C(s) listed buildings. No.8 is not a listed building, although it is included in the SMR and NMRS.

Site No 142
Name: Site of Goods Shed, Kincardine
Local Authority: Fife
Status: None
Type of site: Site of railway building
NMRS number: None
Map reference: NS 9291 8767
Sensitivity: Low
Description: A Goods Shed was shown here on OS maps in 1897 and 1958. It has since been demolished and built over with houses in Ochil View.

Site No 143
Name: Site of railway building, Kincardine
Local Authority: Fife
Status: None
Type of site: Site of railway building
NMRS number: None
Map reference: NS 9289 8759
Sensitivity: Low
Description: An un-named railway building was shown here on OS maps in 1897 and 1958. It has since been demolished and built over with houses in Ochil View.

Site No 144
Name: Gas Holder Station, Kincardine
Local Authority: Fife
Status: None
Type of site: Gas Holder Station
NMRS number: NS98NW 52
Map reference: NS 9306 8756
Sensitivity: Low
Description: Visible in aerial photographs dating from 1946. The NMRS holds two photos from circa 1990, and a location map and site plan from 1966.

Site No 145
Name: Market Cross, High Street, Kincardine-on-Forth
Local Authority: Fife
Status: SAM
Type of site: Market Cross
NMRS number: NS98NW 8
Map reference: NS 9312 8751
Sensitivity: Very High
Description: Kincardine market cross, standing at the S end of the High Street, consists of an octagonal shaft with a moulded base and capital, placed on a rise of six octagonal steps. Above the square abacus is a stone sculptured with the arms of the Earls of Kincardine on the one side and a thistle ornament on the other. The cross must be later than 1647. when the Earldom was created. RCAHMS 1933. The market cross is in good condition and as described. Visited by OS (M H) 13 July 1953.

Site No 146
Name: Elphinstone Street, Kincardine

Local Authority: Fife
Status: None
Type of site: Standing buildings
NMRS number: NS98NW 26-27, 88, 202-207
Map reference: NS 9305 8751 (centred at)
Sensitivity: Low
Description:The NMRS and SMR databases include many buildings in this street, at no.'s 2, 15, 19, 21, 22, 23-25, 27-29, 31-33. No. 22 Elphinstone Street is a shop with an inscribed panel in the wall, badly restored in 1965.

Site No 147
Name: Masonic Hall Lodge & 8, 10 Elphinstone Street
Local Authority: Fife
Status: Listed building category C(s)
Type of site: Standing building
NMRS number: None
Map reference: NS 9305 8572
Sensitivity: Moderate

Site No 148
Name: 9, 11, 13 Ashbraes & The Moorings 25 Ashbraes
Local Authority: Fife
Status: None
Type of site: Standing buildings
NMRS number: NS98NW 72 & 194
Map reference: NS 9298 8755
Sensitivity: Low

Site No 149
Name: Station Road, Kincardine
Local Authority: Fife
Status: None
Type of site: Standing buildings and street (general)
NMRS number: NS98NW 44, 134 & 247-260
Map reference: NS 9293 8750 (centred at)
Sensitivity: Low
Description: Includes standing buildings and street (general). Buildings of historic interest are cited at street no.'s 2, 3, 4, 5,6, 8, 10, 11 (Cross Keys Inn), 12. 14, 16, 18, 20, and Station House. None are listed buildings.

Site No 150
Name: Maritime, Vessel 7, ship graveyard
Local Authority: Fife
Status: None
Type of site: Wreck
NMRS number: NS98NW 8008
Map reference: NS 9287 8725
Sensitivity: Low
Description:N 56 3.97 W 3 43.26(Maritime Fife database no. NS98NW 170.19). This wreck has been identified as that of 19th-century wooden boat, the surviving length being recorded as 12.8m. A line of wooden frames or stakes along one side of the vessel may be a revetment. A concretion is attached to one of the timbers. The wreck lies NW-SE on the solid gravel foreshore and is uncovered between three and four hours either side of low water. NMRS, MS/829/10, pp. 64-7 ('vessel 7').
Bibliographic reference: 'Kincardine (Tulliallan parish), hulks and fish trap structures', Discovery and Excavation, Scotland, Oxley, I, 1996, 52.

Site No 151
Name: Maritime, Vessel 8/9, ship graveyard
Local Authority:Fife
Status:None
Type of site: Wreck
NMRS number: NS98NW 8009
Map reference: NS 9287 8725
Sensitivity:Low
Description: N 56 3.97 W 3 43.26 (Maritime Fife database no. NS98NW 170.02). This wreck has been identified as that of a modern wooden fishing boat, measuring 12.6m in length by 5.45m in beam, which has broken down the centre so that the floors are upstanding. The frame spacing is 0.4m, the fastenings are of iron, and there is a

wood and iron box-like structure on the E side of the wreck. The wreck lies NE-SW in 1m depth of silt and is uncovered between one and two hours either side of low water. NMRS, MS/829/10, pp. 67-72 ('vessel 8/9'). Bibliographic reference: 'Kincardine (Tulliallan parish), hulks and fish trap structures', Discovery and Excavation, Scotland, Oxley, I, 1996, 52.

Site No 152
Name: Site of Kincardine Railway Station
Local Authority: Fife
Status: None
Type of site: Railway Station
NMRS number: NS98NW 246
Map reference: NS 9243 8745
Sensitivity: Low
Description: This intermediate station on the Dunfermline - Culross - Alloa secondary line of the former North British Rly was opened on 18 December 1893; it was closed to regular passenger traffic by the London and North Eastern Rly on 7 July 1930. This stretch of the line was later in regular use by coal traffic to the storage yard at Kincardine power station, the track through the station and the platform-edges being consolidated in about 1998. Information from RCAHMS (RJCM), 12 December 2000.R V J Butt 1995 'The directory of railway stations' (details every public and private passenger station, halt, platform and stopping place, past and present), p133.

Site No 153
Name: Forth Street, Kincardine
Local Authority: Fife
Status: None
Type of site: Standing buildings and street (general)
NMRS number: NS98NW 37 & 100-102
Map reference: NS 9294 8742 (centred at)
Sensitivity: Low
Description: Standing buildings (not listed) and street (general). Includes:
Lucker, 23 Forth St
Shore House, 21 Forth St
Ye Olde House Inn, 25-6 Forth St

Site No 154
Name: Excise Street, Kincardine
Local Authority: Fife
Status: Listed Buildings, Category B & C(s)
Type of site: Standing buildings
NMRS number:NS98NW 28, 29, 31, 32, 92 & 93
Map reference: NS 9304 8746(centred at)
Sensitivity: High & Moderate
Description: No's 14, 16, 20, 22, 24 Excise Street are category B listed buildings. No.'s 3, 5, 17 and 19 Excise Street are category C(s) listed buildings. The Unicorn Hotel at no.15 Excise Street is not a listed building, but is included in the NMRS and SMR.

Site No 155
Name: 18 Paradise Lane, Kincardine
Local Authority: Fife
Status: None
Type of site: Standing building
NMRS number: NS98NW 229
Map reference: NS 9301 8743
Sensitivity: Low

Site No 156
Name: John Street (general), Kincardine
Local Authority: Fife
Status: None
Type of site: Late Medieval street
NMRS number: NS98NW 152
Map reference: NS 9297 8743
Sensitivity: Low

Site No 157

Name: 25, 27 Bank Street, Kincardine
Local Authority: Fife
Status: Listed Building Category B
Type of site: Standing building
Map reference: NS 9295 8735
Sensitivity: High

Site No 158
Name: Keith Street, Kincardine
Local Authority: Fife
Status: None
Type of site: Standing buildings and street (general)
NMRS number: NS98NW 153, 161-2, 164-6 & 215-8
Map reference: NS 9300 8732 (centred at)
Sensitivity: Low
Description: Includes street (general) and standing buildings (not listed) at no.'s 29, 31, 32, 34, 36, 38, 42, 44, 48, 52, & 54 Keith Street.

Site No 159
Name: Ferry Pier, Kincardine
Local Authority: Fife
Status: None
Type of site: Pier
NMRS number: NS98NW 99
Map reference: NS 9265 8737 to 9274 8741
Sensitivity: Low
Description: For Kincardine-on-Forth, East Pier ('Shipping Pier') at NS 9282 8722, see NS98NW 86.Pier [NAT]OS 1:10,000 map, 1991. (Location cited as NS 927 873). Ferry Pier, Kincardine, built 1826-7. A coursed-rubble ramped ferry pier. J R Hume 1976. NMRS hold photos from 1900, 1930 and 1974.

Site No 160
Name: Kincardine Bridge
Local Authority: Fife
Status: None
Type of site: Road bridge
NMRS number: NS98NW 59
Map reference: NS 9253 8715
Sensitivity: Low
Description: Kincardine Bridge, opened 1936. Steel-girder bridge, 2,696ft (822m) long with a central 364ft (111m) swing span, in the form of a steel truss with central bowed portion. J R Hume 1976. Built by Alexander Gibb & Partners, 1932-6, and the earliest road crossing over the Forth built E of Stirling. Steel girders on concrete piers, the central section made to open. J Gifford 1988. This bridge carries the A876 (T) public road over the River Forth immediately SW of the town of Kincardine (NS98NW 48); the river here forms the barrier between the parishes of Tulliallan (Fife) and Airth (Stirlingshire). The swinging mechanism is no longer operational, and the fixed bridge forms a significant barrier to navigation. The bridge is approached up a curving concrete-based North Approach Road from the NE, and up a gently-sloping ramp from the SW. Information from RCAHMS (RJCM), 8 December 2000.

Site No 161
Name: Maritime, Vessel 1, ship graveyard
Local Authority: Fife
Status: None
Type of site: Wreck
NMRS number: NS98NW 8002
Map reference: NS 9280 8727
Sensitivity: Low
Description: N 56 3.98 W 3 43.32. (Maritime Fife database no. NS98NW 170.01). This wreck has been identified as that of a 19th century salmon fishing boat of wooden construction. It measures 13m in length and 4m in beam and has a transom stern; iron fastenings and concretion deposits are apparent.The wreck lies N-S in 1m depth of silt and is easy of access, being uncovered three hours either side of low water. NMRS, MS/829/10, pp. 24-9 ('vessel 1'). Bibliographic reference: 'Kincardine (Tulliallan parish), hulks and fish trap structures', Discovery and Excavation, Scotland, Oxley, I,1996, 52

Site No 162
Name: Proposed Kincardine Crossing

Local Authority: Fife
Status: None
Type of site: Evaluation
NMRS number: NS98NW 286
Map reference: NS 982 872 (centred on)
Sensitivity: n/a
Description: The archaeological evaluation of the proposed new crossing of the Forth at Kincardine was undertaken by GUARD between March and April of 1994. It included the evaluation of all known archaeological and architectural remains, including designed landscapes, as well as the archaeological potential of areas with no known archaeological features. Five alternative crossings were examined and three by-pass schemes. The study consisted of a detailed library and archival analysis together with a detailed field examination. A full and detailed report in two volumes has been lodged with the NMRS. Sponsor: Historic Scotland. Bibliographic reference: 'Kincardine Crossing (Airth/Tulliallan parish): archaeological evaluation', Discovery and Excavation, Scotland, Atkinson, J A, 1994, 8.

Site No 163
Name: East Pier, Kincardine
Local Authority: Fife
Status: None
Type of site: Pier
NMRS number: NS98NW 86
Map reference: NS 9282 8722
Sensitivity: Moderate
Description: For Kincardine-on-Forth, Ferry Pier (NS 9265 8737 to 9274 8741), see NS98NW 99. Kincardine Shipping Pier, completed 1811-13. A rectangular coursed-rubble pier, originally much longer, cut back as a result of land reclamation in 1829. The old sea wall can still be seen. J R Hume 1976. Built by Robert Bald in 1811-13 for use as a ferry pier and under authority given to Lord Keith by an Act of 1810. It was acquired by the North British Railway Co. under an Act of 1829, the ferry service being operated by Mr Bernard Thomson of Kincardine as lessee from 1892. NMRS, MS/829/10 (pp. 17, 127-9, passim). Bibliographic reference: The industrial archaeology of Scotland, Hume, J R, 1976, 144. Unpublished document: Kincardine Crossing Archaeological Evaluation (Avoidance Phase) Volume 2, GUARD, 1994, 33. The pier has a memorial on it erected in 2000 by Kincardine Community Council *'in memory of the ship-builders, owners, masters and crews of ships registered in their home port of Kincardine who sailed world-wide. Records show 108 ships are known to have been wrecked or lost over a period of 100 years. This memorial was funded by the Kincardine Sailors Box Trust Fund'.* It is a large anchor lying on a concrete slab.

Site No 164
Name: Maritime, Vessels 14 & 15, ship graveyard
Local Authority: Fife
Status: None
Type of site: Wreck
NMRS number: NS98NW 8013 & 8014
Map reference: NS 9285 8720
Sensitivity: Low
Description: N 56 3.94 W 3 43.27
Vessel 14: (Maritime Fife database no. NS98NW 170.03). This wreck has been identified that of a modern boat of surviving length 4.8m. Large timbers and thick internal and external planking are evident and may have formed part of a larger vessel or served as a revetment of some sort. The wreck lies SE-NW on solid stone and gravel. NMRS, MS/829/10, pp. 87-9.
Bibliographic reference: 'Kincardine (Tulliallan parish), hulks and fish trap structures', Discovery and Excavation, Scotland, Oxley, I,1996, 52.
Vessel 15: (Maritime Fife database no. NS98NW 170.18). This wreck has been identified as that of one half of a modern small boat, the surviving length being 7.8m. The frame spacing is between 0.3 and 0.35m and identifiable fittings include iron fastenings, an iron fitting with an eye, a possible rudder, a chrome handle attached to one protruding frame, and some angle iron. The wreck lies NE-SW in 1m depth of silt and gravel. NMRS, MS/829/10, pp. 90-3 ('vessel 15').
Bibliographic reference: 'Kincardine (Tulliallan parish), hulks and fish trap structures', Discovery and Excavation, Scotland, Oxley, I, 1996, 52.

Site No 165
Name: Old sea wall, Kincardine
Local Authority: Fife
Status: None
Type of site: Sea wall
NMRS number: NS98NW 227

Map reference: NS 9297 8724
Sensitivity: Low
Description: Remnants of the Old Sea Wall survive on the south edge of Kincardine along the inland edge of land that was reclaimed in 1829. The NMRS holds a photo from 1974, but does not record any further details. Vertical dry stone retaining wall, probably late 18th century, running from Inch Farm to Kincardine. Varies in height from 2-3m. Constructed largely from square stone blocks, c.50cm sq. Present road from Kincardine to Inch Farm follows the course of the wall a built-up causeway behind it. The wall and causeway probably follow the line of the river bank shown on Roy's map.
Ref:Unpublished document: Kincardine Crossing Archaeological Evaluation (Avoidance Phase) Volume 1, GUARD, 1994, 33-34

Site No 166
Name: St Margaret's Lane (general), Kincardine
Local Authority: Fife
Status: None
Type of site: Late Medieval street
NMRS number: NS98NW 236
Map reference: NS 9298 8728
Sensitivity: Low

Site No 167
Name: Site of Roman Fortlet, Kincardine House
Local Authority: Fife
Status: None
Type of site: Cropmark
NMRS number: NS98NW 16
Map reference: NS 930 872
Sensitivity: None
Description: A cropmark, suggesting the ditch of a Roman fortlet, was observed on a large scale specialist photograph by one researcher (T C Welsh). Information contained in letter (and trace) from T C Welsh to OS 20 July 1979. However, this cannot be a Roman antiquity, due to its location on land that was reclaimed during the 1800s.

Site No 168
Name: Silver Street, Kincardine
Local Authority: Fife
Status: None
Type of site: Late Medieval Street and standing building
NMRS number: NS98NW 39 & 245
Map reference: NS 9305 8733
Sensitivity: Low
Description: NMRS and SMR no.'s have been allocated to both the street (general) and to the standing buildings at no.12 Silver Street (not a listed building).

Site No 169
Name: Scotland's Close, Kincardine
Local Authority: Fife
Status: None
Type of site: Late Medieval street
NMRS number: NS98NW 241
Map reference: NS 9305 8760
Sensitivity: Low

Site No 170
Name: Embankment, Kincardine
Local Authority: Fife
Status: None
Type of site: Earthwork
NMRS number: None
Map reference: NS 948 855
Sensitivity: Low
Description: Land reclaimed during 1829-1838. The embankment is constructed of *'stone rubbish and rubble stone on the outside, and of mud within. The mud was chiefly taken from the sea-beach on the outside of the bank'* (Menzies 1838). Stone was brought to the site from Longannet Quarry by means of a railroad. The embankment incorporates tide openings and tunnels used for the drainage of land following the reclaimation.

Ref: see unpublished document: Kincardine Crossing Archaeological Evaluation (Avoidance Phase) Volume 1, GUARD, 1994, 33-34.

Site No 171
Name: Maritime, Vessel 12, ship graveyard
Local Authority: Fife
Status: None
Type of site: Wreck
NMRS number: NS98NW 8011
Map reference: NS 9324 8668
Sensitivity: Low
Description: N 56 3.67 W 3 42.89 (Maritime Fife database no. NS98NW 170.05). This wreck is situated near a sewage outfall and has been identified as that of a modern carvel-built wooden fishing boat of Zulu type, the upright stem and sloping stern being characteristic of this type. The surviving length and beam have been recorded as 13.7m and 4.1m respectively, the frame spacing is 0.42m and the futtock dimensions have been recorded. The vessel may have broken into two halves, one of which has been buried or (more probably) washed away. Round ballast is evident, there is an iron bar lying across the vessel and a round inscribed stone alongside it. This bears the inscription 'The Trottier of Lovagney based in the Seychelles' but is not in direct association and so need not record the name of the vessel.The wreck lies SE-NW in 1m depth of silt and is exposed for two hours either side of low water. NMRS, MS/829/10, pp. 76-83 ('vessel 12').
Bibliographic reference: 'Kincardine (Tulliallan parish), hulks and fish trap structures', Discovery and Excavation, Scotland, Oxley, I, 1996, 52.

Site No 172
Name: Longannet
Local Authority: Fife
Status: None
Type of site: Site of Armament Depot
NMRS number: NS98NW 193
Map reference: NS 940 861
Sensitivity: Moderate
Description: An armament depot with 17 bunkers is visible on a Luftwaffe aerial photograph taken in 1939, on which the extent of the ‘Munitionlager’ has been marked. In 1991, only the westernmost five bunkers remain depicted on the OS 1:10,000 map, the rest of the site having been covered by Longannet Power Station. Information from RCAHMS (KM) 12 August 1996.

Site No 173
Name: Longannet Colliery
Local Authority: Fife
Status: None
Type of site: Industrial/ Extractive; Coal/ Coal Mine
NMRS number: NS98NW 65
Map reference: NS 9450 8625
Sensitivity: Low
Description: Longannet Colliery previously recently served the power station. The NMRS hold several aerial photos of the mine dating from 1990. The mine recently closed due to inundation. Ref:Hutton,G (1999) Fife the mining kingdom Ochiltree Sawmill, The Lade Ochiltree, Ayrshire, 7.

Site No 174
Name: Bridge, Erskine Road, Alloa (OB 117/38)
Local Authority: Clackmannanshire
Status: None
Type of Site: Bridge
NMRS number: None
Map reference: NS 8870 9310
Sensitivity: Low
Description: Former road bridge at the west end of the former Alloa Station site. Features three masonry arches and another to the south spanning the railway. It is now pedestrianised.

Site No 175
Name: Bridge, west of proposed new Alloa Station site (OB 117/37)
Local Authority: Clackmannanshire
Status: None
Type of Site: Bridge
NMRS number: None

Map reference: NS 8880 9310
Sensitivity: Low
Description: Skewed and arched masonry bridge spanning the railway.

APPENDIX 2D: SIGNIFICANCE OF IMPACT ON SITES IN THE PROPOSED DEVELOPMENT AREA,

(ORDERED BY SIGNIFICANCE OF IMPACT)

Site No.	Site	Sensitivity	Designation	Source of data	Locality	Grid Ref			Impact	Significance of impact
1	Signal box, Stirling Middle	Very High	LB Cat A	LB;	Stirling	NS	7996	9333	Slight	Moderate-Major
6	Stirling semaphore signals	Very High	LB Cat A	LB;	Stirling	NS	7976	9358	Slight	Moderate-Major
25	Signal Box, Stirling North	Very High	LB Cat A	NMRS; LB record	Stirling	NS	7990	9350	Slight	Moderate-Major
7	Stirling Railway Station	Very High	LB Cat A	NMRS; LB record	Stirling	NS	7976	9358	Negligible	Moderate
95	Alloa Brewery	Low	None	NMRS	Alloa	NS	8890	9305	Severe	Moderate
175	Skew bridge, Alloa centre (OB 117/37)	Low	None	Site visit	Alloa	NS	8880	9310	Severe	Moderate
99	Hallpark Distillery	Low	None	NMRS;	Alloa	NS	8970	9330	Moderate	Low-Moderate
101	Site of pits	Low	None	Aerial photograph	Alloa	NS	9005	9295	Moderate	Low-Moderate
32	Bridge over Forth, North British Railway	Low	None	NMRS	Stirling	NS	7983	9436	Slight	Low
85	Site of Alloa Harbour railway branch	Low	None	OS maps;	Alloa	NS	8845	9308	Slight	Low
116	Kincardine Branch, Railway	Low	None	SMR	Kincardine	NS	9100	9260	Slight	Low
174	Erskine Road Bridge, Alloa	Low	None	Site visit	Alloa	NS	8870	9310	Slight	Low
123	Railway Bridge, Kilbagie	Low	None	SMR	Kincardine	NS	9300	8975	Negligible	Negligible
4	Site of signal box, Stirling	Low	None	OS maps;	Stirling	NS	7989	9349	Negligible	Negligible
14	Site of railway buildings, Stirling North	Low	None	OS maps;	Stirling	NS	7974	9371	Negligible	Negligible
20	Site of railway building, Stirling North	Low	None	OS maps;	Stirling	NS	7972	9376	Negligible	Negligible
27	Site of railway buildings, Stirling North	Low	None	OS maps;	Stirling	NS	7984	9390	Negligible	Negligible
54	Site of signal box, Manorneuk	Low	None	OS maps;	Manorneuk	NS	8282	9486	Negligible	Negligible
61	Cambus Railway Station	Low	None	NMRS	Cambus	NS	8555	9420	Negligible	Negligible
74	Site of signal box, west Alloa	Low	None	OS maps;	Alloa	NS	8783	9308	Negligible	Negligible
86	Site of former Alloa Station & signal box	Low	None	OS maps;	Alloa	NS	8856	9306	Negligible	Negligible
93	Site of Alloa Station and signal box, Alloa	Low	None	OS maps;	Alloa	NS	8872	9312	Negligible	Negligible
94	Site of railway building & turning circle, Alloa	Low	None	OS maps;	Alloa	NS	8882	9320	Negligible	Negligible
98	Site of signal box & level crossing	Low	None	NMRS	Alloa	NS	8959	9300	Negligible	Negligible

100	Site of signal box, Whinhill, E Alloa	Low	None	OS maps;	Alloa	NS	9006	9281	Negligible	Negligible
103	Site of signal box, Hilton, E of Alloa	Low	None	OS maps;	Alloa	NS	9033	9275	Negligible	Negligible
104	Site of signal box, Kincardine Junction	Low	None	OS maps;	Kennet	NS	9096	9265	Negligible	Negligible
113	Site of Clackmannan & Kennet Station	Low	None	OS maps;	Clackmanna	NS	9157	9193	Negligible	Negligible
121	Site of Kilbagie Station	Low	None	OS maps;	Kilbagie	NS	9310	8995	Negligible	Negligible
122	Railway siding (Fife SMR FF9973)	Low	None	SMR	Kincardine	NS	9295	8980	Negligible	Negligible
124	Railway Bridge, Kilbagie (Fife SMR FF9972)	Low	None	SMR	Kincardine	NS	9286	8936	Negligible	Negligible
128	Culvert, on railway (Fife SMR FF9976)	Low	None	SMR	Kincardine	NS	9282	8898	Negligible	Negligible
152	Kincardine Railway Station (Fife SMR FF9974)	Low	None	NMRS; SMR	Kincardine	NS	9310	8995	Negligible	Negligible
125	Railway siding (Fife SMR FF9975)	Low	None	SMR	Kincardine	NS	9282	8934	None	None
102	Early Medieval cross-slab, cist and burials	Very High	SAM	NMRS; SAM	Alloa	NS	9013	9266	None	None

APPENDIX 2E: TABLE OF SITES IDENTIFIED DURING THE ASSESSMENT

(Note *'Site of ...'* denotes a building or feature which no longer has above-ground remains)

Site No.	Site	Sensitivity	Designation	Source of Data	Locality	Grid Ref.		
1	Signal box, Stirling Middle	Very High	LB Cat A	LB;	Stirling	NS	7996	9333
2	Site of gasworks	Low	None	NMRS	Stirling	NS	7980	9330
3	Port Street Bastion, Stirling Town Wall	Very High	SAM; LB Cat	NMRS; SAM	Stirling	NS	7973	9327
4	Site of signal box, Stirling	Low	None	OS maps;	Stirling	NS	7989	9349
5	Site of Goods Station	Low	None	NMRS; LB record; OS maps	Stirling	NS	7981	9350
6	Stirling semaphore signals	Very High	LB Cat A	LB;	Stirling	NS	7976	9358
7	Stirling Station	Very High	LB Cat A	NMRS; LB record	Stirling	NS	7976	9358
8	Bastion, Stirling Town Wall	Very High	SAM;	NMRS; SAM	Stirling	NS	7943	9342
9	Town Walls	Very High	SAM; LB Cat	NMRS; LB record; SAM	Stirling	NS	7943	9342
10	Site of Friary	Low	None	NMRS	Stirling	NS	7967	9358
11	Royal Bank of Scotland	High	LB Cat B	NMRS	Stirling	NS	7963	9354
12	Royal Bank of Scotland	High	LB Cat B	NMRS	Stirling	NS	7965	9357
13	Site of Friars Wynd Port	Very High	SAM	NMRS; SAM	Stirling	NS	7962	9359
14	Site of railway buildings, Stirling North	Low	None	OS maps;	Stirling	NS	7974	9371
15	Sherriff Court	Low	None	NMRS	Stirling	NS	7960	9370
16	10, 12 Princes St	Moderate	LB Cat C(s)	LB record	Stirling	NS	7950	9370
16	13 Princes St	Moderate	LB Cat C(s)	LB record	Stirling	NS	7950	9370
16	14, 16 Princes St	Moderate	LB Cat C(s)	LB record	Stirling	NS	7950	9370
16	15, 17 Princes St	Moderate	LB Cat C(s)	LB record	Stirling	NS	7950	9370
16	5 Princes St	Moderate	LB Cat C(s)	LB record	Stirling	NS	7950	9370
16	9, 11 Princes St	Moderate	LB Cat C(s)	LB record	Stirling	NS	7950	9370
16	Drillhall Princes St	High	LB Cat B	LB record	Stirling	NS	7950	9370
17	Market Cross	Very High	SAM	NMRS; SAM	Stirling	NS	7932	9370
18	Bothwell House	Very High	SAM	NMRS; SAM	Stirling	NS	7925	9368
19	Kings Knot	Very High	SAM	NMRS; SAM	Stirling	NS	7889	9363
20	Site of railway building, Stirling North	Low	None	OS maps;	Stirling	NS	7972	9376
21	1, 3 Forth Pl	High	LB Cat B	LB record	Stirling	NS	7980	9400

21	13, 15 Forth Pl	High	LB Cat B	LB record	Stirling	NS	7980	9400
21	17, 19 Forth Pl	High	LB Cat B	LB record	Stirling	NS	7980	9400
21	21, 23 Forth Pl	High	LB Cat B	LB record	Stirling	NS	7980	9400
21	25, 27 Forth Pl	High	LB Cat B	LB record	Stirling	NS	7980	9400
21	5, 7 Forth Pl	High	LB Cat B	LB record	Stirling	NS	7980	9400
21	9, 11 Forth Pl	High	LB Cat B	LB record	Stirling	NS	7980	9400
22	Spittal's Hospital	Low	None	NMRS	Stirling	NS	7950	9375
23	Mar's Wark	Very High	SAM; LB Cat A	NMRS; LB record; SAM	Stirling	NS	7923	9374
24	Argyll Lodging	Very High	SAM; LB Cat A	NMRS; LB record; SAM	Stirling	NS	7925	9381
25	Signal Box, Stirling North	Very High	LB Cat A	NMRS; LB record	Stirling	NS	7990	9350
26	4 Irvine Place	Low	None	NMRS	Stirling	NS	7949	9382
27	Site of railway buildings, Stirling North	Low	None	OS maps;	Stirling	NS	7984	9390
28	Castle	Very High	SAM; LB Cat A	NMRS; LB record; SAM	Stirling	NS	7900	9400
29	Site of Engine Shed, Stirling North	Low	None	OS maps;	Stirling	NS	7973	9432
30	Engine shed, Stirling North	Low	None	NMRS	Stirling	NS	7973	9432
31	Watching brief, linear	Low	None	NMRS	Stirling	NS	7975	9455
32	Bridge	Low	None	NMRS	Stirling	NS	7983	9436
33	Bridge, Caledonian Railway	Low	None	NMRS	Stirling	NS	7980	9432
34	Bridge (road)	High	LB Cat B	NMRS; LB record	Stirling	NS	7969	9444
35	Stirling Old Bridge	Very High	SAM; LB Cat A	NMRS; LB record; SAM	Stirling	NS	7900	9400
36	Site of bridge	High	None	NMRS	Stirling	NS	7972	9461
37	Military Road	Low	None	NMRS	Stirling, E of	NS	7970	9330
38	Forth Mill	Low	None	NMRS	Stirling	NS	7981	9467
39	Excavation at Stirling Ancient Bridge, pottery, stones	Low	None	NMRS	Stirling	NS	7978	9470
40	Site of Battle of Stirling Bridge	High	None	NMRS	Stirling	NS	8000	9460
41	Site of Military Road	Low	None	NMRS	Stirling	NS	8000	9380
42	Limekiln, pier	Low	None	OS maps;	Causewayhead	NS	8043	9524
43	Site of Causewayhead Station	Low	None	OS maps;	Stirling	NS	8039	9530
44	Abbey Craig Park House, Hillsfoot Rd	High	LB Cat B	LB record	Stirling	NS	8070	9580
45	Airthrey Castle historic designed landscape	High	Des Land	HS	Abbey Craig	NS	8100	9650
46	Abbey Craig	Very High	SAM	NMRS; SAM	Stirling, E of	NS	8094	9565

47	Wallace Monument, Abbey Craig	Very High	LB Cat A	LB record	Stirling	NS	8090	9565
48	Limekiln, pier	Low	None	NMRS	Stirling, E of	NS	8080	9520
49	Pier	Low	None	NMRS	Stirling, E of	NS	8080	9500
50	Farmstead	Low	None	NMRS	Stirling, E of	NS	8095	9504
51	Coal mine+C118	Low	None	NMRS	Cambus, W of	NS	8290	9468
52	Site of dovecot	Low	None	NMRS	Cambus, W of	NS	8261	9490
53	Site of Manor Castle	Low	None	NMRS	Cambus, W of	NS	8271	9490
54	Site of signal box, Manorneuk	Low	None	OS maps;	Manorneuk	NS	8282	9486
55	Distillery	Low	None	NMRS	Cambus	NS	8530	9420
56	Tullibody Old Bridge	Very High	SAM: LB Cat A	LB record; SAM; NMRS	Tullibody	NS	8465	9513
57	Dovecot	Low	None	NMRS	Cambus	NS	8502	9465
58	Distillery	Low	None	NMRS	Cambus	NS	8544	9407
59	Bridge	Very High	SAM; LB Cat A	NMRS; LB record; SAM	Cambus	NS	8532	9407
60	Cottages, Station Road	Low	None	NMRS	Cambus	NS	8556	9409
61	Railway Station	Low	None	NMRS	Cambus	NS	8555	9420
62	Stableblock, Arnsbrae House, Cambus	Moderate	LB Cat C(s)	LB record	Cambus	NS	8670	9390
63	Lodge, Arnsbrae House, Cambus	Moderate	LB Cat C(s)	LB record	Cambus	NS	8675	9380
64	Arnsbrae House, Cambus	High	LB Cat B	LB record	Cambus	NS	8685	9400
65	Shell midden	Moderate	None	NMRS	Alloa	NS	8693	9370
66	South Lodge, Gean House	Moderate	LB Cat C(s)	LB record	Tullibody	NS	8750	9371
67	The Gean House, Tullibody Road & Claremont	Very High	LB Cat A	LB record	Tullibody	NS	8745	9400
68	North Lodge, Gean House, Tullibody Road	High	LB Cat B	LB record	Tullibody	NS	8760	9412
69	Inglewood West Lodge and Gates, Tullibody Road	High	LB Cat B	LB record	Tullibody	NS	8793	9385
70	Inglewood, Tullibody Road	Very High	LB Cat A	LB record	Tullibody	NS	8800	9390
71	Inglewood East Lodge & Garage Block	High	LB Cat B	LB record	Tullibody	NS	8797	9380
72	Norwood House	Low	None	NMRS	Alloa	NS	8771	9329
73	Cowden Park House	Moderate	LB Cat C(s)	NMRS; LB record	Alloa	NS	8780	9322
74	Site of signal box, west Alloa	Low	None	OS maps;	Alloa	NS	8783	9308
75	West End Park Gates	Low	None	NMRS	Alloa	NS	8783	9302
76	1, 1a, 2 Grange Rd	High	LB Cat B	LB record	Alloa	NS	8790	9280

76	13 Grange Rd	High	LB Cat B	LB record	Alloa	NS	8790	9280
76	3, 3a Grange Rd	High	LB Cat B	LB record	Alloa	NS	8790	9280
76	4, 5 Grange Rd	High	LB Cat B	LB record	Alloa	NS	8790	9280
76	40, 40a Grange Rd	Moderate	LB Cat C(s)	LB record	Alloa	NS	8790	9280
76	Grange School, Grange Rd	High	LB Cat B	LB record	Alloa	NS	8790	9280
76	St John's Rectory, Grange Rd	High	LB Cat B	LB record	Alloa	NS	8790	9280
77	Glass cone, Glasshouse Loan	Very High	SAM; LB Cat A	NMRS; SAM; LB record	Alloa	NS	8800	9241
78	33 Claremont	Moderate	LB Cat C(s)	LB record	Alloa	NS	8810	9320
78	Alloa West Church, Claremont	High	LB Cat B	LB record	Alloa	NS	8810	9320
78	Claremont House, Claremont	Moderate	LB Cat C(s)	LB record	Alloa	NS	8810	9320
78	Craigmyle, 35 Claremont	Moderate	LB Cat C(s)	LB record	Alloa	NS	8810	9320
79	War memorial	High	LB Cat B	NMRS; LB record	Alloa	NS	8831	9303
80	Site of cists	Moderate	None	NMRS	Alloa	NS	8843	9297
81	Marcelle (Regional Offices), Marshill	High	LB Cat B	LB record	Alloa	NS	8840	9295
81	Marchill House, Marshill	High	LB Cat B	LB record	Alloa	NS	8840	9295
81	Ochil House, Marshill & Mar St	High	LB Cat B	LB record	Alloa	NS	8860	9290
81	Town Hall, Marshill	High	LB Cat B	LB record	Alloa	NS	8845	9300
82	Roman coin	Low	None	NMRS	Alloa	NS	8840	9290
83	Alloa North Parish Church, Ludgate	High	LB Cat B	LB record	Alloa	NS	8836	9319
84	Mar Place House, Mar Place	High	LB Cat B	LB record	Alloa	NS	8840	9310
85	Site of Alloa Harbour railway branch	Low	None	OS maps;	Alloa	NS	8845	9308
86	Site of former Alloa Station & signal box	Low	None	OS maps;	Alloa	NS	8856	9306
87	Waggonway Bridge	Low	None	NMRS	Alloa	NS	8857	9293
88	1,3 Mar St & 31 Mill St	High	LB Cat B	LB record	Alloa	NS	8870	9280
88	13, 15 Mar St	High	LB Cat B	LB record	Alloa	NS	8860	9290
88	21 Mar St	High	LB Cat B	LB record	Alloa	NS	8860	9290
88	6, 8, 10 Mar St	High	LB Cat B	LB record	Alloa	NS	8860	9290
88	YMCA, 19 Mar St	High	LB Cat B	LB record	Alloa	NS	8860	9290
89	County & Police Buildings, Drysdale St & Mar St	High	LB Cat B	LB record	Alloa	NS	8865	9290
89	Former County Offices, 70 Drysdale St	High	LB Cat B	LB record	Alloa	NS	8870	9290
89	Moncrieff House, 72 Drysdale St	High	LB Cat B	LB record	Alloa	NS	8870	9290

89	Moncrieff UF Church, Drysdale St	High	LB Cat B	LB record	Alloa	NS	8865	9295
90	Alloa Market Cross, Bank Street	High	LB Cat B	LB record	Alloa	NS	8855	9268
91	Church, Alloa	Very High	SAM; LB Cat B	NMRS; SAM; LB record	Alloa	NS	8863	9258
92	Thistle Brewery, East Vennel & Old Bridge St	High	LB Cat B	LB record	Alloa	NS	8880	9270
93	Site of Alloa Station and signal box, Alloa	Low	None	OS maps;	Alloa	NS	8872	9312
94	Site of railway building & turning circle, Alloa	Low	None	OS maps;	Alloa	NS	8882	9320
95	Alloa Brewery	Low	None	NMRS	Alloa	NS	8890	9305
96	Alloa Tower	Very High	LB Cat A	LB record	Alloa	NS	8890	9250
97	Cairn, Hawk Hill	Very High	SAM	NMRS; SAM	Alloa	NS	8911	9282
98	Signal box & level crossing	Low	None	NMRS	Alloa	NS	8959	9300
99	Hallpark Distillery	Low	None	NMRS	Alloa	NS	8970	9330
100	Site of signal box, Whinhill, E Alloa	Low	None	OS maps;	Alloa	NS	9006	9281
101	Site of pits, E of Alloa	Low	None	APs;	Alloa	NS	9005	9295
102	Stone Cross, Hawk Hill	Very High	SAM; LB Cat B	NMRS; LB record; SAM	Clackmannan, NW of	NS	9013	9266
103	Site of signal box, Hilton, E of Alloa	Low	None	OS maps;	Alloa	NS	9033	9275
104	Site of signal box, Kincardine Junction	Low	None	OS maps;	Kennet	NS	9096	9265
105	Site of Mill	Low	None	NMRS	Clackmannan	NS	9141	9230
106	Bridge	Low	None	NMRS	Clackmannan	NS	9134	9208
107	Bridge	Low	None	NMRS	Clackmannan	NS	9142	9202
108	Motte-and-bailey castle	Moderate	None	NMRS; LB record; SAM	Clackmannan	NS	9060	9190
109	Clackmannan Tower	Very High	SAM; LB Cat A	NMRS; LB record; SAM	Clackmannan	NS	9065	9195
110	King Robert's Stone	Very High	SAM	NMRS; SAM	Clackmannan	NS	9111	9188
110	Market Cross	Very High	SAM; LB Cat B	NMRS; LB record; SAM	Clackmannan	NS	9110	9188
111	Tolbooth	Very High	SAM; LB Cat B	NMRS; LB record; SAM	Clackmannan	NS	9119	9189
112	Watching brief	Low	None	NMRS	Clackmannan	NS	9130	9180
113	Site of Clackmannan & Kennet Station	Low	None	OS maps;	Clackmannan	NS	9157	9193
114	Kennet House Lodge	High	LB Cat B	LB record	Clackmannan	NS	9195	9145
115	Site of colliery, N of Kennet	Low	None	APs; OS maps;	Kennet	NS	9290	9135
116	Kincardine Branch, Railway (Fife SMR FF9821)	Low	None	SMR	Kincardine	NS	NT0938	8656
117	Miners' houses	High	LB Cat B	NMRS; LB record	Kennet	NS	9268	9100

117	Miners' houses	High	LB Cat B	NMRS; LB record	Kennet	NS	9276	9091
118	Site of earthwork	Moderate	None	APs;	Kilbagie	NS	9300	9020
119	Kilbagie House	High	LB Cat B	NMRS; LB record	Kincardine, N of	NS	9282	9009
120	Kilbagie Mills	Moderate	LB Cat C(s)	NMRS; LB record	Kincardine	NS	9280	8990
121	Site of Kilbagie Station	Low	None	OS maps;	Kilbagie	NS	9310	8995
122	Railway siding (Fife SMR FF9973)	Low	None	SMR	Kincardine	NS	9295	8980
123	Railway Bridge, Kilbagie (Fife SMR FF9971)	Low	None	SMR	Kincardine	NS	9300	8975
124	Railway Bridge, Kilbagie (Fife SMR FF9972)	Low	None	SMR	Kincardine	NS	9286	8936
125	Railway siding (Fife SMR FF9975)	Low	None	SMR	Kincardine	NS	9282	8934
126	Dalquhamie Toll (Fife SMR FF9894)	Low	None	SMR	Tulliallan	NS	9304	8937
127	Broomknowe Colliery (Fife SMR FF9970)	Low	None	SMR	Tulliallan	NS	9280	8910
128	Culvert, on railway (Fife SMR FF9976)	Low	None	SMR	Kincardine	NS	9282	8898
129	Old Tulliallan Castle	Very High	SAM; LB Cat A	NMRS; SMR; LB record; SAM	Kincardine	NS	9268	8877
130	Enclosure (Fife SMR FF9977)	Moderate	None	SMR	Tulliallan	NS	9300	8880
131	Tulliallan historic designed landscape	High	Des Land	HS	Tulliallan	NS	9350	8850
132	Tulliallan Doocot	High	LB Cat B	LB record	Tulliallan	NS	9316	8839
133	Blackhall Lodge & Gateway	High	LB Cat B	LB record	Tulliallan	NS	9310	8825
134	Site of Chapel (Regional in Fife SMR)	High	None	NMRS; SMR	Kincardine	NS	9294	8820
135	Chapelhill St (Fife SMR FF218)	Low	None	NMRS; SMR	Kincardine	NS	9290	8805
136	10 Hawkhill Rd (Fife SMR FF90)	Moderate	LB Cat C(s)	NMRS; SMR	Kincardine	NS	9288	8797
136	12 Hawkhill Rd (Fife SMR FF91)	Moderate	LB Cat C(s)	NMRS; SMR	Kincardine	NS	9288	8798
136	14 Hawkhill Rd (Fife SMR FF92)	Moderate	LB Cat C(s)	NMRS; SMR	Kincardine	NS	9288	8800
136	16 Hawkhill Rd (Fife SMR FF93)	Moderate	LB Cat C(s)	NMRS; SMR	Kincardine	NS	9287	8800
136	18 Hawkhill Rd (Fife SMR FF94)	Moderate	LB Cat C(s)	NMRS; SMR	Kincardine	NS	9286	8801
136	2 Hawkhill Rd (Fife SMR FF33)	Moderate	LB Cat C(s)	NMRS; SMR	Kincardine	NS	9290	8795
136	21 Hawkhill Road (Fife SMR FF96)	Low	None	NMRS; SMR	Kincardine	NS	9286	8800
136	23 Hawkhill Rd (Fife SMR FF97)	Low	None	NMRS; SMR	Kincardine	NS	9286	8801
136	24 Hawkhill Rd	Moderate	LB Cat C(s)	NMRS; SMR	Kincardine	NS	9286	8803
136	25 Hawkhill Rd (Fife SMR FF98)	Low	None	NMRS; SMR	Kincardine	NS	9286	8802
136	26 Hawkhill Rd	Moderate	LB Cat C(s)	NMRS; SMR	Kincardine	NS	9286	8805
136	28 Hawkhill Rd	Moderate	LB Cat C(s)	NMRS; SMR	Kincardine	NS	9285	8805

136	30 Hawkhill Rd	Moderate	LB Cat C(s)	NMRS; SMR	Kincardine	NS	9286	8803
136	32 Hawkhill Rd	Moderate	LB Cat C(s)	NMRS; SMR	Kincardine	NS	9286	8803
136	34 Hawkhill Rd	Moderate	LB Cat C(s)	NMRS; SMR	Kincardine	NS	9286	8803
136	36 Hawkhill Rd	Moderate	LB Cat C(s)	NMRS; SMR	Kincardine	NS	9286	8803
136	38 Hawkhill Rd	Moderate	LB Cat C(s)	NMRS; SMR	Kincardine	NS	9286	8803
136	4 Hawkhill Rd (Fife SMR FF87)	Low	None	NMRS; SMR	Kincardine	NS	9290	8796
136	6 Hawkhill Rd (Fife SMR FF88)	Low	None	NMRS; SMR	Kincardine	NS	9289	8796
136	8 Hawkhill Rd (Fife SMR FF89)	Low	None	NMRS; SMR	Kincardine	NS	9289	8787
136	Cottage, 19 Hawkhill Road	Low	None	NMRS; SMR	Kincardine	NS	9286	8800
136	Cottages, 2-20 Hawkhill Road (even no.'s)	Moderate	LB Cat C(s)	NMRS; LB record	Kincardine	NS	9286	8801
136	Cottages, 22-38 Hawkhill Road (even no.'s)	Moderate	LB Cat C(s)	NMRS; LB record	Kincardine	NS	9282	8810
137	Site of Kincardine Power Station	Low	None	NMRS	Kincardine	NS	9250	8810
138	Tulliallan Old Parish Church	High	LB Cat B	LB record	Tulliallan	NS	9338	8808
139	Tulliallan Parish Church, Kirk St	High	LB Cat B	LB record	Kincardine	NS	9325	8790
140	Tulliallan Session House & 71, 73 Kirk Street	Moderate	LB Cat C(s)	LB record	Kincardine	NS	9328	8787
141	36 ('Rosevale'), 38, 40, 42, 44 Kilbagie St	High	LB Cat B	NMRS; SMR; LB record	Kincardine	NS	9298	8770
141	63, 65 Kilbagie St	Moderate	LB Cat C(s)	NMRS; SMR; LB record	Kincardine	NS	9294	8782
141	8 Kilbagie St (Fife SMR FF147)	Low	None	NMRS; SMR	Kincardine	NS	9302	8756
141	Kilbagie St, general (Fife SMR FF146)	High	LB Cat B	NMRS; SMR	Kincardine	NS	9300	8760
141	Primrose Villa, 60 Kilbagie St	High	LB Cat B	NMRS; SMR; LB record	Kincardine	NS	9297	8776
141	The Orchard, 24 Kilbagie St	High	LB Cat B	NMRS; SMR; LB record	Kincardine	NS	9300	8763
142	Site of Goods Shed, Kincardine	Low	None	OS maps;	Kincardine	NS	9291	8767
143	Site of railway building, Kincardine	Low	None	OS maps;	Kincardine	NS	9289	8759
144	Gas Holder Station	Low	None	NMRS; SMR	Kincardine	NS	9306	8756
145	Market Cross	Very High	SAM	NMRS; SAM	Kincardine	NS	9312	8751
146	15 Elphinstone Street (Fife SMR FF200)	Low	None	NMRS; SMR	Kincardine	NS	9303	8750
146	19 Elphinstone Street (Fife SMR FF201)	Low	None	NMRS; SMR	Kincardine	NS	9303	8751
146	21 Elphinstone Street (Fife SMR FF202)	Low	None	NMRS; SMR	Kincardine	NS	9302	8751
146	22 Elphinstone Street (Fife SMR FF15)	Low	None	SMR; NMRS	Kincardine	NS	9303	8753
146	23-25 Elphinstone Street (Fife SMR FF203)	Low	None	SMR; NMRS	Kincardine	NS	9302	8752

146	27-29 Elphinstone Street (Fife SMR FF204)	Low	None	SMR; NMRS	Kincardine	NS	9302	8753
146	31-33 Elphinstone Street (Fife SMR FF205)	Low	None	SMR; NMRS	Kincardine	NS	9301	8753
146	8, 10 Elphinstone St	Low	None	NMRS; SMR	Kincardine	NS	9305	8752
146	Commercial Hotel, 2 Elphinstone St (Fife SMR FF74)	Low	None	NMRS; SMR	Kincardine	NS	9303	8752
147	Masonic Hall Lodge & 8, 10 Elphinstone St	Moderate	LB Cat C(s)	LB record	Kincardine	NS	9305	8752
148	9, 11, 13 Ashbraes (Fife SMR FF60)	Low	None	NMRS; SMR	Kincardine	NS	9298	8755
148	The Moorings, 25 Ashbraes (Fife SMR FF191)	Low	None	NMRS; SMR	Kincardine	NS	9291	8753
149	10 Station Rd (Fife SMR FF260)	Low	None	NMRS; SMR	Kincardine	NS	9293	8750
149	12 Station Rd (Fife SMR FF257)	Low	None	NMRS; SMR	Kincardine	NS	9293	8750
149	14 Station Rd (Fife SMR FF258)	Low	None	NMRS; SMR	Kincardine	NS	9293	8750
149	16 Station Rd (Fife SMR FF190 & 248)	Low	None	NMRS; SMR	Kincardine	NS	9293	8750
149	18 Station Rd (Fife SMR FF249)	Low	None	NMRS; SMR	Kincardine	NS	9293	8750
149	2 Station Rd (Fife SMR FF252)	Low	None	NMRS; SMR	Kincardine	NS	9293	8750
149	20 Station Rd (Fife SMR FF250)	Low	None	NMRS; SMR	Kincardine	NS	9293	8750
149	3 Station Rd (Fife SMR FF253)	Low	None	NMRS; SMR	Kincardine	NS	9293	8750
149	4 Station Rd (Fife SMR FF254)	Low	None	NMRS; SMR	Kincardine	NS	9293	8750
149	5 Station Rd (Fife SMR FF255)	Low	None	NMRS; SMR	Kincardine	NS	9293	8750
149	6 Station Rd (Fife SMR FF256)	Low	None	NMRS; SMR	Kincardine	NS	9293	8750
149	8 Station Rd (Fife SMR FF259)	Low	None	NMRS; SMR	Kincardine	NS	9293	8750
149	Cross Keys Inn, 11 Station Rd (Fife SMR FF49)	Low	None	NMRS; SMR	Kincardine	NS	9293	8750
149	Station House, Station Rd (Fife SMR FF247)	Low	None	NMRS; SMR	Kincardine	NS	9293	8750
149	Station Rd, general (Fife SMR FF251)	Low	None	NMRS; SMR	Kincardine	NS	9293	8750
150	Maritime, Vessel 7, ship graveyard (Fife SMR FF9726)	Low	None	NMRS; SMR	Kincardine	NS	9287	8725
151	Maritime, Vessel 8/9, ship graveyard (Fife SMR FF9727)	Low	None	NMRS; SMR	Kincardine	NS	9287	8725
152	Site of bridge, Kincardine Station (Fife SMR FF246)	Low	None	SMR	Kincardine	NS	9283	8745
152	Kincardine Railway Station (Fife SMR	Low	None	NMRS; SMR	Kincardine	NS	9310	8995

	FF9974)							
153	Forth St, general (Fife SMR FF84)	Low	None	NMRS; SMR	Kincardine	NS	9284	8740
153	Lucker, 23 Forth St (Fife SMR FF)	Low	None	NMRS; SMR	Kincardine	NS	9287	8735
153	Shore House, 21 Forth St (Fife SMR FF83)	Low	None	NMRS; SMR	Kincardine	NS	9291	8733
153	Ye Olde House Inn, 25-26 Forth St (Fife SMR FF176)	Low	None	NMRS; SMR	Kincardine	NS	9291	8733
154	14, 16 Excise St	High	LB Cat B	LB record; NMRS; SMR	Kincardine	NS	9302	8744
154	17, 19 Excise St	Moderate	LB Cat C(s)	LB record; NMRS; SMR	Kincardine	NS	9300	8752
154	20 Excise St	High	LB Cat B	LB record; NMRS; SMR	Kincardine	NS	9303	8748
154	22, 24 Excise St	High	LB Cat B	LB record; NMRS; SMR	Kincardine	NS	9301	8750
154	3, 5 Excise St	Moderate	LB Cat C(s)	LB record	Kincardine	NS	9305	8745
154	Unicorn Hotel, 15 Excise St (Fife SMR FF16)	Low	None	NMRS; SMR	Kincardine	NS	9300	8750
155	18 Paradise Lane (Fife SMR FF228)	Low	None	NMRS; SMR	Kincardine	NS	9301	8743
156	John St, general (Fife SMR FF130)	Low	None	NMRS; SMR	Kincardine	NS	9297	8743
157	25, 27 Bank St	High	LB Cat B	LB record	Kincardine	NS	9295	8735
157	Bank Street (Fife SMR FF192)	Low	None	NMRS; SMR	Kincardine	NS	9293	8737
158	29 Keith St (Fife SMR FF138)	Low	None	NMRS; SMR	Kincardine	NS	9301	8738
158	31 Keith St (Fife SMR FF139)	Low	None	NMRS; SMR	Kincardine	NS	9301	8737
158	32, 34, 36 Keith St (Fife SMR FF213)	Low	None	NMRS; SMR	Kincardine	NS	9298	8737
158	38 Keith St (Fife SMR FF182)	Low	None	NMRS; SMR	Kincardine	NS	9297	8736
158	42 Keith St (Fife SMR FF183)	Low	None	NMRS; SMR	Kincardine	NS	9296	8735
158	44 Keith St (Fife SMR FF214)	Low	None	NMRS; SMR	Kincardine	NS	9296	8734
158	48 Keith St (Fife SMR FF141)	Low	None	NMRS; SMR	Kincardine	NS	9294	8734
158	52 Keith St (Fife SMR FF142)	Low	None	NMRS; SMR	Kincardine	NS	9293	8733
158	54 Keith St (Fife SMR FF143)	Low	None	NMRS; SMR	Kincardine	NS	9292	8733
158	Keith St, general (Fife SMR FF131)	Low	None	NMRS; SMR	Kincardine	NS	9300	8737
159	West Pier (Ferry Pier)	Low	None	NMRS; SMR	Kincardine	NS	9265	8737
160	Kincardine Bridge	Low	None	NMRS	Kincardine	NS	9253	8715
161	Maritime, Vessel 1, ship graveyard (Fife SMR FF9721)	Low	None	NMRS; SMR	Kincardine	NS	9280	8727
162	Kincardine Crossing evaluation	n/a	None	NMRS; SMR	Kincardine	NS	9820	8720
163	East Pier (Shipping Pier) & memorial	Moderate	None	NMRS; SMR	Kincardine	NS	9282	8722

164	Maritime, Vessel 14 & 15, ship graveyard (Fife SMR FF9731-2)	Low	None	NMRS; SMR	Kincardine	NS	9285	8720
165	Old sea wall	Low	None	NMRS; SMR	Kincardine	NS	9297	8724
166	St Margaret's Lane, general (Fife SMR FF236)	Low	None	NMRS; SMR	Kincardine	NS	9298	8728
167	Site of Roman fortlet	None	None	NMRS; SMR	Kincardine	NS	9300	8720
168	12 Silver St (Fife SMR FF28)	Low	None	NMRS; SMR	Kincardine	NS	9305	8733
168	Silver St (Fife SMR FF245)	Low	None	NMRS; SMR	Kincardine	NS	9304	8730
169	Scotland's Close (Fife SMR FF)	Low	None	NMRS; SMR	Kincardine	NS	9305	8760
170	Embankment (Fife SMR FF10003	Low	None	SMR	Kincardine	NS	9486	8551
171	Maritime, Vessel 12, ship graveyard (Fife SMR FF9729)	Low	None	NMRS; SMR	Kincardine	NS	9324	8668
172	Armament depot	Moderate	None	NMRS	Longannet	NS	9400	8610
173	Longannet Mine	Low	None	NMRS	Longannet	NS	9450	8625
174	Bridge, Alloa	Low	None	Field visit	Alloa	NS	8870	9310
175	Bridge, Alloa	Low	None	Field visit	Alloa	NS	8880	9310

APPENDIX 2F: TABLE OF SAMs LOCATED WITHIN 1KM OF THE RAILWAY

SiteNo.	Site	Sensitivity	Designation	Source of data	Locality	Grid Ref		
13	Site of Friars Wynd Port	Very High	SAM	NMRS; SAM	Stirling	NS	7962	9359
17	Market Cross	Very High	SAM	NMRS; SAM	Stirling	NS	7932	9370
18	Bothwell House	Very High	SAM	NMRS; SAM	Stirling	NS	7925	9368
19	Kings Knot	Very High	SAM	NMRS; SAM	Stirling	NS	7889	9363
46	Abbey Craig	Very High	SAM	NMRS; SAM	Stirling, E of	NS	8094	9565
97	Cairn, Hawk Hill	Very High	SAM	NMRS; SAM	Alloa	NS	8911	9282
110	King Robert's Stone	Very High	SAM	NMRS; SAM	Clackmannan	NS	9111	9188
145	Market Cross	Very High	SAM	NMRS; SAM	Kincardine	NS	9312	8751
56	Tullibody Old Bridge	Very High	SAM: LB Cat A	LB record; SAM; NMRS	Tullibody	NS	8465	9513
9	Town Walls	Very High	SAM; LB Cat	NMRS; LB record; SAM	Stirling	NS	7943	9342
3	Port Street Bastion, Stirling Town Wall	Very High	SAM; LB Cat C(s)	NMRS; SAM	Stirling	NS	7973	9327
8	Bastion, Stirling Town Wall	Very High	SAM;	NMRS; SAM	Stirling	NS	7943	9342
23	Mar's Wark	Very High	SAM; LB Cat A	NMRS; LB record; SAM	Stirling	NS	7923	9374
24	Argyll Lodging	Very High	SAM; LB Cat A	NMRS; LB record; SAM	Stirling	NS	7925	9381
28	Castle	Very High	SAM; LB Cat A	NMRS; LB record; SAM	Stirling	NS	7900	9400
35	Stirling Old Bridge	Very High	SAM; LB Cat A	NMRS; LB record; SAM	Stirling	NS	7900	9400
59	Bridge	Very High	SAM; LB Cat A	NMRS; LB record; SAM	Cambus	NS	8532	9407
77	Glass cone, Glasshouse Loan	Very High	SAM; LB Cat A	NMRS; SAM; LB record	Alloa	NS	8800	9241
109	Clackmannan Tower	Very High	SAM; LB Cat A	NMRS; LB record; SAM	Clackmannan	NS	9065	9195
129	Old Tulliallan Castle	Very High	SAM; LB Cat A	NMRS; SMR; LB record; SAM	Kincardine	NS	9268	8877
91	Church, Alloa	Very High	SAM; LB Cat B	NMRS; SAM; LB record	Alloa	NS	8863	9258
102	Stone Cross & site of cists & burials	Very High	SAM; LB Cat B	NMRS; LB record; SAM	Alloa, E of	NS	9013	9266
110	Market Cross	Very High	SAM; LB Cat B	NMRS; LB record; SAM	Clackmannan	NS	9110	9188
111	Tolbooth	Very High	SAM; LB Cat B	NMRS; LB record; SAM	Clackmannan	NS	9119	9189

3. AIR QUALITY

APPENDIX 3A: Construction Dust Legislation

Part III of the Environmental Protection Act 1990 prescribes "fumes, gases, dust, steam, smell or other effluvia emitted from premises (including land) so as to be prejudicial to health or a nuisance" as a statutory nuisance. Local Authorities are required to investigate public complaints of dust and emissions and if they are satisfied that a statutory nuisance exists, or is likely to occur or recur, they must serve an abatement notice. The notice is served on the person responsible for the nuisance and requires either simply the abatement of the nuisance, or works to abate the nuisance to be carried out, or it prohibits or restricts the activity. Contravention of a notice without reasonable excuse is an offence. Right of appeal exists within 21 days of the service of an abatement notice.

Demonstrating the use of 'best practicable means' to minimise emissions is an accepted defence under the statutory nuisance legislation. In determining what constitutes best practicable means the local authority must have regard to the current state of technical knowledge, local conditions and circumstances and the financial implications. With regard to construction dust the test of best practicable means applies to the choice of construction method and equipment, the use of dust control techniques, the timing and duration of the works, and the management of the works. Network Rail have a statutory duty to provide railway infrastructure, the test of best practicable means applies only so far as is compatible with any such duty imposed by law, and with safe working conditions.

APPENDIX 3B: Pollutants

Nitrogen Dioxide

Nitrogen dioxide (NO_2) and nitric oxide (NO) are both oxides of nitrogen collectively referred to as NO_x. All combustion processes produce some NO_x emissions, mainly in the form of NO, which is then converted to NO_2 in the atmosphere, mainly due to a reaction with ozone. Only NO_2 is associated with adverse effects on human health. NO_2 irritates the lungs and increases the symptoms of people suffering from lung diseases.

The main sources of NO_x in the UK are motor vehicles, power stations, industrial processes and industrial boilers used for heating.

The NO_2 annual mean objective of 40 $\mu g/m^3$ is currently exceeded in many urban areas, in particular at roadside locations. National measures including reductions in industrial emissions and tighter controls on vehicles emissions are expected to reduce emissions of NO_x over time.

Fine Particles

Fine particles are less than 10 micrometres (μm) in diameter and are small enough to be carried deep into the lungs where they can worsen the condition of people suffering from heart and lung diseases. Fine particles originate from a wide range of sources, in the UK a significant proportion is derived from regional sources (including long distance transport from Europe). Sources of PM_{10} can be divided into 3 categories:

- Primary Combustion Particles - emitted directly from combustion processes such as vehicles, power stations, industrial combustion processes and domestic solid fuel burning. These particles are generally less than 2.5 μm in diameter.

- Secondary Particles – formed in the atmosphere following their release as a gas, including sulphates and nitrates formed from emissions of SO2 and NOx. These particles are generally less than 2.5 μm in diameter.

- Coarse Particles – emitted from a wide range of non-combustion sources, including resuspended dust from road traffic, construction works, mineral extraction sites, wind blown soil and sea salt. These particles are generally greater than 2.5 μm in diameter.

Current monitoring data indicates that the 2004 annual mean objective of 40 $\mu g/m^3$ is met at almost all sites in the UK including roadside locations. However the 2004 24hr objective of 50 $\mu g/m^3$ is exceeded at most roadside sites, and exceeded or closely approached at many urban and suburban locations. Concentrations at rural sites are well below the 2004 objectives.

Improvements in vehicle emission standards and tighter controls on power stations and industrial processes are likely to reduce emissions of primary and secondary particles. Emissions of coarse particles are largely uncontrolled and are not expected to decline over time.

Sulpher Dioxide

SO_2 irritates the lungs and increases the symptoms of people suffering from lung diseases. The main source in the UK is coal fired power stations, other industrial processes and domestic coal burning are also significant sources. Current monitoring indicates that the 1hr and 24hr objectives of 350 $\mu g/m^3$ and 125 $\mu g/m^3$ respectively, are being met in the UK, except where domestic coal burning is widespread. However the 15 min objective of 266

$\mu g/m^3$ is exceeded at many urban and rural locations.

At the national scale tighter controls on SO_2 emissions from large combustion processes are likely to reduce concentrations in the future, however exceedances are still likely in the vicinity of small combustion plants and in areas of domestic coal burning.

Carbon Monoxide

CO prevents the normal transport of oxygen by the blood which can result in a reduction in the supply of oxygen to the heart, people suffering from heart disease are most at risk of adverse effects. The main source of CO in the UK is motor vehicles, in particular petrol-engined vehicles. As a result exceedances of the 8hr mean objective of 11.6 mg/m^3 have been recorded at roadside locations. A limited number of industrial processes are also significant sources of CO. Improvements in fuel quality are expected to reduce emissions from vehicles and prevent any exceedance of the latest objective by 2003, even at roadside sites.

Benzene

Benzene is a carcinogenic substance, the main sources are petrol-engined vehicles, petrol refining processes and petrol stations without vapour recovery systems.

Current annual mean concentrations even at the kerbside of very busy roads are well below the 2003 objective of 16.25 $\mu g/m^3$.

A number of national measures are expected to reduce benzene emissions over time including a reduction in the benzene content of petrol, increased use of 3-way catalysts in vehicles and the reduction of uncontrolled emissions at petrol stations.

1,3 Butadiene

1,3-Butadiene is a carcinogenic substance, the main source in the UK is motor vehicles and a limited number of industrial processes.

Current annual mean concentrations at all monitoring locations in the UK, including roadside sites, are well below the objective of 2.25 $\mu g/m^3$.

Emissions of 1,3-butadiene are expected to fall in the future as more vehicles are fitted with 3-way catalysts and improvements in fuel quality are implemented.

Carbon Dioxide

CO_2 is a major product of the combustion of all carbon containing materials, such as petrol and diesel. In the UK about 20% of CO_2 emissions are from road transport, rail sources contribute less than 1%.

The Government's Climate Change Programme includes an internationally agreed, legally binding target, to reduce emissions of six greenhouse gases to 12.5% below 1990 levels between 2008 and 2012. The government has also set a domestic goal to cut CO_2 emissions, the main greenhouse gas, to 20% below 1990 levels by 2010.

APPENDIX 3C: DMRB Methodology

The local air quality DMRB methodology requires that the air quality impacts are assessed in two ways:

- Local impact assessment - predict actual concentrations of NO_2, PM_{10}, CO, benzene and 1,3 butadiene at individual residential properties in the existing year, year of opening with and without the Scheme, and the project design year (15^{th} year after opening) with and without the Scheme, and compare with the air quality objectives.

- Generalised local impact assessment – estimate the overall change in concentrations of NO_2 and PM_{10} at properties due to the scheme. The estimates are done for 2005, or the year of opening if later than 2005.

The local air quality impact assessment is carried out for the current year 2002, the year of opening (2005) and 15 years after opening (2020). The choice of residential properties assessed is based on the distance to either the existing affected roads, the A907 Clackmannan Road and the B909 Hilton Road, or the proposed Link Road, and includes the closest properties to these roads.

DMRB suggests that the following increases in pollution concentrations at any residential property should be considered significant:

- an increase in the 90^{th} percentile of 24 hr mean PM_{10} levels of at least 2 $\mu g/m^3$

- an increase in annual mean NO_2 levels of at least 4 $\mu g/m^3$ combined with an exceedence of the NO_2 objective of 40 $\mu g/m^3$

DMRB does not suggest any criteria to define a significant increase in concentrations of CO, benzene or 1,3 butadiene. Therefore, the predicted concentration of these pollutants is simply compared to the Air Quality Strategy objectives.

The generalised local air quality impact assessment is carried out for the year of opening, 2005. The number of properties within 200m of all the affected road links are divided into four 50m bands and 'weighted' using the factors in Table 3C-1 below, to take account of the diminishing contribution that vehicle emissions make to local air quality with distance from the road.

Table 3C-1: Property Weighting Factors

Bands	PM_{10}	NO_2
roadside to 50 m from roadside	1	1
50 m – 100 m from roadside	0.65	0.8
100 m –150 m from roadside	0.55	0.65
150 m – 200 m from roadside	0.5	0.55

The significance of the results of the generalised local air quality impact assessment is determined in two ways:

- calculation of the total number of properties where air quality has improved and worsened due to the Scheme in the year of opening. The higher the number of properties where air quality has improved, the greater the net benefit to the community

as a whole, although individual properties may experience an increase in pollution concentrations, depending on their individual locations;

- calculation of an 'assessment value' for NO_2 and PM_{10} for all affected road links as follows:

  (difference in roadside NO_2 with and without the Scheme in the year of opening) x (total number of weighted properties within 200m of the Route);

  (difference in roadside PM_{10} with and without the Scheme in the year of opening) x (total number of weighted properties within 200m of the Route).

The assessment values for each road link are added together to get an overall assessment value for the whole Scheme. A positive value indicates an increase in pollution, while a negative value indicates a decrease. The larger the value (positive or negative) the greater the change in pollution levels and the greater the number of properties affected.

APPENDIX 3D: Baseline Ambient Air Quality

Nitrogen Dioxide (NO_2)

All the local authorities have determined that the air quality objectives for NO_2 will be met within their area, including emissions from potentially significant industrial processes and major roads, no AQMAs have been declared. Discussions with Fife Council has established that there is currently an area along the A876 North Approach Road in the centre of Kincardine in which NO_2 concentrations are around the air quality objective of 40 $\mu g/m^3$. Monitoring is currently being carried out, however, it is unlikely that an AQMA will be declared due to the construction of the Eastern Link Road, which is expected to begin in 2003. The Eastern Link Road connects the A876 just to the north of the Forth River to the A985 to the east of Kincardine, it is anticipated that traffic through the centre of Kincardine will greatly reduce following the completion of the link road, therefore, NO_2 concentrations will be reduced well below the objective.

The UK National Air Quality Information Archive provides predicted background NO_2 concentrations along the proposed route for 2005. The results are provided in Table 3D-1, divided into each of the three local authorities along the route, the current baseline concentrations in 2002 are predicted using the factors provided in Technical Guidance Note 4.

Table 3D-1: Background NO_2 Concentrations

Local Authority	Year	Annual mean NO_2 concentration $\mu g/m^3$	
		Range along route	Average
Stirling	2002	3.0-13.1	7.4
	2005	2.7-12.0	6.8
Clackmannanshire	2002	3.0-8.5	5.0
	2005	2.7-7.8	4.6
Fife	2002	3.3-20.8	6.9
	2005	3.0-19.0	6.3

Background NO_2 concentrations are very low through all three local authorities, well below the annual mean objective of 40 $\mu g/m^3$. The highest background concentration is in Fife in the vicinity of the Longannet Power Station, power stations are a significant source of NO_2 therefore elevated background concentrations in this area are to be expected. The predicted concentrations are slightly higher in 2002, compared to 2005, as national measures are expected to gradually reduce background concentrations over time.

The background NO_2 concentrations in Stirling suggest that the annual mean objective to protect vegetation and ecosystems is easily met in 2002 and 2005, at all the designated sites in the vicinity of the proposed route, the Site of Special Scientific Interest (SSSI) sites at Abbey Craig and Firth of Forth and the Firth of Forth Special Protection Area (SPA).

Continuous monitoring of NO_2 concentrations is only carried out at one location along the proposed route, in the centre of Kincardine at the façade of the closest houses to the A876 North Approach Road, just to the south of the junction with the A977 and A985. The monitor has been operating since June 2001, however, there have been significant problems with the operation of the monitor, therefore, Fife Council has only been able to provide data for three months where the data capture rate has been over 90%, see Table 3D-2.

Table 3D-2: NO_2 continuous monitoring results in Kincardine

Month	% Data capture	Mean NO_2 concentration μg/m^3
November 2001	93%	40.1
March 2002	97%	38.2
April 2002	97%	36.3

The initial results indicate that NO_2 concentrations at the nearest residential properties are around the 40 μg/m^3 annual mean objective, the operation of the Eastern Link Road is expected to considerably reduce NO_2 concentrations in the centre of Kincardine, as previously discussed.

NO_2 diffusion tube monitoring is carried out at various locations in all three local authorities, the annual average results for sites along the route are provided in Table 3D-3. Diffusion tube sites are classed as kerbside if they are within 1-5m of the kerb and intermediate or background if they are more than 20m from the kerb.

The NO_2 diffusion tube survey in Stirling has only been in operation since February 2001, therefore, only one year of results are available, these indicate that the annual mean objective of 40 μg/m^3 is not exceeded in the centre of Stirling even on the kerbside of major roads such as the A9.

Table 3D-3: NO_2 diffusion tube monitoring results

Location	Type	Annual mean NO_2 μg/m^3						
		1995	1996	1997	1998	1999	2000	2001
Stirling 1	Kerbside	-	-	-	-	-	-	35*
Stirling 3	Kerbside	-	-	-	-	-	-	29
Stirling 9	Intermediate	-	-	-	-	-	-	21*
Stirling 10	Intermediate	-	-	-	-	-	-	21
Stirling 11	Intermediate	-	-	-	-	-	-	18*
Stirling 12	Intermediate	-	-	-	-	-	-	16*
Stirling 14a	Kerbside	-	-	-	-	-	-	33*
Alloa 1N	Kerbside	36.4*	29.4	65.5*	28.1*	30.6*	24.5*	28.4*
Alloa 4N	Intermediate	12.7*	13.8*	36.3*	9.0*	14.3*	11.2*	11.3*
Alloa 6N	Intermediate	22.8*	18.7*	37.2*	11.3*	17.7*	14.6*	12.0*
Alloa 7N	Intermediate	27.2*	23.1*	42.2*	16.7*	19.6*	19.6*	-
Kincardine 15	Kerbside	-	45.8	45.8	44.1	46.5	41.1	51.0

* Based on less than 12 months of data

The monitoring results for Alloa indicate a general decline in NO_2 concentrations at all four sites, concentrations at Alloa 1N, on the kerbside of the A907, are well below the annual mean objective.

Only one NO2 diffusion tube is located in Kincardine, the site is on the kerb of the A876 North Approach Road, levels are consistently above the objective of 40 μg/m^3. The high results from this tube resulted in the installation of the continuous monitor, however the diffusion tube is located on a telegraph pole on the kerb of the road, where as the continuous monitor is set back slightly from the kerb. The continuous monitor is level with the façade of the nearest houses therefore these results are considered more representative of the actual exposure of residents, see Table 3D-2, than the diffusion tube results.

Ambient NO_2 concentrations in close proximity to the majority of the route of the proposed railway are likely to be similar to the background levels provided in Table 3D-1. Levels

are likely to be elevated above background levels, but well below the air quality objectives, where the route passes close to the A907, and at the eastern end of the route around Longannet Power Station.

Fine Particles (PM_{10})

In their current Review and Assessment of air quality all three Councils have concluded that the PM_{10} air quality objectives will be achieved by 2004, including emissions from major roads, potentially significant industrial sources and domestic coal burning emissions. The recently issued supplementary objectives to be achieved by 2010 must be considered by each Local Authority in the next round of Review and Assessment starting in 2003.

The UK National Air Quality Information Archive provides predicted background PM_{10} concentrations along the proposed route for 2004. The results are provided in Table 3D-4, divided into each of the three local authorities along the route. The current baseline concentrations in 2002 and the year of opening concentrations in 2005 are predicted using the factors provided in DMRB, the methodology provided in Technical Guidance Note 4 is not followed as it does not extend beyond 2004.

Ambient background PM_{10} concentrations are well below the annual mean objective of 40 $\mu g/m^3$ to be achieved by 2004. The predicted background concentrations in 2005 in Stirling and Clackmannanshire are just below the latest objective of 18 $\mu g/m^3$ to be achieved by 2010, in Fife this objective is slightly exceeded in the vicinity of Longannet Power Station.

Table 3D-4: Background PM_{10} Concentrations

Local Authority	Year	Annual mean PM_{10} concentration µg/m^3	
		Range along route	Average
Stirling	2002	18.1-18.9	18.5
	2004	17.3-18.1	17.7
	2005	17.0-17.8	17.4
Clackmannanshire	2002	18.1-18.7	18.4
	2004	17.3-17.9	17.6
	2005	17.0-17.6	17.3
Fife	2002	18.3-21.0	18.7
	2004	17.5-20.1	17.9
	2005	17.2-19.8	17.6

PM_{10} monitoring is currently carried out at only 1 location within the three local authorities, at the kerbside of the Ring Road (A907) in the centre of Alloa, Clackmannanshire. However to date, only very limited data has been obtained therefore these results are not considered further.

Ambient PM_{10} concentrations in close proximity to the majority of the route of the proposed railway are likely to be similar to the background levels provided in Table 3D-4. Levels are likely to be slightly elevated above background levels where the route passes close to the A907, within the towns along the route and at the eastern end of the route around Longannet Power Station. Ambient annual mean PM_{10} concentrations in 2002 and 2005 are well below the objective to be achieved by 2004, and close to or slightly above the objective to be achieved by 2010.

Sulpher Dioxide (SO_2)

In their current Review and Assessment of air quality all three Councils have concluded that the SO_2 air quality objectives will be achieved by 2005, including emissions from potentially significant industrial sources and domestic coal burning.

The UK National Air Quality Information Archive provides predicted background annual mean SO_2 concentrations along the proposed route for 1996, and background 99.9th percentile of 15 minute means for 2005. The results are provided in Table 3D-5, divided into each of the three local authorities along the route. No factors are available to convert the background SO_2 concentrations to different years as road traffic emissions, for which future trends are available, are not a significant source of SO_2. Technical Guidance Note 4 simply states that annual mean SO_2 concentrations in 2005 are likely to be half the concentration in 1996.

Table 3D-5: Background SO_2 Concentrations

Local Authority	Year	Annual mean SO_2 µg/m^3		99.9th percentile of SO_2 15 minute means µg/m^3	
		Range along route	Average	Range along route	Average
Stirling	1996	3.0-27.0	5.0	-	-
	2005	1.5-13.5	2.5	62.3-182.7	94.5
Clackmannanshire	1996	3.9-49.1	6.9	-	-
	2005	2.0-24.6	3.5	81.5-222.8	124.2
Fife	1996	6.5-29.3	10.8	-	-
	2005	3.3-14.7	5.4	142.0-292.9	184.4

The predicted background 99.9th percentile of 15 min mean SO_2 concentrations in 2005 are well below the objective in Stirling and Clackmannanshire, however in Fife a small area around the Longannet Power Station is predicted to exceed the objective of 266 μg/m^3.

The background SO_2 concentrations in Stirling suggest that the annual mean objective to protect vegetation and ecosystems is met in 2005, at all the designated sites in the vicinity of the proposed route, the SSSI sites at Abbey Craig and Firth of Forth and the Firth of Forth SPA.

Stirling Council has recently set up an SO_2 monitoring network, based on diffusion tubes which give monthly average concentrations. Monitoring is carried out at six sites, two of which are in Stirling in the vicinity of the proposed route, the results for 2001 are provided in Table 3D-6.

Table 3D-6: SO_2 monitoring results in Stirling 2001

Location	Monthly Mean SO_2 concentrations μg/m^3	
	Range	Average
Stirling 1 - Port Street	1.6-32.0	8.0*
Stirling 17 – Laurencecroft	1.2-4.6	3.0*

* based on less than 12 months data

The average monthly SO_2 concentrations monitored in Stirling in 2001, are similar to the background levels obtained from the UK National Air Quality Information Archive. Though not directly comparable to the various air quality objectives, the low monthly mean concentrations suggest that the objectives are unlikely to be exceeded.

SO_2 monitoring using bubbler samplers, as part of the UK smoke and SO_2 monitoring network, has been carried out at up to 7 sites within the Stirling local authority area, however monitoring was stopped at most sites in the 1970s and 80s. The last site (Stirling (Burgh) 5) located in the centre of Stirling ceased to operate in March 1998, maximum daily mean concentrations in 1996 and 1997 were around 40 μg/m^3, well below the objective of 125 μg/m^3 specified in the Air Quality Objectives.

SO_2 bubbler samplers continue to be used by Fife local authority, however they are located in Ballingry, Cowdenbeath and Kirkcaldy, a considerable distance from the proposed route terminating in Kincardine. The latest maximum daily mean results for 2001 for these sites are in the range 18.5-25.2 μg/m^3, well below the objective, however they may not be representative of concentrations in Kincardine in the vicinity of Longannet Power Station.

As part of the UK smoke and SO_2 monitoring network, SO_2 bubbler samplers were installed at up to four sites in Alloa within Clackmannanshire Council, however the last monitor was removed in 1989. In recent years Clackmannanshire Council have been operating an SO_2 bubbler sampler located at the Town Hall in the centre of Alloa, approximately 25m from the A907, the results are provided in Table 3D-7.

Table 3D-7: SO_2 monitoring results in Alloa

Year	SO_2 concentration μg/m^3	
	Annual mean	Daily Maximum
1998	1	13
1999	3	31
2000	4	13
2001	2	4

The daily maximum SO_2 levels in the centre of Alloa are well below the objective of 125 $\mu g/m^3$.

Modelling of SO_2 emissions from Longannet Power Station has been carried out both by the Scottish Environmental Protection Agency (SEPA) and Falkirk Council, located across the Forth Estuary from Longannet. The modelling is carried out based on three different sets of meteorological data, two sets from Edinburgh Airport and one more local set from Grangemouth. SO_2 levels close to but not exceeding the 15 minute objective were predicted for an area to the north east of Longannet Power Station for all three meteorological data sets, though the lowest results were obtained using the local Grangemouth meteorological data.

Following the results of the SO_2 emission modelling, continuous SO_2 monitors were installed in February 2001 by SEPA at the Police College at Tulliallan, and the primary school in Blair Hall village, to the north west and north east of the power station respectively. The purpose of the monitors is to validate the modelling results and determine if emissions from Longannet Power Station are exceeding the air quality objectives. SEPA has advised that the initial results indicate the objectives are being met with only 5 exceedances of the 15 minute objective recorded to date in 2002 at Blair Hall, and none at Tulliallan, the objective allows 35 per year. Scottish Power the operators of Longannet Power Station are also carrying out continuous monitoring of SO_2, at the request of SEPA, at Blair Mains Farm approximately 2km north east of the power station, however, the results are not available to the public yet. The results of the continuous SO_2 monitoring at these sites is likely to be used to update the Air Quality Archive predictions of background concentrations described in Table 9D-5.

Ambient SO_2 concentrations in close proximity to the route of the proposed railway through Stirling and Clackmannanshire are likely to be similar to the background levels provided in Table 3D-5 and well below the air quality objectives. Levels are higher around Longannet Power Station at the eastern end of the route, but the monitoring carried out by SEPA suggests the objectives will be met.

Carbon Monoxide (CO)

In their Review and Assessment of air quality all three Councils have concluded that the previous CO air quality objective of 11.6 mg/m^3 will be achieved by 2003, including emissions from potentially significant industrial sources and road traffic. The recently announced CO objective of 10 mg/m^3 is only a slight tightening of the previous objective, therefore, it is unlikely that the conclusion of the Review and Assessments would be different using the new objective. As part of the next round of Review and Assessment starting in 2003 the local authorities must consider the new objective.

The UK National Air Quality Information Archive provides predicted background annual mean CO concentrations along the proposed route for 1996. The results are provided in Table 3D-8, divided into each of the three local authorities along the route. The 1996 concentrations are converted to 2002 and 2005 using the factors provided in DMRB, the factors in Technical Guidance Note 4 are not used as they only extend to 2003.

The 8 hour running mean is approximately equivalent to the annual mean multiplied by 10, therefore, the maximum predicted background 8hr running mean CO concentration along the route is 2.2 mg/m^3 in 2002 and 1.9 mg/m^3 in 2005, in Stirling.

No monitoring of ambient CO concentrations is carried out within Stirling or Clackmannanshire. A limited ongoing CO monitoring survey is carried out at roadside sites by the Transportation Service in Fife. A nine day survey was carried out in 1997 in Kincardine at the junction of the A876 North Approach Road and the A977 and A985. The

maximum 8 hour running mean recorded was 8.7 mg/m^3 at this roadside location, below both the previous and revised objectives of 11.6 and 10 mg/m^3 respectively.

Table 3D-8: Background CO Concentrations

Local Authority	Year	Annual mean CO mg/m^3	
		Range along route	Average
Stirling	1996	0.2-0.3	0.2
	2002	0.16-0.22	0.16
	2005	0.15-0.19	0.15
Clackmannanshire	1996	0.2-0.2	0.2
	2002	0.16-0.16	0.16
	2005	0.15-0.15	0.15
Fife	1996	0.2-0.2	0.2
	2002	0.16-0.16	0.16
	2005	0.15-0.15	0.15

Ambient CO concentrations in close proximity to the majority of the route of the proposed railway are likely to be similar to the background levels provided in Table 3D-8. Levels are likely to be elevated above background levels where the route passes close to the A907. Ambient 8 hour running mean CO concentrations in 2002 and 2005 are well below the latest objective to be achieved by 2003.

Benzene

In their Review and Assessment of air quality all three Councils have concluded that the previous benzene air quality objective of 16.25 μg/m^3 will be achieved by 2003, including emissions from road traffic. The recently announced supplementary benzene objective of 3.25 μg/m^3 to be achieved by 2010 is considerably lower than the previous objective, therefore, as part of the next round of Review and Assessment starting in 2003 the local authorities must consider the new objective.

The UK National Air Quality Information Archive provides predicted background annual mean benzene concentrations along the proposed route for 1996. The results are provided in Table 3D-9, divided into each of the three local authorities along the route. The 1996 concentrations are converted to 2002 using the factors in Technical Guidance Note 4, the factors only extend to 2003 therefore they cannot be used to predict likely background concentrations in 2005. The minimum and average background benzene concentrations are too low to allow the DMRB methodology of predicting future concentrations to be used, therefore, no predictions for the year of opening 2005 are provided.

Table 3D-9: Background Benzene Concentrations

Local Authority	Year	Annual mean Benzene μg/m^3	
		Range along route	Average
Stirling	1996	0.23-1.14	0.50
	2002	0.11-0.54	0.24
Clackmannanshire	1996	0.23-1.07	0.50
	2002	0.11-0.50	0.24
Fife	1996	0.23-0.35	0.30
	2002	0.11-0.16	0.14

Background annual mean benzene concentrations in 2002 are very low, well below the latest objective of 3.25 μg/m^3, concentrations are expected to decline over time therefore levels in 2005 are likely to be even lower.

Due to the low background concentrations no monitoring of benzene concentrations is carried out within the three local authorities.

Ambient benzene concentrations in close proximity to the majority of the route of the proposed railway are likely to be similar to the background levels provided in Table 3D-9. Levels are likely to be slightly elevated above background levels where the route passes close to the A907.

1,3 Butadiene

In their Review and Assessment of air quality all three Councils have concluded that the current air quality objective of 2.25 μg/m^3 will be achieved by 2003, including emissions from road traffic.

The UK National Air Quality Information Archive provides predicted background annual mean 1,3 butadiene concentrations along the proposed route for 1996. The results are provided in Table 3D-10, divided into each of the three local authorities along the route. The 1996 concentrations are converted to 2002 using the factors in Technical Guidance Note 4, the factors only extend to 2003 therefore they cannot be used to predict likely background concentrations in 2005. The minimum and average background concentrations are too low to allow the DMRB methodology of predicting future concentrations to be used, therefore, no predictions for the year of opening, 2005 are provided.

Table 3D-10: Background 1,3 Butadiene Concentrations

Local Authority	Year	Annual mean 1,3 Butadiene μg/m^3	
		Range along route	Average
Stirling	1996	0.03-0.15	0.06
	2002	0.01-0.07	0.03
Clackmannanshire	1996	0.03-0.15	0.10
	2002	0.01-0.07	0.05
Fife	1996	0.03-0.04	0.04
	2002	0.01-0.02	0.02

Background annual mean 1,3 butadiene concentrations in 2002 are very low, well below the objective of 2.25 μg/m^3, concentrations are expected to decline over time therefore levels in 2005 are likely to be even lower.

Due to the low background concentrations no monitoring of 1,3 butadiene concentrations is carried out within the three local authorities.

Ambient 1,3 butadiene concentrations in close proximity to the majority of the route of the proposed railway are likely to be similar to the background levels provided in Table 3D-10. Levels are likely to be slightly elevated above background levels where the route passes close to the A907.

APPENDIX 3E: Background Air Quality – Alloa Eastern Link Road

The background pollution concentrations provided in the UK National Air Quality Information Archive for the grid square easting 692500, northing 289500, are illustrated in Table 3E-1. These background pollution concentrations are used in the DMRB assessment of the change in road traffic emissions due to the proposed AELR. The background concentrations of PM_{10}, CO, benzene and 1,3 butadiene for 2002, 2005 and 2020 are predicted using the DMRB methodology as this method can be used beyond the year of compliance of the air quality objectives (2003-2005). The background NO_x concentration in 2002 is calculated following the method in Technical Guidance Note 4, however this method does not extend beyond 2005. The DMRB methodology can not be used as the NO_x concentrations are so low. Therefore, as a conservative estimate, the background NO_x concentration in 2020 is assumed to be the same as for 2005.

Table 3E-1: Background Air Quality Alloa Eastern Link Road

Pollutant	Archive Data			Current year	Year of opening	15 yrs after opening
	1996	2004	2005	2002	2005	2020
NO_x $\mu g/m^3$	-	-	7.9	9.3	7.9	7.9
PM_{10} $\mu g/m^3$	-	17.7	-	18.5	17.4	16.1
CO mg/m^3	0.2	-	-	0.16	0.15	0.14
Benzene $\mu g/m^3$	0.93	-	-	0.81	0.76	0.71
1,3 Butadiene $\mu g/m^3$	0.13	-	-	0.11	0.11	0.10

APPENDIX 3F: Train Emission Factors

The train emission factors used in the prediction of pollution emissions from freight and passenger trains are provided in Table 3F-1. A range of emission factors were provided by the National Atmospheric Emissions Inventory, the most appropriate for the train types proposed to operate on the new route were used.

Table 3F-1: Train Emission Factors

Train Type	Emission Factor g/km			
	NO_x	PM_{10}	SO_2	CO_2 as C
Freight Class 66	129.6	4.68	26.95	5496.6
Passenger sprinter per dmu	19.15	0.12	2.26	461.0

APPENDIX 3G: Road Traffic Emissions Alloa Eastern Link Road

Table 3G-1 contains the predicted baseline roadside pollution concentrations for Hilton Road, Clackmannan Road and the Link Road, in 2000, 2005 and 2020, with (H) and without the new houses.

The highest baseline pollution concentrations are predicted for Clackmannan Road East as this has the highest traffic flow of the roads assessed. The inclusion of the proposed 210 houses increases traffic flows on Hilton Road and Clackmannan Road therefore the predicted pollution concentrations are slightly higher when these proposed houses are included.

Table 3G-2 contains the predicted operational roadside pollution concentrations for Hilton Road, Clackmannan Road and the Link Road, in 2005 and 2020, with (H) and without the new houses. Table 9G-3 illustrates the difference between the baseline and operational pollution concentrations at the six residential receptors.

As for the baseline, the highest operational pollution concentrations are predicted for Clackmannan Road East. The greatest reduction in roadside pollution concentrations due to the AELR occurs on Hilton Road and Clackmannan Road East, as would be expected. On Clackmannan Road West roadside pollution concentrations fall slightly, without the new houses, with the new houses concentrations rise slightly.

Table 3G-1: Baseline Roadside Pollution concentrations

Road	Year	NO_2 (µg/m^3)			PM_{10} (µg/m^3)			CO (mg/m^3)	Benzene (µg/m^3)	1,3 butadiene (µg/m^3)
		Annual Mean	99.8th percentile of hourly means	No. hours / yr >200	Annual Mean	90th percentile of 24 hr means	No.days/ yr >50	8 hr mean	Annual Mean	Annual Mean
Hilton Road	2002	16.9	76.3	0	19.3	34.6	0	1.97	1.04	0.14
	2005	14.2	65.8	0	18.0	32.3	0	1.76	0.91	0.13
	2005 (H)	14.7	67.9	0	18.1	32.3	0	1.78	0.92	0.13
	2020	11.6	55.0	0	16.4	29.4	0	1.48	0.79	0.11
	2020 (H)	12.0	56.6	0	16.5	29.5	0	1.49	0.79	0.11
Clackmannan Road (East)	2002	35.8	137.5	0	21.2	38.0	7	2.62	1.51	0.21
	2005	29.6	118.9	0	19.4	34.7	0	2.24	1.19	0.16
	2005 (H)	29.9	119.7	0	19.4	34.7	0	2.25	1.19	0.17
	2020	21.9	94.0	0	17.2	30.8	0	1.72	0.94	0.13
	2020 (H)	22.0	94.6	0	17.2	30.8	0	1.73	0.94	0.13
Clackmannan Road (West)	2002	26.3	108.4	0	20.2	36.2	2	2.25	1.25	0.17
	2005	21.8	93.9	0	18.6	33.4	0	1.97	1.03	0.14
	2005 (H)	22.1	94.9	0	18.7	33.4	0	1.98	1.04	0.14
	2020	16.8	75.8	0	16.8	30.1	0	1.59	0.86	0.12
	2020 (H)	16.9	76.5	0	16.8	30.1	0	1.59	0.86	0.12
Link Road	2002	7.7	36.1	0	18.5	33.1	0	1.63	0.81	0.11
	2005	6.6	30.7	0	17.4	31.2	0	1.50	0.76	0.11
	2005 (H)	6.6	30.7	0	17.4	31.2	0	1.50	0.76	0.11
	2020	6.6	30.7	0	16.1	28.9	0	1.35	0.71	0.10
	2020 (H)	6.6	30.7	0	16.1	28.9	0	1.35	0.71	0.10

Table 3G-2: Operational Roadside Pollution concentrations

Road	Year	NO_2 (µg/m^3)			PM_{10} (µg/m^3)			CO (mg/m^3)	Benzene (µg/m^3)	1,3 butadiene (µg/m^3)
		Annual Mean	99.8th percentile of hourly means	No. hours / yr >200	Annual Mean	90th percentile of 24 hr means	No.days/ yr >50	8 hr mean	Annual Mean	Annual Mean
Hilton Road	2005	7.9	37.0	0	17.5	31.3	0	1.53	0.78	0.11
	2005 (H)	7.9	37.0	0	17.5	31.3	0	1.53	0.78	0.11
	2020	7.4	34.6	0	16.1	28.9	0	1.37	0.72	0.10
	2020 (H)	7.4	34.6	0	16.1	28.9	0	1.37	0.72	0.10
Clackmannan Road (East)	2005	23.2	98.4	0	18.8	33.6	0	2.01	1.06	0.15
	2005 (H)	26.1	107.8	0	19.0	34.1	0	2.11	1.12	0.15
	2020	17.6	78.9	0	16.8	30.2	0	1.61	0.87	0.12
	2020 (H)	19.5	85.9	0	17.0	30.4	0	1.66	0.90	0.12
Clackmannan Road (West)	2005	21.4	92.5	0	18.6	33.3	0	1.95	1.02	0.14
	2005 (H)	24.2	101.8	0	18.8	33.8	0	2.05	1.08	0.15
	2020	16.5	74.8	0	16.8	30.0	0	1.58	0.85	0.12
	2020 (H)	18.3	81.3	0	16.9	30.3	0	1.63	0.88	0.12
Link Road	2005	16.0	72.8	0	18.1	32.4	0	1.76	0.91	0.13
	2005 (H)	18.9	83.7	0	18.4	32.9	0	1.85	0.96	0.13
	2020	12.8	60.3	0	16.5	29.5	0	1.48	0.79	0.11
	2020 (H)	14.8	68.0	0	16.6	29.8	0	1.53	0.82	0.11

Table 3G-3: Difference between Baseline and Operational Pollution concentrations at the residential receptors

Receptor	Year	NO_2 (µg/m^3)			PM_{10} (µg/m^3)			CO (mg/m^3)	Benzene (µg/m^3)	1,3 butadiene (µg/m^3)
		Annual Mean	99.8th percentile of hourly means	No. hours / yr >200	Annual Mean	90th percentile of 24 hr means	No.days/ yr >50	8 hr mean	Annual Mean	Annual Mean
1 – 46 Hilton Road	2005	-4.9	-22.1	0	-0.4	-0.8	0	-0.19	-0.11	-0.01
	2005 (H)	-5.0	+22.0	0	-0.4	-0.8	0	-0.20	-0.11	-0.02
	2020	-3.0	+14.7	0	-0.2	-0.4	0	-0.10	-0.06	-0.01
	2020 (H)	-3.1	+14.9	0	-0.2	-0.4	0	-0.10	-0.06	-0.01
2 – 7 Hilton Crescent	2005	+3.4	+16.4	0	+0.3	+0.5	0	+0.05	+0.05	+0.01
	2005 (H)	+4.9	+22.7	0	+0.4	+0.7	0	+0.08	+0.08	+0.01
	2020	+2.2	+10.6	0	+0.1	+0.3	0	+0.03	+0.03	0
	2020 (H)	+3.1	+15.1	0	+0.2	+0.4	0	+0.04	+0.04	+0.01
3 – The Bungalow, Clackmannan Road	2005	-5.5	-18.1	0	-0.5	-0.9	0	-0.11	-0.11	-0.02
	2005 (H)	-3.3	-10.7	0	-0.3	-0.5	0	-0.07	-0.07	-0.01
	2020	-3.6	-13.3	0	-0.3	-0.5	0	-0.06	-0.06	-0.01
	2020 (H)	-2.2	-7.9	0	-0.2	-0.3	0	-0.04	-0.04	0
4 – 66 Hawkhill Road	2005	-2.5	-9.3	0	-0.2	-0.4	0	-0.06	-0.06	-0.01
	2005 (H)	-0.9	-3.3	0	-0.1	-0.2	0	-0.03	-0.03	0
	2020	-6.6	-24.7	0	-0.5	-0.9	0	-0.11	-0.11	-0.02
	2020 (H)	-5.4	-20.1	0	-0.4	-0.8	0	-0.09	-0.09	-0.01
5 – New House (North)	2005	+5.6	+25.3	0	+0.4	+0.8	0	+0.09	+0.09	+0.01
	2005 (H)	+7.9	+34.3	0	+0.6	+1.2	0	+0.13	+0.13	+0.02
	2020	+3.6	+17.2	0	+0.2	+0.4	0	+0.05	+0.05	+0.01
	2020 (H)	+5.1	+23.5	0	+0.3	+0.6	0	+0.07	+0.07	+0.01
6 – New House (South)	2005	+6.8	+31.0	0	+0.5	+1.0	0	+0.11	+0.11	+0.02
	2005 (H)	+9.3	+40.6	0	+0.7	+1.3	0	+0.16	+0.16	+0.02
	2020	+4.7	+22.3	0	+0.3	+0.5	0	+0.06	+0.06	+0.01
	2020 (H)	+6.2	+29.0	0	+0.4	+0.7	0	+0.08	+0.08	+0.01

APPENDIX 3H: Alloa Eastern Link Road - DMRB Assessment Value

Tables 4H-1 – 4H-4 provide the DMRB assessment value calculations for the four road links Hilton Road, Clackmannan Road east and west and the Link Road, without the proposed new houses. The calculations including the proposed new houses are provided in Table 3H-5 – 3H-8.

Table 3H-1: DMRB Assessment Value – Hilton Road 2005 no houses

	Distance band (m)				
	Rd – 50 (i)	**50 – 100 (ii)**	**100 – 150 (iii)**	**150 – 200 (iv)**	**Rd – 200 (v)**
Properties (a)	42	44	43	37	166
PM_{10} weights (b)	1.00	0.65	0.55	0.50	-
PM_{10} weighted properties (c=a*b)	42	28.6	23.7	18.5	112.8
NO_2 weights (d)	1.00	0.80	0.65	0.55	-
NO_2 weighted properties (e=a*d)	42	35.2	28.0	20.4	125.5
	Baseline (I)	**Operation (II)**	**Difference (III=II-I)**	**PM_{10} assessment (c(v)*f(III))**	**NO_2 assessment (e(v)*g (III))**
Roadside PM_{10} (f)	32.3	31.3	-0.96	-108.1	
Roadside NO_2 (g)	14.2	7.9	-6.31		-791.4

Table 3H-2: DMRB Assessment Value – Clackmannan Road (east) 2005 no houses

	Distance band (m)				
	Rd – 50 (i)	**50 – 100 (ii)**	**100 – 150 (iii)**	**150 – 200 (iv)**	**Rd – 200 (v)**
Properties (a)	4	0	0	0	4
PM_{10} weights (b)	1.00	0.65	0.55	0.50	-
PM_{10} weighted properties (c=a*b)	4	0	0	0	4
NO_2 weights (d)	1.00	0.80	0.65	0.55	-
NO_2 weighted properties (e=a*d)	4	0	0	0	4
	Baseline (I)	**Operation (II)**	**Difference (III=II-I)**	**PM_{10} assessment (c(v)*f(III))**	**NO_2 assessment (e(v)*g (III))**
Roadside PM_{10} (f)	34.7	33.6	-1.07	-4.3	
Roadside NO_2 (g)	29.6	23.2	-6.45		-25.8

Table 3H-3: DMRB Assessment Value – Clackmannan Road (west) 2005 no houses

	Distance band (m)				
	Rd – 50 (i)	**50 – 100 (ii)**	**100 – 150 (iii)**	**150 – 200 (iv)**	**Rd – 200 (v)**
Properties (a)	78	89	88	51	306
PM_{10} weights (b)	1.00	0.65	0.55	0.50	-
PM_{10} weighted properties (c=a*b)	78	57.9	48.4	25.5	209.8
NO_2 weights (d)	1.00	0.80	0.65	0.55	-
NO_2 weighted properties (e=a*d)	78	71.2	57.2	28.1	234.5
	Baseline (I)	**Operation (II)**	**Difference (III=II-I)**	**PM_{10} assessment (c(v)*f(III))**	**NO_2 assessment (e(v)*g (III))**
Roadside PM_{10} (f)	33.4	33.3	-0.07	-13.7	
Roadside NO_2 (g)	21.8	21.4	-0.40		-94.8

Table 3H-4: DMRB Assessment Value – Link Road 2005 no houses

	Distance band (m)				
	Rd – 50 (i)	**50 – 100 (ii)**	**100 – 150 (iii)**	**150 – 200 (iv)**	**Rd – 200 (v)**
Properties (a)	10	18	44	48	120
PM_{10} weights (b)	1.00	0.65	0.55	0.50	-
PM_{10} weighted properties (c=a*b)	10	11.7	24.2	24.0	69.9
NO_2 weights (d)	1.00	0.80	0.65	0.55	-
NO_2 weighted properties (e=a*d)	10	14.4	28.6	26.4	79.4
	Baseline (I)	**Operation (II)**	**Difference (III=II-I)**	**PM_{10} assessment (c(v)*f(III))**	**NO_2 assessment (e(v)*g (III))**
Roadside PM_{10} (f)	31.2	32.4	1.24	86.9	
Roadside NO_2 (g)	6.6	16.0	9.40		746.7

Table 3H-5: DMRB Assessment Value – Hilton Road 2005 with new houses

	Distance band (m)				
	Rd – 50 (i)	**50 – 100 (ii)**	**100 – 150 (iii)**	**150 – 200 (iv)**	**Rd – 200 (v)**
Properties (a)	53	77	71	66	267
PM_{10} weights (b)	1.00	0.65	0.55	0.50	-
PM_{10} weighted properties (c=a*b)	53	50.1	39.1	33.0	175.1
NO_2 weights (d)	1.00	0.80	0.65	0.55	-
NO_2 weighted properties (e=a*d)	53	61.6	46.2	36.3	197.1
	Baseline (I)	**Operation (II)**	**Difference (III=II-I)**	**PM_{10} assessment (c(v)*f(III))**	**NO_2 assessment (e(v)*g (III))**
Roadside PM_{10} (f)	32.3	31.3	-1.04	-182.5	
Roadside NO_2 (g)	14.7	7.91	-6.83		-1345.9

Table 3H-6: DMRB Assessment Value – Clackmannan Road (east) 2005 with new houses

	Distance band (m)				
	Rd – 50 (i)	**50 – 100 (ii)**	**100 – 150 (iii)**	**150 – 200 (iv)**	**Rd – 200 (v)**
Properties (a)	8	43	57	52	160
PM_{10} weights (b)	1.00	0.65	0.55	0.50	-
PM_{10} weighted properties (c=a*b)	8	28.0	31.4	26.0	93.3
NO_2 weights (d)	1.00	0.80	0.65	0.55	-
NO_2 weighted properties (e=a*d)	8	34.4	37.1	28.6	108.1
	Baseline (I)	**Operation (II)**	**Difference (III=II-I)**	**PM_{10} assessment (c(v)*f(III))**	**NO_2 assessment (e(v)*g (III))**
Roadside PM_{10} (f)	34.7	37.1	-0.64	-60.14	
Roadside NO_2 (g)	29.9	26.1	-3.78		-408.7

Table 3H-7: DMRB Assessment Value
Clackmannan Road (west) 2005 with new houses

	Distance band (m)				
	Rd – 50 (i)	**50 – 100 (ii)**	**100 – 150 (iii)**	**150 – 200 (iv)**	**Rd – 200 (v)**
Properties (a)	78	89	88	51	306
PM_{10} weights (b)	1.00	0.65	0.55	0.50	-
PM_{10} weighted properties (c=a*b)	78	57.9	48.4	25.5	209.8
NO_2 weights (d)	1.00	0.80	0.65	0.55	-
NO_2 weighted properties (e=a*d)	78	71.2	57.2	28.1	234.5
	Baseline (I)	**Operation (II)**	**Difference (III=II-I)**	**PM_{10} assessment (c(v)*f(III))**	**NO_2 assessment (e(v)*g (III))**
Roadside PM_{10} (f)	33.4	33.8	0.33	69.3	
Roadside NO_2 (g)	22.1	24.2	2.04		478.8

Table 3H-8: DMRB Assessment Value –
Link Road 2005 with new houses

	Distance band (m)				
	Rd – 50 (i)	**50 – 100 (ii)**	**100 – 150 (iii)**	**150 – 200 (iv)**	**Rd – 200 (v)**
Properties (a)	99	87	94	50	330
PM_{10} weights (b)	1.00	0.65	0.55	0.50	-
PM_{10} weighted properties (c=a*b)	99	56.6	51.7	25.0	232.3
NO_2 weights (d)	1.00	0.80	0.65	0.55	-
NO_2 weighted properties (e=a*d)	99	69.9	61.1	27.5	257.2
	Baseline (I)	**Operation (II)**	**Difference (III=II-I)**	**PM_{10} assessment (c(v)*f(III))**	**NO_2 assessment (e(v)*g (III))**
Roadside PM_{10} (f)	31.2	32.9	1.70	395.0	
Roadside NO_2 (g)	6.56	18.91	12.36		3178.5

References – Air Quality

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4. LANDSCAPE AND VISUAL EFFECTS

4.1 Introduction

This chapter contains the following information in support of Volume 2, Chapter 8:

- Methodology including criteria for assessment;
- The key characteristics of the landscape character types identified in SNH LCA Nos. 124, 96 and 19;
- Vegetation management
- Appendix 4A Landscape Analysis;
- Appendix 4B Visual Baseline and Visual Analysis

4.2 Methodology

Legislation and Government guidance recognises that landscape and visual issues are important in the Environmental assessment process. The recommended methodology for the assessment of the landscape and visual effects of proposed development involves subjective and objective professional judgements. However it takes a structured approach to differentiate between subjective opinion and more objective quantifiable judgements. Landscape and visual effects are assessed separately. Landscape effects are the changes in the physical landscape (which is considered an environmental resource). Changes to the landscape resource may affect its character and how it is experienced. Visual effects are the modifications to the views, caused by changes to the landscape, which affect the visual amenity of the population.

The Guidelines for Landscape and Visual Impact Assessment recommends that the suggested methodology should be adapted to each site. The methodology adopted for this project is outlined in Volume 2, Chapter 8. The criteria used for each stage is given below:

- Scoping
  The study area for the assessment of effects is determined by the zone of visual influence (see below). However a wider area is taken for the landscape character assessment to show the landscape in its wider context. The area taken is shown in Volume 2 Figure 8.2 and encompasses the Forth Flood plain from Stirling to Longannet and the foothills to the north and east.
- The zone of visual influence is the extent of visibility of the scheme. It was determined by site visits so that local variations in topography could be taken into account. Minor areas of planting which act as a screen were not included.
- Baseline studies
  Both the landscape and visual baseline is examined. The study involved a desk review of relevant information such as designations in the local plans relating to landscape and visual issues and a field survey. Information was collected about the landscape patterns, landform, vegetation cover, extent of visibility, land use etc. and also the sensitive landscape and visual receptors.
- The landscape baseline examines the landscape character as identified in Scottish Natural Heritage studies and categorises the area within the zone of visual influence into local landscape character areas. The local landscape character areas are then assessed for value (based on the presence of designations and a subjective assessment) and sensitivity (based on a subjective assessment of the capacity of the landscape to absorb development).
- The visual baseline identifies the extent of visibility, the location of receptors, their approximate numbers (a range is given based on an estimate), their distance from the scheme and the current condition of the landscape as it affects visual amenity. An

assessment of the level of sensitivity of the receptors is then made based on these factors.

- Assessment
  The assessment looks at the landscape and visual effects at various stages in the life cycle of the project and is detailed as follows;

  - Landscape effects- The sensitivity assessment is taken from the baseline assessment. The landscape effects comprise the sources and nature of the effects in each local landscape character area. A rating for the magnitude of effects is based on a judgement of the scale, nature i.e. adverse or beneficial and the duration of the effects. The magnitude is then set against the sensitivity to produce the significance of the effects, which is a professional judgement.
  - Visual effects- The visual effects are assessed as they relate to groups of receptors identified during the field survey. The level of sensitivity is taken from the baseline study. The same procedures are adopted for assessing the landscape effects but the judgements are made as they relate to the visual amenity of the groups of receptors.
  - Stages of assessment- These and the reasons for them are given in Volume 2, Chapter 8. The judgement of the magnitude of effects is given at year 1 to show the effects at scheme completion. The significance of effects is taken at year 15 after mitigation measures have taken effect.

Mitigation and residual effects- Mitigation proposals are recommended for both landscape and visual effects. In some instances there is no opportunity for mitigation even though effects are identified. The residual effects (after mitigation) are recorded. In other instances the effects are insignificant and therefore mitigation is not recommended.

4.3 Landscape Character Assessment

The key characteristics of the landscape character types identified in SNH LCA Nos. 124, 96 and 19 are described as follows:

'Lowland River Valley' landscape character type ('Carse of Forth, East Stirling' and 'Lower Devon Carselands' landscape units)

- Flat, unenclosed, expansive, horizontal form of the carselands with the dramatically sharp edge to the Ochil hills escarpment and more transitional edge to the hill fringes;
- Very large scale fields with few hedges or hedgerow trees and occasional shelterbelts conspicuous buildings and other landscape features;
- The acute meanders of the River Forth wind across the floodplain from Stirling to the estuary and riverine features include tributaries, tidal banks, river islands (the Alloa Inches), riparian woodlands and flood banks.

'*Coastal Flats*' landscape character type ('*Longannet*' and '*Kincardine*' landscape units).

- Flat, low lying, open, large scale, exposed landscape with intensively cultivated, geometrically laid out fields;
- Sinuous or angular roads raised above fields, straight ditches, sea walls and flood banks with small bridges and isolated, scattered farmsteads.

'Valley Fringes' landscape character type ('Devon Forth' landscape unit).

- Strongly rolling, undulating ground with rounded ridgelines separating the Forth estuary and Devon Water with panoramic views of the Forth flood plain and the Ochil Hills;
- Varied farmland including rough grassland and improved pasture. Large coniferous blocks merging with fringes and pockets of mixed woodland and areas of policy landscape. Scattered farmsteads and settlements and prominent infrastructure and mine workings.

'Lowland Hills and Valleys' landscape character type (Central Area, west of Dunfermline landscape unit).

- Open, regular farmland patterns of medium scale fields of arable and grasslands, tall hedges and hedgerow trees;
- Extensive plantations, shelter planting, roadside planting and policies.

4.4 Vegetation Management

Vegetation is generally removed from a corridor 3-5 metres back from each rail and any trees beyond which overhang or look as if they could fall or drop leaves on to the line. Where the line is in cutting, vegetation will be removed from an area 2-3 metres beyond the solum; where the line is level, vegetation will be removed from an area approximately 2 metres beyond the solum; and where the line is on embankment, vegetation will be removed from an area approximately 1-2 metres beyond the solum.

APPENDIX 4A: LANDSCAPE ANALYSIS

Local Landscape Character Area	Sensitivity of Landscape Resource	Landscape Effects	Magnitude of Effects	Mitigation (does not include mitigation of the effects on individual receptors- see Table 4B)	Significance of Effects		
					Construction	Year 1	Year 15
LLCA1 Stirling	Medium/High	Vegetation removal. erection of security fencing, alterations to level crossings, installation of signalling equipment, construction works to Forth Viaduct. introduction of new passing loop. Erection of temporary works compounds.	An established rail route largely within the town centre. Although the route borders the Conservation Area and the Castle Amenity Area the townscape and spatial pattern will not be affected. The loss of vegetation along the embankment to the north of the Forth Viaduct will be a significant landscape change *Moderate adverse*.	Tree planting to mitigate the effects of vegetation removal along the Forth embankment. Hedge planting to screen signalling equipment. Re- seeding of temporary works compounds	**Moderate Adverse**	**Minor Adverse**	**Minor Adverse**
LLCA2 Stirling to Alloa	High	Vegetation removal, erection of security fencing, introduction of new passing	Established route within transport corridor forming part of existing landscape pattern. The route forms a prominent linear feature in the	Re-seeding of temporary works compounds	**Moderate Adverse**	**Minor Adverse**	**Minor Adverse**

		loop, alterations to level crossings, new access road, installation of signalling equipment, erection of temporary works compounds.	landscape defined by largely open embankment to the west of the area and mature trees within the solum to the east. The loss of vegetation will cause a significant change initially until it re-establishes within the solum. *Moderate adverse*				
LLCA3 Alloa	High	Erection of new station with associated access from new roundabout and car parking. Construction of new link road, including high level bridge, at Hilton Road. Vegetation removal, erection of security fencing. Erection of new footbridges at Grange Road and Hilton Road. Alterations to level crossings, installation of	An established rail route largely within the town centre. Although close to the Conservation Area the route is largely in cutting and will not affect the existing pattern of enclosures. There will be permanent loss of 'background' vegetation, which will have an adverse effect. (Vegetation within the cutting will be cleared and maintained at a low level for track safety). The new station and associated roundabout will form part of a general redevelopment of the brewery site, which will improve the appearance of this part of	Tree and shrub planting to soften the new station environment. Tree and shrub planting to set the Alloa Eastern Link Road into the landscape. Tree planting to screen the proposed footbridge at Grange Road. Hedge planting to screen signalling equipment. Replacement tree planting to mitigate the erosion of the Tree Preservation Order.	**Substantial Adverse**	**Moderate Adverse**	**Minor Adverse**

		signalling equipment and temporary works compounds.	Alloa. The new link road at Hilton Road will result in the loss of established vegetation at Brothie Burn and will affect a Tree preservation Order at the junction with the A907. There has been a lot of redevelopment in the area including associated recent planting. The new link road could be absorbed satisfactorily into the proposed location. *Moderate adverse/Moderate beneficial*				
LLCA4 Alloa to Kilbagie	High/Medium	Vegetation removal, erection of security fencing, alterations to level crossings, installation of signalling equipment, passing loop, erection of temporary works compounds.	Established route within transport corridor. The route forms a prominent linear feature in the landscape as a line of mature trees The loss of vegetation will cause a significant change initially until it re-establishes. *Moderate adverse*	Re-seeding of temporary works compounds	**Moderate Adverse**	**Minor Adverse**	**Minor Adverse**
LLCA5 Kilbagie to Longannet	High/Medium	Vegetation removal. Erection of	Established route within transport corridor forming part of the	Re- seeding of temporary works compounds	**Moderate Adverse**	**Minor Adverse**	**Minor Adverse**

		security fencing, realignment of a section of the track, alterations to level crossings, installation of signalling equipment, erection of temporary works compounds.	existing landscape pattern. The line in northern part of the area is on a high embankment. The southern part of the line is already operational. The loss of vegetation will initially cause a significant landscape change in the northern part of the area. *Low adverse*	compounds			

APPENDIX 4B: VISUAL BASELINE AND VISUAL ANALYSIS

Route Section	Location of Receptors and approximate no.s	Baseline Conditions	Distance from Railway/ Scheme	Level of Sensitivity	Visual Effects	Magnitude of Effects at year 1	Mitigation	Significance of Effects			
								Construction	Year 1	Year 15	Residual Effects at year 15
Stirling	Houses at Forth Place and Forth Street. (90-100 properties) Industry/businesses (8 premises)	Railway on small embankment or at grade. Vegetation within the solum and screen planting on Forth Street. Some properties very close. Existing operational line	Adjacent-50m 15-20m	Medium Low	Cutback of vegetation resulting in open views of traffic on line. REB at Stirling North signal box. Temporary works compounds opposite properties on Forth Street.	Moderate/ Slight adverse Slight adverse	No opportunity for mitigation except landscape area of temporary works compound. Site REB to avoid compromising the setting of the listed building (Stirling North Signal Box).	**Moderate Adverse** **Minor Adverse**	**Minor Adverse** **Minor Adverse**	**Minor Adverse** **Minor Adverse**	
	Houses along Causewayhead Road in Stirling, which overlook the railway. (46 properties)	Railway at grade rising to embankment. Trees/hedge to the north of this section but large open stretches. Mature trees adjacent to the line. TPO at former Causewayhead Railway Station.	20m	Medium/ High	Loss of trees and hedge resulting in open views of traffic on line. Open gap in embankment to allow access to temporary works compound. Passing loop at Forth viaduct will be at high level. Works to Viaduct.	Severe adverse	Re-instate embankment at access to temporary works compound. Installation of noise barrier. Replacement planting on embankment.	**Substantial Adverse** **Minor Adverse**	**Substantial Adverse** **Minor Adverse**	**Moderate Adverse**	The line will be visible at first floor level and the tops of the wagons at ground floor level.

	Businesses (7 properties)		20m	Low		Slight adverse			**Adverse**	**Minor Adverse**	
	Houses at Goosecroft Road and Wallace Street. (70-100 properties) Shops/businesses (10-20)	Railway in established transport corridor. Hedge within the solum provides screening at ground floor level. High town centre buildings. Existing operational line.	100m 30m	Low Low	Open view of traffic on line at first floor level.	Slight adverse Slight adverse	Not necessary to screen general view over rail corridor.	**Minor Adverse** **Minor Adverse**	**Minor Adverse** **Minor Adverse**	**Minor Adverse** **Minor Adverse**	
	Development site at Forth Shore. (undeveloped site)	Cleared site. Existing operational line. No current screening.	Adjacent	Low	Open view of traffic on line.	Slight adverse	Not necessary. Opportunity to provide screening with the development.	**Minor Adverse**	**Minor Adverse**	**Minor Adverse**	
	4-storey flats at east of town centre (20 properties)	Overlook line from above. Existing operational line within established transport corridor.	100m	Low	Open view of traffic on line.	Slight adverse	Not necessary to screen general view over town centre	**Minor Adverse**	**Minor Adverse**	**Minor Adverse**	
	Sports clubs, allotments and footpath users at	Established high level route on bridges and	Adjacent (at lower level)	Low	Cut back of vegetation will result in open view of	Slight adverse	Tree planting to replace screen. Re-seeding of	**Moderate Adverse**	**Minor Adverse**	**Minor Adverse**	

	Bridgehaugh. (Casual users- no information on no.s) Houses at Riverside (50 properties)	embankments. Screened by mature vegetation.	300-400m	Low	traffic on line and security fences. Temporary works compound/accesses on playing fields. Viewed from a distance.	Slight adverse	area used for temporary works compound.	**Minor Adverse**	**Minor Adverse**	**Minor Adverse**	
	Houses adjacent to railway at Sheriffmuirlands, Wallace gardens/Craig Crescent and Ladysneuk Road (level crossing) on the northern fringe of Stirling. (30-40 properties) Industry (4 properties)	Houses close to line overlook track. Railway at grade. Little vegetation within the solum. Boundary fences and shrubs within gardens provide some screening at ground floor level. Cleared site allocated for housing in Local Plan	Adjacent-20m Adjacent-20m	High Low	Open view of traffic on line and security fences. Level crossing upgrade at Waterside. Installation of REB and temporary works compounds.	Severe adverse Moderate adverse	Opportunity to provide screening within the proposed housing development. Installation of noise barrier. Replacement planting where there is loss due to noise barrier. Planting to screen REB. Re seeding of areas used for temporary works compounds . Not necessary as industrial premises have low sensitivity.	**Substantial Adverse** **Minor Adverse**	**Substantial Adverse** **Minor Adverse**	**Moderate Adverse** **Minor Adverse**	View of traffic on the line at first floor level. Mitigation may shade south facing gardens where high boundary fencing does not exist.
	Isolated line-side houses at Angersville	Line at grade. Houses close to	Adjacent-10m	High	Open view of traffic on line and security	Severe adverse	Installation of noise barrier.	**Substantial Adverse**	**Substantial Adverse**	**Substantial Adverse**	Some properties

	houses at Angersville (2 properties)	line. No screening	10m		fences. New access road proposed to south. Temporary works compounds		Replacement planting where there is loss due to noise barrier. Re seeding of areas used for temporary works compounds .	**Adverse**	**Adverse**	**Adverse**	are too close to the line and have no opportunity to mitigate. Direct view over the line.
	Users of roads near to the line in Stirling. (Many- no information)	View fragmented for large sections of route. Viewers travelling at speed. Line within an established transport corridor	Adjacent – 50m	Low	Loss of vegetation and intermittent views of traffic on line, security fences and temporary works compounds, scaffolding etc..	Slight adverse	Not necessary to screen general views	**Minor Adverse**	**Minor Adverse**	**Minor Adverse**	
	Visitors to Stirling Castle (Many- no information)	Overview of route from a distance. Vegetation provides screen. Route appears as an established feature in the landscape.	0.75km	Low	Loss of vegetation	Slight adverse	Not necessary to screen a distant view	**Minor Adverse**	**Minor Adverse**	**Minor Adverse**	
	Visitors to the Wallace Monument. (Many- no information)	Overview of route from a distance. Vegetation provides screen. Route appears	0.5km	Low	Loss of vegetation	Slight adverse	Not necessary to screen a distant view	**Minor Adverse**	**Minor Adverse**	**Minor Adverse**	

		as an established feature in the landscape.									
Stirling to Alloa	Properties along Alloa Road at Craigmill, (15 properties)	Railway on embankment. Open flood plain. Occasional trees/scrub within the solum.	75-180m	Medium	Open views of traffic on line and security fencing. Loss of vegetation. Temporary works compounds.	Moderate adverse	Reseeding of areas used for temporary works compounds. Installation of noise barrier. Replacement planting where there is loss due to noise barrier.	**Moderate Adverse**	**Moderate Adverse**	**Moderate Adverse**	
	Broom Farm (1 property)	Railway on embankment. Open flood plain. Occasional trees/scrub within the solum.	250m	Medium/ Low	Open views of traffic on line and security fencing. Loss of vegetation. Temporary works compounds.	Moderate / Slight adverse	Reseeding of areas used for temporary works compounds.	**Moderate/ Minor Adverse**	**Moderate/ Minor Adverse**	**Moderate/ Minor Adverse**	
	Properties at Manorneuk (1 property)	Railway on embankment. Mature vegetation on both sides of the line.	50m	Medium	Open views of traffic on line and security fencing. Loss of vegetation. Temporary works access and alteration to level crossing. Change in position of power lines.	Moderate /High adverse	Screen planting along boundary. Reseeding of areas used for temporary works compounds.	**Moderate/substantial Adverse**	**Moderate/ Substantial Adverse**	**Moderate Adverse**	Traffic on the line will be visible at first floor level.
	Bonded warehouses at Manor Steps/Garvel	Railway at grade. Screening to south of the	30-50m	Low	Open views of traffic on line and security fencing. Loss of vegetation. Level	Slight adverse	Re- seeding of areas used for temporary works	**Minor Adverse**	**Minor Adverse**	**Minor Adverse**	

	(12 warehouses)	line.			crossing upgrade at Blackgrange and erection of REB. Temporary works compounds/ access track. Change in position of power lines.		compounds, and access track.				
	Houses next to level crossing at Station Road, Cambus and houses between A907 and railway immediately east of Station Road (19 properties)	Railway at grade. Vegetation on the line. Screening provided by fences and planting within adjoining property. Houses with large gardens adjacent to line.	12-100m	Medium	Open views of traffic on line and security fencing. Loss of vegetation. Temporary works compound opposite houses. Erection of REB. Open views of traffic on line and security fencing. Loss of vegetation.	Moderate adverse	Installation of noise barrier. Replacement planting where there is loss due to noise barrier. Planting to screen REB. Re-instate car park and areas used for temporary works compound.	**Substantial Adverse**	**Moderate Adverse**	**Moderate Adverse**	
	Orchard Farm and Orchard House (2 properties)	Screening to south of line. New industrial units being developed.	400-450m	Low	Open views of new loop, traffic on line and security fencing. Loss of vegetation. Temporary works compound.	Slight adverse	Not necessary as screening will remain.	**Minor Adverse**	**Minor Adverse**	**Minor Adverse**	
	Isolated property at The Gables (1 property)	House close to line. Railway on embankment with trees to the south of the line.	10m	High	Open views of new loop, traffic on line and security fencing. Loss of vegetation. Temporary works compound	Severe adverse	Screen planting along the boundary. Re-seeding area of temporary works compound.	**Substantial Adverse**	**Substantial Adverse**	**Moderate Adverse**	View of traffic on line at first floor level. Mitigation measures may shade garden.

	New commercial properties at Pavilions Business Park (4 properties)	Railway on embankment. Vegetation within the solum provides screening	20-50m	Low	Open views of traffic on line and security fencing. Loss of vegetation. Temporary works compound and access to south of line.	Slight adverse	Re-instate/ landscape area of temporary works compound	**Minor Adverse**	**Minor Adverse**	**Minor Adverse**	
	Users of the A907 Alloa Road (Many- no information)	Route highly visible but line seen as an established feature in the landscape. Screened by mature vegetation for much of this section. Viewers travelling at speed.	Adjacent-0.5km	Low	Loss of vegetation. Intermittent open views of traffic on line and security fencing. Temporary works compounds.	Slight adverse	Re-instate/ landscape areas of temporary works compounds	**Minor Adverse**	**Minor Adverse**	**Minor Adverse**	
	Visitors to the Ochil Hills (Many- no information)	Overview of route from a distance. Vegetation provides screen. Route appears as an established feature in the landscape.	3km	Low	Loss of vegetation. Construction works will appear prominent in the landscape.	Slight adverse	Not necessary as distant view	**Moderate Adverse**	**Minor Adverse**	**Minor Adverse**	
Alloa	Properties close to the railway at the western edge of Alloa eg Grange Road level crossing, northern edge of Dirleton Lane, Dirleton Gardens and Mitchell	Railway at grade going into cutting. The cutting is well wooded within the solum, which provides a screen to	5-50m	High	Open views of traffic on line and security fencing. Loss of vegetation. Proposed footbridge at Grange Road will be a large structure close to houses. Potential	Severe adverse	Installation of noise barrier. Replacement planting where there is loss due to noise barrier. Planting to soften	**Substantial Adverse**	**Substantial Adverse**	**Moderate Adverse**	Mitigation measures will be very close to some houses. Large structure of

	Crescent. (20-30 properties)	adjacent properties. Some properties very close to the line.			overlooking (although 1.8m barrier). Temporary works compounds at Grange road.		footbridge structure. Reinstate area used for temporary works compounds.				footbridge close to houses. Potential overlookin g.
	Cricket ground and playing fields at Stirling Road. (Casual recreational receptors- no information)	Railway at grade rising to embankment. Screened by mature vegetation.	Adjacent	Low	Open views of traffic on line and security fencing. Loss of vegetation. Temporary works compound to south of line. Erection of REB.	Slight adverse	Re-instate/ landscape area of temporary works compound	**Moderate Adverse**	**Minor Adverse**	**Minor Adverse**	
	Users of West End Park (Casual recreational receptors- no information)	Railway at grade. Mature trees along northern boundary of park provides screen.	20m	Low	Loss of vegetation, which will reduce the density of existing screen.	Slight adverse	Not necessary as screening exists	**Minor Adverse**	**Minor Adverse**	**Minor Adverse**	
	Houses at Tulligarth Park, Kellie Place and the Claremont Hotel (20- 30 properties)	Railway in well wooded cutting. Screen provided by mature vegetation	Adjacent-50m	High	Open views over cutting and security fencing. Loss of vegetation. Temporary works compound.	High adverse	Screen planting on boundary.	**Substantial Adverse**	**Substantial Adverse**	**Moderate Adverse**	Loss of vegetation
	Properties on Izatt Street. Users of sports centre. (10-20 premises)	Commercial properties. Railway in well wooded cutting. Screen provided by mature vegetation	5-50m	Low	Open views over cutting and security fencing. Loss of vegetation. Erection of REB.	Moderate adverse	Not necessary as properties have low sensitivity within the town centre.	**Minor Adverse**	**Minor Adverse**	**Minor Adverse**	

		vegetation									
	Properties at Sunnyside Court. (15-20 properties) Users of open space (Casual recreational receptors- no information)	Line coming out of cutting. Mature vegetation within the solum provides screen.	50-80m Adjacent	Medium/Low Medium	Open views of new station and associated access, parking and new roundabout, traffic on line and security fencing. Loss of vegetation. Temporary works compound on the site will result in temporary loss of open space. Erection of REB.	Moderate adverse Moderate adverse	Planting to provide screen. Re-instate open space used by temporary works compound and landscape.	**Substantial Adverse** **Substantial Adverse**	**Moderate Adverse** **Moderate Adverse**	**Minor Adverse** **Moderate Adverse**	View of station.
	Properties at Brothie Burn and Whins Road (20-25 properties)	Mainly commercial property. Houses overlook at high level. Cleared development site	Ajacent to Brewery site	Low	View over new station with car parking and associated development. Loss of vegetation.	Moderate beneficial	Installation of noise barrier. Replacement planting where there is loss due to noise barrier.	**Moderate Adverse**	**Minor Adverse**	**Minor Adverse**	
	Properties close to railway at eastern end of Alloa around Hilton Road level crossing (eg north end of Park Place, Balfour Street and Bruce Street, south end of Arrol Crescent and Gaberston Avenue) (60-70 properties)	Railway on embankment, going into cutting. Vegetation within the solum provides screen. Houses very close to the line.	Adjacent-50m	High	Open views of traffic on line and security fencing. Loss of vegetation. Closure of level crossing. Proposed footbridge at Hilton Road will be a large structure close to houses. Potential overlooking (although 1.8m barrier). Installation of REB. Temporary works compound on	Severe adverse	Installation of noise barrier. Replacement planting where there is loss due to noise barrier. Re-instate car park used as temporary works compound. Planting to set new road into the landscape.	**Substantial Adverse**	**Substantial Adverse**	**Moderate Adverse**	View over line at first floor level. Mitigation measures may shade some gardens. Large structure of footbridge close to some houses.

					car park. The proposed eastern link road will result in the loss of vegetation around Brothie Burn and the opening up of land to the rear of properties on Hilton Road with the introduction of the road structure and associated embankments. Removal of bonded warehouses.		Planting to soften the proposed footbridge.				Potential overlookin g. The proposed eastern link road will result in a permanent new structure in the landscape.
	Properties in the vicinity of the roundabout at Whins Road, Hilton Road and Carsebridge Road (10 properties)	Mixed uses, residential and commercial.	Adjacent	High	The proposed eastern link road will result in the loss of vegetation around Brothie Burn and the opening up of land to the rear of properties on Hilton Road and Carsebridge Road with the introduction of the road structure and associated embankments. Removal of bonded warehouses	Severe adverse	Planting to screen from houses and to set the proposed road into the landscape.	**Substantial Adverse**	**Substantial Adverse**	**Moderate Adverse**	The proposed eastern link road will result in a permanent new structure in the landscape.
	Football ground, fire station and businesses at Hilton Road (Many receptors- no information)	Railway at grade. Very close to adjacent properties	Adjacent	Low	Open views of traffic on line and security fencing. Loss of vegetation. The proposed eastern link road will introduce a bridge at high level and associated access roads. Installation of	Slight adverse	Planting to set new road into landscape. Re-instate area used for temporary works compound.	**Substantial Adverse**	**Substantial Adverse**	**Minor Adverse**	The proposed eastern link road will result in a permanent new structure in the

					REB, Passing loop, temporary works compounds. TPO will be affected by AELR.						landscape.
	Users of roads near to line in Alloa (Many receptors- no information)	Fragmented views of route. Viewers travelling at speed. Route either in cutting or well screened.	Adjacent-50m	Low	Intermittent open views of traffic on line and security fencing. Loss of vegetation. New road layout and high level bridge. Temporary works compounds. Erection of REB.	Slight adverse	Not necessary to screen general views over the rail corridor. Planting to screen REB.	**Substantial Adverse**	**Moderate Adverse**	**Minor Adverse**	The proposed eastern link road will result in a permanent new structure in the landscape.
Alloa to Kilbagie	Houses at north end of Clackmannan (around Devonway) and Rosemourne (40-50 properties)	Railway on embankment. Mature vegetation within the solum provides a screen. Existing chain link security fence. Recreation ground adjacent to the line including children's playground.	5-50m	High	Open views of traffic on line and security fencing, at high level for part of area, and security fencing. Loss of vegetation. Work to bridges. Installation of REB. Temporary works compounds, and use of roads for access.	Severe adverse	Replacement planting to embankment. Installation of noise barrier. Replacement planting where there is loss due to noise barrier. Reinstate areas used for temporary works compounds.	**Substantial Adverse**	**Substantial Adverse**	**Moderate Adverse**	Direct view of high level line from the houses.
	Visitors to Clackmannan Tower (Casual recreational receptors- no information)	Railway screened by mature vegetation. Viewed as an established feature in the	700m	Low	Loss of vegetation. Installation of REB. Temporary works compounds.	Slight adverse	Reinstate areas used for temporary works compounds.	**Moderate Adverse**	**Minor Adverse**	**Minor Adverse**	

	information)	landscape pattern									
	Houses at Helensfield (9 properties)	Railway on embankment. Mature vegetation within the solum provides a screen.	20m	Medium/High	Open views of traffic on line and security fencing. Loss of vegetation. Temporary works compounds.	Moderate /high adverse	Replacement planting to embankment. Reinstate areas used for temporary works compounds	**Moderate/ Substantial Adverse**	**Moderate/ Substantial Adverse**	**Moderate/ Minor Adverse**	
	Houses at Alexander Court, Millbank Crescent, Mill Road, Alloa Road, Park Place (60-70 properties)(	Railway in well wooded cutting	5-50m	High	Open views of traffic on line or over cutting and security fencing. Loss of vegetation. Temporary works compound.	Severe adverse	Installation of noise barrier. Replacement planting where there is loss due to noise barrier. Reinstate areas used for temporary works compound.	**Substantial Adverse**	**Substantial Adverse**	**Moderate Adverse**	Loss of vegetation.
	New properties at Brucefield Crescent and Hetherington Drive. Houses at St Serfs Grove. (50-60 properties)	Railway in slight cutting. Vegetation within the solum. Houses directly overlook from close range.	5-20m	High	Open views of traffic on line and security fencing. Loss of vegetation. Temporary works compound and access to south of track.	Severe adverse	Installation of noise barrier. Replacement planting where there is loss due to noise barrier. Landscape area used for temporary works compound.	**Substantial Adverse**	**Substantial Adverse**	**Moderate Adverse**	View over line from first floor. Loss of vegetation.

	Kennet cottages and Meadowend. (50-55 properties)	Railway in slight cutting. Vegetation within solum provides a screen.	90-150m	Medium	Open views of traffic on line and security fencing. Loss of vegetation. Temporary works compound.	Moderate / Severe adverse	Installation of noise barrier. Replacement planting where there is loss due to noise barrier. Reinstate areas used for temporary works compound.	**Moderate/ Substantial Adverse**	**Moderate/ Substantial Adverse**	**Moderate/ Minor Adverse**	
	West Lodge and The Moss (3 properties)	Railway at grade screened by mature vegetation. Both properties well screened.	100-200m	Low	Open views of traffic on line at high level and security fencing. Loss of vegetation. Temporary works compound	Slight adverse	Replacement planting to embankment. Reseeding to area used for temporary works compound.	**Moderate Adverse**	**Minor Adverse**	**Minor Adverse**	
	Properties at Kilbagie, (5-10 properties) Kilbagie Mill (1 premises)	Railway at grade/in cutting rising to embankment. Mature vegetation within the solum provides a screen	Adjacent-200m 150m	Low Low	Open views of traffic on line and security fencing. Loss of vegetation. Temporary works compounds to the west and east of the line.	Slight adverse Slight adverse	Replacement planting to embankment. Re- seed area used for temporary works compounds.	**Medium Adverse** **Minor Adverse**	**Minor Adverse** **Minor Adverse**	**Minor Adverse** **Minor Adverse**	
	Visitors to hills between Devon and Forth.	Overview of route from a distance. Vegetation provides screen.	2km	Low	Loss of vegetation. Temporary works compounds	Slight adverse	Reinstate areas used for temporary works compounds	**Minor Adverse**	**Minor Adverse**	**Minor Adverse**	

	(Casual recreational receptors- no information)	Route appears as an established feature in the landscape. Low number of receptors					compounds				
	Users of A907, A977(T) and roads near to the line in Clackmannan (Many receptors- no information)	Viewers travelling at speed. Fragmented views of route within the built up area. Route appears as a green corridor within the established landscape pattern from the A907 and A977 (T)	Adjacent – 50m	Low	Open views of traffic on line at high level and security fencing. Loss of vegetation. Temporary works compounds.	Slight adverse	Reinstate areas used for temporary works compounds	**Moderate Adverse**	**Minor Adverse**	**Minor Adverse**	
Kilbagie to Longannet	Properties at Broomknowe (2-5 properties) Users of Broomknowe golf course	Railway on well wooded embankment. Intermittent planting to the east of the A977(T) provides some screening to the golf course.	100m 200m	Medium Low	Open views of traffic on line at high level and security fencing. Loss of vegetation. Temporary works compound.	Moderate Low adverse Slight adverse	Replacement planting to embankment. Reinstate areas used for temporary works compounds	**Moderate/ Minor Adverse** **Minor Adverse**	**Moderate/ Minor Adverse** **Minor Adverse**	**Minor Adverse** **Minor Adverse**	

	course (Casual recreational receptors- no information)										
	Broomknowe Drive. (24 properties)	Railway line at grade. Mature vegetation within the solum. Properties close to line.	10-50m	High	Open views of traffic on line and security fencing. Loss of vegetation. Temporary access.	Severe adverse	Installation of noise barrier. Replacement planting where there is loss due to noise barrier.	**Substantial Adverse**	**Substantial Adverse**	**Moderate Adverse**	View of line at first floor level. Loss of vegetation.
	Properties at Hawkhill and Old Tullallian Castle (2 properties)	Railway at grade. Mature vegetation on line is viewed as a woodland strip within the existing landscape pattern of woodland and hedgerows. Existing mature vegetation within grounds of properties.	100m	Medium	Open views of traffic on line and security fencing. Loss of vegetation. Temporary works compound.	Moderate adverse	Augment existing planting. Landscape area used for works compound.	**Moderate Adverse**	**Moderate Adverse**	**Minor Adverse**	
	Houses on Hawkhill Road. (40 properties)	Railway at grade. Low growing vegetation, no screening. Existing boundary fences to adjacent properties. Existing	20m	High	Re-alignment of track. Open views of traffic on line and security fencing. Erection of REB.	Severe adverse	Screen planting to boundary.	**Substantial Adverse**	**Substantial Adverse**	**Moderate Adverse**	View of line at first floor level.

		operational line.									
	Properties along western edge of Kincardine Village (eg Ochil View and Station Road) (30-40 properties)	Railway at grade. Low growing vegetation, no screening. Houses above the level of the line and directly overlook from very close range.	Adjacent-50m	High	Re-alignment of track. Open views of traffic on line and security fencing. Upgrade of level crossing. Erection of REB. Temporary works access.	Severe adverse	Installation of noise barrier. Replacement planting where there is loss due to noise barrier. Planting to screen REB.	**Substantial Adverse**	**Substantial Adverse**	**Substantial Adverse**	Some properties are too close to the line and have no opportunity to mitigate. Direct view over the line.
	Users of coast footpath (casual recreational receptors- no information)	Railway at grade. Viewed as a woodland strip within the existing pattern of vegetation. Existing operational line.	5-20m	Medium/Low	Re-alignment of track. Open views of traffic on line and security fencing. Upgrade of level crossing. Erection of REB. Temporary works compound and access.	Moderate / Slight adverse	Planting to screen line. Re-instate area used for temporary works compound.	**Substantial Adverse**	**Moderate Adverse**	**Minor Adverse**	
	Inch Farm (2 properties)	Railway at grade along coast. Low growing vegetation. Receptor on rising ground overlooking the line. Existing operational route.	300m	Low	Open views of traffic on line and security fencing. Temporary works compound.	Slight adverse	Reinstate areas used for temporary works compound.	**Minor Adverse**	**Minor Adverse**	**Minor Adverse**	
	Users of the A977(T) and A985(T)	Viewers travelling at speed.	1km	Low	View of security fencing and traffic on line. Temporary	Slight adverse	Reinstate areas used for temporary	**Minor Adverse**	**Minor Adverse**	**Minor Adverse**	

	(Many receptors- no information)	Overview of route from high level.			works compounds.		works compounds				
	Visitors to Devilla Forest. (casual recreational receptors- no information)	Overview of route from high level. Low number of receptors	2km	Low	View of security fencing and traffic on line. Temporary works compounds.	Slight adverse	Reinstate areas used for temporary works compounds.	**Minor Adverse**	**Minor Adverse**	**Minor Adverse**	

5. ECOLOGY

APPENDIX 5A: Phase 1 Target Notes – Stirling-Alloa-Kincardine 21.08.02 – 22.08.02

TN1 Longannet Power Station – Kincardine Bridge

Scattered scrub (A2.2) and tall ruderal (C3.1) is found in thin strips either side of the track. To the south of the line are hard engineering defences, mudflats and the River Forth. To the north is Longannet Power Station and agricultural fields. Species include gorse (*Ulex europaeus*), rosebay willowherb (*Chamerion angustifolium*), bramble (*Rubus fruticosus*), dog rose (*Rosa canina*), common nettle (*Urtica dioica*), creeping thistle (*Cirsium arvense*), birdsfoot trefoil (*Lotus corniculatus*), ribwort plantain (*Plantago lanceolata*), hawthorn (*Crataegus monogyna*), Yorkshire fog (*Holcus lanatus*), willow (*Salix sp.*), and common sorrel (*Rumex acetosa*).

TN2 Kincardine Bridge – Kincardine Power Station

The ground flora is a mix of neutral grassland (B2), tall ruderal (C3.1) and scattered broadleaved trees (A3.1). Species present include broom (*Sarothamnus scoparius*), bramble, hawthorn, common nettle, dog rose, with tree including ash (*Fraxinus excelsior*), silver birch (*Betula pendula*), sycamore (*Acer pseudoplatanus*), ivy (*Hedra helix*), maple (*Acer campestre*), elder (*Sambucus nigra*) and willow. There is a culverted stream that passes under the track in this section, but it has low flow and has been heavily altered by the use of gabion baskets along its length.

TN3 Kincardine Power Station – NS 9285 8925

This whole stretch has developed into continuous scrub (A2.1) and scattered young trees (A3.1) since the rail line was last used, and at times is almost impenetrable. Tree species include oak (*Quercus robur*), rowan (*Sorbus aucuparia*), silver birch, ash, beech (*Fagus sylvatica*), and sycamore. Other species, either in the scrub layer or as part of the ground flora include hawthorn, ivy, bramble, dog rose, common nettle, rosebay willowherb, tufted hair-grass (*Deschampsia cespitosa*), red campion (*Silene dioica*), and self heal (*Prunella vulgaris*). Elder and bramble are the dominant species in this section.

TN4 NS 9285 8925 – NS 9300 8972

At some stage just prior to the Phase 1 survey, this section had just been cleared of the thick scrub and scattered trees such as that found in TN3. The track itself is classified as bare ground (J4), as the only species are very occasional bramble, Yorkshire fog, ribwort plantain, and creeping buttercup (Ranunculus repens). To the side of the track is scattered trees (A3.1) and continuous scrub (A2.1), with species present including elder, hawthorn, silver birch, dog rose, willow, ash, oak and sycamore. Ground flora amongst the scrub layer included white clover (Trifolium repens), self heal, yarrow (Achillea millefolium), common knapweed (Centaurea nigra), eyebright (Euphrasia officinalis) and birdsfoot trefoil.

A buzzard (*Buteo buteo*) was seen drinking from a small puddle on one of the access tracks that passes underneath the rail line in this section.

TN5 NS 9300 8972 – Kilbagie Overbridge

This section was similar to that in TN4, but rosebay willowherb and common nettles (C3.1) dominated the line and the surrounding vegetation. The occasional trees (A3.1) to the side of the line included sycamore, ash and silver birch. Before reaching the Kilbagie overbridge, a culverted and fast-flowing stream is crossed.

TN6 Kilbagie Overbridge – Kennet Cottages Overbridge

In this section the solum has about 50% cover of neutral grassland (B2). To the sides are scattered trees (A3.1) with an understorey of scattered scrub (A2.2) and frequent rosebay willowherb.

TN7 Kennet Cottages Overbridge – A907 lay-by

This section has developed into immature broadleaved woodland (A1.1.2) dominated by silver birch that has obviously encroached from the area where it was originally planted to the side of the track. There is an understorey of rosebay willowherb (C3.1) and scattered scrub (A2.2). Herb robert (*Geranium robertianum*) was also found in this area.

TN8 A907 lay-by – Clackmannan Overbridge

The track on this section is a mixture of bare ground (J4) and neutral grassland (B2). The vegetation to the side of the track is dominated by rosebay willowherb and common nettle (C3.1), but there is also scattered bramble and dog rose scrub (A2.2) and scattered broadleaved trees such as silver birch, sycamore and wild cherry (*Prunus avium*). Just before reaching the Clackmannan overbridge the line has not been managed or cleared and the vegetation is developing dense scrub (A2.1) and immature broadleaved woodland (A1.1.2). Again, the encroaching woodland has been classified as of plantation origin due to the fact that it has probably spread from trees that were planted alongside the original line. Species close to the bridge include ash (which is dominant), ivy, elder and hawthorn. There is evidence of fly tipping underneath the bridge.

TN9 Clackmannan Overbridge – A907 Underbridge

The dense, continuous and mature scrub (A2.1) continues until the bridge over the Black Devon River is reached. From the river to the bridge over the A907, the scrub has been recently cleared although the remaining scrub is both mature and dense on either side of the track. Scrub species include bramble, hawthorn (dominant), dog rose, ivy, elder and willow. The species found on the track include rosebay willowherb, red fescue (*Festuca rubra*), bramble, creeping buttercup, Yorkshire fog, common nettle, ribwort plantain, white clover, and cow parsley (*Anthriscus sylvestris*).

TN10 A907 Underbridge – Hilton Manor Farm Level Crossing

From the bridge towards the level crossing, the vegetation is dominated by immature silver birch broadleaved woodland (A1.1.2), with occasional willow and sycamore. The solum is neutral grassland with developing scattered scrub (A2.2). Ground flora species included eyebright and common knapweed. At the time of survey, this section was having much of the vegetation cleared from the line.

TN11 Hilton Manor Level Crossing – Whins Road Underbridge

Again this section had neutral grassland (B2) along the solum, with fringing continuous scrub (A2.1). Species included, creeping thistle, rosebay willowherb, common knapweed, silver birch, hawthorn, and occasional hawthorn, sycamore, willow, ivy and bramble. Between the B909 and the A908 other species present include rowan, elder, planted conifers, Yorkshire fog, field horsetail (*Equisetum arvense*), red campion, broadleaved willowherb (*Epilobium montanum*), and orpine (*Sedum telephium*).

TN12 Whins Road Underbridge – Claremont Overbridge

From the A908 westwards, the line is continuous scrub (A2.1) with a sparse understorey. Tree and scrub species include wild cherry, ash, hawthorn, bramble, elder, dog rose, horse chestnut (*Aesculus hippocastanum*), willow, sycamore, broom, and silver birch. The ground flora includes rosebay willowherb, eyebright, creeping buttercup, tufted hair-grass, cow parsley, pot marigold (*Calendula officinalis*), creeping thistle, ribwort plantain, field horsetail, broadleaved dock, common nettle, white clover, and common ragwort (*Senecio jacobaea*).

TN13 Claremont Overbridge – Grange Road Level Crossing

There is broadleaved woodland (A1.1.2) on either side of the track, with scattered mature trees and an understorey of scrub in the cutting. Towards the end of this section there was construction work ongoing at the time of the survey and much of the track would be classified as bare ground (J4).

TN14 Grange Road Level Crossing – Riverbank Estate

To the west of the level crossing is a short strip of broadleaved woodland (A1.1.2), but this soon opens out into an area of recently disturbed ground and new units of a development park. To the north of the rail line there is a thin strip of hawthorn and silver birch and a tall stand of mature poplar trees (*Populus sp.*). Most of this area can be described as neutral grassland (B2)

TN15 Riverside Estate – Cambus Level Crossing

For nearly all of this section the solum is classified as bare ground, with just very occasional grass species and bramble. Rosebay willowherb and common nettle (C3.1) are dominant along certain sections of this section. On both the north and south sides of the track there are thin strips of deciduous woodland (A1.1.2) and scattered scrub (A2.2). Tree and scrub species include hawthorn, goat willow (*Salix caprea*), bramble, dog rose, silver birch and oak. The ground flora includes French cranesbill (*Geranium endressii*), giant hogweed (*Heracleum mantegazzianum*), Japanese knotweed (*Fallopia japonica*), common nettle, and creeping thistle. There is a dry drainage ditch to the north of line, bordering the agricultural field.

TN16 Cambus Level Crossing – Blackgrange Level Crossing

The whole length of solum in this section is classified as bare ground (J4). Up to where the River Devon is crossed, both side of the track have fringing vegetation of continuous scrub (A2.1) with scattered broadleaved trees (A3.1). Beyond the River Devon the fringing vegetation is immature broadleaved woodland of plantation origin (A1.1.2). Species along this section include alder (*Alnus glutinosa*), dog rose, rowan, sycamore, hawthorn, bramble,

willow, ash and wild cherry. In the area just before reaching Blackgrange Crossing the tree cover becomes less frequent, and the vegetation becomes a mix a of tall ruderal (C3.1), scattered scrub (A2.2) and trees. Species found in this mosaic area include perennial saw-thistle (*Sonchus arvensis*), mouse-ear hawkweed (*Pilosella officianarum*), spear thistle (*Cirsium vulgare*), dandelion (*Taraxacum sp.*), field horsetail, broom, common ragwort, tufted hair-grass, eyebright, common nettle, and bramble.

TN17 Blackgrange Level Crossing – Manorneuk Farm Level Crossing

This section is split between continuous scrub (A2.1) and large stands of tall ruderal (C3.1) with the occasional tree or area of scattered scrub. A line of tall, mature poplar trees lines the boundary to the bonded warehouses. Species include dog rose, elder, hawthorn, willows, silver birch and broom.

TN18 Manorneuk Farm Level Crossing – Craigmill

There was a lot of digging activity about 150m to the west of the Manorneuk crossing, but rabbits as opposed to badgers caused this. The solum in this area is completely free of all vegetation and would be mapped as bare ground (J4). There are limited areas of scattered scrub (A2.2) on both sides of the track and tall ruderal (C3.1), dominated by common nettle and rosebay willowherb is the dominant habitat in thin strips.

TN19 Craigmill – Abbey Craig Level Crossing

Again, the solum here is completely bare of vegetation (J4). The north side of the track is bordered by a thin strip of mature broadleaved woodland (A1.1.2), with a ditch immediately adjacent to the trees. Tree species include sycamore, willow, elder, rowan, beech and European larch (*Larix decidua*), with occasional hawthorn, ivy and bramble. On the south side of the track there is a thin strip of tall ruderal (C3.1) with an unmanaged hawthorn and sycamore hedge behind. Other species in the hedge include dog rose, ash and hedge bindweed (*Calystegia nigra*).

TN20 Abbeycraig Level Crossing – Scrap Metal Works Access

This section again has bare ground on solum, but either side is dominated by tall ruderal (C3.1) and scattered scrub (A2.2), with the occasional scattered tree. Rosebay willowherb is the dominant species, but Japanese knotweed and giant hogweed are both frequent in this section.

TN21 Scrap Metal Works Access – Stirling RFC

The solum again has no vegetation in this section, and would be mapped as bare ground (J4). The side of the track adjacent to the road here has a linear section of mature planted mixed trees (A1.3.2), with the species including ash (abundant), wild cherry, larch, elder, rowan, goat willow, oak, horse chestnut, beech, hazel (*Corylus avellana*), and spruce (*Picea sp.*). There is an area of mature deciduous woodland (A1.1.1) on the banks of the River Forth, with species including crack willow (*Salix fragilis*) and alder. The riverside also has frequent Japanese knotweed and giant hogweed.

TN22 Stirling RFC – Stirling Railway Station

The solum is again bare ground (J4). Between the rugby club and the bridge over the river, tall ruderal (C3.1) lines both sides of the track, with mature and continuous scrub (A2.1)

behind. On the bridge itself, the solum is mainly clear of vegetation, though there is scattered birch and willow development. Between the bridge and the station there are thin strips of tall ruderal in front of even-aged silver birch, with occasional willow, bramble and hawthorn.

APPENDIX 5B: Phase 1 Target Notes – Eastern Alloa Link Road 22.10.02

TN1 Distillery Boundary, NS 8972 9298

There is a thin line of fringing trees and scrub that are within the boundary fence of the distillery grounds. There is a stand of mature planted poplar (*Populus sp.*) on the west, south and east sides of the boundary, with other occasional scrub species including bramble (*Rubus fruticosus*), dog rose (*Rosa canina*), elder (*Sambucus nigra*), and rhododendron (*Rhododendron ponticum*). Scattered scrub (A2.2) with scattered broad-leaved trees (A3.1) and a small area of amenity grassland (J1.2).

TN2 Area next to Brathie Burn, NS 8950 9338

There is an open area surrounded by planted trees just to the north of the Brothie Burn. The open are to the centre is dominated by common nettle (*Urtica dioica*) and bramble, with occasional rosebay willowherb (*Chamaenerion angustifolium*). The trees around the edge of this area have been planted at some stage, though those that line the burn are mature and or earlier origin. Sycamore (*Acer pseudoplatanus*) is the dominant trees species, with horse chestnut (*Aesculus hippocastanum*) present, with ivy (*Hedra helix*) and hawthorn (*Crataegus monogyna*) in the lower canopy. Scattered broad-leaved trees (A3.1) with the central area tall ruderal (C3.1).

TN3 Proposed Housing Development, NS 8955 9330

This area has a number of different habitats within a very small area, though none of them are of particular ecological importance. The habitats present include marshy grassland, tall ruderal and improved grassland. Again there is a line of trees that line both the stream and the boundary of the areas. Species include silver birch (*Betula pendula*), sycamore, horse chestnut, and willow (*Salix sp.*). The area has been designated for housing in the local plan. Scattered trees (A3.1) and improved grassland (B4).

TN4 Woodland Area, NS 9003 9287

In an area between the agricultural field and the railway line, there is an area of scattered broadleaved woodland and developing scrub. Tree species include oak (*Quercus robur*), beech (*Fagus sylvatica*), and ash (*Fraxinus excelsior*). The species that make up the scrub under storey include ivy, hawthorn, silver birch, bramble, dog rose and willow. Other species recorded at the time of the survey were common nettle, rosebay willowherb and common ragwort (*Senecio jacobaea*). Broad-leaved woodland of plantation origin (A1.1.2).

TN5 Access Road, NS 9000 9315

There is a metalled road accessed by Hilton Farm level crossing that heads northwards to Jellyholm Farm and the eastern side of the distillery. The road has a line of trees to the west, no more than one tree thick at any one point, and to the east is a thin strip of broadleaved woodland. Tree species noted at the time of the survey included ash, oak, elder, horse chestnut, sycamore, beech and holly (*Ilex aquifolium*). Other species present include dog rose, ivy, common nettles and hawthorn. Broad-leaved woodland of plantation origin (A1.1.2).

TN6 Corner of Arable Field, NS 8910 9277

It is possible that a roundabout would be constructed in the corner of the arable field at the above grid reference, as part of this scheme. A drainage ditch lies between the path and the boundary fence of the arable field. There is a defunct hedgerow with occasional trees along the boundary fence of this field, and species include sycamore, hawthorn, elder, willow, and rosebay willowherb. Defunct species-poor hedge (J2.2.2) with occasional broad-leaved trees (A3.1).

TN7 Improved Grassland in Agricultural Field, NS 8985 9205

Large agricultural field dominated by improved grassland (B4). However, there is a small area of marshy grassland (B5) between the bonded warehouses to the north and the railway to the south. At the time of survey this was slightly waterlogged with small amounts of standing water, though this was after an extended period rainfall. The area has frequent patches of rush (Juncus sp.), indicating that this area is normally wetter than the rest of the field. This could be possible habitat for amphibians such as great crested newt.

APPENDIX 5C: Species List

Flora

- Beech (Fagus sylvatica)
- Oak (Quercus robur)
- Field maple (Acer campestre)
- Sycamore (Acer pseudoplatanus)
- Horse chestnut (Aesculus hippocastanum)
- Ash (Fraxinus excelsior)
- Silver birch (Betula pendula)
- Poplar trees (Populus sp.)
- Goat willow (Salix caprea)
- Willow (Salix sp.)
- Holly (Ilex aquifolium)
- European larch (Larix decidua)
- Wild cherry (Prunus avium)
- Alder (Alnus glutinosa)
- Rowan (Sorbus aucuparia)

- Gorse (Ulex europaeus)
- Broom (Sarothamnus scoparius)
- Dog rose (Rosa canina)
- Bramble (Rubus fruticosus)
- Elder (Sambucus nigra)
- Hawthorn (Crataegus monogyna)
- Rhododendron (Rhododendron ponticum)

- Ivy (Hedra helix) - eg
- Rosebay willowherb (Chamerion angustifolium)
- Common nettle (Urtica dioica)
- Creeping thistle (Cirsium arvense)
- Birdsfoot trefoil (Lotus corniculatus)
- Ribwort plantain (Plantago lanceolata)
- Red campion (Silene dioica)
- Self heal (Prunella vulgaris)
- Common sorrel (Rumex acetosa)
- Creeping buttercup (Ranunculus repens)
- White clover (Trifolium repens)
- Yarrow (Achillea millefolium)
- Common knapweed (Centaurea nigra)
- Eyebright (Euphrasia officinalis)
- Cow parsley (Anthriscus sylvestris)
- Field horsetail (Equisetum arvense)
- Broadleaved willowherb (Epilobium montanum)
- Orpine (Sedum telephium)
- Pot marigold (Calendula officinalis)
- French cranesbill (Geranium endressii)
- Giant hogweed (Heracleum mantegazzianum)
- Japanese knotweed (Fallopia japonica)
- Perennial saw-thistle (Sonchus arvensis)
- Mouse-ear hawkweed (Pilosella officianarum)
- Dandelion (Taraxacum sp.)

- Hedge bindweed (Calystegia nigra)
- Common sorrel (Rumex acetosa)

- Spear thistle (Cirsium vulgare)
- Common ragwort (Senecio jacobaea)
- Herb robert (Geranium robertianum)

- Red fescue (Festuca rubra)
- Yorkshire fog (Holcus lanatus)
- Tufted hair-grass (Deschampsia cespitosa)

Fauna

- Buzzard (Buteo buteo)

APPENDIX 5D: Badger Surveys

Methodology

In August 2002 the existing rail route was surveyed; with a further survey in the agricultural fields either side of the road between the Gartarry roundabout and Kincardine undertaken in October. The method followed the accepted standard approach of looking for signs of badger. This entails walking across the area concerned looking for signs. These are characteristic and sometimes quite obvious and include tufts of hair caught on barbed wire fences, conspicuous badger paths, footprints, small excavated pits or latrines in which droppings are deposited, scratch marks on trees, and snuffle holes, which are small scrapes where badgers have searched for insects and plant tubers, and setts.

APPENDIX 5E: Further Otter and Water Vole Survey, Friday 24th January

Survey Scope

All three watercourses were surveyed 100m upstream and downstream of where the SAK railway crosses them on rail bridges. The areas were searched for both signs of water voles and otter.

The water vole survey followed the methodology as set out in the Water Vole Conservation Handbook (WCRU, 1998), and any field signs were recorded on a standard water vole survey form. This includes looking for the following field signs:

- Faeces;
- Latrines;
- Feeding stations;
- Burrows;
- Lawns;
- Nests;
- Footprints;
- Runways in vegetation.

Otters are rarely seen and so field signs are often the only way of confirming their presence. Generally the only evidence seen of the otter is its faeces or 'spraint'. This is deposited along a watercourse in prominent positions, for example on stones, tree roots and ledges under bridges. The fresh spraint is olive green to black and tar-like with a not unpleasant fishy small. Spraints generally fade to a greyish colour with time. Fish scales and bones are generally present in the spraint. Footprints can be seen on sandy or muddy riverbanks, and are five-toed prints about 5cm across. Other less common signs include meal remains, runs and slides on the riverbank.

Black Devon, Clackmannan

The riparian zone is lined on either side by a strip of woodland approximately 10m wide. The species in this zone include oak, hawthorn, alder, sycamore, with bramble dominating the ground flora. The water levels did not appear to be particularly high given the recent rainfall. The left hand bank downstream of the bridge was inaccessible due to the steep riverbanks, though this area could be easily seen from the opposite bank. Downstream of the railway bridge the riparian woodland backs onto amenity grassland with residential housing in close proximity, and upstream this woodland backs onto an agricultural grazing field and housing. There were no field signs found for either otter or water voles during the survey. However, there is a great deal of rubble along the left hand bank downstream of the bridge from previous bridges or riverbank strengthening works. This could potentially provide holts, couches and laying-up areas for otter, and the vegetation would provide a lot of cover in the summer with very little disturbance from nearby residents or dog walkers.

River Devon, Cambus

At the time of survey the river levels were high and the flow was fast, though it was apparent that they had been higher in the recent past e.g. bank high. Some of the riverbank at this point has been strengthened, with the occasional gabion basket. The left banks of the river (looking downstream) at this point are grazing fields for cattle with a few scatted trees. At the time of survey there were two bulls in the field and no access was possible to the riverbanks. This bank was observed through binoculars from the right bank but no burrows

were evident. There were perhaps 2-3 fallen trees in the field on the left bank, which could provide otter with a couch or lying-up site. A similar area was apparent just upstream of the bridge on the right side of the river. There is a small group of trees, some of which have fallen down to expose the root systems and associated holes. At the time of survey these trees were surrounded by a small ephemeral wetland that at the correct time of year could provide feeding opportunities for otter if amphibians are present. Two similar ephemeral wetlands were present immediately downstream of the bridge on the left bank and could again provide feeding opportunities.

The only field signs found were two probable otter footprints found in soft sand about 10m upstream of the bridge on the right bank. No otter spraints or water vole field signs were found.

River Forth, Stirling

The riverbanks both upstream and downstream of the currently disused railway bridge are generally steep with a mud / silt substrate. There is evidence of past management of the banks, with occasional gabion baskets and other bank defences. The vegetation along the bank consists of tall reeds with small patches of grassland and bramble, and occasional willow trees. This area is tidal and was checked at low tide.

The vegetation on the downstream left bank (backing on to the allotments and the rugby club) is slightly different in that there are numerous willow trees forming a continuous canopy and with evidence of recent and extensive giant hogweed removal. It was in this area that two otter spraints were found on top of a fallen tree trunk, above the water levels of recent flooding or high water marks. Both spraints were not recent, and were situated approximately 30m downstream from the SAK railway bridge. Reeds and tall grasses still fringe the water at this point, and this section of riverbank would provide the otters with a lot of cover and lying-up sites, though the other sections checked at this location would not. Disturbance in all areas would be minimal as access is quite restricted and there does not appear to be evidence of use (e.g. dog walkers) apart from the activity near to the allotments.

No signs of water voles were found.

APPENDIX 5F: Habitats Lost to Landtake

Table 5.1: Permanent Land Take

Location	Existing Land Use	Land Take (approx. m^2)	Habitats lost to Landtake
Ladysneuk Road	Waste ground		n/a
Ladysneuk Road, Stirling	Hard-standing and access		n/a
Abbeycraig Level Crossing	Existing road access		n/a
Blackgrange Level Crossing	Agricultural	150	Tall ruderal, scrub and scattered trees.
Cambus Level Crossing, Cambus	Former pumping station – potential development land	100	Scrub and scattered trees.
Alloa West, former Marshalling Yard	Development Land	100	Broadleaved woodland, scrub and ruderal.
Grange Road, Alloa	Council green-space		n/a
Mar Place, Alloa	Recreational		n/a
Former brewery site, Alloa	Development Land		n/a
Petrol Station, Ring Road, Alloa	Commercial	100	Scattered broadleaved trees
Alloa Business Centre, Whins Road, Alloa	General infrastructure		n/a
Hilton Road, Alloa	General Land	1000	Scrub, neutral grassland
Diageo Bonded Warehouses and Hilton Farm	Industrial Agricultural Commercial General	4450 1700 1000 1000 100	Improved grassland Scattered trees Tall ruderal Broadleaved woodland Amenity grassland
21 Hilton Road, Alloa	Residential		n/a
Recreation Park, Hilton Road, Alloa	Recreational/car park		n/a
Playground off Gaberston Avenue	Recreational		n/a
Hiltonhawk Way, Alloa	Public road and hard-standing		n/a
Farmland south of A907	Agricultural		n/a
Off A907 Helensfield	Highway verge		n/a
Station Road, Kincardine	Scottish Power – Development Land	75	Scattered trees, tall ruderal
	TOTAL	**9,775**	

Table 5.2: Temporary Land Take

Location	Existing Land Use	Land Take (approx. m^2)	Habitats lost to Landtake
Stirling Station	Public road and footway		n/a
Forth Street (adjacent to Forth Viaduct)	Embankments, public road and footways, electricity substation, verges paths and steps.		n/a
Lover's Walk, Stirling	Public road		n/a
River Forth and banks	River, banks, bridge, land	1000	Amenity grassland, scattered trees.
Bridgehaugh, Stirling Rugby Football Club	Car Park, hard-standing and playing fields	300	Scattered trees, tall ruderal
Causewayhead Road, Stirling	Public road, footway, layby and verge		n/a
Abbeycraig Level Crossing	Field and Land Agricultural	1500	Tall ruderal and scrub.
Logie Burn, Stirling	a) Agricultural/Farm track	200	Tall ruderal
Grangehall, Stirling	Agricultural		n/a
Manor Neuk Level Crossing	Agricultural	50	Scrub, tall ruderal
Manor Powis Level Crossing	Field and Land	200	Scrub, tall ruderal
Blackgrange Level Crossing	Field, land and electricity pylons	250	Tall ruderal, scrub, scattered trees
New Mills Level Crossing	Agricultural/open land	500	Scrub, scattered trees
Cambus Level Crossing, Cambus	Diageo storage area		n/a
Alloa New Marshalling Yard	Disused Railway Marshalling Yard	3,000	Broadleaved woodland, scrub, scattered trees
Grange Road and Dirleton Gardens	Public road and footway		n/a
Alloa Sports Centre	Recreational	500	Broadleaved woodland, neutral grassland
Erskine Street, Alloa	Road, footways, cycle routes and general land		n/a
Former Brewery site, Alloa	Embankment, land, footways, public road and verge	500	Scrub, scattered trees
Recreation Park, Alloa	Recreation associated use	250	Scrub
Bonded warehouses, Hilton Road, Alloa	Industrial		n/a
Hilton Farm, Alloa	Agricultural		n/a
Helensfield, Clackmannanshire	Public road, verges, footway and land	750	Scrub
Black Devon river crossing	River Access and land Residential	1000	Scrub
Cattle Market off	Access, land and verge	1000	Scrub

Alloa Road, Clackmannan			
Kennet, Clackmannanshire	Access and verges	500	Scattered trees, scrub
Kennet, Clackmannanshire	Verge and layby	500	Broadleaved woodland, tall ruderal, scrub
Meadow End, Clackmannanshire	Agricultural Road, verges and land	1500	Scattered trees, scrub
Kilbagie, Clackmannan/Fife	Watercourse and drainage	250	Broadleaved woodland, scrub, ruderal
Kilbagie, Clackmannan/Fife	Fields and land	350	Scattered trees, scrub, tall ruderal
Broomknowe, Fife	Fields and land		n/a
Tulliallan Bridge	Field and Land	150	Broadleaved woodland
Kincardine Power Station Fife	Access and verges		n/a
Kincardine Power Station Fife	Land and scrub	250	Neutral grassland, tall ruderal, scattered broadleaved trees.
	TOTAL	**14,500**	

6. NOISE AND VIBRATION

APPENDIX 6A: Noise Terminology, Guidance and Criteria

Terminology

Between the quietest audible sound and the loudest tolerable sound there is a million to one ratio in sound pressure (measured in pascals, Pa). Because of this wide range a noise level scale based on logarithms is used in noise measurement called the decibel (dB) scale. Audibility of sound covers a range of approximately 0 to 140 dB.

The human ear system does not respond uniformly to sound across the detectable frequency range and consequently instrumentation used to measure noise is weighted to represent the performance of the ear. This is known as the 'A weighting' and annotated as dB(A).

The following table lists the sound pressure level in dB(A) for common situations.

Table 6.1-1: Noise Levels for Common Situations.

Typical Noise Level,dB(A)	*Example*
0	Threshold of hearing
30	Rural area at night, still air
40	Public library Refrigerator humming at 2m
50	Quiet office, no machinery Boiling kettle at 0.5m
60	Normal conversation
70	Telephone ringing at 2m Vacuum cleaner at 3m
80	General factory noise level
90	Heavy goods vehicle from pavement Powered lawnmower, operator's ear
100	Pneumatic drill at 5m
120	Discotheque - 1m in front of loudspeaker
140	Threshold of pain

The noise level at a measurement point is rarely steady, even in rural areas, and varies over a range dependent upon the effects of local noise sources. Close to a busy motorway, the noise level may vary over a range of 5 dB(A), whereas in a suburban area this may increase up to 40 dB(A) and more due to the multitude of noise sources in such areas (cars, dogs, aircraft etc.) and their variable operation. Furthermore, the range of night-time noise levels will often be smaller and the levels significantly reduced compared to daytime levels. When considering environmental noise, it is necessary to consider how to quantify the existing noise (the ambient noise) to account for these second to second variations.

A parameter that is widely accepted as reflecting human perception of the ambient noise is the background noise level, L_{A90}. This is the noise level exceeded for 90% of the measurement period and generally reflects the noise level in the lulls between individual noise events. Over a one hour period, the L_{A90} will be the noise level exceeded for 54 minutes.

The equivalent continuous A-weighted sound pressure level, L_{Aeq}, is the single number that represents the total sound energy measured over that period. L_{Aeq} is the sound level of a notionally steady sound having the same energy as a fluctuating sound over a specified measurement period. It is commonly used to express the energy level from individual sources that vary in level over their operational cycle.

The index adopted by the Government to assess traffic noise is $L_{A10,18h}$, which is the arithmetic mean of the noise levels exceeded for 10% of the time in each of the eighteen 1-hour periods between 06:00 and 24:00. A reasonably good correlation has been shown to exist between this index and residents' perception of traffic noise over a wide range of exposures.

The $L_{Amax,fast}$ measurement parameter is the maximum instantaneous sound pressure level attained during the measurement period (30 seconds, 5 minutes etc.), measured on the 'fast' response setting of the sound level meter. It is generally used to assess potential for night-time sleep disturbance.

Most environmental noise measurements and assessments are undertaken for 'free-field', away from any existing reflecting surfaces (other than the ground). However, it is sometimes necessary to consider noise levels immediately external to a façade when considering the impact on residents inside properties and this requires the addition of 3 dB(A) to the predicted (or measured) free-field level due to noise reflection from the façade. The assessment of road traffic noise, for example, is based on a predicted (or measured) façade noise level (using the L_{A10} statistical parameter).

Human subjects, under laboratory conditions, are generally only capable of noticing changes in steady levels of no less than 3 dB(A). It is generally accepted that a change of 10 dB(A) in an overall, steady noise level is perceived to the human ear as a doubling (or halving) of the noise level. (These findings do not necessarily apply to transient or non-steady noise sources such as changes in noise due to changes in road traffic flow, or intermittent noise sources).

Guidelines and Criteria

World Health Organisation

The World Health Organisation's (WHO) 'Guidelines for Community Noise' (Reference 1) reports, for external environmental noise levels, that;

During the daytime, few people are seriously annoyed by activities with L_{Aeq} levels below 55 dB; or moderately annoyed with L_{Aeq} levels below 50 dB. Sound pressure levels during the evening and night should be 5-10 dB lower than during the day…

Table 4.1 of the WHO guidelines recommends environmental daytime limits of 55 dB L_{Aeq} or less over the 16 hour daytime period (07.00-23.00) "*to avoid minimal serious annoyance"*, and 50 dB L_{Aeq} "*to avoid minimal moderate annoyance"*.

or night-time noise sources the WHO guidelines recommend a night-time (23.00-07.00) 8-hour noise level of 45 dB L_{Aeq} "*outside bedroom windows*" (for a reasonably steady noise source) and on a sleep disturbance basis the WHO guidelines state in Section 3.3 that:

"For a good sleep, it is believed that indoor sound pressure levels should not exceed approximately 45 dB L_{Amax} more than 10-15 times per night……"

This recommended limit specific to sleep disturbance is confirmed in Table 5 of British Standard BS 8233: 1999 'Sound Insulation and noise reduction for buildings' (Reference 2) where it states for noise levels internal to a bedroom that:

"For a reasonable standard in bedrooms at night, individual noise events (measured with F time-weighting) should not normally exceed 45 dB $L_{Amax.}$"

The WHO guidelines recommends a limit of level of 60 dB $L_{Amax,(fast)}$ for *"Outside bedrooms, sleep disturbance, window open, outdoor values"*. This follows since an open window will provide an insertion loss of approximately 15 dB(A) and consequently a noise level of 60 dB $L_{Amax,fast}$ external to an open bedroom window would lead to a resulting internal level of 45 dB $L_{Amax,fast}$.

Construction Noise – Impacts to Residential Areas

Noise levels generated by construction activities are regulated by guidelines and subject to local authority control. Advice is contained within British Standard BS 5228: 1997 *'Noise and vibration control on construction and open sites'* (Reference 3). It contains a database on the noise emission from individual items of equipment and activities and routines to predict noise from demolition and construction methods to identified receptors. The prediction method gives guidance on the effects of different types of ground, barrier attenuation and how to assess the impact of fixed and mobile plant.

As far back as 1963 the Wilson Committee report on noise recommended that outside the windows of the nearest occupied dwelling in an urban area a noise level of 75 dB(A), and in suburban or rural areas a level of 70 dB(A), should not be exceeded by noise from construction work. This serves as a useful general guideline, but is not sufficiently definite on whether the quoted levels can be exceeded at all, or whether a construction project taking one or two days should be treated differently from one taking one or two years or even longer.

Minerals Planning Guidance 11: '*The Control of Noise at Surface Mineral Workings*' (MPG 11) (Reference 4) was issued by the Department of the Environment and the Welsh Office in April 1993 and provides advice to developers and planning authorities for noise generated at noise-sensitive developments due to mineral extraction, open cast coal extraction and landfill operations. MPG 11 identifies periods where it may be permissible to modify normal noise limits where high noise levels generated during site preparation and restoration work (at minerals extraction sites etc.) are unavoidable. In paragraphs 42 and 61 MPG 11 states:

"It will often be necessary to raise the noise limits to allow temporary but exceptionally noisy phases .....It is suggested that 70 dB $L_{Aeq,1h}$ (free field) for periods of up to 8 weeks in a year should be considered to facilitate this…"

Operational Noise – Fixed Plant

British Standard BS 4142: 1997 'Method for rating noise affecting mixed residential and industrial areas' (Reference 5) details a method of rating the acceptability of increases in the background noise level L_{A90} at noise-sensitive developments affected by noise from fixed plant (pumps, generators, HVAC units etc.) at existing or proposed fixed developments, such as superstores, factories and commercial/industrial units.

In Section 8 "Assessing the noise for complaint purposes" it is stated that an excess above the existing background noise level L_{A90} of up to 5 dB(A) due to noise from fixed plant at a new development is of 'marginal significance'. This has been interpreted, since the introduction of the Standard in 1967, that a 5 dB(A) excess due to new, fixed plant noise source is, in general, acceptable. An excess of between 5 and 10 dB(A) falls into an intermediate area where local conditions may affect the likelihood of complaints arising (such as local feeling towards the development, the nature of the development etc.). An excess above the background noise level of greater than 10 dB(A) can be taken as a positive indication that complaints are likely.

The ambient background noise varies throughout the day and night-time periods. For new plant that may operate on a 24-hour basis it is appropriate to measure the reasonable minimum ambient background noise level (which would normally occur in the early hours of the morning) at nearest noise-sensitive receptors (normally local residential property) and to use this value for comparison against the predicted noise level from the new plant. If it can be shown that the noise from the proposed new fixed plant would not exceed the minimum background ambient noise level by more than 5 dB(A) for the quietest period of the night then it follows that the 5 dB(A) excess will be met at all other times throughout a 24 hour period.

Operational Noise – Rail Traffic

When addressing the potential impact of a new road or railway noise source the indication is that it is necessary to consider the short-term impact (upon opening of the scheme) and the long -term impact (when residents are familiar with the scheme).

GoMMMS (Guidance on the Methodology for Multi-Modal Studies, DETR, 2000) Volume 2, Chapter 4, Section 4.3 (Reference 6) offers guidance on how to assess the noise impacts of multi-modal plans and strategies. The approach is based on the difference in the estimated population annoyed by noise between the do-minimum and do-something scenarios. A long-term annoyance response curve for rail traffic noise is given in Table 4.2 of GoMMMS, an extract of which is reproduced below, Table 6.1-2.

Table 6.1-2: Extract From Table 4.2, GoMMMS

Rail-noise ($L_{Aeq,18h}$)	% Annoyed (long term)
55	11
60	16
65	22
70	30

It is known that for an abrupt increase in noise levels associated with the opening of a new road (or railway) there may be an immediate community response to the change in noise level, which is known to diminish with time due to familiarisation. The above table represents the percentage of an exposed population 'annoyed' by long-term railway noise but there is no evidence in the literature proposing a short-term annoyance rating (due to lack of social studies, although such information exists for road schemes). Short-term annoyance may best be described by the actual increase in noise levels due to the scheme above the ambient noise levels, whereas long-term annoyance may best be described in terms of the overall final noise level due to the scheme (regardless of the pre-existing ambient noise level).

GoMMMS states:

" *it is important to be aware that at low noise levels (over large distances), the annoyance response function is uncertain and prediction becomes inaccurate. Consequently, it is recommended that a cut-off noise level is introduced to the appraisal, below which only a small percentage of the population would be annoyed…… PPG24* [PAN56 in Scotland] *and WHO suggest an onset of community noise impact at daytime 55 dB* $L_{Aeq,18h}$. *This corresponds to a population annoyed from road and rail traffic of about 10%. Therefore 55 dB* $L_{Aeq,18h}$ *is the recommended cut-off level to use in estimating the total population annoyed*."

Draft Guidelines For Noise Impact Assessment, issued by the Institute of Acoustics and the Institute of Environmental Management and Assessment (Reference 7) aim to "*set good practice standards for the scope, content and methodology of noise impact assessments*". Chapter 7 of that document gives guidance on assessment and how judgements on the severity of impacts can be made. It also presents an example table, reproduced below as Table 6.1-3, categorizing the significance of noise changes. It is stressed that this table is merely an example and should not be used to define the description of the noise change in an assessment, and that the words used to describe the impact should be determined by the assessor for the particular scheme under consideration.

Table 6.1-3: Example of Categorizing the Significance of the Basic Noise Change

Noise Change, dB(A)	Category
< 1	No impact
1 < 3	Slight impact
3 < 5	Moderate impact
5 < 10	Substantial impact
> 10	Severe impact

Based on the guidance given in GoMMMS and the IOA/IEMA document and with reference to short-term and long-term changes in the ambient noise due to the scheme, a significance table has been developed as shown in Table 6.1-4, and this is the basis of the assessment for railway noise used in this assessment:

Table 6.1-4: Categorization of the Significance of Noise Impact

Façade $L_{Aeq,18h}$ (from railway)	Increase in L_{Aeq} (day, evening, night periods)			
	1 < 3	3 < 5	5 < 10	>10
< 55	negligible	negligible	minor	minor
55 < 60	negligible	minor	moderate	moderate
60 < 65	negligible	minor	moderate	substantial
> 65	negligible	moderate	substantial	substantial

An additional criterion, to reflect the likelihood of night-time sleep disturbance, is $L_{Amax,fast}$ the maximum pass-by noise level, as discussed in the WHO Guidelines previously referenced. Noise impacts are identified where levels of 60 dB $L_{Amax,fast}$ and above occur at the bedroom window façade of a residential property during the period 23:00-07:00 (assuming an open bedroom window; a higher façade level would be appropriate with a closed bedroom window).

Under certain circumstances, occupiers of dwellings affected by rail traffic noise from a new or additional railway may be entitled to noise insulation treatment (acoustic glazing and acoustic ventilation to habitable rooms) under the Railway Noise Insulation Regulations (Reference 8). These regulations apply in England and Wales but have no equivalent in Scotland. However, legal advice is that the criteria and standards embodied in the regulations can be applied in cases such as this, where no equivalent or alternative is available. The circumstances for entitlement are defined by three conditions which have to be met

- the combined expected maximum rail traffic noise level (i.e. the relevant noise level from the new or altered railway) must not be less than the specified noise levels (68 dB $L_{Aeq,18h}$ daytime (06:00-24:00) and 63 dB $L_{Aeq,6h}$ night-time (24:00-06:00).

- the relevant noise level is at least 1.0 dB(A) more than the prevailing noise level.

- the contribution to the increase in the relevant noise level from the new or altered railway must be at least 1.0 dB(A).

Noise from the railway shall be assessed at a reception point located 1 metre outward of the external side of a qualifying window. The railway flows to be used in the calculation shall be the noisiest expected traffic flows occurring during the specified day and night periods within a period of 15 years after opening the system.

It is not necessary to meet the criteria for both day and night-time operation. For example, certain windows may qualify for noise insulation for proposed daytime operation even if night-time proposed operation does not meet the criteria.

Operational Noise – Road Traffic

The Design Manual for Road and Bridges (DMRB) Volume 11 Section 3 Part 7 '*Traffic Noise and Vibration'*, 1994 (Reference 9) provides a method of evaluating both the immediate and long term impact of abrupt changes in the 18-hour traffic flow (06:00-24:00) in terms of the effects on people and, principally, occupiers of residential property. (Statistical data in DMRB cannot be applied to assessment of railway noise due to different public perception of road and rail sources).

Individuals vary widely in their response to traffic noise, although the average or community response from a large number of people to the same level of traffic noise is fairly stable. Consequently, a community average degree of annoyance can be related to the $L_{10,18h}$ traffic noise level. The annoyance caused by the existing traffic noise and the predicted future traffic noise is calculated, therefore enabling the increase, or decrease in the percentage of people likely to be annoyed to be determined.

DMRB requires that an assessment is undertaken where an increase in a road traffic flow of 25% or greater is predicted (equivalent to an increase or decrease in road traffic noise of approximately 1 dB(A)), implying that road traffic flow increases of up to 25% offer no significant impact in environmental noise terms.

New Housing

Planning Advice Note: PAN56 (Reference 10) includes advice to local authorities on the use of their planning powers to minimise the adverse impact of noise when determining

planning applications for new residential development. It introduces the concept of noise exposure categories (NECs) for residential development, encourages their use and recommends appropriate levels for exposure to different sources of noise. A brief discussion of the most relevant paragraphs of PAN56 follows.

Paragraphs 50 and 51 of PAN56 state:

"This advice note suggests the use of Noise Exposure Categories (NECs)to help planning authorities determine applications for residential development on sites subjected to noise from road, rail air and mixed transportation noise……"

"For category A sites, noise is unlikely to be a determining factor, while for category D sites refusal of planning permission is likely to be the most appropriate solution. Categories B and C deal with situations where noise mitigation measures may make development acceptable…. "

PAN56 recommends adopting a 16-hour daytime period of 07.00-23.00 and an 8 hour night-time period of 23.00-07.00. Annex 1 of PAN56 sets out the approach in more detail and puts forward a range of recommended values.

In summary, if the daytime noise level across a proposed residential development site is below 55 dB $L_{Aeq,16h}$ (corresponding to Noise Exposure Category A) and night-time below 45 dB $L_{Aeq,8h}$ then PAN56 states that:

"Noise need not be considered as a determining factor in granting planning permission, although the noise level at the high end of the category should not be regarded as a desirable level".

A further criterion is given in note vi) to the table in Appendix 1 of PAN56. If there are more than two events per hour during the period 23:00 to 07:00 where $L_{Amax,slow}$ values exceed 82 dB(A), then the site should classed in NEC C, regardless of the daytime and night-time L_{Aeq} values.

For areas falling into Noise Exposure Category B or C (day or night-time) it is possible to address moderate or high levels of environmental noise by specifying noise reduction measures such as acoustic barriers to reduce noise levels to gardens and facades, and acoustic ventilation and glazing to reduce internally-transmitted noise.

APPENDIX 6B: Vibration Terminology, Guidance and Criteria

Basic Theory

When an object is in contact with a vibrating surface it is displaced about its reference (stationary) position. Displacement (in mm) is therefore one parameter that can be used to describe the magnitude of a vibration. For sinusoidal signals, displacement, velocity (ms^{-1}) and acceleration (ms^{-2}) amplitudes are related mathematically by a function of frequency and time. If phase is neglected, as is always the case when making time-average measurements, then the velocity can be obtained by dividing the acceleration signal by a factor proportional to frequency (measured in Hertz, Hz) and the displacement can be obtained by dividing the acceleration signal by a factor proportional to the square of frequency. Modern electronic integrating meters are capable of providing a wide range of measurement parameters during any single vibration measurement.

For a complex acceleration signal giving rise to a complicated time history, there are several additional quantities which can be used to describe this vibration:

- the peak value is the maximum instantaneous acceleration measured during the measurement time, T. It is a useful indicator of the magnitude of short duration shocks;

- the root mean square value (rms) is obtained by taking the square root of the mean of the sum of the squares of the instantaneous acceleration measured during the total measurement time, T;

- the peak particle velocity (ppv) is the maximum instantaneous velocity of a particle at a point during a given time interval.

Perception

Human perception to vibration is of the order of $0.15mms^{-1}$ to $0.3mms^{-1}$ ppv, in the frequency range 0.1 Hz to 1500 Hz. (The lowest note, 'A', on a full size piano keyboard has a fundamental frequency of 28 Hz). However, the human body is not equally sensitive to all frequencies of vibration and weighting curves to reflect the frequency dependency of the body have been developed and are contained within ISO Standards. Those frequencies to which the human body is most sensitive are given a much heavier weighting than those at frequencies to which the body is less sensitive. This weighting gives a good correlation between the measured vibration level and the subjective feeling or impact produced by the vibration.

The weightings can be incorporated into modern vibration meters, thus enabling measurement of vibration levels that correspond to human perception. Those vibrations occurring between 1-80 Hz are of particular interest when measuring exposure to whole-body vibration.

Sensitivity to mechanical vibration is also known to be dependent on the direction of excitation and also the human body responds differently when standing (longitudinal) compared to when lying down (lateral). Whole-body vibrations are consequently measured in the directions of an orthogonal co-ordinate system having its origins at the location of the heart.

Day and night-time assessment routines differ to account for longitudinal (daytime) body position and lateral (night-time) body position.

Vibration Limits – Nuisance

Ground vibrations may cause reactions ranging from 'just perceptible', through 'concern' to 'alarm' and 'discomfort'. The subjective response varies widely and is a function of situation, information, time of day and duration.

British Standard BS 6472: 1992 *'Guide to evaluation of human exposure to vibration in buildings (1 Hz to 80 Hz)* (Reference 12) gives base curves of vibrations for minimal adverse comment, and also vibration dose values (VDVs) at which complaints are probable. VDVs may be used to assess the severity of impulsive and intermittent vibration, such as experienced from blasting at quarries or from rail traffic, and steady vibration such as from a busy road or fixed plant.

The adoption of the VDV parameter is based on social studies undertaken in the 1980s and early 1990s into human response to vibration. BS 6472 requires that the VDV be determined separate for the 16 hour daytime (07:00-23:00) and 8 hour night-time (23:00-07:00) periods.

The VDV is given by the fourth root of the integral of the fourth power of the acceleration after it has been frequency-weighted:

$$VDV = \int_0^T a^4(t)dt)^{0.25}$$

where VDV is the vibration dose value (in $ms^{-1.75}$)

$a(t)$ is the frequency-weighted acceleration (ms^{-2})

T is the total period of the day (in seconds) during which vibration may occur

The basic procedure is to estimate, or measure, the frequency weighted root mean square (r.m.s.) acceleration levels, and to integrate the several components with respect to time over the day or night-time period so as to compute the VDV. The VDV is measured in each of the three whole-body orthogonal axes and the maximum from the three axes used. Where the vibration conditions are constant or regularly repeated throughout the day and assessment is based on measured data, only one representative period need be measured, and the 16 hour daytime (or 8 hour night-time) overall VDV level may be calculated from the shortened measurement.

The predicted or measured VDV may then be compared to Table 7 in the Appendix of BS 6472, reproduced below, to identify the likelihood of complaint:

Table 6.2-1: (from BS 6472: 1992) Vibration Dose Values ($ms^{-1.75}$) above which various degrees of adverse comment may be expected in residential buildings.

Location	Low probability of adverse comment	Adverse comment possible	Adverse comment probable
	VDV, $ms^{-1.75}$		
Residential buildings, 16 h day	0.2 to 0.4	0.4 to 0.8	0.8 to 1.6
Residential buildings, 8 h night	0.13	0.26	0.54

For example, between 0.4 and 0.8 $ms^{-1.75}$ adverse comment regarding daytime vibration levels becomes possible, also when the VDV increases above 0.54 $ms^{-1.75}$ at night adverse comment becomes probable. Data included in BS 6472: 1992 may therefore be used to assess the likelihood of adverse comment arising from construction vibration to local residential properties.

Based on the above table, the following impact descriptor has been concluded, Table 5.2-2:

Table 6.2-2: Impact descriptor for residential vibration

VDV, daytime $ms^{-1.75}$	VDV, night-time $ms^{-1.75}$	Impact descriptor
Residential buildings 16 h day	Residential buildings 8 h night	
<0.2	<0.13	negligible
0.2-0.4	0.13-0.26	slight
0.4-0.8	0.26-0.54	moderate
>0.8	>0.54	severe

Vibration Limits – Building Damage

Buildings are reasonably resilient to ground-borne vibration and vibration-induced damage is rare; there are less than 12 confirmed instances of vibration-induced damage to buildings in the UK over the last 10 years.

Vibration-induced damage can arise in different ways, making it difficult to arrive at universal criteria that will adequately and simply indicate damage risk. Damage can occur directly due to high dynamic stresses, due to accelerated ageing or indirectly, when high quasi-static stresses are induced by, for example, soil compaction.

There are currently two British Standards that offer advice on acceptable levels of vibrations in structures. British Standard BS 7385: Part 2: 1993 *'Evaluation and measurement for vibration in buildings Part 2. Guide to damage levels from ground-borne vibration'* (Reference 13) gives guidance on the levels of vibration above which the building structures could be damaged. It considers only the direct effect of vibration on a building, since the other mechanisms are different.

For the purposes of BS 7385 damage is classified as cosmetic (formation of hairline cracks), minor (formation of large cracks) or major (damage to structural elements). Guide values given in the Standard are associated with the threshold of cosmetic damage only, usually in wall and/or ceiling lining materials.

Since case-history data, taken alone, has so far not provided an adequate basis for identifying thresholds for vibration-induced damage, data using controlled vibration sources within buildings has been established to enable definition of vibration thresholds judged to give a minimal risk of vibration-induced damage.

Limits for primarily transient vibration (from a train, for example) above which cosmetic damage could occur are reported in tabular form and graphical form in the Standard and reproduced exactly below:

Table 6.2-3:Transient Vibration Guide Values for Cosmetic Damage

(from BS 7385: Part 2: 1993).

Transient vibration guide values for cosmetic damage			
Line *(see Figure)*	**Type of building**	**Peak component particle velocity in frequency range of predominant pulse**	
		4 Hz to 15 Hz	**15 Hz and above**
1	Reinforced or framed structures. Industrial and heavy commercial buildings	50 mm/s at 4 Hz and above	
2	Unreinforced or light framed structures Residential or light commercial type buildings	15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz	20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above
NOTE 1. Values referred to are at the base of the building NOTE 2. For line 2, at frequencies below 4 Hz, a maximum displacement of 0.6 mm (zero to peak) should not be exceeded.			

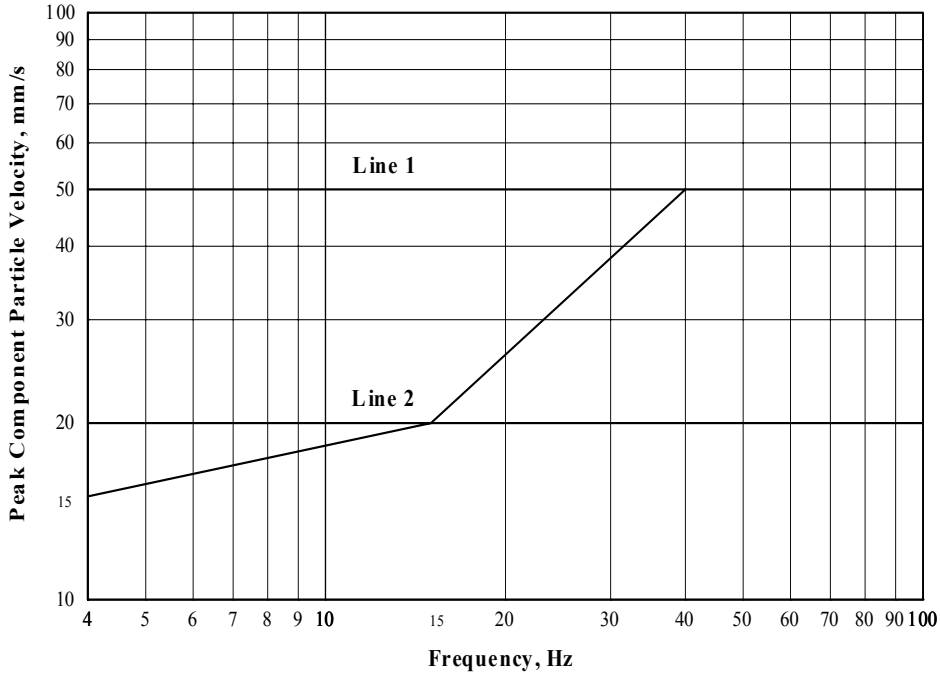

Figure 6.2-1: Summary of damage thresholds for transient vibration on domestic structures

The Standard indicates, for example, that for a residential building (line 2) a ppv of greater than 15 mms^{-1} at 4 Hz or greater than 50 mms^{-1} at 40 Hz or above, measured at the base of the building, may be expected to result in cosmetic damage.

Guidance on acceptable vibration levels in structures is also provided in BS 5228: Part 4: 1992 *'Code of practice for noise and vibration control applicable to piling operations"*

(Reference 14). This Standard recommends that a conservative threshold for minor or cosmetic damage should be taken as a peak particle velocity of 10 mms^{-1} for intermittent vibration and 5 mms^{-1} for continuous vibrations to determine whether there is any risk of building damage, particularly from construction works involving piling. It is not clear why there is a discrepancy between the two Standards.

The criteria shown in Table 6.2-4 below (compiled from paragraph 8.4.2, page 24 of BS 5228: Part 4: 1992) can be applied in the case of continuous vibration from piling works.

Table 6.2-4: Vibration Limits Relating to Minor or Cosmetic Damage to Buildings from Piling Operations (from BS 5228: Part 4: 1992)

Building Classification	Intermittent Vibration (ppv, mms^{-1})	Continuous Vibration (ppv, mms^{-1})
Residential in generally good repair	10	5
Residential where preliminary survey reveals significant defects	5	2.5
Industrial/commercial - light and flexible structure	20	15
Industrial/commercial - heavy and stiff structure	30	15

BS 5228: 1992 part 4 may therefore be used to assess the likelihood of structural damage arising from vibration associated with construction, both to local residential property and development buildings.

APPENDIX 6C: BASELINE NOISE MEASUREMENTS

Locations for baseline noise monitoring were decided in conjunction with the Environmental Health Departments of Stirling, Clackmannanshire and Fife councils.

A combination of long-term and short-term monitoring was undertaken at a total of 13 locations along the length of the proposed railway. The monitoring procedures adopted were in conformance with the requirements of BS 7445:1991 *'Description and measurement of environmental noise'* (Reference 17). The long-term measurements are presented here in Figures 1 through 9. Average day, evening and night-time noise levels were calculated from this data (tabulated in the Environmental Statement) and used in the assessment.

The range of day, evening and night-time ambient noise levels monitored is not unusual for suburban and semi-suburban areas and generally lower that the nationwide average levels. The most recent National Noise Incidence survey found that 54% of the population of the UK live in dwellings exposed to daytime (07:00-23:00) noise levels above 55 dB L_{Aeq} and 67% to night-time noise levels above 45 dB L_{Aeq}.

For some of the long-term measurements the L_{A90} noise level fell below the noise floor of the monitoring instrument for brief periods during the early hours of the morning. However, the assessment of rail noise in the report is based on changes in daytime L_{Aeq} noise levels (since there will be minimal night-time rail movements). Some of the baseline L_{A90} noise levels are used to assess the impact of the new station at Alloa but this, however, is for the periods 06:00-07:00 and 23:00-24:00, and the baseline L_{A90} noise levels during these periods are well within the set range. For fixed plant noise assessment a minimum night-time background noise level of 20 dB L_{A90} is used.

Baseline noise levels are summarized as follows (Figures 6.3-1 to 6.3-9):

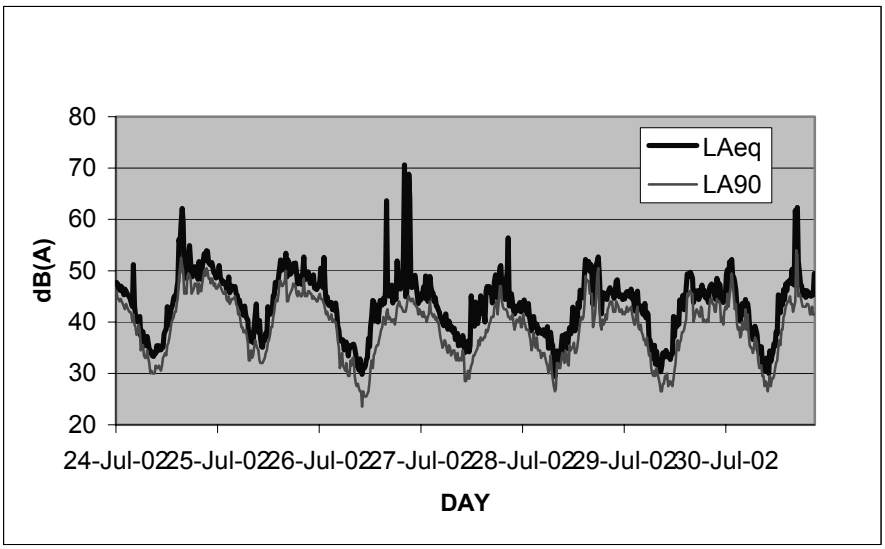

Figure 6.3-1 Baseline Noise Measurements. Position S2

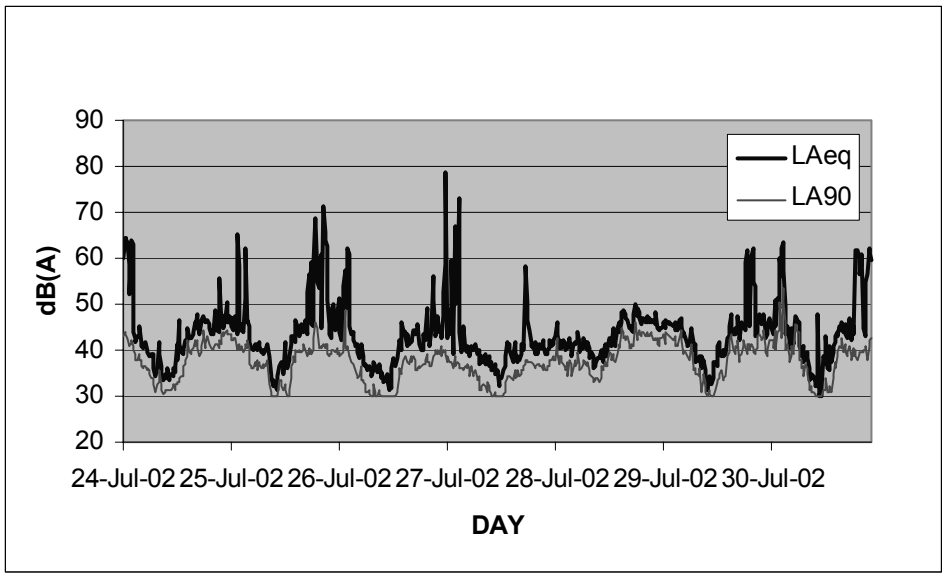

Figure 6.3-2: Baseline Noise Measurements. Position C1

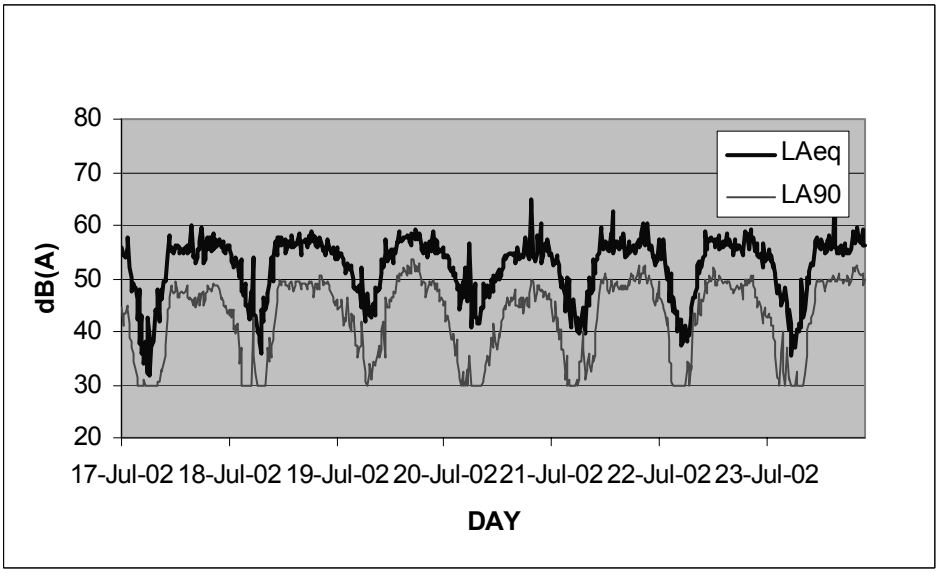

Figure 6.3-3: Baseline Noise Measurements. Position C2

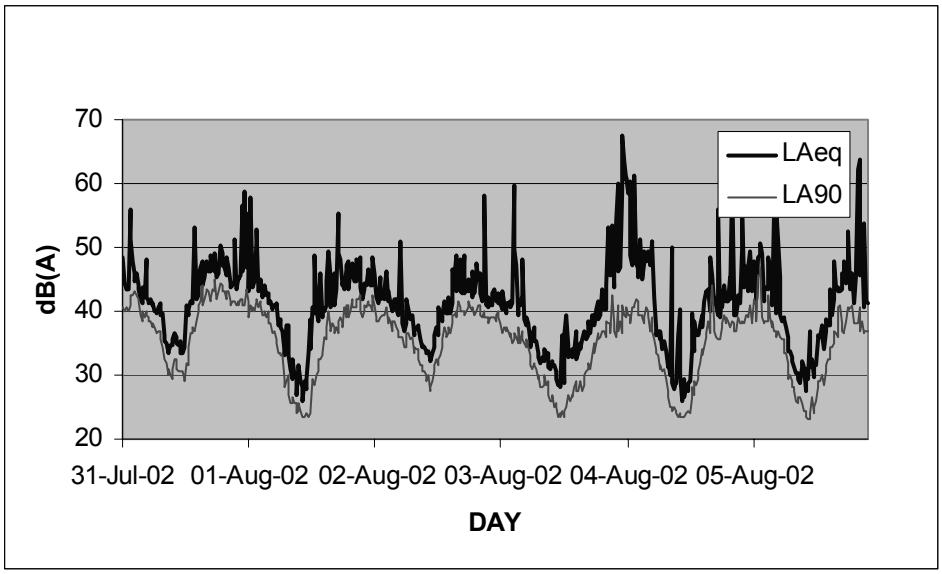

Figure 6.3-4: Baseline Noise Measurements. Position C5

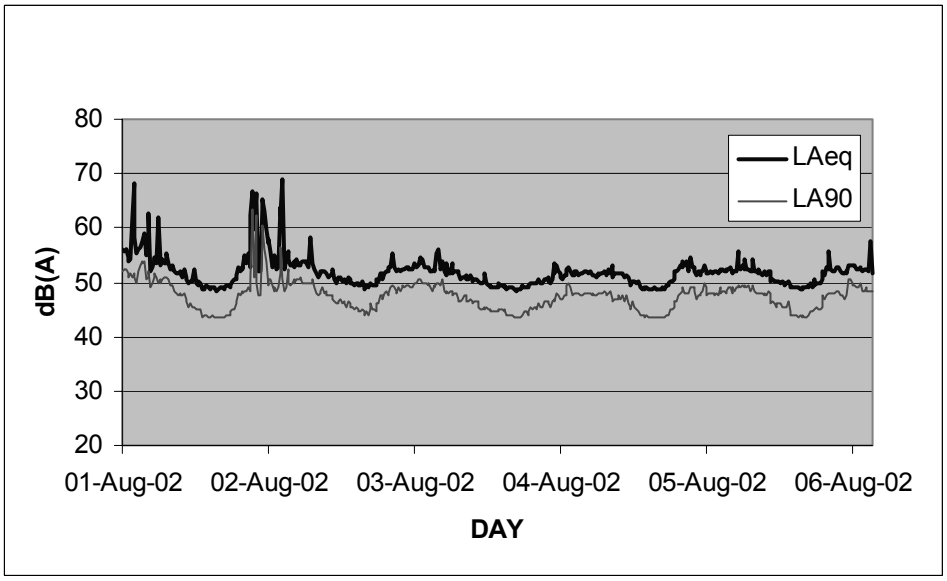

Figure 6.3-5: Baseline Noise Measurements. Position C6

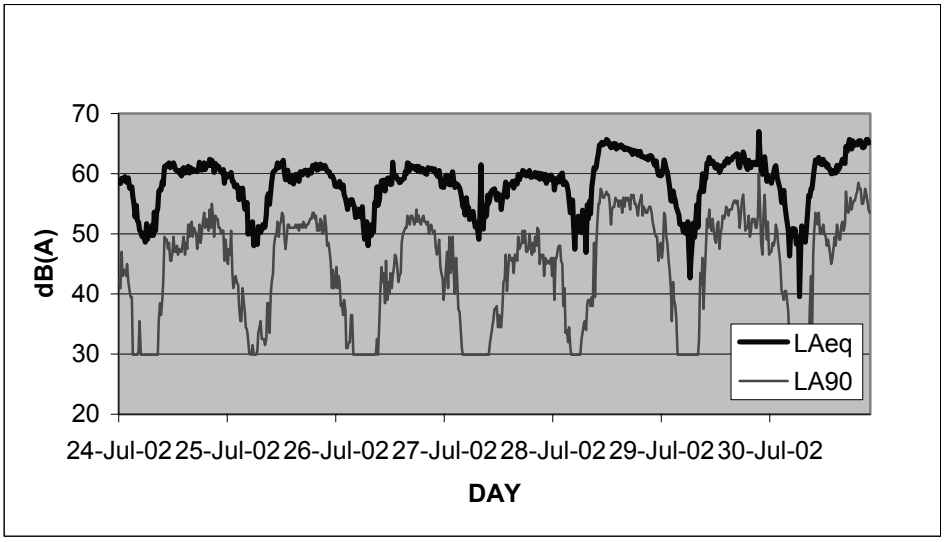

Figure 6.3-6: Baseline Noise Measurements. Position C8

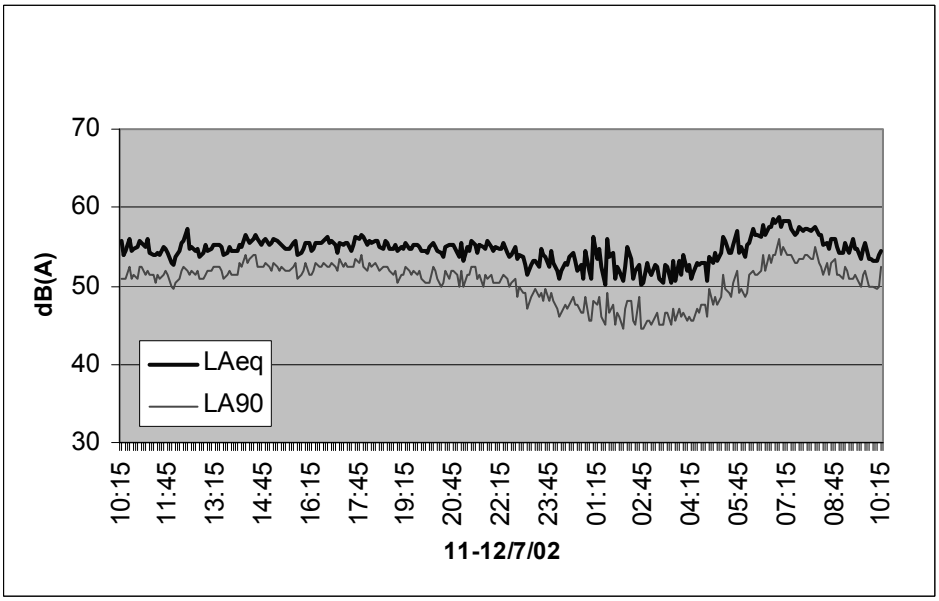

Figure 6.3-7: Baseline Noise Measurements. Position C9

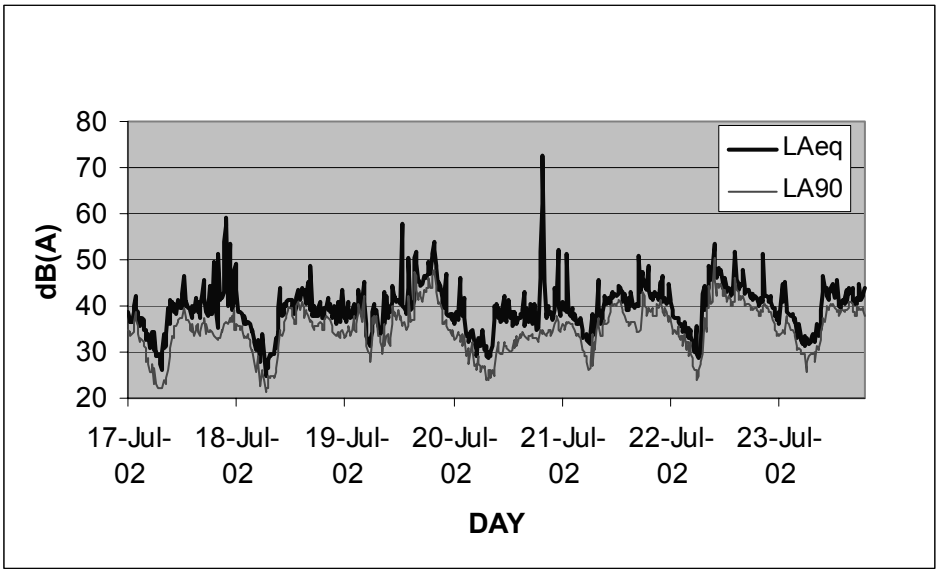

Figure 6.3-8: Baseline Noise Measurements. Position F1

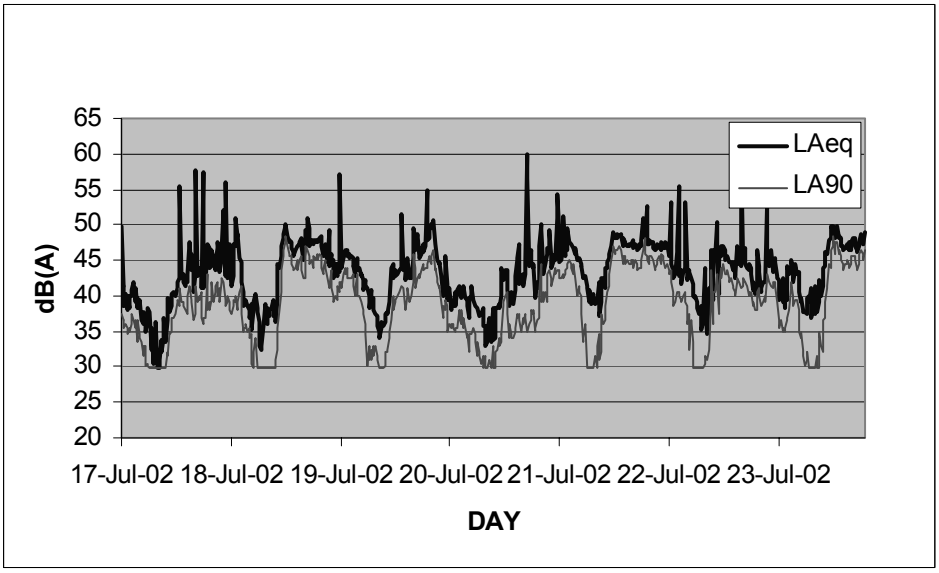

Figure 6.3-9: Baseline Noise Measurements. Position F2

APPENDIX 6D: Railway Construction Noise and Vibration

Noise

Noise levels generated by a development and experienced by local receptors depends upon a number of variables, the most significant of which are:

- the noise generated by plant or equipment used on site, rail traffic, road traffic and other sources, generally expressed as sound power levels (SWL);
- the periods of operation of the plant on the site, known as its "on-time" (which may be 100% for fixed plant such as fans and boilers);
- the distance between the noise source and the receptor;
- the attenuation due to ground absorption, air absorption and barrier effects;
- in some instances, the reflection of noise due to the presence of hard surfaces such as the sides of buildings or quarry faces.

The main prediction method used in this assessment for construction and fixed plant noise sources is based on those outlined in International Standard ISO 9613-2 (Reference 11) and BS 5228: 1997 which are used to predict noise as a free-field equivalent continuous noise level averaged over a one-hour period ($L_{Aeq,1h}$).

Construction plant, scheduling and phasing is not currently available for the proposed development. However, based on previous experience with West Coast Main Line development a list of likely construction plant and phasing has been compiled and the expected subsequent construction activities and equipment associated with the reopening of the line are given in Table 6.4-1. For each activity, free-field $L_{Aeq,1h}$ values were calculated at the nearest sensitive receptors, using the SoundPLAN suite of programs. This prediction tool implements the procedures of ISO9613-2 for the calculation of industrial noise, which shares many features with BS5228 Part 1. Construction compounds located near sensitive receptors were assumed to be enclosed by 2 metre boarding, which is standard practice for compounds of this type.

The results are given in Tables 6.4-2 to 6.4-5. Free field $L_{Aeq,I\ hour}$ levels were calculated for all construction activities on the line without mitigation. Where calculated levels for any activity were above the short term criterion of 70 dB $L_{Aeq,I\ hour}$ at any receptor, noise levels were recalculated with mitigation in place (in the form of 2 metre high boarding adjacent to the working area)..Prediction calculations show that, except for one area in Clackmannan, predicted noise levels, with mitigation, are at or below the short term limit of 70 dB $L_{Aeq,1h}$. For many of the construction activities the predicted noise levels are below the longer term limit of 65 dB $L_{Aeq,1h}$.

At Devonway, Clackmannan (ref. B-C1) the short-term limit is slightly exceeded for two of the operations associated with the installation of new track. The railway is on an embankment in this area and barrier positions were assumed to be at the railway property boundary in the calculations (i.e. at the foot of the embankment). The barrier attenuation will be small in this case. Employment of temporary screens, close to the work, during welding and jointing and rail stressing would reduce noise levels to below the short-term limit and is recommended.

No information was available regarding traffic flows on local roads or construction traffic numbers and routes. Thus, a detailed assessment of construction traffic noise was not possible. However, it is the intention to utilise the rail corridor to bring in as much of the construction materials as possible. This should bring significant benefits in terms of reduced road traffic noise impacts.

Vibration

With the exception of certain types of piling construction plant, equipment likely to be used at SAK is not recognised as sources of high levels of environmental vibration. Additionally, due to the nature of the work, construction activities will not be carried out for extended periods of time near sensitive receptors and vibration resulting from line work and operation of compounds is unlikely to be problematic.

Vibration from any necessary piling work on the Forth Viaduct would depend upon local ground conditions and the type of equipment used, but small diameter (150 – 200 mm) rotary bored piling equipment is expected to be used and would result in generally lower noise and vibration levels than other types of piling equipment and is to be preferred (there are various other low noise and low vibration piling options). British Standard BS 5228: part 4 lists ppvs measured at various distances from rotary bored piling operations and from these values and the calculation procedure listed in BS 6472 it is possible to empirically predict the daytime VDV at the nearest sensitive properties, which will be in Forth Street, 70 metres distant.

A typical rotary bored piling rig would generate a ppv of the order of 0.54 mms^{-1} at 5m from the operation (from BS 5228: part 4, 1992). Using the propagation relationship given in BS 5228, this results in a ppv of 0.04 mms^{-1} at properties in Forth Street, well below the level required to cause even cosmetic damage to properties and probably below the level of human perception. A steady piling vibration level of 0.04 mms^{-1} equates to an acceleration level, from BS 6472, of less than 0.005 ms^{-2}. When operating continually for a 10-hour day the corresponding vibration dose value, VDV, at properties in Forth Street is calculated to be less than 0.10 $ms^{-1.75}$. This predicted daytime VDV is well below the bottom end of the range for 'low probability of adverse comment' (0.20-0.40 $ms^{-1.75}$), and complaints regarding vibration from piling work on the Forth viaduct are highly unlikely.

Table 6.4-1: Construction Activities and Associated Equipment

Ref.	Construction Activity	Operation	Associated Equipment	No. of Units	% Ontime	SWL per Unit (dB(A))	Source Height (m)
1	Clearance of solum and slopes	a. Cutting back vegetation	Chain saw	2	10	110	1.5
			Dumper Trucks	1	50	112	1.5
2	Installation of new fencing	a. Excavation of Foundations	Excavator	1	50	110	1.5
			Lorries	2	33	105	1.5
		b. Laying Foundations	Concrete Pump	1	50	106	1.0
			Concrete Mixer	1	50	110	1.0
			Lorries	2	33	105	1.5
		c. Erection of Fencing	Hand Tools	3	50	107	1.5
			Lorries	2	10	105	1.5
3	Installation of new track	a. Drainage	Excavator	1	50	110	1.5
			Compactor	1	50	105	1.0
		b. Track Laying	Crane	1	50	109	1.0
			Excavator	1	50	110	1.5
		c. Welding and Jointing	Rail Saw	1	10	124	0.5
			Grinder	1	30	111	0.5
			Welding Kit	1	10	40	0.5
		d. Ballast Placing and Tamping	Tamper	1	50	113	1.5
			Works Train	1	100	102	1.5
		e. Rail Stressing	Rail Saw	1	10	124	0.5
			Grinder	1	15	111	0.5
			De-stressing kit	1	25	111	0.5
4	Bridge repairs and cleaning	a. Devegetation	Chain Saw	2	10	110	1.5
			Dumper Trucks	1	50	112	1.5
		b. Structural Repairs/Replacement	Excavator	1	50	110	1.5
			Loading Crane	1	50	109	1.0
		c. Blast Cleaning	Cleaning Kit	1	75	110	variable
		d. Piling (Forth Viaduct)	Piling Rig	1	50	107	variable

Table 6.4-1: (continued)

Ref.	Construction Activity	Operation	Associated Equipment	No. of Units	% Ontime	SWL per Unit (dB(A))	Source Height (m)
5	Installation of signalling and telecoms	a. Troughing Installation	Excavator	1	60	110	1.0
			Loading Crane	1	60	109	1.0
			Disc Cutter	1	5	112	0.5
		b. Cable Installation	Excavator	1	10	110	1.0
			Works Train	1	100	102	1.5
6	Construction of Alloa station	a. Foundations	Piling Rig	1	75	107	1.5
			Concrete Pump	2	50	106	1.0
			Lorries	3	33	105	1.5

		b. Main Structures/Buildings	Loading Crane Lorries	1 3	50 33	109 105	1.0 1.5
7	Roadworks (level crossings/carparks/access)	a. Removal/Repair of Existing Structures	Breaker Compressor	1 1	50 100	116 93	0.5 0.5
		b. Resurfacing/Repair	Resurfacing Kit Lorries	1 2	75 33	108 105	0.5 1.5

8	Operation of Construction Compounds	a. Loading/Unloading of Materials	Loading Crane Forklift Lorries	1 1 3	50 75 33	109 108 105	1.0 1.0 1.5
		b. Other General Site Activities	Generator Hand Tools	1 3	100 10	95 105	0.5 1.5

Table 6.4-2: Construction of SAK Railway. Calculated $L_{Aeq,1\ h}$ values (with and without mitigation)

Construction Activity	Operation	Receptor Position					
		B-S2	B-S6	B-S7	B-S10	B-S13	B-S14
		Predicted noise level, dB $L_{Aeq,1h}$					
Clearance of solum and slopes	a. Cutting back vegetation	69 (61)	69 (63)		72 (64)	61	67 (61)
Installation of new fencing	a. Excavation of Foundations	68 (60)	67 (61)		71 (63)	60	66 (60)
	b. Laying Foundations	69 (61)	70 (64)		72 (64)	61	67 (61)
	c. Erection of Fencing	69 (61)	58 (52)		71 (63)	60	66 (60)
Installation of new track	a. Drainage	67 (59)	57 (51)		70 (62)	59	65 (59)
	b. Track Laying	69 (61)	69 (63)		72 (64)	61	67 (61)
	c. Welding and Jointing	74 (66)	74 (68)		75 (67)	66	72 (66)
	d. Ballast Placing and Tamping	70 (62)	70 (64)		73 (65)	62	68 (62)
	e. Rail Stressing	74 (66)	74 (68)		77 (69)	66	72 (66)
Bridge repairs and cleaning	a. Devegetation						67 (61)
	b. Structural Repairs						67 (61)
	c. Blast Cleaning						64 (58)
	d. Piling (Forth Viaduct)						61 (55)
Installation of signalling and telecoms	a. Troughing Installation	68 (60)	70 (64)		73 (65)	62	68 (62)
	b. Cable Installation	63 (55)	63 (57)		66 (58)	55	61 (55)
Construction of Alloa station	a. Foundations	69 (61)	70 (64)		72 (64)	61	67 (61)
	b. Main Structures/Buildings	69 (61)	70 (64)		72 (64)	61	67 (61)
Roadworks	a. Removal/Repair of Existing Structures			60			
	b. Resurfacing/Repair			65			
Operation of Construction Compounds	a. Loading/Unloading of Materials b. Other General Site Activities					55	60

Note: calculated noise levels with mitigation given in brackets

Table 6.4-3: Construction of SAK Railway. Calculated $L_{Aeq,1\ h}$ values (with and without mitigation)

Construction Activity	Operation	Receptor Position							
		B-A2	B-A6	B-A9	B-A10	B-A11	B-A12	B-A13	B-A16
		Predicted noise level, dB $L_{Aeq,1h}$							
Clearance of solum and slopes	a. Cutting back vegetation	63	75 (65)	68 (62)	65	68 (60)	75 (63)	74 (65)	71 (63)
Installation of new fencing	a. Excavation of Foundations	62	74 (64)	67 (61)	64	67 (59)	74 (62)	73 (64)	70 (62)
	b. Laying Foundations	63	75 (65)	68 (62)	65	68 (60)	75 (63)	74 (65)	71 (63)
	c. Erection of Fencing	62	74 (64)	67 (61)	64	67 (59)	74 (62)	73 (64)	70 (62)
Installation of new track	a. Drainage	61	73 (63)	66 (60)	63	64 (58)	73 (61)	72 (63)	69 (61)
	b. Track Laying	63	75 (65)	68 (62)	65	68 (60)	75 (63)	74 (65)	71 (63)
	c. Welding and Jointing	68	80 (70)	73 (67)	70	73 (65)	80 (68)	79 (70)	76 (68)
	d. Ballast Placing and Tamping	64	76 (66)	69 (63)	66	69 (61)	76 (64)	75 (66)	72 (64)
	e. Rail Stressing	68	80 (70)	73 (67)	70	73 (65)	80 (68)	79 (70)	76 (68)
Bridge repairs and cleaning	a. Devegetation						75 (63)		
	b. Structural Repairs						75 (63)		
	c. Blast Cleaning						72 (60)		
	d. Piling (Forth Viaduct)								
Installation of signalling and telecoms	a. Troughing Installation	64	76 (66)	69 (63)	66	69 (61)	76 (64)	75 (66)	72 (64)
	b. Cable Installation	57	69 (59)	62 (56)	59	62 (54)	69 (57)	68 (59)	65 (57)
Construction of Alloa station	a. Foundations	65	75 (65)	68 (62)	65	68 (60)	75 (63)	74 (65)	71 (63)
	b. Main Structures/Buildings	65	75 (65)	68 (62)	65	68 (60)	75 (63)	74 (65)	71 (63)
Roadworks	a. Removal/Repair of Existing Structures	56							
	b. Resurfacing/Repair	61							
Operation of Construction Compounds	a. Loading/Unloading of Materials b. Other General Site Activities		59			61	64		

Note: calculated noise levels with mitigation given in brackets

Table 6.4-4: Construction of SAK Railway. Calculated $L_{Aeq,1\ h}$ values (with and without mitigation)

Construction Activity	Operation	Receptor Position							
		B-C1	B-C2	B-C3	B-C9	B-C11	B-C13	B-C15	B-C16
		Predicted noise level, dB $L_{Aeq,1h}$							
Clearance of solum and slopes	a. Cutting back vegetation	73 (68)	67 (61)	71 (64)	73 (65)	59	62	67 (61)	65
Installation of new fencing	a. Excavation of Foundations	72 (67)	66 (60)	70 (63)	72 (64)	58	61	66 (60)	64
	b. Laying Foundations	73 (68)	67 (61)	71 (64)	73 (65)	59	62	67 (61)	65
	c. Erection of Fencing	72 (67)	66 (60)	70 (63)	72 (64)	58	61	66 (60)	64
Installation of new track	a. Drainage	71 (66)	65 (59)	69 (62)	71 (63)	59	60	65 (59)	63
	b. Track Laying	73 (68)	67 (61)	71 (64)	73 (65)	59	62	67 (61)	65
	c. Welding and Jointing	78 (73)	72 (66)	76 (69)	78 (70)	64	67	72 (66)	70
	d. Ballast Placing and Tamping	74 (69)	68 (62)	72 (65)	74 (66)	60	63	68 (62)	66
	e. Rail Stressing	78 (73)	72 (66)	76 (69)	78 (70)	64	67	72 (66)	70
Bridge repairs and cleaning	a. Devegetation	73 (68)		71 (64)	72 (64)			67 (61)	
	b. Structural Repairs	73 (68)		71 (64)	73 (65)			67 (61)	
	c. Blast Cleaning	70 (65)		68 (61)	70 (62)			64 (58)	
	d. Piling (Forth Viaduct)								
Installation of signalling and telecoms	a. Troughing Installation	73 (69)	68 (62)	72 (65)	74 (66)	60	63	68 (62)	66
	b. Cable Installation	67 (62)	61 (55)	65 (58)	67 (59)	53	56	61 (55)	59
Construction of Alloa station	a. Foundations	73 (68)	67 (61)	71 (64)	73 (65)	59	62	67 (61)	65
	b. Main Structures/Buildings	73 (68)	67 (61)	71 (64)	73 (65)	59	62	67 (61)	65
Operation of Construction Compounds	a. Loading/Unloading of Materials b. Other General Site Activities		56			54			51

Note: calculated noise levels with mitigation given in brackets

Table 6.4-5: Construction of SAK Railway. Calculated $L_{Aeq,1\ h}$ values (with and without mitigation)

Construction Activity	Operation	Receptor Position					
		B-K1	B-K2	B-K4	B-K5	B-K7	B-K8
		Predicted noise level, dB $L_{Aeq,1h}$					
Clearance of solum and slopes	a. Cutting back vegetation	71 (64)	51	77 (65)		52	53
Installation of new fencing	a. Excavation of Foundations	70 (63)	50	76 (64)		51	55
	b. Laying Foundations	71 (64)	51	77 (65)		51	56
	c. Erection of Fencing	70 (63)	50	76 (64)		51	55
Installation of new track	a. Drainage	69 (62)	49	75 (63)		50	54
	b. Track Laying	71 (64)	51	77 (65)		52	56
	c. Welding and Jointing	76 (69)	56	80 (70)		57	61
	d. Ballast Placing and Tamping	72 (65)	52	78 (66)		53	57
	e. Rail Stressing	76 (69)	56	80 (70)		57	61
Bridge repairs and cleaning	a. Devegetation	71 (64)	51	77 (65)		52	56
	b. Structural Repairs	71 (64)	51	77 (65)		52	56
	c. Blast Cleaning	68 (61)	48	74 (62)		49	53
	d. Piling (Forth Viaduct)						
Installation of signalling and telecoms	a. Troughing Installation	72 (65)	52	78 (66)		53	57
	b. Cable Installation	65 (58)	45	71 (59)		46	50
Construction of Alloa station	a. Foundations	71 (64)	51	77 (65)		52	56
	b. Main Structures/Buildings	71 (64)	51	77 (65)		52	56
Roadworks	a. Removal/Repair of Existing Structures				53		
	b. Resurfacing/Repair				58		
Operation of Construction Compounds	a. Loading/Unloading of Materials	46					

Note: calculated noise levels with mitigation given in brackets

APPENDIX 6E: AELR Construction Noise and Vibration

Noise

The activities and equipment associated with the construction of the link road are given in Table 6.5-1. For each activity, worst case free-field $L_{Aeq,1h}$ values were calculated at the nearest sensitive receptors, using the SoundPLAN suite of programs. This prediction tool implements the procedures of ISO9613-2 for the calculation of industrial noise, which shares many features with BS5228 Part 1. For most activities it was assumed that a 2 metre temporary or permanent barrier was in place to shield sensitive receptors from construction work noise (in the form of close boarded fencing or earth bunding). No shielding was assumed for topsoil removal and part of the demolition work. The receptor positions employed in the calculations were;-

- Property fronting roundabout, north end of Hilton Road
- Property backing on to proposed link road, Hilton Crescent
- Proposed new housing to south of Hilton Crescent, assumed to be 25 metres from proposed link road
- Property on Clackmannan Road, nearest to proposed new roundabout

The results are summarized in Table 6.5-2. It can be seen that predicted noise levels are below the short-term daytime limit of 70 dB $L_{Aeq,1h}$ at any given single receptor and that, for much of the work, the predicted noise levels are below the long term daytime limit of 65 dB $L_{Aeq,1h}$. The noise levels in the above table are worst-case values, with the construction activities assumed to be at the nearest approach to the receptors. In practice, the construction work will be at greater distances from the receptors for much of the time and receptor noise levels will be significantly lower.

Vibration

Apart from piling, the equipment assumed for the calculations is not recognised as sources of high levels of environmental vibration.

The nature of any piling work required for the construction of the bridge over the railway line at the south end of the link road has not yet been specified and would depend upon local ground conditions, but rotary bored piling would result in generally lower noise and vibration levels and is to be preferred (there are various other low noise and low vibration piling options). British Standard BS 5228: part 4 lists ppvs measured at various distances from rotary bored piling operations and from these values and the calculation procedure listed in BS 6472 it is possible to empirically predict the daytime VDV at the nearest sensitive properties, which will be "The Bungalow" on Clackmannan Road, at over 300 metres distance, or the possible new housing between Hilton Road and the Relief Road, the exact location of which has not been decided.

From BS6472, to be below the range for a "low probability of adverse comment", the VDV value must be less than 0.2 $ms^{-1.75}$ during the daytime. For a 10-hour working day this equates to a ppv value of 0.282 mms^{-1}. A typical rotary bored piling rig would generate a ppv of the order of 0.54 mms^{-1} at 5m from the operation (from BS 5228: part 4, 1992). Using the propagation relationship given in BS 5228 part 4, a rotary bored piling rig would generate a level of 0.282 mms^{-1} at a distance of approximately 10 metres. This is well

below the distance to any existing properties. Any new housing within 10 metres of the bridge piling work would be subject to levels of vibration that may lead to adverse comment.

Table 6.5-1: Alloa Eastern Link Road. Construction Activities

Ref.	Construction Activity	Operation	Associated Equipment	No. of Units	% Ontime	SWL per Unit (dB(A))	Source Height (m)
1	Demolition of Buildings	a. Demolition and Site Clearance	Tracked Crane	1	75	120	1.5
			Lorries	2	10	105	1.5
			Loader	1	50	105	1.5
2	Ground Stabilisation	a. Pressure Grouting	Pump	1	75	106	1.0
3	Road Building	a. Topsoil Removal and Bund Construction	Scraper	2	50	110	1.5
			Bulldozer	1	33	110	1.5
		b. Sub-base	Bulldozer	1	50	110	1.5
			Compactor	1	50	117	1.5
		c. Surfacing	Asphalt Spreader	1	75	101	1.5
			Roller	1	50	101	1.5
			Lorries	2	10	105	1.5
4	Roundabout Construction	a. Breaking and Removal of Surface	Excavator	1	75	110	1.5
			Lorries	2	10	105	1.5
		b. Sub-base	Loader	1	50	105	1.5
			Compactor	1	50	110	1.5
		c. Surfacing	Asphalt Spreader	1	75	101	1.5
			Roller	1	50	101	1.5
			Lorries	2	10	105	1.5
5	Bridge Construction	a. Piling	Piling Rig	1	50	116	variable
		b. Concreting	Pump	1	75	109	1.5
			Poker Vibrator	2	50	102	1.0
		c. Assembly	Tracked Crane	1	75	120	1.5
			Lorries	2	10	105	1.5

Table 6.5-2: Construction of Alloa Eastern Relief Road. Calculated $L_{Aeq,1h}$ Values

Activity	Operation	Receptor Position, $L_{Aeq,1h}$			
		1	2	3	4
Demolition of Buildings	Demolition/Site Clearance	-	70.0		-
Ground Stabilisation	Pressure Grouting	58.0	50.0	57.4	37.5
Road Building	Topsoil Removal/Bund Building	64.0	62.0	69.4	-
	Sub-base	68.0	60.0	67.4	-
	Surfacing	56.0	48.0	55.4	-
Roundabout Construction	Breaking/Removal of Surface	69.8	-	-	41.5
	Sub-base	68.8	-	-	40.5
	Surfacing	63.8	-	-	35.5
Bridge Construction	Piling	-	-	41.1	45.5
	Concreting	-	-	37.1	41.5
	Assembly	-	-	47.1	51.5

6.1 Railway Operational Noise

For the supplied train schedule and speed profile, façade noise levels were calculated to both ground and first floor levels, using the Calculation of Railway Noise 1995 (CRN) (Reference 15) method, for selected properties fronting the railway corridor along the full length of the route. This method allows calculation of day (06:00-24:00) and night-time (24:00-06:00) railway noise levels. Initially, no noise mitigation was assumed. A total number of 30 rail freight movements (15 each way) and 34 rail passenger movements (17 each way) were used , based on information supplied. Rail freight movements will occur along the whole length of the line, but passenger movements only between Stirling and Alloa. The detailed results are given in Tables 6.6-1 to 6.6-4 at the end of this section.

The following rail movements were used:

- 30 freight movements comprising 19 type HTA coal wagons hauled by Class 66 diesel locomotive
- 34 passenger movements comprising 2-car Class 166 DMU.

These reflect the design capacity of the route taking into account, particularly the signaling system and the number of passing places. It is expected in reality that on an average day the number of coal train movements will be significantly less than this but that some of the spare path capacity could be used by other freight trains.

The façade noise levels were converted to daytime (07:00-19:00) and evening (19:00-23:00) free-field levels using recognized formulae (since a precise rail movement timetable is not currently available to allow actual time period calculation). For night-time (23:00-07:00) the indication is that there would only be two passenger train movements, allowing an exact prediction of night-time railway noise. Calculation of day, evening and night-time noise levels is a requirement for environmental noise impact assessment of EC Directive 2002/49/EC 'Relating to the assessment and management of environmental noise' (Reference 18). These data were processed with the measured ambient noise levels to estimate the increases in daytime, evening and night-time free-field levels due to the operation of the line. The detailed results are given in Tables 6.6-5 to 6.6-8.

These results were used to assess the need for mitigation in the form of lineside barriers. Applying the defined methodology, all residential properties subject to a façade noise level (due to railway noise) equal to or greater than 55 dB $L_{Aeq,18h}$, and subject to an increase in free-field noise level equal to or greater than 5dB were considered for mitigation.

Barriers for line sections requiring mitigation were specified (in the form of 2 metre high reflective barrier, such as close-boarded timber fencing) and façade noise levels for the selected properties were recalculated. The detailed results are given in Tables 6.6-9 to 6.6-12.

As before, the façade noise levels were converted to daytime (07:00-19:00), evening (19:00-23:00) and night-time (23:00-07:00) free-field levels. These data were processed with the measured ambient noise levels to estimate the increases in daytime, evening and night-time free-field levels due to the operation of the line. The detailed results are given in Tables 6.6-13 to 6.6-16.

From the tables below it can be seen that, after noise barrier mitigation, there are four properties where daytime railway noise levels approach the limit of 68 dB $L_{Aeq,16h}$ and these

properties may qualify for noise treatment to the provisions of the Noise Insulation Regulations (although it is not clear if these currently apply in Scotland). CRN requires that noise levels are measured where properties are within 10m of the railway to validate any tentative predictions at such close distance. Consequently it will be necessary to revisit these properties and take actual façade noise measurements once the railway is operational to confirm the predicted noise levels and hence the qualification for noise insulation. These properties (or areas) are:

1. 60 Alloa Road, Stirling

2. Park Place, Alloa

3. Northfield Gardens, Clackmannan

4. Devonway, Clackmannan

From the tables below and from property counts taken from noise maps provided by the SoundPLAN noise prediction software the following overall noise impact table, after noise mitigation, has been concluded, Table 6.6-17

Table.6-17: Overall Summary of Noise Impact

Due To Operation Of Railway (With Mitigation)

Daytime ground floor façade noise level (due to railway) dB $L_{Aeq,18h}$	Total number of residential properties	Increase in Evening L_{Aeq}	Number of residents likely to be annoyed (from GoMMMS) (long term)	Actual number of residents likely to be annoyed (long term)
55 < 60	12 2 31 33	< 1 1 < 3 3 < 5 5 < 10	<16%	< 30
60 < 65	2 15	3 < 5 5 < 10	<22%	< 9
65 > 70	0	-	<30%	0

The residual impact, after mitigation in the form of lineside acoustic barriers, results in 48 properties along the route of the line exposed to a short-term moderate impact (an increase of 5-10 dB) and 33 properties exposed to a minor short-term impact (an increase of 3 to 5 dB(A)), as defined in Volume 2, Table 11.1, from a total of approximately 410 properties within 50m of the track along its proposed 21 km length.

It can be seen that 95 properties would be exposed to a long-term daytime noise level in excess of 55 dB $L_{Aeq,18h}$ (after mitigation). Specific to long term annoyance, using the average household occupancy of 2.4 residents per property, statistical information from Table 4.2 of GoMMMS indicates that less than 39 residents along the length of the 21 km railway would be 'annoyed' in the long term by rail traffic noise.

There is no recognised method for assessing the short-term impact of an increase in railway noise (although short-term impact assessment is reported in DMRB for increases in road

traffic noise) due primarily to the lack of social studies along railways subject to abrupt increases (or reductions) in rail traffic. It is expected that in the short-term (from day of opening) there would be more residents annoyed by noise, this decreasing in the long term due to familiarisation. By considering a requirement for noise mitigation for areas subject to increases above 5 dB(A) (and above 55 dB(A)) it is considered that short-term annoyance has been reduced as far as reasonably practicable. Reference to the above table indicates that there would be only 48 properties subject to increases of 5-10 dB(A) (to above 55 dB $L_{Aeq,18h}$) and if every resident at each of those properties were 'annoyed' in the short term then this is equivalent to approximately 115 residents, this reducing in the long term to the final figure (concluded above) of less than 39 residents 'annoyed'. (Other residents along the route may be annoyed in the short-term but since the final railway noise level at their properties would be below 55 dB $L_{Aeq,18h}$ the implication is that in the long term those residents would not eventually be 'annoyed' by railway noise).

There are only two passenger train movements during night-time, one occurring in each period 23:00-24:00 and 06:00-07:00. Consequently, increases in night-time L_{Aeq} values at first floor level, due to the operation of the railway, are generally negligible, except for two properties on Alloa Road, Stirling, where the increases are approximately 6 dB. At these properties, however, the resultant free-field noise levels are still below 45 dB $L_{Aeq,8h}$ and should prove acceptable.

Specific to night-time sleep disturbance, the $L_{Amax,fast}$ level can be estimated from the train sound exposure level (SEL) using the equation;

$L_{Amax,fast} = 0.973\ SEL - 3.9 \log_{10}(t)$

Where t is the time taken for the train to pass (in seconds)

For a two car DMU travelling at 70 mph estimated façade noise levels are;-

$L_{Amax,fast}$ = 75 to 81 at 10 metres from the line, depending on the barrier attenuation

$L_{Amax,fast}$ = 70 to 72 at 20 metres from the line, depending on the barrier attenuation

Inspection of the ambient baseline measurements shows a number of current exceedances of the 60 dB $L_{Amax,fast}$ limit during the night-time period prior to railway development, at Wallace Gardens, Stirling, Dirleton Gardens, west Alloa and Bruce Street, Alloa. Consequently residents at these locations currently choosing to sleep with bedroom windows open might experience sleep disturbance from existing noise sources. Sleeping with bedroom windows closed would protect against likely sleep disturbance up to a façade level of 75 dB $L_{Amax,fast}$. Given that there would be only one passenger movement in each period 23:00-24:00 and 06:00-07:00 and that the maximum noise level may only exceed 75 dB $L_{Amax,fast}$ at bedroom windows within approximately 15m of the track it is considered unlikely that $L_{Amax,fast}$ levels due to these two train movements will contribute to sleep disturbance at properties in Stirling and Alloa. Indication is that there would be no timetabled railway movements at all in the period 24.00-06.00.

6.1.1 Fixed Plant Noise

Ambient night-time noise levels indicate that the background noise falls to approximately 20 dB L_{A90} in the early hours of the morning at some residential properties along the proposed railway. This is a particularly low night-time noise level.

It is proposed that a limit of 25 dB L_{Aeq} at nearest residential property is set for noise from fixed plant that may operate on a 24-hour basis. For plant that operates on a daytime only basis a relaxed criterion of 40 dB L_{Aeq} is appropriate (from an evening minimum ambient background noise level of 34.5 dB L_{A90} measured at 22 Brooknowe Drive, Kincardine, Volume 2, Table 11-2).

Although proposed location of some plant is known, the actual fixed plant schedule is not finalised. Once this is finalised it is recommended that a specific fixed plant noise impact prediction is undertaken to enable identification of any necessary noise mitigation measures.

Fixed plant is relatively easy to attenuate (specification of noise-reduced plant, in-duct silencers, lined cowls, screening, purpose built enclosures etc.) and there is no reason why noise from fixed plant should prove problematical for the SAK development.

6.1.2 Alloa Station

A new single platform station, and associated 50 space car park, is planned for Alloa. The operation of the station has the potential to cause noise nuisance due to station operations and car park activity.

The station will be accessed from the ring road in Alloa via a new roundabout. The ring road is a busy through route (>15000 vehicles per day) and the extra traffic due to the operation of the station car park is very unlikely to increase traffic levels to such an extent that traffic noise changes are noticeable.

Noise measurements at a similar sized station with associated car park (slightly larger at approximately 100 spaces) gave measured noise levels of 55-58 dB $L_{Aeq,15min}$ at a location 25 metres from the station during the morning (07:00 to 09:00) and evening (17:00 to 19:00) "rush hour" periods. At Alloa, the nearest residential properties to the proposed station are in Sunnyside Court, 90 metres to the north. A level of 58 dB(A) at 25 metres is equivalent to 47 dB(A) at 90 metres. Also, properties in Sunnyside Court will be shielded from the station car park activity by the station buildings and fencing to the railway, resulting in an estimated "worst-case" noise level at Sunnyside Court of approximately 40 dB L_{Aeq}.

This level is only 4 dB(A) above the prevailing background noise level during the most sensitive periods (23:00-24:00 and 06:00-07:00); the station will not be operational during night-time and consequently it is concluded that noise from station activity will be significant at Alloa.

6.1.3 Level Crossings (Audible Warnings)

Level crossings which are to be maintained and upgraded on the line will require audible warning signals. The Railtrack Group Standard, GK/RT0300 deals specifically with this issue and requires that the audible signal output be adjustable to suit local background noise conditions to ensure audibility in areas of high background noise level and to reduce

potential for complaint in areas of low background noise level (an adjustment range of 60 to 80 dB(A) at 3 metres from the equipment is cited). There will be 8 level crossings along the scheme, with residential property within 10m at Kincardine Station Road and 13m at Waterside. At all other crossings residential property is at significantly increased distance.

At minimum setting, an alarm noise level of 60 dB(A) at 3m becomes less than 50 dB(A) at 10m at property at Kincardine Station Road (for example). Ambient daytime noise levels to that area are reasonably low at typically 48 dB L_{Aeq} (location F2, 17 Ochilview, Kincardine). Consequently in proximity to the rail crossing the alarm would prove perfectly audible to pedestrians, exceeding the ambient noise by at least 10 dB(A), but at nearest residential property would not exceed ambient noise levels by more than 5 dB(A). This should prove perfectly acceptable. Warning horns are likely to prove highly directional and if directed to the footway and away from properties the noise level at the properties would be further reduced.

6.1.4 Proposed Residential Development

There are currently four areas planned for residential development along the route of the railway. The potential impact of railway noise on those areas of land is considered here;-

Area between north end of Causewayhead Road and railway, Stirling

Without mitigation the daytime 55 dB(A) contour, due to the operation of the railway, would be 50 metres from the rail head. Consequently, potential residential development within 50 metres from the rail head would require some form of mitigation to reduce daytime noise levels to below the upper limit of Noise Exposure Category A (NEC A) defined in PAN56 for noise not to be a concern. This would primarily involve a noise barrier to garden areas to protect garden areas and ground floor facades. Actual mitigation measures would depend on the layout of the proposed housing. Any such barrier is not included in the current specification for this railway.

With mitigation in the form of 2 metre high close-boarded wooden fencing (or similar) at the railway boundary, the daytime 55 dB(A) contour is reduced to 10 metres from the rail head, bringing a substantial part of the site into NEC A. For any areas of the site that remain in NEC B noise mitigation measures would be possible to reduce noise levels internal to habitable rooms (at NEC B this would primarily consist of acoustic ventilation).

Area to the rear of Station Road, Cambus, adjacent to the railway

Similarly, without mitigation the daytime 55 dB(A) NEC contour, due to the operation of the railway, would be 60 metres from the rail head.

With mitigation, in the form of 2 metre high close-boarded wooden fencing (or similar) at the railway boundary, the 55 dB(A) contour is reduced to 16 metres from the rail head, bringing a substantial part of the site into NEC A. Any such barrier is not included in the current specification for this railway.

Area between Hilton Road and the proposed Alloa Relief Road

Without mitigation the 55 dB(A) contour, due to the operation of the railway, is at 50 metres from the rail head. With mitigation, in the form of 2 metre high close-boarded wooden fencing (or similar) at the railway boundary, the 55 dB(A) contour is reduced to 12 metres from the rail head. Any such barrier is not included in the current specification for this railway.

Area to the north of Kennet, Clackmannan, adjacent to the railway

Without mitigation the 55 dB(A) contour, due to the operation of the railway, is at 55 metres from the rail head. With mitigation, in the form of 2 metre high close-boarded wooden fencing (or similar) at the railway boundary, the 55 dB(A) contour is at 10 metres from the rail head, bringing a substantial part of the site into NEC A. Any such barrier is not included in the current specification for this railway.

Table 6.6-1: Predicted Façade L_{Aeq} Levels For Operation Of Railway (No Mitigation)

Ref.	Location	Daytime 06:00-24:00	
		Floor	
		1	2
B-S1	126 Causewayhead Road, Stirling	63.8	63.8
B-S2	100 Causewayhead Road, Stirling	64.8	64.7
B-S3	74 Causewayhead Road, Stirling	65.9	65.7
B-S4	50 Causewayhead Road, Stirling	61.3	61.4
B-S5	53 Causewayhead Road, Stirling	57.2	57.3
B-S6	36 Wallace Gardens, Stirling	65.4	65.4
B-S7	58 Wallace Gardens, Stirling	69.2	69.1
B-S8	5-8 Alloa Road, Stirling, Stirling	66.0	66.0
B-S9	48 Alloa Road, Stirling, Stirling	68.7	68.6
B-S10	58-60 Alloa Road, Stirling, Stirling	68.1	67.9
B-S11	“Abbeycraig”, off Alloa Road, Stirling	69.1	68.9
B-S12	Sidas Craigmill House, Alloa Road	57.7	57.8
B-S13	Manorneuk Farm, off A907	57.2	57.3
B-S14	3-4 Forth Street, Stirling	56.6	56.7
B-S15	46-48 Forth Street, Stirling	58.7	58.6

Table 6.6-2: Predicted Façade L_{Aeq} Levels For Operation Of Railway (No Mitigation)

Ref.	Location	Daytime 06:00-24:00	
		Floor	
		1	2
B-A1	Southern edge of Tullibody	53.1	53.3
B-A2	12 Station Road, Cambus	62.0	62.1
B-A3	“Woodside”, off A907 near Cambus	67.0	66.9
B-A4	“The Gables”, off A907 near Cambus	68.6	68.5
B-A5	14-16 Mitchell Crescent, West Alloa	62.5	62.5
B-A6	75 Grange Road, West Alloa	71.1	71.0
B-A7	25 Grange Road, West Alloa	62.5	69.2
B-A8	50 Stirling Road, West Alloa	56.6	56.8
B-A9	9 Kellie Place, Alloa	51.1	56.7
B-A10	2 Erskine Street, Alloa	49.9	51.4
B-A11	39 Sunnyside Court, Alloa	56.9	58.3
B-A12	26-28 Kingswell Park, Alloa	66.4	66.3
B-A13	22 Park Place, Alloa	69.5	69.3
B-A14	21 Bruce Street, Alloa	68.3	68.2
B-A15	3 Arrol Crescent, Alloa	67.5	67.4
B-A16	House, Hilton Road Crossing, Alloa	67.5	67.4
B-A17	“The Bungalow”, Clackmannan Road	64.9	64.9
B-A18	Within Tullibody	42.3	46.3
B-A19	10 Alexandra Drive, Alloa	40.5	42.5
B-A20	15 Hotton Park, Alloa	50.6	50.8

Table 6.6-3: Predicted Façade L_{Aeq} For Operation Of Railway (No Mitigation)

Ref.	Location	Daytime 06:00-24:00	
		Floor	
		1	2
B-C1	101 Devonway, Clackmannan	68.6	68.6
B-C2	"Dalairn", Helensfield, Clackmannan	59.3	59.4
B-C3	1 Mill Road, Clackmannan	65.2	65.0
B-C4	45 Alloa Road, Clackmannan	63.5	63.2
B-C5	2 Park Place, Clackmannan	62.2	62.1
B-C6	9 Park Place, Clackmannan	61.8	61.7
B-C7	21 Brucefield Gardens, Clackmannan	65.1	64.9
B-C8	1 Northfield, Clackmannan	66.2	
B-C9	Northfield, Clackmannan	65.7	65.5
B-C10	39 St Seres Grove, Clackmannan	61.2	61.2
B-C11	20 Ladywood, Clackmannan	57.4	57.4
B-C12	Meadow Grove, Kennet	54.9	55.1
B-C13	20 Main Street, Kennet	56.6	56.8
B-C14	"Meadowend Bungalow", Kennet	57.3	57.4
B-C15	"Bracken Brae", Kennet	66.7	66.7
B-C16	"Ambleside Haven", Kilbagie	61.4	61.4
B-C17	"Darhamie Toll", Broomknowe	53.4	53.6
B-C18	"Broomknowe", Broomknowe	54.3	54.5

Table 6.6-4: Predicted Façade L_{Aeq} Levels For Operation Of Railway (No Mitigation)

Ref.	Location	Daytime 06:00-24:00	
		Floor	
		1	2
B-K1	22 Broomknowe Drive, Tulliallan	57.0	66.7
B-K2	49 Hawkhill Road, Kincardine	55.9	55.8
B-K3	Kilbagie Street, Kincardine	50.4	50.5
B-K4	17 Ochilview, Kincardine	59.6	59.0
B-K5	16 Ochilview, Kincardine	59.6	59.4
B-K6	21 Forth Street, Kincardine	51.8	51.9
B-K7	13 Orchard Grove, Kincardine	44.2	44.4
B-K8	Tulliallan Castle, Tulliallan	46.3	47.1

Table 6.6-5: Predicted Increases In Free Field L_{Aeq} Levels For Operation Of Railway (No Mitigation)

Ref.	Location	Daytime 07:00-19:00		Evening 19:00-23:00		Night-time 23:00-07:00	
		Floor		Floor		Floor	
		1	2	1	2	1	2
B-S1	126 Causewayhead Road, Stirling	1.7	1.7	6.8	6.8	2.7	2.7
B-S2	100 Causewayhead Road, Stirling	2.0	2.0	7.6	7.5	3.1	3.1
B-S3	74 Causewayhead Road, Stirling	2.5	2.4	8.6	8.4	3.7	3.7
B-S4	50 Causewayhead Road, Stirling	1.0	1.1	5.0	5.0	1.7	1.7
B-S5	53 Causewayhead Road, Stirling	0.4	0.4	2.6	2.7	0.7	0.8
B-S6	36 Wallace Gardens, Stirling	12.6	12.6	19.4	19.4	4.1	4.0
B-S7	58 Wallace Gardens, Stirling	16.3	16.2	23.2	23.1	6.7	6.7
B-S8	5-8 Alloa Road, Stirling, Stirling	13.2	13.2	20.0	20.0	4.4	4.4
B-S9	48 Alloa Road, Stirling, Stirling	15.8	15.7	22.7	22.6	6.3	6.2
B-S10	58-60 Alloa Road, Stirling, Stirling	15.2	15.0	22.1	21.9	5.8	5.7
B-S11	“Abbeycraig”, off Alloa Road, Stirling	16.2	16.0	23.1	22.9	6.7	6.5
B-S12	Sidas Craigmill House, Alloa Road	6.0	6.0	12.0	12.1	1.0	1.0
B-S13	Manorneuk Farm, off A907	5.6	5.7	11.5	11.6	0.9	0.9
B-S14	3-4 Forth Street, Stirling	5.2	5.2	11.0	11.1	0.1	0.1
B-S15	46-48 Forth Street, Stirling	6.7	6.7	12.9	12.8	0.0	0.0

Table 6.6-6: Predicted Increases In Free Field L_{Aeq} Levels For Operation Of Railway (No Mitigation)

Ref.	Location	Daytime 07:00-19:00		Evening 19:00-23:00		Night-time 23:00-07:00	
		Floor		Floor		Floor	
		1	2	1	2	1	2
B-A1	Southern edge of Tullibody	1.5	1.5	4.2	4.3	0.4	0.4
B-A2	12 Station Road, Cambus	6.2	6.3	11.3	11.4	5.1	5.2
B-A3	“Woodside”, off A907 near Cambus	10.4	10.3	16.1	16.0	4.2	4.2
B-A4	“The Gables”, off A907 near Cambus	11.9	11.8	17.7	17.6	5.2	5.2
B-A5	14-16 Mitchell Crescent, West Alloa	5.1	5.1	7.4	7.4	0.3	0.3
B-A6	75 Grange Road, West Alloa	12.4	12.3	15.2	15.1	1.8	1.8
B-A7	25 Grange Road, West Alloa	5.1	10.6	7.4	13.4	0.3	1.3
B-A8	50 Stirling Road, West Alloa	2.8	2.9	4.5	4.6	0.6	0.6
B-A9	9 Kellie Place, Alloa	1.0	2.9	1.8	4.6	0.2	0.6
B-A10	2 Erskine Street, Alloa	0.8	1.1	1.4	1.9	0.1	0.2
B-A11	39 Sunnyside Court, Alloa	3.0	3.7	4.7	5.4	0.2	0.5
B-A12	26-28 Kingswell Park, Alloa	15.5	15.4	19.4	19.4	-	-
B-A13	22 Park Place, Alloa	18.6	18.4	22.5	22.3	-	-
B-A14	21 Bruce Street, Alloa	17.4	17.3	21.3	21.2	-	-
B-A15	3 Arrol Crescent, Alloa	16.6	16.5	20.5	20.4	-	-
B-A16	House, Hilton Road Crossing, Alloa	10.9	10.8	13.7	13.6	-	-
B-A17	“The Bungalow”, Clackmannan Road	8.6	8.6	11.2	11.2	-	-
B-A18	Tullibody	0.5	1.3	1.3	2.7	0.4	0.5

B-A19	10 Alexandra Drive, Alloa	0.4	0.6	0.9	1.3	-	-
B-A20	15 Hotton Park, Alloa	2.8	2.9	5.2	5.3	-	-

Table 6.6-7: Predicted Increases In Free Field L_{Aeq} Levels For Operation Of Railway (No Mitigation)

Ref.	Location	Daytime 07:00-19:00		Evening 19:00-23:00		Night-time 23:00-07:00	
		Floor		Floor		Floor	
		1	2	1	2	1	2
B-C1	101 Devonway, Clackmannan	18.7	18.7	21.6	21.6	-	-
B-C2	"Dalairn", Helensfield, Clackmannan	4.3	4.4	7.2	7.3	-	-
B-C3	1 Mill Road, Clackmannan	15.3	15.1	18.3	18.1	-	-
B-C4	45 Alloa Road, Clackmannan	13.7	13.4	16.6	16.3	-	-
B-C5	2 Park Place, Clackmannan	12.5	12.4	15.3	15.2	-	-
B-C6	9 Park Place, Clackmannan	12.1	12.0	14.9	14.8	-	-
B-C7	21 Brucefield Gardens, Clackmannan	15.2	15.0	18.2	18.0	-	-
B-C8	1 Northfield, Clackmannan	4.2	-	6.3	-	-	-
B-C9	Northfield, Clackmannan	3.9	3.8	6.0	5.8	-	-
B-C10	39 St Seres Grove, Clackmannan	11.5	11.5	14.4	14.4	-	-
B-C11	20 Ladywood, Clackmannan	8.1	8.1	10.8	10.8	-	-
B-C12	Meadow Grove, Kennet	1.7	1.8	2.1	2.2	-	-
B-C13	20 Main Street, Kennet	2.4	2.5	2.8	2.9	-	-
B-C14	"Meadowend Bungalow", Kennet	2.7	2.7	3.2	3.2	-	-
B-C15	"Bracken Brae", Kennet	9.2	9.2	10.1	10.1	-	-
B-C16	"Ambleside Haven", Kilbagie	11.7	11.7	14.6	14.6	-	-
B-C17	"Darhamie Toll", Broomknowe	5.0	5.2	7.3	7.5	-	-
B-C18	"Broomknowe", Broomknowe	5.7	5.8	8.0	8.2	-	-

Table 6.6-8: Predicted Increases In Free Field L_{Aeq} Levels For Operation Of Railway (No Mitigation)

Ref.	Location	Daytime 07:00-19:00		Evening 19:00-23:00		Night-time 23:00-07:00	
		Floor		Floor		Floor	
		1	2	1	2	1	2
B-K1	22 Broomknowe Drive, Tulliallan	11.3	20.7	15.1	24.7	-	-
B-K2	49 Hawkhill Road, Kincardine	6.9	6.8	10.3	10.2	-	-
B-K3	Kilbagie Street, Kincardine	3.2	3.3	5.7	5.8	-	-
B-K4	17 Ochilview, Kincardine	10.1	9.5	13.8	13.2	-	-
B-K5	16 Ochilview, Kincardine	10.1	9.9	13.8	13.6	-	-
B-K6	21 Forth Street, Kincardine	4.0	4.1	6.8	6.9	-	-
B-K7	13 Orchard Grove, Kincardine	1.0	1.1	2.2	2.3	-	-
B-K8	Tulliallan Castle, Tulliallan	3.2	3.6	5.7	6.3	-	-

Table 6.6-9: Predicted Façade L_{Aeq} Levels For Operation Of Railway (With Mitigation)

Ref.	Location	Daytime 06:00-24:00	
		Floor	
		1	2
B-S1	126 Causewayhead Road, Stirling	52.6	54.8
B-S2	100 Causewayhead Road, Stirling	53.0	55.7
B-S3	74 Causewayhead Road, Stirling	52.0	53.0
B-S4	50 Causewayhead Road, Stirling	49.0	49.8
B-S5	53 Causewayhead Road, Stirling	47.4	48.4
B-S6	36 Wallace Gardens, Stirling	53.4	56.8
B-S7	58 Wallace Gardens, Stirling	55.4	65.3
B-S8	5-8 Alloa Road, Stirling, Stirling	53.7	58.4
B-S9	48 Alloa Road, Stirling, Stirling	54.0	68.2
B-S10	58-60 Alloa Road, Stirling, Stirling	52.7	67.7
B-S11	"Abbeycraig", off Alloa Road, Stirling	56.1	61.8
B-S12	Sidas Craigmill House, Alloa Road	49.6	50.5
B-S13	Manorneuk Farm, off A907	47.5	48.0
B-S14	3-4 Forth Street, Stirling	48.5	49.1
B-S15	46-48 Forth Street, Stirling	47.2	50.9

Table 6.6-10: Predicted Façade L_{Aeq} Levels For Operation Of Railway (With Mitigation)

Ref.	Location	Daytime 06:00-24:00	
		Floor	
		1	2
B-A1	Southern edge of Tullibody	49.3	49.5
B-A2	12 Station Road, Cambus	51.6	52.9
B-A3	"Woodside", off A907 near Cambus	54.9	57.0
B-A4	"The Gables", off A907 near Cambus	56.0	61.8
B-A5	14-16 Mitchell Crescent, West Alloa	51.9	53.7
B-A6	75 Grange Road, West Alloa	56.5	64.3
B-A7	25 Grange Road, West Alloa	55.4	60.0
B-A8	50 Stirling Road, West Alloa	49.1	49.7
B-A9	9 Kellie Place, Alloa	48.3	51.8
B-A10	2 Erskine Street, Alloa	47.9	48.8
B-A11	39 Sunnyside Court, Alloa	48.9	49.8
B-A12	26-28 Kingswell Park, Alloa	52.6	61.8
B-A13	22 Park Place, Alloa	53.5	68.8
B-A14	21 Bruce Street, Alloa	55.0	61.2
B-A15	3 Arrol Crescent, Alloa	53.8	60.3
B-A16	House, Hilton Road Crossing, Alloa	54.6	59.8

B-A17	"The Bungalow", Clackmannan Road	53.1	56.8
B-A18	Within Tullibody	40.6	44.6
B-A19	10 Alexandra Drive, Alloa	39.9	42.2
B-A20	15 Hotton Park, Alloa	43.2	44.3

Table 6.6-11: Predicted Façade L_{Aeq} Levels For Operation Of Railway (With Mitigation)

Ref.	Location	Daytime 06:00-24:00	
		Floor	
		1	2
B-C1	101 Devonway, Clackmannan	56.0	68.2
B-C2	"Dalairn", Helensfield, Clackmannan	59.7	59.8
B-C3	1 Mill Road, Clackmannan	50.0	55.9
B-C4	45 Alloa Road, Clackmannan	47.6	53.6
B-C5	2 Park Place, Clackmannan	46.3	51.0
B-C6	9 Park Place, Clackmannan	47.4	52.4
B-C7	21 Brucefield Gardens, Clackmannan	51.8	58.6
B-C8	1 Northfield, Clackmannan	51.8	
B-C9	Northfield, Clackmannan	50.2	66.5
B-C10	39 St Seres Grove, Clackmannan	49.4	53.7
B-C11	20 Ladywood, Clackmannan	46.0	51.4
B-C12	Meadow Grove, Kennet	54.9	55.1
B-C13	20 Main Street, Kennet	56.4	56.6
B-C14	"Meadowend Bungalow", Kennet	57.6	57.7
B-C15	"Bracken Brae", Kennet	53.1	63.2
B-C16	"Ambleside Haven", Kilbagie	51.0	53.3
B-C17	"Darhamie Toll", Broomknowe	47.2	47.6
B-C18	"Broomknowe", Broomknowe	46.2	46.6

Table 6.6-12: Predicted Façade L_{Aeq} Levels For Operation Of Railway (With Mitigation)

Ref.	Location	Daytime 06:00-24:00	
		Floor	
		1	2
B-K1	22 Broomknowe Drive, Tulliallan	51.4	57.9
B-K2	49 Hawkhill Road, Kincardine	43.8	45.8
B-K3	Kilbagie Street, Kincardine	39.9	40.9
B-K4	17 Ochilview, Kincardine	43.8	57.1
B-K5	16 Ochilview, Kincardine	44.0	59.2
B-K6	21 Forth Street, Kincardine	45.9	46.5
B-K7	13 Orchard Grove, Kincardine	44.2	44.4
B-K8	Tulliallan Castle, Tulliallan	47.2	48.0

Table 6.6-13: Predicted Increases In Free Field L_{Aeq} Levels For Operation Of Railway (With Mitigation)

Ref.	Location	Daytime 07:00-19:00		Evening 19:00-23:00		Night-time 23:00-07:00	
		Floor		Floor		Floor	
		1	2	1	2	1	2
B-S1	126 Causewayhead Road, Stirling	0.2	0.3	1.1	1.7	0.3	0.4
B-S2	100 Causewayhead Road, Stirling	0.2	0.3	1.2	2.0	0.3	0.5
B-S3	74 Causewayhead Road, Stirling	0.1	0.2	1.0	1.2	0.2	0.3
B-S4	50 Causewayhead Road, Stirling	0.1	0.1	0.5	0.6	0.1	0.1
B-S5	53 Causewayhead Road, Stirling	0.0	0.1	0.4	0.5	0.1	0.1
B-S6	36 Wallace Gardens, Stirling	3.2	5.3	8.1	11.1	0.4	0.8
B-S7	58 Wallace Gardens, Stirling	4.4	12.5	9.9	19.4	0.6	4.0
B-S8	5-8 Alloa Road, Stirling, Stirling	3.4	6.5	8.4	12.6	0.4	1.1
B-S9	48 Alloa Road, Stirling, Stirling	3.5	15.3	8.6	22.2	0.5	5.9
B-S10	58-60 Alloa Road, Stirling, Stirling	2.9	14.8	7.5	21.7	0.3	5.6
B-S11	"Abbeycraig", off Alloa Road, Stirling	4.8	9.3	10.5	15.9	0.7	2.2
B-S12	Sidas Craigmill House, Alloa Road	1.6	1.9	5.2	5.8	0.2	0.2
B-S13	Manorneuk Farm, off A907	1.1	1.2	3.8	4.1	0.1	0.1
B-S14	3-4 Forth Street, Stirling	1.3	1.5	4.4	4.8	0.0	0.0
B-S15	46-48 Forth Street, Stirling	1.0	2.1	3.7	6.1	0.0	0.0

Table 6.6-14: Predicted Increases In Free Field L_{Aeq} Levels For Operation Of Railway (With Mitigation)

Ref.	Location	Daytime 07:00-19:00		Evening 19:00-23:00		Night-time 23:00-07:00	
		Floor		Floor		Floor	
		1	2	1	2	1	2
B-A1	Southern edge of Tullibody	0.7	0.7	2.2	2.3	0.3	0.3
B-A2	12 Station Road, Cambus	1.1	1.4	3.3	4.1	2.1	2.3
B-A3	"Woodside", off A907 near Cambus	2.1	3.0	5.4	7.0	0.4	0.7
B-A4	"The Gables", off A907 near Cambus	2.5	6.0	6.2	11.1	0.5	1.7
B-A5	14-16 Mitchell Crescent, West Alloa	0.8	1.1	1.4	2.0	0.0	0.0
B-A6	75 Grange Road, West Alloa	1.9	6.4	3.3	8.9	0.1	0.5
B-A7	25 Grange Road, West Alloa	1.6	3.5	2.7	5.5	0.1	0.2
B-A8	50 Stirling Road, West Alloa	0.7	0.7	1.2	1.4	0.1	0.1
B-A9	9 Kellie Place, Alloa	0.5	1.1	1.0	2.0	0.1	0.2
B-A10	2 Erskine Street, Alloa	0.5	0.6	1.0	1.1	0.1	0.1
B-A11	39 Sunnyside Court, Alloa	0.6	0.8	1.2	1.4	0.1	0.1
B-A12	26-28 Kingswell Park, Alloa	3.9	11.1	6.7	14.9	-	-
B-A13	22 Park Place, Alloa	4.4	17.9	7.4	21.8	-	-
B-A14	21 Bruce Street, Alloa	5.5	10.6	8.6	14.4	-	-
B-A15	3 Arrol Crescent, Alloa	4.6	9.8	7.6	13.5	-	-
B-A16	House, Hilton Road Crossing, Alloa	2.0	4.6	3.3	6.8	-	-
B-A17	"The Bungalow", Clackmannan Road	1.5	2.9	2.6	4.6	-	-
B-A18	Tullibody	0.4	0.9	0.9	2.0	0.4	0.4

B-A19	10 Alexandra Drive, Alloa	0.3	0.5	0.8	1.2	-	-
B-A20	15 Hotton Park, Alloa	0.7	0.8	1.5	1.9	-	-

Table 6.6-15: Predicted Increases In Free Field L_{Aeq} Levels For Operation Of Railway (Wih Mitigation)

Ref.	Location	Daytime 07:00-19:00		Evening 19:00-23:00		Night-time 23:00-07:00	
		Floor		Floor		Floor	
		1	2	1	2	1	2
B-C1	101 Devonway, Clackmannan	7.0	18.3	9.5	21.2	-	-
B-C2	"Dalairn", Helensfield, Clackmannan	4.6	4.6	7.5	7.6	-	-
B-C3	1 Mill Road, Clackmannan	3.0	6.9	4.8	9.4	-	-
B-C4	45 Alloa Road, Clackmannan	2.0	5.2	3.3	7.5	-	-
B-C5	2 Park Place, Clackmannan	1.5	3.5	2.7	5.5	-	-
B-C6	9 Park Place, Clackmannan	1.9	4.4	3.2	6.5	-	-
B-C7	21 Brucefield Gardens, Clackmannan	4.0	9.2	6.0	11.9	-	-
B-C8	1 Northfield, Clackmannan	0.3	-	0.5	-	-	-
B-C9	Northfield, Clackmannan	0.2	4.4	0.3	6.6	-	-
B-C10	39 St Seres Grove, Clackmannan	2.7	5.2	4.4	7.5	-	-
B-C11	20 Ladywood, Clackmannan	1.5	3.8	2.5	5.7	-	-
B-C12	Meadow Grove, Kennet	1.7	1.8	2.1	2.2	-	-
B-C13	20 Main Street, Kennet	2.3	2.4	2.7	2.8	-	-
B-C14	"Meadowend Bungalow", Kennet	2.8	2.9	3.3	3.4	-	-
B-C15	"Bracken Brae", Kennet	1.2	6.3	1.5	7.1	-	-
B-C16	"Ambleside Haven", Kilbagie	3.5	5.0	5.5	7.2	-	-
B-C17	"Darhamie Toll", Broomknowe	1.8	2.0	3.1	3.3	-	-
B-C18	"Broomknowe", Broomknowe	1.5	1.6	2.6	2.8	-	-

Table 6.6-16: Predicted Increases In Free Field L_{Aeq} Levels For Operation Of Railway (With Mitigation)

Ref.	Location	Daytime 07:00-19:00		Evening 19:00-23:00		Night-time 23:00-07:00	
		Floor		Floor		Floor	
		1	2	1	2	1	2
B-K1	22 Broomknowe Drive, Tulliallan	6.5	12.2	9.9	16.0	-	-
B-K2	49 Hawkhill Road, Kincardine	0.9	1.4	2.0	2.9	-	-
B-K3	Kilbagie Street, Kincardine	0.4	0.5	1.0	1.2	-	-
B-K4	17 Ochilview, Kincardine	0.9	7.9	2.0	11.4	-	-
B-K5	16 Ochilview, Kincardine	1.0	9.7	2.1	13.4	-	-
B-K6	21 Forth Street, Kincardine	1.4	1.6	3.0	3.3	-	-
B-K7	13 Orchard Grove, Kincardine	1.0	1.1	2.2	2.3	-	-
B-K8	Tulliallan Castle, Tulliallan	3.7	4.1	6.3	7.0	-	-

6.2 Railway Operational Vibration

To provide baseline vibration data for coal wagon railway movements, vibration measurements have been undertaken at varying distance from railway track at Eggborough, near Selby for freight train pass-bys similar to those proposed for SAK.

To assist with prediction of ground-borne vibration an investigation into propagation of ground vibration has been undertaken at two locations along SAK where properties would be in relatively close proximity (within 20m) to the nearest running rail.

6.2.1 Train Measurements

Eleven pass-bys were monitored at Eggborough, Selby comprising five Class 66 hauling HTA coal wagons trains travelling eastbound loaded towards Drax power station and six travelling westbound unloaded back to Gascoigne Wood. All trains consisted of one locomotive hauling 19 wagons, identical to that proposed for SAK. The speeds for trains travelling in both directions were between 40 and 50 kph (measured with a radar speed gun).

Weight of a Class 66 loco is 126 ton, an empty wagon 27 ton and a loaded wagon 102 ton. Consequently a fully loaded train would weigh of the order of 2064 ton, and an unloaded train 639 ton. A two-car Class 158 passenger train weighs of the order of 76 ton (empty).

Vibration measurements were made at 11m from the nearest running rail, a similar distance to the closest receptors on the proposed SAK railway. The track formation was of the same generic design, namely continuously welded rail supported on concrete sleepers laid on a ballast bed. A number of trains pass-bys were measured to provide a representative sample.

Vibration measurements were not undertaken at any railway serving Longannet power station since freight trains are different in type compared to those proposed for the SAK railway.

6.2.2 Ground-borne vibration

Investigation of ground-borne transmission was made at two sites at SAK where the track will be in close proximity to vibration sensitive premises.

Vibration transmission was monitored by striking the ground and measuring the peak particle velocity (ppv) at two known distances from the striking point to obtain the decay with distance.

Train Measurements

The Eggborough site consists of a two-track railway with a third line used as a long siding to the south side. The track construction consisted of continuously welded rail supported on concrete sleepers (with Pandrol shoulders and clips) on ballasted track.

Measurements were taken on open ground away from any other sources of vibration. Propagation was across flat ground consisting of a field covered with the stubble of a recently harvested cereal crop. The weather remained dry throughout the measurement period. The sky was overcast with a light breeze of 2 to 3 ms^{-1} blowing from the east.

In addition, noise measurements were also undertaken for comparison of rail movements between the eastbound and westbound tracks.

Ground-borne propagation

At Stirling the scheme is underlain by raised beach deposits and associated marine and estuarine alluvium. These consist of soft silts and clays as the route runs close to the river Forth. All these materials are expected to have a density from 16.0 kgm^{-3} to 18.0 kgm^{-3}. The centre of Alloa and the areas south of Clackmannan and north of Kincardine are underlain by fluvial sands and gravels, with expected densities of 19.0 kgm^{-3} to 23.0 kgm^{-3}. These materials overlie solid geology of Carboniferous Limestone series between Stirling and the Blackgrange Crossing, Millstone Grit from Blackgrange and the western outskirts of Alloa and Productive Coal Measures beneath the rest of the route.

At Eggborough the area is underlain by silts and clays with expected densities from 16.0 kgm^{-3} to 21.0 kgm^{-3}, not dissimilar to those found at Stirling. Glacial sands and gravels are also likely to underlie the site, with densities expected from 19.0 kgm^{-3} to 23.0 kgm^{-3}.

6.2.3 Measurements

Vibration measurements for both the pass-by and ground propagation measurements were undertaken with a fully calibrated Vibroc V801 seismograph. The V801 is a tri-axial vibration analyser with electronic data storage of events. The unit is dual channel, enabling simultaneous analysis of two tri-axial transducers with continuous vibration monitoring to provide peak particle velocity (ppv) measurements on one channel and vibration dose values (VDV) assessment on the second channel.

The vibration transducers were buried in the ground in accordance with manufacturer's instructions to ensure representative measurement of ground-borne vibration. For pass-by measurement two types of vibration measurements were undertaken (not simultaneously):

- ppv and VDV monitoring, both channels at a distance of 11m from the nearest running rail.
- ppv monitoring moved to 20m from nearest running rail. VDV monitoring kept at 11 m.

For ground propagation both transducers were set to ppv mode.

6.2.4 Results

Train measurements

Subjectively it was just possible to distinguish the passage of trains by ground-borne vibration transmitted through the feet at the measurement position. There was no other indication of ground-borne vibration (fences swaying, vibration-induced noise from local fixtures and fittings etc.).

Results from these measurements are shown in Tables 6.7-1 and 6.7-2. Vibration measurements were based on event VDVs (30-second events). VDV and noise levels were measured at 11m from the nearest running rail eastbound and 14.4m from the nearest running rail westbound (with some exceptions):

Table 6.7-1: Trains travelling EB, loaded (near track, 11m except *)

Time	$L_{Amax,fast}$ (dB)		VDV train	ppv
	Loco	Wagons	($ms^{-1.75}$)	(mms^{-1})
09:26	78	70-71	0.078	1.807
10:11	80	73-74	0.082	1.345
11:28	81	71-73	0.070	1.647
11:56	83	71-73	0.074	1.245
14:58	67	64-67	0.036	*0.502**
			Mean 0.072	

* 20m distance

Table 6.7-.2: Trains Travelling WB, unloaded (far track, 14.4m except *)

Time	$L_{Amax,fast}$ (dB)		VDV train	ppv
	Loco	Wagons	mms^{-1}	(mms^{-1})
09:47	75	74-75	0.083	1.968
10:22	76	74-75	0.087	1.767
11:24	76	75	0.089	1.847
12:16	77	75-77	0.071	*1.104**
12:59	76	76	0.084	*1.004**
14:25	70	66-70	0.056	*1.044**
			Mean 0.080	

*24.4m distance

The measurements of Class 66 locomotives hauling HTA wagons show higher levels of both noise and vibration for trains travelling on the far track (westbound). The noise level of the locomotive is likely to be dominated by engine operating condition whereas the level for the wagons will be highly dependant on rail condition.

Comparing the noise levels of wagons, the levels for the far track are higher than those for the near. As the trains are travelling at similar speed in both directions this suggests that the condition of the far track is below that of the near and that rail roughness is likely to be high on the far track. Consequently, for the purposes of assessing the vibration impact of the proposed SAK railway, measurements from vehicles travelling on the far track have been ignored. The SAK railway is a new railway and therefore will be built to a high standard. It is assumed that the condition of the new SAK railway will be as good or above that of the eastbound track of the Gascoigne Wood to Drax line. The mean VDV level of vibration for trains travelling eastbound was 0.072 $ms^{-1.75}$.

Consequently, for the purposes of this assessment a baseline VDV of 0.072 $ms^{-1.75}$ is adopted for pass-by of a coal wagon train travelling at 45 kph at 11m from the nearest rail.

The ppv values shown in italics are for measurements made at a distance of 20m and 23.4m from the nearest EB and WB running rails respectively, the other values are for measurements at 11m and 14.4m respectively. It can be seen that the vibration levels measured at the further distances are much lower.

Ground-borne propagation

The mean decay with distance for the resultant ppv at each measurement point at SAK was calculated using the following procedure:

Step 1 calculate the ration of the resultant (mms^{-1}) for d_{ref}/d_2 for each measurement

Step 2 calculate the mean ratio for each measurement distance

Step 3 plot mean ratio against d_2

Propagation information obtained from four measurements (three at position 1, one at position 2) are plotted on Figure 6.7-1. It can be seen that, at the two monitoring locations investigated at SAK, propagation is a direct function of reciprocal of distance (namely a linear decay with distance).

Consequently, for the ground conditions investigated at SAK, doubling the distance halves the ppv (and consequently the VDV).

Referring to the ppv measurements at Eggborough, Selby for the westbound line (discounted from use due to suspect poorly maintained track giving rise to excess vibration levels), it can be seen that the average of the last 3 ppv measurements taken at 24.4 m distance is proportionately reduced compared to the average of the first 3 ppv measurements taken at 14.4 m, implying that doubling the distance roughly halves the ppv value at that location also.

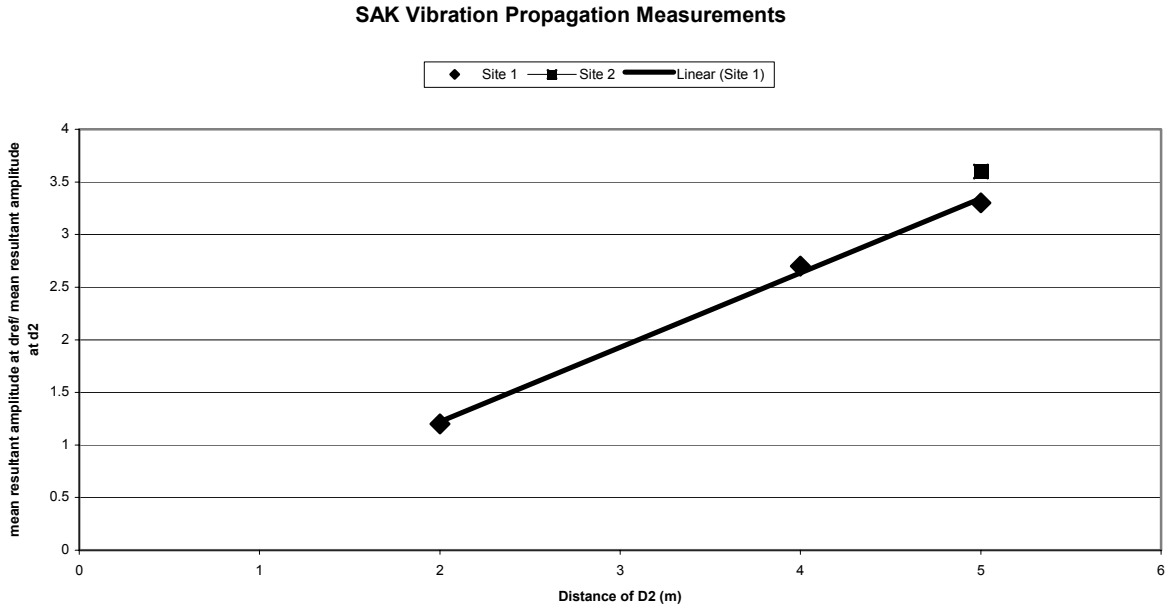

Figure 6.7-1: Decay of peak particle velocity with distance, two locations along SAK.

6.2.5 Vibration Annoyance

The predicted VDV values for 10, 20 and 30 freight train pass-bys for daytime, corrected for speed, are given below in Table 6.7-3, based on a VDV of 0.072 $ms^{-1.75}$ for a single train pass-by at 45 kph. (It is understood that freight trains will only operate during the daytime period, 07.00-23.00). Contribution from passenger trains, (at most less than 20% the weight of a goods train) are ignored.

Number of Pass-bys

The equation used to correct the VDV to account for the number of pass-bys is:

$$VDV_{Total} = VDV_{Train} * N^{1/4}$$

Where N = number of trains

Speed Correction

VDV measurements were undertaken at Eggborough at an average pass-by speed of 45 kph (approximately 30 mph).

Actual pass-by speeds along SAK for freight trains will primarily be at 60 mph, and 20 mph in Kincardine.

For change in train speed a factor of the square root of the new speed to measured speed can be applied to the measured vibration. This factor was used to in the assessment of railway vibration for the West Coast Main Line Upgrade. This factor accounts reasonably well for a change in root-mean-square acceleration, which is directly proportional to the VDV. It does not, however, account for changes in pass-by time, and therefore represents a slightly conservative approach for increased speed conversion, and pessimistic approach for reduced speed conversion.

$$\text{Speed correction} = \sqrt{\frac{V_2}{V_1}}$$

Consequently, at 60 mph the baseline VDV will be increased by a factor of 1.414, and at 20 mph the baseline VDV will be reduced by a factor of 0.816.

Distance

Using the reciprocal distance transfer function derived from the SAK site measurements, VDV levels at 20m from the nearest running rail were calculated from the 11m measurement baseline distance by using a transfer factor of 0.55 (i.e. 11/20ths)

Building Transfer Functions

It is assumed that there is no attention of vibration between the foundations of the buildings and the underlying soil. It is generally the case that the surface area of the foundations of most residential properties is fairly large and in intimate contact with the underlying soil.

The propagation of vibration through a building structure and the response of the floors, walls and ceilings are very complex in nature. These surfaces can be subject to significant amplifications of vibration relative to the foundation vibration. For the building transfer functions an amplification factor of 2 has been used to predict the level for ground floor

compared with ground vibration and an amplification factor of 4 has been used to first floor from ground vibration, these generally being accepted as pessimistic (higher levels of vibration transmitted) transfer function figures. It is known that these factors have been used elsewhere by other consultants including the environmental impact assessment of the West Coast Main Line Upgrade and the Channel Tunnel Rail Inquiry, although to date there is no standard accepted calculation method nor any accepted data in the literature. Clearly the actual transfer function will vary from building to building depending on construction, and from area to area depending on ground conditions.

Table 6.7-3: Predicted daytime VDV levels for various conditions

Location	VDV ($ms^{-1.75}$) per number of train pass-bys in the 16 hr daytime period					
	10 pass-bys	Impact	20 pass-bys	Impact	30 pass-bys	Impact
20 mph, 11m from nearest running rail						
Open ground	*0.11*	--	*0.12*	--	*0.14*	--
Ground floor	0.21	2	0.25	2	**0.28**	**2**
First Floor	0.42	3	0.50	3	**0.55**	**3**
60 mph, 11m from nearest running rail						
Open ground	*0.18*	--	*0.22*	--	*0.24*	--
Ground floor	0.36	2	0.43	3	**0.48**	**3**
First Floor	0.72	3	0.86	4	**0.95**	**4**
60 mph, 20m from nearest running rail						
Open ground	*0.1*	--	*0.12*	--	*0.13*	--
Ground floor	0.20	1/2	0.24	2	**0.26**	**2**
First Floor	0.40	2/3	0.48	3	**0.52**	**3**

Impact - 1 - Less than low probability of adverse comment
2 - low probability of adverse comment
3 - adverse comment possible
4 - adverse comment probable

For 30 rail freight pass-bys per daytime period (the expected number) it can be seen from the above table that, at 11m from the nearest running rail (generally the nearest approach for any property on the SAK), at ground floor building level (i.e. daytime habitable rooms) there will be a '*low probability of adverse comment*' for trains travelling at 20 mph and '*adverse comment possible*' for trains travelling at 60 mph. (Calculations indicate (not shown in the table) that if the speed is limited to 40 mph then daytime, ground floor VDV will fall into '*low probability of adverse comment*' for properties at 11m distance).

At daytime first floor property levels (usually bedrooms, but possibly daytime habitable rooms in flats) the VDV figures are doubled from ground floor building level and it can be seen that adverse comment becomes '*possible*' or '*probable*' at both speeds (20 mph and 60 mph respectively). This is primarily due to the pessimistic amplification factor of 2 assumed between earth (open ground) to ground floor, and between ground floor to first floor of a residential property. The indication is that there is only one set of residential flats along the length of the SAK within 20 m from the track.

At 20m from the nearest running rail the predicted VDV is reduced substantially due to losses in the ground and, for 30 pass-bys at 60 mph, there becomes '*low probability of*

adverse comment' at ground floors of properties, but '*adverse comment possible*' at first floor level (flats, for example). The indication is that the cut-off distance between '*low probability of adverse comment*' and '*adverse comment probable*' for ground floor would occur at approximately 13m from the nearest running rail (for 30 pass-bys at 60 mph).

There are a number of assumptions in the above calculations, namely:

- uncertain nature of the state of track at Eggborough, Selby. Poor maintenance would result in higher levels of vibration than for the new SAK track.

- pessimistic transmission factor of two used between earth (open ground) and ground floor building, and two between ground floor building and first floor. This transmission factor critically affects the calculated VDV values within properties. This factor will vary between buildings due to different construction (foundations etc.).

- the calculations assume no vibration mitigation at all for SAK. Anti-vibration measures (ballast mats, baseplate pads, floating slab track etc.) incorporated into the design of the SAK track in sections where it is in close proximity to residential property would reduce transmitted vibration by a factor of up to 10, depending on local conditions. A reduction of only approximately 20% is required to reduce daytime VDV at ground floors at 11m from the track at 60 mph to '*low probability of adverse comment*'.

It can be seen that reducing the number of freight train pass-bys does not significantly affect the predicted VDV values.

6.2.6 Building Damage

Building damage is assessed using peak particle velocity (ppv) measured '*at the base of the building*' to the requirements of BS 7385.

The worst case open ground ppv recorded at Eggborough was 1.807 mms^{-2} (eastbound loaded, 11 m from track) at 45 kmh. At 60 mph this would be increased to approximately 2.6 mms^{-1} using the velocity correction. At the base of a building (ground floor) this may be doubled to 5.2 mms^{-1}. This figure is well below the limit of 15 mms^{-1} (at 4Hz) specified in BS 7385, and below the limit of 10 mms^{-1} for intermittent vibration specified in BS 5228:Part 4: 1992. Use of anti-vibration measures incorporated into the design of the track where it passes close to residential property would further reduce the predicted ppv.

Consequently it is unlikely that vibration from passage of fully loaded freight trains travelling at 60 mph would give rise to even cosmetic damage at properties as close as 11m from the nearest running rail.

6.2.7 Conclusions

For 30 daytime rail freight pass-bys travelling at 60 mph to ground floor habitable room at 11m from the nearest running rail the daytime VDV would be 0.48 $ms^{-1.75}$. The indication from BS 6472 is that this would fall into the '*adverse comment possible*' range (0.40-0.80 $ms^{-1.75}$), with a 'moderate' impact. This calculated level is undertaken using worst-case pessimistic prediction routines and without rail vibration mitigation. A reduction in the ppv of approximately 20% is required to reduce this figure into the '*low probability of adverse comment*' category (slight impact).

Installation of anti-vibration measures in the track where it passes within 20m of residential properties is recommended. These measures might include ballast mats, baseplate pads, floating slab track etc., depending on local conditions (such as ground condition, crossings, points etc.). Further research at local level is required to identify the measure appropriate to each identified part of track. The indication from manufacturers is that anti-vibration measures can reduce ground-transmitted vibration by as much as 90%.

It is considered most unlikely that passage of trains, even without track vibration mitigation, would give rise to damage of even a cosmetic nature at nearest properties.

6.3 AELR Operational Noise

A noise assessment, according to the procedures given in DMRB, was carried out for all sensitive properties within 300 metres of Hilton Road, Clackmannan Road and the proposed link road using the calculation routine specified in Calculation of Road Traffic Noise (CRTN) (Reference 16). Nine scenarios were considered;-

1. 2002 baseline

2. 2005 baseline without new housing to east of Hilton Road

3. 2005 baseline with new housing to east of Hilton Road

4. 2020 baseline without new housing to east of Hilton Road

5. 2020 baseline with new housing to east of Hilton Road

6. 2005 operation without new housing to east of Hilton Road

7. 2005 operation with new housing to east of Hilton Road

8. 2020 operation without new housing to east of Hilton Road

9. 2020 operation with new housing to east of Hilton Road

Façade noise levels for all scenarios were calculated at a set of twenty receptors, representative of groups of residences within the 300 metre corridors. Combined with house counts within the defined groups of residences, this enabled the changes in noise level, and hence nuisance level, to be estimated for the range of scenarios.

The Noise Assessment Summary Tables are given in Tables 6.8-1 to 6.8-8. These tables classify the prevailing ambient noise levels in bands of <50 $L_{A10,18h}$, $50 - 60$ $L_{A10,18h}$, $60 - 70$ $L_{A10,18h}$ and > 70 $L_{A10,18h}$. The numbers of properties within each band subject to specific changes in noise level for each scenario are shown, along with the corresponding numbers of properties subject to specific changes in nuisance level. From these tables the total number of properties within 300 metres of Hilton Road, Clackmannan Road and the proposed relief road bothered “very much” or “quite a lot” is estimated.

From data in these tables the overall noise impact of the proposed link road has been assessed and conclusions reported in the Environmental Statement.

Table 6.8-1: DMRB Traffic Noise Assessment

Ambient Noise Band $L_{A10,18h} < 50$	2005 Baseline without houses	2005 Baseline with houses	2020 Baseline without houses	2020 Baseline with houses
Increase in Noise Level				
1<3	0	0	0	312
3<5	0	0	0	
5<10	0	0	0	
10<15	0	0	0	
>=15	0	0	0	
Increase in Nuisance Level				
<10%				312
10<20%				
20<30%				
30<40%				
>=40%				
Decrease in Noise Level				
1<3	0	0	0	
3<5	0	0	0	
5<10	0	0	0	
10<15	0	0	0	
>=15	0	0	0	
Decrease in Nuisance Level				
<10%				
10<20%				
20<30%				
30<40%				
>=40%				

Table 6.8-2: DMRB Traffic Noise Assessment

Ambient Noise Band $L_{A10,18h}$ < 50	2005 Operational without houses	2005 Operational with houses	2020 Operational without houses	2020 Operational with houses
Increase in Noise Level				
1<3				30
3<5	3	3	3	
5<10				3
10<15				
>=15				
Increase in Nuisance Level				
<10%			3	33
10<20%				
20<30%				
30<40%	3	3		
>=40%				
Decrease in Noise Level				
1<3	76	26	26	26
3<5				
5<10				
10<15				
>=15				
Decrease in Nuisance Level				
<10%			26	26
10<20%				
20<30%	76	26		
30<40%				
>=40%				

Table 6.8-3: DMRB Traffic Noise Assessment

Ambient Noise Band $L_{A10,18h}$ = 50 - 60	2005 Baseline without houses	2005 Baseline with houses	2020 Baseline without houses	2020 Baseline with houses
Increase in Noise Level				
1<3	0	0	0	285
3<5	0	0	0	
5<10	0	0	0	
10<15	0	0	0	
>=15	0	0	0	
Increase in Nuisance Level				
<10%				285
10<20%				
20<30%				
30<40%				
>=40%				
Decrease in Noise Level				
1<3	0	0	0	
3<5	0	0	0	
5<10	0	0	0	
10<15	0	0	0	
>=15	0	0	0	
Decrease in Nuisance Level				
<10%				
10<20%				
20<30%				
30<40%				
>=40%				

Table 6.8-4: DMRB Traffic Noise Assessment

Ambient Noise Band $L_{A10,18h}$ = 50 - 60	2005 Operational without houses	2005 Operational with houses	2020 Operational without houses	2020 Operational with houses
Increase in Noise Level				
1<3				96
3<5				
5<10	9	9	9	
10<15		50		50
>=15				
Increase in Nuisance Level				
<10%			9	96
10<20%				50
20<30%				
30<40%	9	9		
>=40%		50		
Decrease in Noise Level				
1<3		22	22	
3<5	22			
5<10	29	29	29	29
10<15				
>=15				
Decrease in Nuisance Level				
<10%			51	29
10<20%				
20<30%	51	51		
30<40%				
>=40%				

Table 6.8-5: DMRB Traffic Noise Assessment

Ambient Noise Band $L_{A10,18h}$ = 60 - 70	2005 Baseline without houses	2005 Baseline with houses	2020 Baseline without houses	2020 Baseline with houses
Increase in Noise Level				
1<3	0	0	0	45
3<5	0	0	0	
5<10	0	0	0	
10<15	0	0	0	
>=15	0	0	0	
Increase in Nuisance Level				
<10%				45
10<20%				
20<30%				
30<40%				
>=40%				
Decrease in Noise Level				
1<3	0	0	0	
3<5	0	0	0	
5<10	0	0	0	
10<15	0	0	0	
>=15	0	0	0	
Decrease in Nuisance Level				
<10%				
10<20%				
20<30%				
30<40%				
>=40%				

Table 6.8-6: DMRB Traffic Noise Assessment

Ambient Noise Band $L_{A10,18h}$ = 60 - 70	2005 Operational without houses	2005 Operational with houses	2020 Operational without houses	2020 Operational with houses
Increase in Noise Level				
1<3				
3<5				
5<10				
10<15				
>=15				
Increase in Nuisance Level				
<10%				
10<20%				
20<30%				
30<40%				
>=40%				
Decrease in Noise Level				
1<3				
3<5				
5<10				
10<15	18		18	
>=15		18		18
Decrease in Nuisance Level				
<10%				
10<20%				
20<30%			18	18
30<40%				
>=40%	18	18		

Table 6.8-7: DMRB Traffic Noise Assessment

Ambient Noise Band $L_{A10,18h}$ >70	2005 Baseline without houses	2005 Baseline with houses	2020 Baseline without houses	2020 Baseline with houses
Increase in Noise Level				
1<3	0	0	0	13
3<5	0	0	0	
5<10	0	0	0	
10<15	0	0	0	
>=15	0	0	0	
Increase in Nuisance Level				
<10%				13
10<20%				
20<30%				
30<40%				
>=40%				
Decrease in Noise Level				
1<3	0	0	0	
3<5	0	0	0	
5<10	0	0	0	
10<15	0	0	0	
>=15	0	0	0	
Decrease in Nuisance Level				
<10%				
10<20%				
20<30%				
30<40%				
>=40%				

Table 6.8-8: DMRB Traffic Noise Assessment

Ambient Noise Band $L_{A10,18h}$ >70	2005 Operational without houses	2005 Operational with houses	2020 Operational without houses	2020 Operational with houses
Increase in Noise Level				
1<3				9
3<5				
5<10				
10<15				
>=15				
Increase in Nuisance Level				
<10%				9
10<20%				
20<30%				
30<40%				
>=40%				
Decrease in Noise Level				
1<3	1			
3<5				
5<10				
10<15	3	3	3	3
>=15				
Decrease in Nuisance Level				
<10%				
10<20%	1			
20<30%			3	3
30<40%				
>=40%	3	3		

6.4 References

1 Guidelines for Community Noise, World Health Organisation, 1999

2 British Standard BS 8233: 1999 'Sound insulation and noise reduction for buildings – Code of practice' British Standards Institution, 1999

3 British Standard BS 5228: 1997 'Noise and vibration control on construction and open sites'. British Standards Institution, 1997

4 Minerals Planning Guidance 11: The control of noise at surface mineral workings. Department of the Environment, The Welsh Office, April 1993

5 British Standard BS 4142: 1997 'Rating industrial noise affecting mixed residential and industrial areas'. British Standards Institution, 1997

6 Guidance on the Methodology for Multi-Modal Studies, DETR, 2000

7 Guidelines On Noise Impact Assessment (Draft), Joint Working Party of Institute of Acoustics and Institute of Environmental Management and Assessment, 2002

8 Noise Insulation Regulations (Railways and Other Guided Transport Systems), 1996.

9 Design Manual for Roads and Bridges Volume 11 Part 7, 1994. The Department of Transport

10 Planning Advice Note: PAN56. The Scottish Office, 1999

11 SO 9613-2 Attenuation of Sound During Propagation Outdoors, 1996

12 British Standard BS 6472: 1992 *Guide to Evaluation of human exposure to vibration in buildings (1 Hz to 80 Hz).* British Standards Institution 1992

13 British Standard BS 7385: Part 2: 1990 *Evaluation and measurement for vibration in buildings. Part 2. Guide for measurement of vibrations and evaluation of their effects on buildings.* British Standards Institute 1990

14 British Standard BS 5228: Part 4: 1992 *Noise control on construction and open sites. Part 4. Code of practice for noise and vibration control applicable to piling operations.* British Standards Institute 1992

15 Calculation of Railway Noise, Department of Transport, 1995

16 Calculation of Road Traffic Noise, Department of Transport and the Welsh Office,1988

17 British Standard BS 7445: 1991 'Description and Measurement of Environmental Noise' British Standards Institution, 1991

18 Directive 2002/49/EC of the European Parliament and of the Council of 25 June 2002 relating to the assessment and management of environmental noise

7 WATER RESOURCES

APPENDIX 7A: Assessment Methodology

This section gives further details in regard to the potential generic impacts on water resources, which may arise from construction or operation of such a scheme.

Geomorphological impacts

- Changes to the drainage pattern of the area (e.g. the location of outfalls from scheme drainage or the location of stream crossings, interception of overland flows across the route by the creation of embankments and cuttings, etc.),
- Changes to the shape and size of streams due to changes in rates of erosion and deposition of sediment.

Hydrological impacts

- Changes to the capacity of culverts and bridges conveying streams across the scheme alignment,
- Changes to embankment shape and size, leading to loss of floodplain and effects on flood conveyance,
- Changes to sub surface flows due to ground improvement works, interception of groundwater, etc.,
- Additional flows generated by the proposed works, due (for example) to changes in surface type and decreased permeability,

Water quality impacts

- Impacts arising from construction of the scheme, e.g. fuel or chemical spillages, mobilisation of sedimentations,
- Impacts due to operation of the scheme, e.g. sanitary wastes, fuels and oils, herbicides, Copper and Zinc deposition from road drainage, etc.

APPENDIX 7B: Baseline Conditions

Data Sources

Hydrological Data

Hydrological features along the scheme were identified initially from Ordnance Survey maps, an aerial video of the route, and previous studies undertaken on the feasibility of the project. In addition, site surveys were undertaken on 1 August and 22 October 2002 to investigate, record details of, and photograph these features.

Flow data for the major streams that SEPA monitor in this area (viz. the River Forth, River Devon, and River Black Devon) was secured from the SEPA web site (www.sepa.org.uk). Flow estimates for the remaining streams were derived using Institute of Hydrology Report 101 (Low Flow Estimation in Scotland) and 108 (Low Flow Estimation in the United Kingdom). These methods assess low and average flows based on catchment data and typical rainfall figures for the area.

Water Quality Data

Water quality data for the three major rivers was obtained from the SEPA website, and Water Quality Classifications were obtained from discussions with SEPA personnel. A Water Quality Classification was also provided by SEPA for the Brothie Burn in Alloa. The definitions of the various water quality classifications adopted by SEPA are found on the SEPA website.

In regard to the minor streams, SEPA agreed that the baseline conditions and classification could be based on a visual/qualitative assessment. This assessment was carried out on the basis of the records and photographs taken during the site visit.

Groundwater Data

Groundwater data was sourced from:

- "Geotechnical Review" (Babtie, 2002), a study carried out during the feasibility stage of this project, and which contained historical borehole data,
- The "Hydrogeological Map of Scotland" (BGS, 1988),
- The "Groundwater Vulnerability Map of Scotland" (BGS, et al, 1995),
- "Groundwater Protection Strategy for Scotland" SEPA 1997.

Proposed Eastern Link Road Data

Additional information on the baseline conditions in the area around the proposed ELR gathered during a further site visit undertaken on 22 October 2002. During the site visit additional information was also gathered in relation to the route of culverts through the bonded warehouses, surface water drainage of the site, flooding, and recent works to channels from the Business Leader Mr Tom Duncan.

Description of Water Resources Features

River Forth

The River Forth drains a large part of central Scotland from Aberfoyle in the west, high ground to the north of Callander, the Ochil Hills to the north of Alloa, and the Touch Hills to the west of Stirling. The topography of the Forth estuary area is locally modified by subsidence associated with the long history of mine working in the area.

At the Forth Viaduct, Stirling, the River Forth is approximately 30 metres in width and the channel section is characteristic of a low land river flowing within its own flood plain. At Kincardine the channel width increases to between 600m and 1000m. The River Forth is tidal and estuarine in nature between Stirling and Kincardine, and has a well developed meander system. The river course has been constrained at certain locations (e.g. at the Forth Viaduct in Stirling, and along the north bank at Alloa) due to development of the floodplain and subsequent bank protection works.

It is also noted that the 'Fife Shoreline Management Plan (June 1999)' concludes a strategy of 'holding the line' (i.e. maintaining the existing coastal alignment) is appropriate for this 'Management Unit' (Kincardine to Longannet).

Historical flow records from the Craigforth gauging station (located just upstream of Stirling) show that the average flow for 3 selected years out of the last ten (1993, 1995, and 2000) was in the region of 42.80 m^3/s. SEPA have recorded peak flows in the region of 331m^3/s, taken from figures recorded over the last ten years. The minimum flow recorded in the river in the last 10 years is in the region of 3.1m^3/s.

The designation of the middle reach (Cambus to Alloa) as Class C is mainly due to an oxygen lag in that reach, caused by poor tidal flushing and possibly the effects of a number of industrial and treated sewage discharges.

Black, et al, 2000 comment on this effect as follows:

"The upper Forth Estuary has for many years suffered from depressed dissolved oxygen levels. The development of an oxygen sag in the stretch of the estuary between Alloa and Stirling is a result of the combined direct and indirect effects on water quality of discharged organic material. This sag is particularly pronounced over spring tides, especially in conjunction with periods of low river flow."

It is noted that all discharges into the Devon, Black Devon, or any of the other burns in the area eventually reach the River Forth, and therefore present a cumulative loading effect on the Forth. The full range of point source discharges to the Forth and its tributaries consists mainly of effluent from sewage treatment plants, combined sewer overflows, and a high BOD discharge from the QUEST plant of Menstrie.

River Devon

The River Devon drains a catchment on the north side of the River Forth, including substantial part of the River Forth flood plain between Tullibody and Dollar, as well as parts of the Ochils around the Upper and Lower Glen Devon Reservoirs. The River Devon flows within a relatively narrow floodplain, constrained to the north by the Ochil Hills and to the south by a ridge of high ground running east west.

At the point where the River Devon passes under the railway it is approximately 15 metres in width and the channel section is constrained by the bridge abutments and a mid-stream pier. The Devon exhibits some slight meanders, but is constrained in a number of places by road and rail crossings, which serve to curtail any significant meanders. There is a short stretch of the Devon that is tidal, between Cambus and the River Forth, demarcated from the fluvial stretches by a weir near Cambus.

Historical flow records from the Glenochil gauging station (located to the north of Tullibody) indicate an average flow for 3 selected years out of the last ten (1992, 1995, and 2000) in the region of 4.9m^3/s. SEPA have recorded peak flows in the last 10 years in the region of 52m^3/s. The minimum flow recorded in the river over the last 10 years is in the region of 0.9m^3/s.

There are two small sewage treatment plants, at Alva and Tillicoultry, which have licensed discharges into the River Devon. There is also a combined sewer overflow to the River Devon at Cambus (downstream of the railway).

River Black Devon

The River Black Devon drains a modest catchment area to the NNE of Clackmannan, with two minor tributaries. The Black Devon exhibits little in the way of meanders, and is largely constrained in its path through Clackmannan by several residential developments. In addition, the watercourse flows in an incised channel near Clackmannan.

At the point where the River Black Devon passes under the railway it is approximately 6 metres in width and the channel section is constrained at this point by the bridge abutments. There is a short stretch of the Black Devon that is tidal, about 1.5km before its outfall into the Forth.

Historical flow records from the Fauld Mill gauging station show peak flows in the region of 14.4m^3/s, taken from figures recorded over the last ten years. Whilst no other flow data was available for the Black Devon, the average flow rate was estimated at 0.90 m^3/s (approximately 20% that of the River Devon).

There is a combined sewer overflow at Clackmannan (in the vicinity of the railway) that discharges into the Black Devon. No other licensed discharges have been identified by SEPA for this river.

Brothie Burn

For the purposes of this report the burn downstream of this confluence will be referred to as the Brothie Burn, whilst the two burns upstream will be referred to as the Brothie Burn (north) and the Brothie Burn (south). With the Brothie Burn (south) being the outflow from the Gartmorn Dam. The Brothie burn is heavily culverted through Alloa and is not thought to be a significant fishery for migratory or non-migratory fish.

The Brothie Burn (north) would appear to be made up of two secondary burns; one running north and east draining an area around Keilarsbrae, Post Hill, and possibly as far north as Schaw Park, and the second runs north and west draining an area around Branshill. Both of these secondary burns would appear to be heavily culverted underneath the adjacent residential and light industrial areas.

Upstream of the proposed road crossing the burn emerges from a culvert approximately 1.5m in width, located at the north west corner of the bonded warehouse site. The channel has recently been cleared by the landowners and would appear to be 2 – 3 metres wide under normal conditions, based on the existing tree line. However, at the time of the site visit the area had experienced 24 hours of extremely heavy rainfall, and the burn was approximately 6 – 8 metres in width and flooding its local flood plain.

The Brothie Burn (south) is the outflow from a weir across the west end of the Gartmorn Dam, and in addition it drains an area of agricultural land between the dam and the bonded warehouses. Just upstream of the proposed crossing the burn emerges from a culvert that is approximately 2 metres in width. From this point the burn is culverted right under the warehouses to the east, and then re emerges in another culvert to the west of the warehouses. The channel leading into the upstream culvert is approximately 2 metres in width and forested on either side.

During the site visit this burn was flowing quickly, although it showed no signs of being out with its normal channel. This is possibly due to the flow control on this burn exerted by the Gartmorn Dam. There is a grate at the upstream culvert, which was clear and allowing free flow at the time of the site visit.

The cumulative catchment area for the north and south Brothie Burns is in the region of 6.5 square kilometres. Although owing to their heavily culverted nature it is difficult to ascertain exactly where each burn begins and what area it drains. After the confluence the Brothie Burn flows through an area of woodland before reaching the existing B909 road, where the burn passes through a small stone arch bridge.

Upstream of this bridge there was local flooding of the burn into the surrounding woodland, and the channel was approximately 5 – 6 metres in width during the visit. The local tree line would suggest that the channel is normally around 3 metres in width. Downstream of the bridge the burn is heavily constrained between a park and housing, and had begun to break its banks at the time of the visit. The channel at this location was approximately 2 metres in width, and the flow appeared to be slightly backed up upstream of the bridge.

In line with general observations of the rivers in this area, the peak flows would appear to be in the region of 10 times the average flow. Therefore an estimate of the peak flow in the Brothie Burn might be in the order of $1m^3/s$.

The owners of the bonded warehouses reported no known problems with flooding of the Brothie Burn on their land. However, during the site visit in October 2002 local flooding was noted in the wooded area and the small park downstream of the bonded warehouses. The extent of the flooding in these areas was relatively minor, and only affected the undeveloped land in the immediate vicinity of the burn.

SEPA have given the Brothie Burn a water quality classification of grade B (Fair). Although at the time of the site visit in August 2002 there was a considerable amount of littering of this burn just downstream of the railway crossing. During the October 2002 visit the Brothie Burn the water was highly coloured and turbid, due to the recent heavy rainfall. It is also noted that part of the surface water drainage network for the bonded warehouses discharges to the Brothie Burn.

During the site visit the presence of large diameter pipe running across the Brothie Burn just downstream of the confluence of the north and south sections was noted. The pipe was approximately 0.5 metres in diameter, and had a rectangular hole cut in it just above the

longitudinal centreline. This hole was located above the centre of the burn, and at the time of survey water was being discharged from this pipe into the burn. Further investigations (review of Scottish Water drawings for the area) indicate that it is very likely that this pipe is a part of the Scottish Water combined surface water / foul water gravity system. With the discharge being the Scottish Water Combined Storm Overflow noted on their plans in this vicinity.

Other minor streams and burns

The Powis Burn is the largest of these streams draining the area between Stirling and the River Devon. The Powis Burn passes under the railway by means of a concrete slab bridge, approximately 3 – 4 metres in width.

The remaining streams drain the south side of a ridge that runs east west between the River Devon and River Forth, and tapers to a point near Tullibody. With the exception of the Logie Burn, which drains an area to the north of the Wallace Monument. All of these streams pass under the railway in culverts, typically 1.2m wide by 0.9m to 1.2m in height.

The Fairy Burn is mostly culverted through Alloa, and passes beneath the old railway station area in Alloa.

Other Surface Water Features

This local depression is approximately 70 metres in length and 30 metres wide, and lies between a small ridgeline to the north and an embankment before the railway to the south. During the first site visit in August 2002 the feature was probably in the region of 300mm deep in places with grass showing in others. During the October 2002 site visit it was less than 100mm deep with numerous tufts of grass showing.

The geotechnical investigation undertaken in support of the proposed link road has shown that there is extensive clay deposits underlying this area. In addition, a trial pit on the railway embankment in the vicinity of this feature noted a perched water table at 1 – 2 metres below ground level. It is possible that the topographic, geological drift, and man made features have combined to create temporary water retention in this area. Notwithstanding this, the feature is deemed to have little natural value in terms of flora and fauna, and is likely to be more of an inconvenience for the farmer.

Ground Water

From the Hydrogeological Map of Scotland, the majority of the scheme corridor (and out to 1000m either side of the scheme) is located on Quaternary Coastal and River Alluvium. Such Quaternary deposits are generally made up from fine-grained sands, silts, and clays, with occasional sands and gravel deposits.

This area is described as “aquifers of limited potential, regions without significant groundwater”. Borehole yields are generally noted as small, typically 1 l/s to 2 l/s.

However, between 0.5km and 1km to the north of the railway, in the Tullibody area, there is an area of Lower and Middle Old Red Sandstone. Such deposits are classed as potentially being “locally important aquifers”. They are generally made up from fine to medium-grained sandstones, but may also contain mudstones and siltstones. Potential borehole yields vary from 1 l/s to 12 l/s depending on the condition and nature of the bed.

The "Groundwater Vulnerability Map of Scotland" shows that the corridor along the railway is classed as moderately permeable land. The information on the map goes on to state that these formations "seldom produce large quantities of water for abstraction; they are important for local supplies and in supplying base flow to rivers". It is also noted that the estimated infiltration based on geology, topography and base flow data is between 100 and 300 mm/year.

Track Drainage Discharge and Water Quality

The existing drains in the cuttings are overgrown and frequently contain standing water. These cuttings may be drained by either channel drains or piped french drains, discharging to the surface at one or other end of the cutting. Significant outfalls to watercourses have not been identified in earlier investigations or in this present study.

Inspection of the existing track ballast and adjacent areas along the railway route showed that the surface is not significantly contaminated with grease or oils, and it is therefore unlikely that the ballast itself is contaminated. An assessment of contamination is made in the Geology and Soils Chapter of this ES.

The larger structures crossing water resources features (e.g. bridges) generally have soffit drains that allow infiltrated water to discharge directly to the watercourse below. However, during the inspection there was no sign of drainage infrastructure on the railway viaduct crossing the River Forth at Stirling. It was noted that the track ballast was underlain with pitch waterproofing, which it is assumed covers the entire bridge deck. There are no significant upstands along the edge of the bridge to prevent track ballast or other solids being shed directly into the River Forth. It is therefore assumed that surface water percolates readily through the track ballast and is possibly directed to the river via drainage holes in the bridge soffit.

The Cambus Viaduct over the River Devon appears to have track drainage consisting of a number of drainage pipes on the underside of the bridge, directing infiltrated water directly into the River Devon.

The bridge over the River Black Devon is a steel single span structure. It is likely that track drainage is directed through the bridge superstructure and falls directly into the river.

APPENDIX 8C: Aspects of the Proposed Scheme Affecting Water Resources

Temporary Facilities

It is anticipated that some 12 temporary works compounds will be used during construction. The two compounds to be located either side of the Forth Viaduct (Stirling) and the compound located at Longannet Power Station would appear to be the only compounds adjacent to a water resources feature, although no compound locations have been identified for the ELR. The operation of these compounds could result in construction stage impacts, and the measures required to avoid such effects are noted in the mitigation section in Volume 1.

Permanent Way

Major works along a railway route that might affect overall hydrology/hydraulics of the water resources could include filling within floodplains to create new embankments and re-direction of the flow path of crossing watercourses. The present proposal is to contain the works within the existing rail corridor, and it is understood that no new embankments or cuttings are required. On that basis, the works are not anticipated to have any impacts on flood levels in adjacent floodplains (e.g. of the River Forth), or to re-route existing watercourses.

There may be some protection works required to the left bank of the River Forth where the railway embankment is adjacent to the railway downstream of the Forth Viaduct at Stirling.

In cuttings, the proposed railway will be drained by french drains. These will receive runoff from the cutting slopes, as well as seepage from the track surface via the ballast. The french drains incorporate a longitudinal pipe to take drainage water longitudinally out of the cutting area, to outfall headwalls. The french drains incorporate catchpits at regular spacings. These allow maintenance and also trap sediment from being exported with drainage water.

Bridge Works

A number of bridges will be refurbished during this project. Of these, three will be the subjects of major refurbishment over water resources features, namely the Forth Viaduct, the Cambus Viaduct, and the Black Devon Bridge.

The scope of works to these structures is described in Volume 1 of this ES. These works will be undertaken over or adjacent to the rivers, and may also involve working in the watercourses themselves (e.g. scour protection). The proposed works are unlikely to significantly change the waterway area or hydraulic conveyance of the structures.

Culverts

Of the 14 culverts that cross the railway alignment, seven brick culverts are to be replaced with concrete box culverts as part of the Scheme. Such works will involve removal of existing works and construction of new box sections. During such works it has been assumed that the watercourse will require to be diverted around or over-pumped across the site. The remaining seven culverts will be the subjects of de vegetation and masonry repairs. These works may also require the watercourses to be temporarily diverted to allow construction access. The design of the culverts (where these are to be replaced) will require to account for the hydraulic impacts upstream.

Stations and Railway Yards

A new station is to be constructed at Alloa. This will include a new siding, station buildings and car parking areas. There is the potential for pollution from these facilities, including grease, oils and waste from trains using the siding, and uncontrolled surface water runoff from buildings and roads/hardstanding areas. It has been assumed that foul drainage facilities will be incorporated into the new Station and piped into the existing Scottish Water sewerage system.

ELR Crossing over the Brothie Burn

The construction and drainage of a crossing over the Brothie Burn, just upstream of the existing Hilton Road / Brothie Burn Bridge, will have the potential to impact upon the geomorphology, hydrology, and water quality of the Brothie Burn. The impacts of such a crossing should be considered in detail prior to completion of scheme design. No detailed information was available on this crossing for this assessment. However, generic impacts for such a crossing have been discussed in Volume 1 Chapter 14 of this ES.

Control and disposal of surface water run off from the ELR

There were limited details available in regard to the proposals for surface water drainage of the proposed Alloa Eastern Link Road for this assessment. However, generic water quality impacts relating to highway developments have been discussed in Volume 2 of this ES.

Appendix 7D: References

- Babtie, 2002 "Geotechnical Review"
- Black, et al, 2000 "Heavily Modified Waters In Europe – Case Study on the Forth Estuary"
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- British Geological Survey, 1995 "Groundwater Vulnerability Map of Scotland"
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- IOH, 1987 "Low Flow Estimation in Scotland"
- IOH, 1992 "Low Flow Estimation in the United Kingdom"
- Scottish Environment Protection Agency Web Site www.sepa.org.uk
- SEPA, et al "PPG1 – General Guide to the Prevention of Pollution"
- SEPA, et al "PPG5 – Works In, Near, or Liable to Affect Watercourses"
- SEPA et al "PPG6 – Working at Construction and Demolition Sites"
- SEPA et al "PPG23 – Maintenance of Structures over Water"