A9 DUALLING
PERTH TO INVERNESS

A9 Dualling Dalraddy to Slochd

Stage 2 Scheme Assessment

Report Volume 1 –

Part 6 Appendices

September 2017

TRANSPORT SCOTLAND
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Glossary and abbreviations

Terminology	Abbreviation	Description
Alluvium		Sediment deposited by a river.
Baseline		The existing conditions which form the basis or start point of the environmental assessment.
Bedrock		Hard rock that lies beneath a superficial cover of soils and sediments.
Biodiversity		Biological diversity or species richness of living organisms present in representative communities and populations.
Catchment		The area contributing flow to a point on a drainage system.
Channel morphology		Physical characteristics of stream channels, such as width/depth ratio and sinuosity.
Controlled Activity Regulations (Scotland) 2011 as amended	CAR	Controls all engineering activity in or near watercourses.
Design Manual for Roads and Brides	DMRB	A series of 15 volumes that provide standards, advice notes and other documents relating to the design, assessment and operation of trunk roads, including motorways in the United Kingdom.
Desk study		Assessment of a site usually preceding ground investigations typically incorporating a review of available site information, consultation with relevant bodies and a site visit.
Dualling		The widening of an existing road in order to provide two carriageways in both directions.
Ecology		The branch of biology concerned with the relations of organisms to one another and to their physical surroundings.
Ecosystem		A biological community of organisms interacting with one another and the surrounding physical environment.
Environmental Impact Assessment	EIA	The process of evaluating the likely environmental impacts of a proposed project or development, taking into account inter-related socio-economic, cultural and human-health impacts, both beneficial and adverse.
Ephemeral watercourse (also referred to as winterbourne)		A watercourse which does not flow all year round, predominantly dry throughout the summer months.
Exchange (see Primary Function)		Sediment output is approx. equal to input from upstream (as for a transfer reach), but incoming sediment is exchanged with that derived within the reach, featuring active erosion and depositional sites.
Fluvial geomorphology		The study of landforms associated with river channels and the sediment processes which form them.
Geomorphology		The branch of geology concerned with the structure, origin and development of topographical features of the earth's crust.
Habitat		Term most accurately meaning the place in which a species lives, but also used to describe plant communities or agglomerations of plant communities, as used, for example in a Phase 1 Habitat Survey.

Terminology	Abbreviation	Description
Hydromorphology		A term largely created for the Water Framework Directive comprising a blend of hydrology and geomorphology
Incision		Scouring of a river bed.
Infrastructure		The basic structure or features of a system or organisation.
Landform		Combination of slope and elevation producing the shape and form of the land surface.
Landscape		Human perception of the land, conditioned by knowledge and identity with a place.
Main water body		Designated under the WFD and visible on 1:50k OS maps.
Minor watercourse		Not shown on 1:50k OS maps.
Mitigation		Term used to indicate avoidance, remediation or alleviation of adverse impacts.
Ordnance Survey	OS	Mapping provider.
Palaeochannel		Remnant of an old river channel that has been filled or buried by younger sediment.
Planform		Channel shape and composition as viewed from above.
Pool and riffle sequence		In a flowing stream a riffle-pool sequence develops as an area of alternating areas of relatively shallow and deeper water. Riffles describe shallow water where the flow is rippling over gravel deposits whereas pools are deeper and calmer areas.
Primary Function		Describes the general sediment balance occurring (in the context of the A9) along a given surveyed watercourse reach. This is described as either a source, sink, transfer, exchange or ephemeral watercourse (see accompanying descriptions in glossary) depending on the amount of sediment input and/or output from a reach.
Primary Process		Describes a channels general response to the hydromorphological function. An exchange reach where the input is broadly in balance with output is likely to result in a lateral migration, a source reach may be either widening or incising, whilst a sink may be narrowing or aggrading. Transfer reaches are characterised as stable.
Proposed Scheme		The scheme design for the Dalraddy to Slochd section of the A9 used as the basis for environmental assessment and reporting.
Residual impacts		Residual impact means the environmental impact after the provision of mitigation measures, if any.
Riparian habitat		Natural home for plants and animals occurring in a thin strip of land bordering a stream or river.
River Basin District		The area of land and sea, made up of one or more river basins, together with the associated groundwater and coastal waters, identified by the Water Framework Directive as the main unit for the management of river basins.
River Basin Management Plan	RBMP	A plan setting out actions required within a river basin to achieve set environmental quality objectives, reviewed on a six yearly basis.
River Habitat Survey	RHS	A survey to assess the physical structure of freshwater streams and rivers, providing a broad assessment of habitat quality.

Terminology	Abbreviation	Description
Runoff		Water that flows over the ground surface to the drainage system. This occurs if the ground is impermeable or if permeable ground is saturated.
Scottish Environment Protection Agency	SEPA	Regulating body responsible for the welfare of the water environment and enforcing the WFD
Sink reach (see Primary Function)		Sediment input to the reach is greater than sediment output to the next reach downstream
Source reach (see Primary Function)		Sediment output from the reach is greater than sediment supply from upstream.
Step-pool sequence		Often occur in upland channel where the gradients are over 4%. Naturally forming features which regulate steep gradients and dissipate high flow energy.
Transfer reach		Sediment output is approx. equal to input from upstream. Sediment is transmitted through the reach, which features few sites of active erosion, or deposition either because the channel is adjusted and naturally stable or because the bed and banks have been stabilised artificially.
Water Body		A body of surface water or a body of groundwater. The WFD defines surface water bodies should be discrete, but not necessarily a whole river, while groundwater bodies should be distinct.
Water Framework Directive	WFD	Wide-ranging European environmental legislation (2000/60/EC). Addresses inland surface waters, estuarine and coastal waters and groundwater. The fundamental objective of the WFD is to maintain "high status" of waters where it exists, preventing any deterioration in the existing status of waters and achieving at least "good status" in relation to all waters by 2015.
Water quality		The chemical and biological status of various parameters within the water column and their interactions, for example dissolved oxygen, indicator metals such as dissolved copper, or suspended solids (the movement of which is determined by hydrological process and forms geomorphological landforms).

1. Introduction

1.1. Purpose of the Assessment

1.1.1. The assessment informs Chapter 10 Road Drainage and the Water Environment of the Stage 2 Scheme Assessment Report in relation to potential hydromorphological impacts of The Proposed Scheme on the receptors (affected fluvial watercourses) during the construction and operation phases.

1.1.2. The assessment also examines the potential mitigation measures which may be considered to remove and reduce hydromorphological impacts on the watercourses.

1.1.3. The specific objectives of this assessment are to:

- Assess the baseline characteristics of each watercourse and categorise each with a sensitivity classification.
- Assess the potential impact on each watercourse for each of the proposed options.
- Provide an outline of mitigation measures to be considered at DMRB Stage 3 Assessment.
- Identify any further investigations required to complete DMRB Stage 3 Assessment.

1.1.4. Direct and indirect impacts will also be considered with regards to the cumulative impacts relating to the wider Water Framework Directive (WFD) objectives in the vicinity of The Proposed Scheme.

1.2. Study Area

1.2.1. The study area for this assessment focuses on The Proposed Scheme within a 250m proximity. The Proposed Scheme begins around NGR 2851 8086 southeast of Loch Alvie, passing by Inverdruie and Aviemore on the west and ending west of Strathdearn at NGR 2281 8271. Figure A10.1.1 in Annex A provides an overview of The Proposed Scheme extent and study area.

2. Approach and Methodology

2.1.1. The hydromorphology impacts have been determined by assessing the sensitivity of each watercourse and then the magnitude of the potential impact(s) of The Proposed Scheme Options on each watercourse. The following section outlines the approach to the classification criteria and the methodology by which this has been applied to the watercourse assessment. The combination of the sensitivity and magnitude produces an overall significance of impact.

2.1.2. To some degree, the assessment of sensitivity and impacts relies on the professional judgement of the surveyor and therefore is partially subjective. Consequently it is important that a wide range of information is considered when assigning values to each watercourse. A desk study was undertaken which complemented specific site visits to those watercourses screened in as potentially vulnerable to an adverse impact (see Section 3.1 for more details).

2.2. Desk Study

2.2.1. The desk study was undertaken to identify current hydromorphological conditions and trends in watercourse behaviour. Table 2-1 lists the data used during the desk study and what information each type of data source provided.

Table 2-1 Desk study data sources

Data source	Description and information provided
Contemporary aerial photographs	Aerial photographs provide contextual information about the site and surrounding landscape, including land use and vegetation types. It can also provide some insight into the distribution of fluvial features, such as gravel bars, palaeochannels and wetland features.
Contemporary Ordnance Survey mapping	Providing basic contextual information, such as elevation, relative relief and an indication of channel gradients.
Geological mapping (solid and drift plus soils)	Indicates the underlying geology and feeds into the understanding of potential response/stability.
Historical mapping (where available): National Library of Scotland (online) Old maps (online)	Comparison of historical maps to determine channel change over a period of approx. 150 years. Provides important context and understanding to modifications and existing fluvial processes, also allows insight into long-term instability issues.
Topographic survey	Understanding the arrangement and topography of existing features and landscapes in the study area.
River Basin Management Plans (RBMPs)	The RBMPs indicate which water bodies are classified under the WFD as main rivers and their relative status. It will also provide an insight into the proposed mitigation measures and targets which can be built into future designs.
The Proposed Scheme Options	To assess the potential impacts to the watercourses.

2.3. Field Study

2.3.1. The field study complements and builds on the findings of the desk study to determine the specific character of the geomorphological forms and processes for each watercourse.

2.3.2. The field study comprised a rapid hydromorphological walkover along each watercourse to broadly assess the following:

- landscape and floodplain;
- channel modifications;
- planform and boundary conditions (bed and banks);
- existing operating fluvial processes and features; and
- riparian and in-channel vegetation.

2.4. Watercourse Sensitivity

2.4.1. The DMRB does not outline a specific methodology or guidance for assessing hydromorphological impacts.

2.4.2. The sensitivity of the identified watercourses has therefore been determined based on broad classification criteria (Table 2-2) which has been adapted from similar guidance[i], taking into account research and development programmes of the Environment Agency and Scottish National Heritage (SNH) as complied in the Guidebook to Applied Fluvial Geomorphology[ii] and SEPA's Good Practice Guide[iii], as well as professional experience.

2.4.3. The WFD underpins the fundamental basis of the assessment and outlines the general objectives for each water body (a segment of or an entire watercourse), as such, the WFD classification has also been considered in the development of the classification criteria and define the minimum sensitivity value (i.e. Moderate = Medium and Good = High etc.), although higher values can be assigned if observations on site indicate the morphological features and processes warrant it.

2.4.4. The criteria is based on direct impacts to reportable water bodies, i.e. those identified by the Scottish Environment Protection Agency (SEPA), as opposed to the water body catchment.

Table 2-2 Watercourse sensitivity classification criteria

Value	Criteria
Very High	A watercourse exhibiting a wide range of morphological features such as pools and riffles, active gravel bars and varied river bank types, such morphological variability is a primary determinant of ecological diversity. No signs of modification and/or morphological pressure. WFD overall status of 'High'.
High	A watercourse exhibiting a range of morphological features with very little modification and/or morphological pressures. WFD overall status of 'Good'.
Medium	A watercourse exhibiting some signs of modifications, but displaying signs of recovery towards a natural equilibrium. Limited morphological features and a limited range of fluvial processes. WFD overall status of 'Moderate'.

Value	Criteria
Low	A watercourse exhibiting no morphological diversity; flow is uniform, gravel bars absent and bank type's uniform and stable, with no evidence of active fluvial processes. Such watercourses may have been subject to past modification such as straightening, bank protection and culverting, or other anthropogenic pressures. May have insufficient capacity for recovery, primarily acting as a transfer or sink system. WFD overall status less than 'Moderate'.

Source: adapted from table 14, WebTAG Unit A3, Department for Transport, 2014

2.5. Impact Assessment

2.5.1. Similarly to the sensitivity criteria, there is little guidance on the classification of the potential magnitude of hydromorphological impacts. The criteria used in this assessment is based on similar guidance as stated above. The guidance criteria is outlined in Table 2-3 below.

Table 2-3 Magnitude of impacts classification criteria

Value	Criteria
Major Adverse	Significant channel realignment (e.g. >10m in length), new or extended embankments or one of more watercourse crossing structure having an impact on the water body scale. Impacts result in loss of feature(s) and potential failure of hydromorphological elements (morphology, quantity and dynamics of flow) resulting from the works. Loss or damage to existing habitats. Significant/extensive alteration to channel planform and/or cross section, including modification to bank profiles or the replacement of a natural bed. Deterioration in overall water body status or/and preventing attainment of 'Good'.
Moderate Adverse	One or more watercourse crossing and/or structure(s) (e.g. embankments etc.) resulting in wider than localised impacts, but not water body scale. Results in adverse impact on integrity of feature(s) or loss of part of feature / moderate shift away from baseline conditions. Potential failure of one or more hydromorphological elements (morphology, quantity and dynamics of flow) resulting from the works. Some damage or loss to habitat due to the modifications. Some alteration to channel planform and/or cross section, including modification to bank profiles or the replacement of a natural bed. Prevents a WFD water body attaining overall status of 'Good'.
Minor Adverse	Upgrade to, and/or extension of, existing watercourse crossing and/or structure, with minor channel realignment required (e.g. <10m in length) that has a localised impact. Potential failure in one of hydromorphological elements (morphology, quantity and dynamics of flow) resulting from the works. Results in minor adverse impact on feature / minimal shift away from baseline conditions or partial loss or damage to habitat due to modifications.
Negligible	No alteration to hydromorphological elements. Some impact on feature(s), but of insufficient magnitude to affect the use / integrity, approximating to a 'no change' situation.
Minor Beneficial	Results in minor beneficial impact on feature or a reduced risk of adverse effect occurring. Potential improvement(s) in one of the hydromorphological elements (morphology, quantity and dynamics of flow) resulting from the

Value	Criteria
	works. Slight change / deviation from baseline conditions or partial improvement or gain in riparian or in-channel habitat.
Moderate Beneficial	Results in moderate improvement of feature(s) or water body which could lead to achieving an Ecological WFD status of 'Good'. Improvement in one or more hydromorphological elements (morphology, quantity and dynamics of flow) resulting from the works. Partial creation of both in-channel and riparian habitat. Includes partial or complete removal of structures and/or artificial materials.
Major Beneficial	Results in major improvement of feature(s) or water body, which could lead to achieving an Ecological WFD status of 'Good' or higher. Extensive creation of both in-channel and riparian habitat, vastly improving the water body from baseline conditions. Removal of modifications, structures, and artificial materials.

Source: Adapted from table 15 of WebTAG Unit A3

2.5.2. The overall impact is determined using the impact matrix outlined in Table 2-4 which cross-references the sensitivity and the magnitude of impact ratings. The overall impact uses a significance rating score from Neutral to Very Large as per the significance rating in the DMRB[iv].

Table 2-4 Overall significance of impact matrix

Sensitivity	Magnitude of Impact			
	Major	Moderate	Minor	Negligible
Very High	Very Large	Large / Very Large	Moderate / Large	Neutral
High	Large / Very Large	Moderate / Large	Slight / Moderate	Neutral
Medium	Large	Moderate	Slight	Neutral
Low	Slight / Moderate	Slight	Neutral	Neutral

2.6. Limitations

2.6.1. Limitations to be aware of relating to the findings of this report are as follows:

- The results are based on a rapid fluvial geomorphological walkover rather than a full fluvial audit approach. The findings of the walkover are focused around the immediate vicinity of the proposed A9 crossings and are not broken into reaches, except for those sections upstream and downstream. Where possible, a minimum of 250m upstream and downstream was surveyed.
- Access was limited by the relevant permissions and safe/easy access. Where access was not possible, spot checks were undertaken at existing crossings or via footpaths.
- The features and processes observed may vary over time/seasons and high flow events. The survey was undertaken under relatively dry conditions, and the overall function and stability was inferred through professional judgement and the interpretation of features on site.
- The Proposed Scheme Options are currently subject to ongoing design and the precise nature of the impacts on the watercourses are uncertain. In all cases the worst case scenario has been considered and assessed.

3. Baseline

3.1. Initial Screening

3.1.1. A long list of watercourses crossed by The Proposed Scheme was initially developed and included over 100 watercourse crossings.

3.1.2. The crossings were screened based on the available site photographs and desk study information (basemaps and aerial imagery) to confirm their elimination or inclusion into further assessment.

3.1.3. The screening aimed to identify those crossings which met a broad set of criteria based on a similar process undertaken for the aquatic ecology assessment (Appendix A11.2 Aquatic Ecology). These are:

- the watercourse is a permanent flowing system with a channel width >1m;

  AND

- the watercourse is to be lost/culverted/diverted or potentially experience a significant change in water quality or quantity[1];

  AND

- is not obviously canalised or heavily managed;

  OR

- is hydraulically linked to a designated water-dependant site.

3.1.4. This assessment required some interpretation and professional judgement, therefore where it was unclear whether the watercourse crossing met the above criteria it was included for further investigation.

3.1.5. The screening exercise resulted in a total of 16 watercourses being identified for further investigation. These watercourses are outlined in Table 3-1 and their locations are shown on Figures A10.1.2a to A10.1.2i in Annex A. The assessment has been undertaken at watercourse level rather than for each individual crossing.

Table 3-1 Watercourses requiring further assessment (from south to north)

Watercourse Name	Crossing ID
Allt an Fheàrna	DS-WC-001
Allt Chriochaidh	DS-WC-002, DS-WC-003
Caochan Ruadh	DS-WC-004
Ballinluig Burn	DS-WC-005
Allt na Criche (Lynwilg)	DS-WC-007
Aviemore Burn	DS-WC-014
Unnamed Drain	N/A – not crossed by existing or proposed A9
The Shieling / Easter Aviemore Burn	DS-WC-016
Allt na Criche (Granish)	DS-WC-021, DS-WC-022
Southern Avie Lochan Burn	DS-WC-024

[1] Note. this was difficult to assess at the time as the options were still be confirmed

Watercourse Name	Crossing ID
Northern Avie Lochan Burn	DS-WC-026
Unnamed Drain	DS-WC-031
Allt Cnapach	DS-WC-032
Fèith Mhòr	DS-WC-036
River Dulnain	DS-WC-046
Allt nan Ceatharnach	DS-WC-048
Bogbain Burn	N/A – not crossed by existing or proposed A9
Allt Slochd Mhuic	DS-WC-056, DS-WC-057, DS-WC-058, DS-WC-059, DS-WC-060, DS-WC-061, DS-WC-062

3.2. Desk Study Results

Historical mapping analysis

3.2.1. A number of sources were investigated including the National Library of Scotland's online database[v] and Old-Maps.co.uk[vi].

3.2.2. All of the watercourses surveyed and affected by The Proposed Scheme have existing road and/or railway crossings which appear to have no / minimal impact on the watercourses.

3.2.3. Maps from the 19th century indicate that Aviemore Burn and Allt Cnapach were modified to provide offtakes for mills at NH 8940 13740 and NH 9121 18370, respectively, which were removed in the late-19th and mid-20th centuries. Both watercourses show signs of recovery after removal of the offtakes, with some ponding of water and minimal channel change downstream.

3.2.4. The River Dulnain, Allt an Fheàrna and Allt nan Ceatharnach all exhibit some active meandering, with greater activity of natural processes (including mid-channel bars) seen in the larger River Dulnain, as shown on the 19th century maps. All three channels were stable through the 20th century and up to the present day with no other significant channel change or modification visible on maps, apart from an offtake for a saw mill on the River Dulnain at NH 89948 22909 in the 19th century, although this appears to have no impact on the planform of the river.

3.2.5. Some artificial straightening is evident along both The Shieling/Easter Aviemore Burn (NH 89683 14192) and Feith Mhor (NH 92319 22308) in the 19th century, but are otherwise naturally meandering and show no other significant channel change or modification through the 20th century and up to the present day.

3.2.6. Throughout the 19th and 20th century maps the Unnamed Burn through Milton exhibits a natural planform which then flows into Aviemore Burn. However, the present day map (2015) indicates that the channel bifurcates at NH 88149 14509, which was not seen on the earlier maps. Both channels then appear to flow into Aviemore Burn, as previously.

3.2.7. Evidence for the remaining watercourses suggest that Allt Chriochaidh, Caochan Burn, Ballinluig Burn, Allt na Criche, Unnamed Tributary of Loch Puladdern and the Southern Avie Lochan Burn have undergone no significant channel change or modification over the past 170 years. All five watercourses are crossed by the existing A9 road and exhibit no evidence of channel change as a result of this construction.

3.2.8. The watercourses in this region of Inverness exhibit the planforms and processes of typical upland river systems. Overall, there is minimal modification of many of the watercourses and the structures that do exist appear to have very little / localised impact on their planforms and processes, with the exception of Allt Slochd Mhuic, Southern Avie Lochan Burn and Allt Chriochaidh which are heavily modified at the crossings.

Geology

3.2.9. The geological maps indicate that the site is underlain by metasedimentary and igneous rocks.

3.2.10. The site is underlain by a range of Quaternary Age superficial deposits. Quaternary Age glacial sand and gravel, till and diamicton are present in this region as a result of the Ice Age conditions which dominated up to 3 million years ago.

3.2.11. There is also evidence for pockets of peat of approximately the same age which were formed from organic accumulations in anaerobic conditions. The local environment was controlled by rivers up to 2 million years ago, resulting in alluvium deposits which dominate on the present-day floodplains. The alluvium is comprised of sands which would have been deposited by rivers to form river terraces, as well as fine silts and clays from subsequent overbank floods.

3.2.12. A more comprehensive study of the bedrock geology and superficial deposits can be found in the Geotechnical Preliminary Sources Study Report for the A9 Dualling Perth to Inverness, Slochd to Moy (B1557620/GEO/PSSR/11, Revision 04) prepared in October 2013.

Water Framework Directive (WFD)

3.2.13. As mentioned in Section 2.4 above, the WFD underpins the very nature of the assessment overall and will drive much of the design for the crossing structures and channel realignments.

3.2.14. The status of each water body is listed within the RBMP[vii] but monitored, updated and published online. The reportable WFD water body status applies to designated main water bodies (defined broadly as those watercourses visible on a 1:50k OS map). However, the water body catchment comprises a network of tributaries, small watercourse and drains. Hydrologically they are linked and therefore modifications to this network can have a direct impact on the main water body status. It is important to consider the impacts within this context.

3.2.15. The Proposed Scheme will directly affect four WFD water bodies, all of which will require a crossing. There are other WFD water bodies which would be indirectly affected cumulatively and/or within close proximity of the works. Please note this report does not constitute a WFD compliance assessment, but one should be undertaken during the DMRB Stage 3 Assessment.

3.2.16. Those water bodies directly affected are listed in Table 3-2, below.

Table 3-2 WFD Water Body status

Water Body Name	River Spey – River Feshie to River Nethy	River Dulnain – Lower Catchment	River Dulnain – Allt an Aonaich	River Dulnain – Allt Ruighe Magaig	River Dulnain – Feith Mhor	Allt na Fearna [sic] – u/s Loch Alvie
Water Body ID	23097	23106	23110	23112	23113	23126
National Grid Reference	NH 9126 1432	NH 9072 2293	NH 84215 22453	NH 8870 2513	NH 9186 2181	NH 8222 0796
Catchment	River Spey	River Spey	River Spey	River Spey	River Spey	River Spey
Heavily Modified	No	No	No	No	No	No
Parameter						
Overall status	**Moderate**	**Good**	**Good**	**Good**	**Poor**	**Poor**
Overall ecology	Moderate	Good	Good	Good	Poor	Poor
Physico-Chem	Good	High	High	High	High	Good
Dissolved Oxygen	High	High	High	High	High	High
pH	High	High	High	High	High	Good
Biological elements	Good	High	High	High	Poor	Poor
Fish	Good	High	High	High	Poor	Poor
Fish ecology	-	High	-	-	-	-
Fish barrier	Good	High	High	High	Poor	Poor
Specific pollutants	-	Pass	-	-	-	-
Hydromorphology	Moderate	Good	Good	Good	Good	Good
Morphology	Moderate	Good	Good	Good	Good	Good
Hydrology (medium/high flows)	Good	High	High	High	High	High

3.3. Field Survey Results

3.3.1. A site walkover was undertaken between the 1st and 4th December 2015. The information obtained from the walkover (in combination with the desk study) forms the basis of the sensitivity classification. Please refer to Figures A10.1.2a to A10.1.2i in Annex A for the location of watercourses.

Watercourse Name	**Allt an Fheàrna – upstream of existing A9**
Crossing References	**DS-WC-001**
Primary function	**Exchange**
Primary process	**Laterally Adjusting (Minor Incision)**
Description	

The surveyed watercourse began just downstream of Easter Delfour. It was boarded by a low valley side on the left hand bank (LHB) and an open floodplain on the right hand bank (RHB), and broadly sits within the broader Spey Valley. The general land-use was primarily grazing pasture for cattle and sheep, however there was a good corridor of woodland (buffer) along much of the channel, becoming slightly sparser towards the existing crossing under the A9. The channel possessed a naturalised and sinuous planform. The channel became straightened leading up to the A9 and the tree line was much thinner, and there was also a ford crossing immediately before the bridge crossing of the A9. The cross-section throughout was quite varied, and the channel was well connected to its floodplain. There were also areas where the channel bifurcated around mid-channel islands and bar features.

The bed comprised coarse substrates, such as cobbles and gravels, with smaller sandier material at the margins where flow energies were lower. The bank material was obscured on the day of the survey due to recent snow cover, but observations indicated it comprised predominantly earth and sandy soils.

The channel presented a diverse range of sedimentary features and processes, including the mid-channel and marginal gravel bars discussed above, but riffles and large woody debris features were observed as well. The channel suggested some lateral adjustment occurring, with occasional steep eroded banks on the outside of meanders and shallow gravel bars on the inside, although on the whole the tree line has stabilised the channel planform. There were some signs that incision had occurred, with a knickpoint[2] / woody step (see P1040399 below) and some toe erosion along the banks.

P1040399 – View upstream of large woody debris dam and evidence of incision (NGR 2852 8091)

P1040405 – View downstream; eroding outer bank on the right and shallow gravel bar on the inside indicating a lateral adjustment (NGR 2852 8091)

[2] A knickpoint describes a step in a watercourse or a sharp change in channel slope. They reflect different conditions and processes on the river often caused by previous erosion and can often lead to instability.

Watercourse Name	**Allt an Fheàrna – downstream of existing A9**
Crossing References	**DS-WC-001**
Primary function	**Transfer**
Primary process	**Stable**
Description	

Access along the downstream section of Allt an Feàrna was restricted due to ongoing construction works associated with the A9. The channel continued to exhibit a predominantly gravel bed and sandy earth banks. The once dense woodland now constitutes a thin tree line having been removed as part of the construction works. Otherwise there was a wide floodplain on the RHB and the road embankment was set a little further back on the LHB.

The planform was also slightly less natural, appearing to have been historically straightened (probably relating to the construction of the existing A9) and eventually joins Loch Alvie some 600-700m downstream. The channel underneath the A9 was contained within a concrete lined channel (bed and banks), and temporary bank protection had been installed associated with the construction works.

There were no obvious signs of erosion and fewer gravel deposits than upstream within the channel from the limited section surveyed, suggesting sediment was being efficiently transferred through.

P1040416 – View upstream towards existing A9 crossing; the channel had been lined artificially with rip-rap and boulder protection as part of the ongoing construction works (NGR 2855 8092)

P1040417 – View downstream from temporary crossing showing wide and uniform channel leading towards Loch Alvie (NGR 2855 8092)

Watercourse Name	**Allt Chriochaidh – upstream of existing A9**
Crossing References	**DS-WC-002**
Primary function	**Transfer**
Primary process	**Stable**
Description	

Access to the channel upstream of the existing A9 was restricted due to an impassable high fence line.

OS maps show the channel winding its way off the steep valley side through a narrow gorge or valley to the north west. Where it is crossed by the A9 the gradient was slightly lower than upstream, but still relatively steep. The landscape was primarily coniferous woodland. The channel appeared to be naturally straight (likely due to the gradient), and there was a significant concrete cascade structure immediately before the channel entered the culvert underneath the A9 (P1040419).

The bed and banks were primarily formed of coarse substrate, with sandy soils beyond. The steep gradient and coarse sediment had formed a step-pool sequence along the viewed section indicating a high potential stream power. There were no signs of erosion or significant deposition features, and the channel presented itself as stable transfer system.

P1040418 – View upstream from A9 verge showing a steep gravel bed stream in a dense woodland (NGR 2857 8095)

P1040419 – View of existing A9 crossing with concrete stepped cascade leading into culvert (NGR 2857 8095)

Watercourse Name	**Allt Chriochaidh – downstream of existing A9**
Crossing References	**DS-WC-002 and DS-WC-003**
Primary function	**Exchange**
Primary process	**Lateral Adjustment (Stable)**
Description	

Continuing from the upstream catchment the channel flowed through coniferous woodland, although the gradient was much lower than upstream as the channel joined Loch Alvie some 300 to 400m downstream. On the whole the channel remained natural, except for a small area immediately downstream of the A9 where some boulders have been placed artificially (and subsequently failed), probably to form bank protection. The planform was irregularly sinuous, with a number of marginal and mid-channel gravel bars creating a divergence of the flow.

The bed substrate comprised cobbles and boulders, much like upstream. The banks were similarly sandy earth banks with coarse sediments embedded. Flows were mostly energetic and step-pools were also common throughout.

There was some evidence of lateral adjustment with some bank erosion on the outside of bends, however this was mostly kept in check by the surrounding woodland and on the whole the channel was stable. There was also some evidence of incision around the outlet of the culvert with the invert perched above the bed (P10401425), however this appeared to be localised and was likely a result of the construction of the existing A9.

P1040425 – View of culvert outlet with signs of incision downstream and the invert was perched above the channel bed (NGR 2857 8095)

P1040434 – View downstream showing sinuous planform with some evidence of minor lateral adjustment (NGR 2858 8095)

Watercourse Name	**Caochan Ruadh – upstream of existing A9**
Crossing References	**DS-WC-004**
Primary function	**Exchange**
Primary process	**Stable (Lateral Adjustment)**
Description	

The Caochan Ruadh ("Red Stream") flows off the Creag Ghleannain to the northwest. During the survey the river was partially in spate due to snowmelt from the previous day. Broadly, the upper sections of the surveyed channel flowed through a peaty grassland and were well connected to the floodplain before flowing through a narrow and steep wooded gorge.

There was a ford crossing and some localised embankments at the downstream end of the reach. The surrounding area had broadly been cleared and transformed for agricultural purposes (primarily grazing). The planform although relatively unmodified meandered as it followed the topography and confined by bedrock rather than meandering as a result of fluvial processes.

The bed was formed from coarse substrate (cobbles, boulders and gravels) as well as bedrock in places. The banks were predominantly earth and bedrock, although at the upstream and downstream extents earthy soils were more dominant. Due to the steepness and roughness flows were highly energetic, with a number of chutes and cascades of step features, with some areas of rippled flow where the gradient was less steep.

Erosion and bank slips were common along the steeper channel and there were occasional gravel bars suggesting some lateral adjustment was occurring, but overall the channel was relatively stable.

P1040513 – View upstream towards start of surveyed reach; note a chicken farm on the left of the image (RHB) (NGR 2864 8102)

P1040514 – View downstream of wooded gorge, with landslips and bank erosion visible on the left; gravel bar on the RHB (inside bank) (NGR 2864 8102)

Watercourse Name	**Unnamed tributary to Caochan Ruadh – upstream of existing A9**
Crossing References	**DS-WC-004**
Primary function	**Transfer**
Primary process	**Stable**
Description	

This minor tributary joined Caochan Ruadh just upstream of the existing A9 crossing. It was situated within an open, yet steep hillside, dominated by grassland (grazing land). It flowed along a field boundary near Ballinluig. Further upstream the planform was slightly more sinuous and more vegetated, but broadly followed a straight course, partially due to the gradient and partially as a result of historic resectioning.

Again, much like Caochan Ruadh, the channel was in spate at the time of surveying due to the snowmelt. The survey did show that the channel was likely to have been modified for agricultural purposes, i.e. drainage. The channel was crossed a few times (culvert and fords) for farm access along the track to Ballinluig.

There were some localised sections where boulders were apparent, forming step-pool sequences, but on the whole the bed was mostly obscured by vegetation, indicating potential for much finer sediment to be present (silt and fine gravels perhaps). This may also indicate that the channel had little flow for large parts of the year, thus allowing the vegetation to establish. There were few signs of instability and on the whole the channel was a stable transfer reach.

P1040489 – View upstream showing well vegetated channel (NGR 2866 8103)

P1040500 – View downstream of straightened course following the field boundary (NGR 2866 7102)

Watercourse Name	**Caochan Ruadh – downstream of existing A9**
Crossing References	**DS-WC-004**
Primary function	**Transfer**
Primary process	**Stable**
Description	

The downstream reach of Caochan Ruadh only flowed for a small distance (c.130m) before it joined Loch Alvie. The channel flows through a long culvert underneath the A9 before emerging into a low gradient woodland, which was well connected to its floodplain (flooding out at the time of the survey).

The channel broadly followed a straight planform toward the Loch, although it did gently wander within this course. The bed was obscured at the time of survey, but indicated predominantly fine gravels and possibly silt. The banks comprised sandy soils, with some gravels.

There were no signs of erosion and it was difficult to see any in-channel deposits, although there were some large woody material which had fallen in from the adjacent woodland. As such the channel was a stable transfer.

P1040532 – The channel emerges from a large culvert underneath the A9 (NGR 2867 8100)

P1040537 – View downstream as the (flooded) channel flows through the woodland towards Loch Alvie (NGR 2867 8100)

Watercourse Name	**Ballinluig Burn – upstream of existing A9**
Crossing References	**DS-WC-005**
Primary function	**Transfer**
Primary process	**Stable**
Description	

The Ballinluig Burn upstream of the A9 winds through a narrow self-contained valley. The channel was relatively small being approximately 0.5 to 1.0m wide. A dirt access track followed the valley downstream, crossing over the channel along the way on the RHB. Overall the vegetation was predominantly grasses, with the occasional overhanging tree. There appeared to be a lot of in-channel vegetation present suggesting that the flows were normally quite minimal.

The channel possessed a naturally meandering planform, although had been constrained by the adjacent road, being crossed several times and the road embankment forming part of the valley side. A two-stage channel profile was common and there was a well-connected floodplain throughout. The existing A9 crossing comprised a concrete culvert.

The substrate was primarily gravels and sands on the bed, the banks comprised sandy soils. The flows were rippled, with some cascades over infrequent steps, but there was little sign of any fluvial activity, with few areas of erosion and no deposition features. Overall the channel was considered to be a stable transfer reach.

P1040486 – View upstream from track crossing; track shown on the right (LHB) (NGR 2870 8103)

P1040471 – View upstream immediately before crossing underneath the A9 (NGR 2869 8102)

Watercourse Name	**Ballinluig Burn – downstream of existing A9**
Crossing References	**DS-WC-005**
Primary function	**Transfer**
Primary process	**Stable**
Description	

The Ballinluig Burn downstream of the A9 was much more open than upstream, the narrow valley disappears and instead the channel flows through open agricultural fields. The channel was likely to have been modified historically, probably as a result of the A9 construction, with the channel possessing a slightly straighter planform than upstream. The channel was crossed once more a little further downstream of the A9 by an access track. The vegetation was dominated by grasses, with occasional trees. Downstream, just before the channel joined Loch Alvie there was small stand of woodland.

The banks were composed of sandy, earth soils. The channel immediately downstream (c.50 to 70m) of the A9 had a dense stand of in-channel emergent vegetation, which given the time of year indicated the channel was likely to have a low flow much of the year and the presence of fine substrate and some gravels were noted on the bed.

There were, once again, few signs of instability and flows were slightly less energetic (although still rippled given the high flows) than upstream due to the lesser gradient. The amount of vegetation growth downstream potentially indicates some degree of aggradation, or deposition of fine sediments, however on the whole this was quite localised. Generally, Ballinluig Burn downstream of the existing A9 was a stable transfer reach.

P1040479 – View immediately downstream of the existing A9 crossing (NGR 2869 8101)

P1040482 – Crossing over the Ballinluig Burn (NGR 2869 8101)

Watercourse Name	**Allt na Criche (Lynwilg) – upstream of existing A9**
Crossing References	**DS-WC-007**
Primary function	**Transfer (Sink)**
Primary process	**Stable**
Description	

Allt na Criche (Lynwilg) upstream of the A9 can be separated into two reaches, with the upper section operating as a sink for coarse sediment and the downstream section primarily a transfer.

The channel winds its way through a narrow wooded valley gradually widening out downstream before it joins the River Spey (downstream of the A9). The woodland gradually thins out towards the A9. An access track for the various properties and Alltnacriche activity centre follows closely on the LHB and crossed the channel several times for access. It was constrained by the adjacent valley sides and access track, creating a broadly straightened course. At the downstream end around Lynwilg House and Farm the channel was also lined with gabion baskets along both banks (some of which had failed), and around the existing A9 crossing the channel had been channelised and protected with reinforced concrete and stone protection.

The bed substrates were predominantly gravels and cobbles, with the much larger material present at the top of the surveyed reach and smaller cobbles/gravel downstream. The channel had a range of high energy flows, including cascades and ripples over cobble bed features. The banks comprised sandy soils, with some vegetative growth over established gravel bars elsewhere.

There were a number of step-pools and large gravel bars in the upper section, coinciding with a likely decrease in gradient. As the gradient increased slightly towards the Lynwilg properties the deposits were more infrequent, the channel overall was primarily a transfer, and largely stable except for some isolated areas of bank failure.

P1040923 – View upstream toward large gravel bars and high energy flows (NGR 2877 8109)

P1040449 – View downstream towards existing A9 crossing; the channel here has been channelised and bank protected around residential properties (NGR 2881 8107)

Watercourse Name	**Allt na Criche (Lynwilg) – downstream of the existing A9**
Crossing References	**DS-WC-007**
Primary function	**Sink**
Primary process	**Narrowing**
Description	

The access to Allt na Criche downstream of the A9 was constrained by poor access across the railway track. The channel was constrained underneath three major crossings (the A9, B9152 and the railway bridge). A short distance downstream of this the Allt na Criche joins the River Spey.

Because of these constraints the channel had been modified and straightened, including installation of concrete bed and bank protection (some of which had become damaged, see P1040468 below). There were few signs of fluvial erosion. However there were a number of side bars underneath the crossings which were probably formed when coarser material from upstream has been transferred through and deposited where the gradient was less and the channel was wider. From the observations made the channel appears to be narrowing through the preferential deposition of coarse material, however this may be localised underneath these crossings.

P1040468 – Collapse concrete/cobble bed leading towards the existing A9 crossing (NGR 2884 8106)

P1040470 – View upstream towards A9 crossing (NGR 2884 8106)

Watercourse Name	**Aviemore Burn – upstream of existing A9**
Crossing References	**DS-WC-014**
Primary function	**Transfer**
Primary process	**Stable**
Description	

The upper sections of Aviemore Burn were situated within a steep, self-contained wooded valley before flowing through the built up urban area of Milton, a suburb of Aviemore. The channel was a product of a number of upland tributaries joining together off Carn Dearg Mór.

Upstream the channel remains largely unmodified as it naturally wound (broadly in a straight course) through the steep woodland. However, through Milton the channel was more clearly modified, having been culverted under a road (Carn Elrig View) and another private road crossing a little further upstream of this. The channel was bank protected around these crossings with large boulders set in concrete (see P1040811). The landscape was also more manicured with mowed grassy banks associated with residential properties. The gradient noticeably lowered through Milton.

The banks (where not artificial) were predominantly earth, whilst the bed substrate comprised boulders, cobbles and gravels, with some sands at the margins.

The coarse bed material and steep gradient upstream formed a series of steps creating a range of energetic flows, including chute and cascade flows. Further downstream the flows were more rippled. There were no obvious signs of erosion, and only localised deposits. Overall the channel was behaving as a stable transfer.

P1040806 – The upstream section of Aviemore Burn was steep and wooded, a series of step-pools had formed created an energetic flows over the top (NGR 2892 8139)

P1040811 – As the channel flows through Milton the gradient reduces slightly, and the channel was affected much more by the surrounding development (NGR 2893 8138)

Watercourse Name	**Aviemore Burn – downstream of existing A9**
Crossing References	**DS-WC-014**
Primary function	**Transfer**
Primary process	**Stable**
Description	

Downstream of the A9 the channel gradient remained moderate. The adjacent land-use was clearly more constrained by residential properties, but there was still a good line of trees and riparian vegetation along the bank tops. The channel was crossed several times by access roads, and the channel was protected in places by boulder rip-rap.

From observations onsite and OS mapping the channel appears to have been resectioned, probably as a result of residential developments. Although there were a few areas where the channel had retained its sinuosity.

The bed still comprised cobbles and gravels, with some boulders immediately downstream of the A9 crossing and sands at the margins. The banks were sandy earth and well vegetated. Despite the likely modification and adjacent constraints the channel possessed a diverse range of flows, with some chute flow over and around boulders, cascade and also ponded flow behind large boulders.

There were overall few signs of erosion and only localised minor deposition. The channel was primarily a stable transfer.

P1040829 – View upstream towards existing A9 crossing (NGR 2894 8139)

P1040828 – View downstream from Grampian View (NGR 2895 8137)

Watercourse Name	**Unnamed Drain – upstream of existing A9**
Crossing References	**N/A – not crossed by existing or proposed A9**
Primary function	**Unknown**
Primary process	**Unknown**
Description	

The Unnamed Drain through Milton was not surveyed during the site walkover as its location could not be identified at the time. Subsequent hydrology site visits found the channel to be significantly modified through Milton, having been culverted several times for the recently constructed housing estate and access roads.

The channel appears to be <0.5m wide and overall impacted by the surrounding landscape, but the open watercourse does show signs of some morphological diversity, albeit limited.

The channel appears to join with Aviemore Burn immediately upstream of the existing A9 crossing, having diverged from the same watercourse some 1.5km upstream. OS mapping shows the channel to possess a sinuous planform and, given the topography, likely to possess step-pools observed elsewhere. A gravel substrates layer can be observed also.

The channel does not appear to show any signs of instability, but an assessment on the primary function cannot be established due to limited information.

No photo reference – View upstream towards culvert approx. 450mm (NGR 2892 8139)

No photo reference – Open channel leading towards Aviemore Burn (NGR 2893 8139)

Watercourse Name	**The Shieling / Easter Aviemore Burn – upstream of existing A9**
Crossing References	**DS-WC-016**
Primary function	**Transfer**
Primary process	**Stable**
Description	

This tributary is adjacent to a new housing development at Milton within a sparsely wooded strip of land. The catchment was relatively steep and well vegetated (with grasses), including established and newly planted woodland along both banks. In the upper reaches the channel was naturally straight due to its gradient, however the channel became more modified further downstream as the track was culverted twice under the A9 and another smaller access track. The channel was fenced off and protected leading into the A9 culvert with boulder protection along the banks.

The bed comprised cobbles and coarse gravels, and the occasional boulder. The banks were predominantly earth with some boulders inset, and were well vegetated. Step-pools were common along the upper sections helping to create chute flow, cascades and rippled flows.

Overall there was little erosion and no deposition to indicate instability, the channel was functioning as a stable transfer.

P104837 – View upstream of tributary; new housing development shown on the left of the image (RHB) and new planting along bank tops likely associated with the development (NGR 2893 8142)

P1040843 – Gravel bed channel through grassy woodland (NGR 2894 8142)

Watercourse Name	**The Shieling / Easter Aviemore Burn – downstream of existing A9**
Crossing References	**DS-WC-016**
Primary function	**Transfer (Minor Sink)**
Primary process	**Stable**
Description	

Compared with upstream the gradient was much lower downstream of the A9. The landscape was more open grassland floodplain, used for grazing (horses). The planform although more sinuous compared with upstream indicated it had been resectioned probably as part of residential developments and for agricultural use.

The channel was crossed a number of times by a footpath and farming access, as well as road crossings (e.g. the A9 and the B9152). It was also embanked towards the lower end of the surveyed channel near to the B9152.

The bed was predominantly coarse substrate, such as cobbles and gravels, however the lower gradient had encouraged more fine sediment to be present. The banks were well vegetated (grass) and comprised sandy earth.

There were some step-pools where the gradient allowed it, creating chute flows, although predominantly the flows were rippled. There was little erosion or deposition, and although fine sediment was noticeably increased from upstream the channel was still mainly transferring sediment downstream.

P1040853 – View immediately downstream of A9 culvert outlet (NGR 2895 8141)

P1040865 – View immediately upstream of B9152 crossing (NGR 2897 8143)

Watercourse Name	**Allt na Criche (Granish) – upstream of existing A9**
Crossing References	**DS-WC-021 and DS-WC-022**
Primary function	**Transfer (Minor Sink)**
Primary process	**Stable**
Description	

Allt na Criche (Granish) flows steeply down from Cairn Mòr to the west, before the survey picked it up along a relatively low gradient valley bottom running parallel to the A9. The mainly grassy landscape was heavily saturated at the time of survey and the channel appeared very well connected to its floodplain. Although there were few signs of modification directly to the river channel, the channel was constrained by two embankments on either side, albeit the one on the LHB was part of a steep hillside already. The channel appeared naturally straight, although did occasionally wander slightly around its floodplain. The vegetation was primarily tussocky grassland, with some occasional tree cover. The valley side on the west comprised dense forestry. Concrete bed and bank protected had been installed leading up to the existing A9 culvert.

The bed primarily comprised fine sandy deposits, with coarser material in the minority. Some localised lengths of boulders were noted creating some step-pool sequences. The banks were sandy earth, although an orange hue to the channel suggested some peat.

Flows ranged from rippled to chute flow, and unbroken standing waves were noted in some locations where steep sections transitioned back to more moderate gradients. The more energetic flows were localised and primarily caused by boulders or woody material within the channel. Although there were some areas of erosion noted (mainly undercutting) and some fine sediment deposition along the bed (particularly due to the low gradient), overall the channel appeared quite stable and to be transferring material downstream.

P104751 – View downstream along channel course; flows appeared relatively high at the time of survey (NGR 2899 8155)

P104754 – View downstream along short wooded section of channel; the channel course was still largely straight but wood debris and steps occurred in some localised areas (NGR 2900 8155)

Watercourse Name	**Allt na Criche (Granish) – downstream of existing A9**
Crossing References	**DS-WC-022**
Primary function	**Transfer (Minor Sink)**
Primary process	**Stable**
Description	

The surrounding landscape was not too dissimilar to upstream, although there was clearly more woodland present. The valley side on the LHB disappears as the channel moves eastwards towards Loch nan Carriagean (where the channel seemingly doesn't continue to flow according to OS mapping). The gradient remained relatively flat, but the channel did still have a reasonable flow, probably due to the high flows it was experiencing.

Overall the planform was quite sinuous and (with the exception of the road crossings) appeared unmodified. The channel was culverted underneath the A9 and the A95, and was fenced off for some sections.

The bed substrate comprised a mixture of fine and coarse gravels (with occasional boulders), and fine sediment (mainly sand), which formed a cohesive and armoured bed. The banks comprised sandy earth and were well vegetated with grass. Flows were a diverse range from rippled flows and chute around localised steps, as well as some ponded flows behind the boulders.

Fine sediment deposition was common throughout and some minor undercutting was evident, but only in localised stretches. Overall the channel was functioning primarily as a stable transfer.

P1040769 – View downstream from just after the A9 crossing, wooded catchment with meandering watercourse (NGR 2902 8157)

P1040872 – View upstream from the A95 crossing (NGR 2905 8156)

Watercourse Name	**Southern Avie Lochan Burn – upstream of existing A9**
Crossing References	**DS-WC-024**
Primary function	**Transfer**
Primary process	**Stable**
Description	

The steeply graded unnamed tributary travels down from the forested hillside west of Avielochan. The landscape was dominated by woodland, with some occasional tracks across the stream for forestry access. The immediate banks were covered with grasses and ferns. Overall the channel was naturally quite sinuous flowing between the trees and formed of a series of steps. There are some areas of bank protection associated with the various crossings and a series of concrete steps leading into the A9 crossing (see P1040794 below). The channel was fenced off at the downstream end towards the A9, probably to keep deer from accessing the carriageway.

The channel bed was formed from large boulders which created the steps, with cobbles and gravels also noted. There was also some well sorted sand deposits in sheltered areas, i.e. behind boulders and along the margins. Large woody material (sourced from the surrounding woodland) occasionally helped create some ponded areas. The well vegetated banks were formed from sandy soils. Due to the steep gradient and coarse substrate the channel possessed a diverse range of flow types, primary comprising energetic flows such as chute, cascade, but sheltered areas helped form ponded areas.

Despite the high energies there was very little erosion noted (only some minor localised undercutting), as the tree roots and boulders help to naturally regulate the channel's energies, and overall the channel was a very stable transfer system.

P1040785 – Step-pool sequence upstream just downstream of forestry access crossing (in background) (NGR 2901 8165)

P1040794 – Artificial concrete steps leading into existing A9 crossing (NGR 2902 8164)

Watercourse Name	**Southern Avie Lochan Burn – downstream of existing A9**
Crossing References	**DS-WC-024**
Primary function	**Transfer (Minor Sink)**
Primary process	**Stable**
Description	

Downstream of the A9 the channel gradient was much lower than upstream. The forested landscape opened out, although there was a constant presence of trees on the banks, only less dense than upstream of the A9 crossing. The banks were still well vegetated with grasses and ferns. General Wade's Military Road crosses at this location, although the stone bridge was in a state of disrepair. Elsewhere the channel was fenced off on the RHB separating an area of much denser woodland, whilst the LHB was occupied by a herd of cattle.

The channel possessed a meandering course and had enough gradient to form steps, although less regularly than upstream. The meandering planform and low gradient did in place encourage some gravel point bars to form (P1040889). The bed substrate comprised coarse gravels and cobbles with some fines (sands) on the margins. The banks comprised sandy soils. Flows were varied, including cascade and chutes over steps, but predominantly rippled flow.

There was little fluvial erosion, although some poaching from the resident cattle was noted. There were however a few deposition features, but mostly corresponding with natural fluvial activity (point bars) and not widespread. Overall the channel was functioning as stable transfer, with some function as a minor sink for fine sediment.

P1040798 – View from existing A9 crossing downstream (NGR 2902 8164)

P1040889 – View downstream of meandering planform with gravel point bars and woody debris across the channel. (NGR 2903 8163)

Watercourse Name	**Northern Avie Lochan Burn – upstream of existing A9**
Crossing References	**DS-WC-026**
Primary function	**Unknown**
Primary process	**Unknown**
Description	

Northern Avie Lochan Burn was not surveyed during the hydromorphology walkover due to it being initially screened out, but has been subsequently inspected as part of the hydrology walkover. The watercourse possessed a variety of morphological features, including step-pool system and a steep, meandering planform upstream.

The channel is <1.0m wide, with its bed comprising coarse gravels and cobbles with the occasional boulder forming the step-pools, although towards the A9 the channel appears to be slightly incised, although no active signs of instability are visible in the photographs.

The channel around the existing A9 is heavily modified and culverted. No further survey information exists downstream of the A9.

P3230023 – View upstream of A9 crossing showing deep, gravel/cobble bed stream existing a steep hillside (NGR 2903 8168)

PB110128 – View downstream of structure underneath A9 with minimal flow and a lot of leaf litter (NGR 2904 8167)

Watercourse Name	**Unnamed Drain**
Crossing References	**DS-WC-031**
Primary function	**Ephemeral**
Primary process	**Stable**
Description	

The survey of the Unnamed Drain leading toward Loch Vaa found no sign of a channel upstream (west of) the A9 and only an artificially modified drainage ditch on the downstream end. There was no water or flow within the channel at the time of survey. The bed of the channel was well vegetated with grass and appeared to have had little prolonged flow contained within it for some time.

No further survey was undertaken and the channel has been screened out of further survey.

P1040925 – View across towards channel and floodplain from A9 embankment (NGR 2909 8178)

P1040929 – Ephemeral watercourse with no signs of recent flow and well vegetated bed (NGR 2910 8179)

Watercourse Name	**Allt Cnapach – upstream of existing A9**
Crossing References	**DS-WC-032**
Primary function	**Transfer**
Primary process	**Stable**
Description	

Situated within a self-contained valley with steep valley sides either side, the Allt Cnapach flows down from the west towards Kinveachy. The steep channel, although possessing a sinuous course, mostly followed the winding topography and where possible took a more direct path downhill. The channel became less steep towards the A9. The surrounding landscape was predominantly mixed woodland, with a variety of grasses and ferns along the bank tops. Although largely unmodified in the upper sections the channel was crossed (culverted) twice for access into the woodland and around Kinveachy Lodge. The channel leading into existing A9 culvert was protected with a short length of stone bed and bank protection.

The bed comprised primarily gravels, with the occasional bedrock and boulders forming pronounced step sequences. Fines (sand) were less common and confined to the margins. The banks were well vegetated and comprised sandy earth soils, with embedded boulders and tree roots stabilising the bank line.

Fallen trees were also common interacting with the channel, helping form energetic and diverse flow types along the course, dominated by a series of cascades over steps (note flows were considered high at the time of survey). There was however minimal erosion, except for minor undercutting downstream of large steps and some woody debris diverting flow towards vulnerable banks. Deposits were also uncommon and overall the channel was a stable transfer.

P1040704 – Channel had high flows at the time of the survey (NGR 2909 8185)

P1040712 – View downstream of broadly straight course towards existing A9 (NGR 2910 8185)

Watercourse Name	**Allt Cnapach – downstream of existing A9**
Crossing References	**DS-WC-032**
Primary function	**Transfer (Minor Sink)**
Primary process	**Stable**
Description	

Compared with upstream the gradient was much lower and the landscape was more open. The first 50m of channel was lined with stone bed and bank protection as the channel flowed underneath the railway line, having also been artificially straightened. The channel continued to be constrained by a track downstream of the railway crossing and along the A95. The bank tops were still lined with trees, with the landscape primarily used for grazing pasture. At the time of the survey the channel around the A95 was flooding, with a number of overland flow paths evident.

The bed substrates appeared to comprise mostly cobbles, gravels and sand, with the fines increasing further downstream as the channel became more ponded. The banks consisted of sandy earth soils with some boulders and cobbles.

Although no fluvial erosion was noted, there were clear signs of poaching from animal crossings just downstream of the railway bridge forming a fine sediment source. Flows were mainly rippled over and around woody features and cobble substrate, however the channel became increasingly ponded downstream as the watercourse was constrained by the culvert underneath the A95 and flowed into a series of ponds downstream of the road. The channel presents several functions over a relatively short distance, with the upper modified section transferring sediment, then an area of sediment input from poaching and finally a sink around and downstream of the A95 where the flows are ponded. Although the function more relevant to the A9 scheme was a sediment transfer and downstream sink, overall the channel was stable.

P1040720 – View downstream through the railway arch bridge and straight (and lined) channel (NGR 2911 8185)

P1040725 – View upstream just after the railway bridge with thin tree line and signs of poaching along the bank tops (NGR 2911 8185)

Watercourse Name	**Fèith Mhòr – upstream of existing A9**
Crossing References	**DS-WC-036**
Primary function	**Transfer (Minor Source)**
Primary process	**Stable (Incising)**
Description	

The watercourse here was situated within a woodland, although the majority of the bank tops were dominated by tussocky grassland. The channel was crossed a couple of times by forestry access tracks (fords and culvert), but otherwise the channel was natural. The meandering planform was quite deep and appeared somewhat disconnected with its floodplain and had a number of adjoining tributaries.

The bed substrates were mainly sands and fine gravels, coarse sediments (gravels and cobbles) although initially in the minority increase further downstream towards the A9. The banks, as with most other areas, comprised sandy earth soils.

The deep channel was probably a result of a series of knickpoints creating incision moving upstream and leading to some destabilisation of the banks as they are undercut and steepened. The knickpoints and occasional fallen woody material help form a stepped longitudinal profile. Flows over these steps are energetic cascades, although lengths of rippled and smooth running flows were more common. Lower down in the reach coarser substrate forms riffles, and the channel appeared better connected to the floodplain and flows were more uniform.

The function here included incision, but was primarily transfer and therefore stable.

P1040644 – Knickpoint and scour pool downstream displaying higher energy flows and evidence of incision (NGR 2905 8205)

P1040670 – Further downstream towards A9 the channel was wider and better connected to the adjacent floodplain (NGR 2907 8207)

Watercourse Name	**Fèith Mhòr – downstream of existing A9**
Crossing References	**DS-WC-036**
Primary function	**Transfer**
Primary process	**Stable**
Description	

Downstream of the A9 Fèith Mhòr was still situated within a woodland, although denser than upstream, trees were right up on the bank tops. The gradient was noticeably lower downstream also. The channel was crossed several times by the A9, railway and A95. The planform was straightened but not clearly modified, and was perhaps regulated by the adjacent trees either side.

The bed substrates were mainly fine sediments (sands and gravels), with some cobbles also present. Downstream of the railway sand deposits dominated. The banks unsurprisingly comprised sandy soils.

There were occasional steps and knickpoints suggesting some incision, but not nearly as common as upstream. Large trees which had fallen into the channel are envisaged to play a key role in regulating flows, creating both pooled and rippled flows, however the flows were mostly uniform rippled/smooth. The channel on the whole was a stable transfer system.

P1040985 – Fine sandy deposits on the bed with some emergent in-channel vegetation (NGR 2909 8210)

P1040690 – Typical view downstream along Fèith Mhòr (NGR 2909 8211)

Watercourse Name	**River Dulnain – upstream of existing A9**
Crossing References	**DS-WC-046**
Primary function	**Transfer (Exchange)**
Primary process	**Stable (Lateral Adjustment)**
Description	

Flows were higher than what would be considered normal during the time of the survey. The river flowed through a largely rural landscape with wide open grazing pastures either side, although the immediate bank tops comprised trees and rough grasses. Closer to the A9 crossing, the RHB becomes more of a valley side constraining the river. Broadly speaking the river had a moderate gradient. The channel has been previously modified and constrained, with lengths of bank protection (gabions and stone) and riparian management, including fencing. However the natural fluvial processes within the Dulnain still operate.

The size of the channel and high flows made it difficult to accurately assess the bed substrate, however observations suggested that it comprised cobbles and boulders, with some coarse gravels and sands at the margins. The banks were mainly sands and earth, some boulders were also noted, but may have been placed artificially as bank protection.

Aerial imagery suggests the gravel bars were more extensive than observed during the survey, although many were still visible. There were few signs of active erosion, although the Dulnain is known to have laterally migrated further upstream. Flows were perhaps more energetic than would normally be expected, with broken and unbroken standing waves over underwater obstructions. With little erosion, but a large number of coarse deposits noted it could be determined that the Dulnain was predominantly a sink, however it more likely (according to historic channel changes) the channel was a stable system and these deposits are transient features which are constantly re-worked and re-organised within the wider river corridor.

P1040593 – View upstream on River Dulnain with gravel deposits clearly visible (NGR 2887 8225)

P1040609 – View downstream towards existing A9 bridge over the Dulnain (NGR 2856 8225)

Watercourse Name	**River Dulnain – downstream of existing A9**
Crossing References	**DS-WC-046**
Primary function	**Transfer (Minor Sink)**
Primary process	**Stable**
Description	

The River Dulnain downstream of the A9 crossing was much more constrained by adjacent residential developments than upstream of the A9. However, the immediate bank tops were still well vegetated and there was a persistent tree presence throughout. The A9 crossing itself, along with the railway, had resulted in the channel being protected with gabions and stone. The channel was clearly well connected to its floodplain having already partially flooded out at the time of the survey.

The bed comprising (where visible) coarse substrate and there was still an obvious amount of sands in the channel, but mostly confined to the margins. Bedrock was also more pronounced through this reach, and even more so around Carrbridge downstream. The banks were still well vegetated and comprised sandy earth, and increasingly more bedrock downstream.

There was some bank erosion on the RHB immediately downstream of the railway, but likely that gravel bars still dominate (according to the aerial imagery). In contrast to upstream of the A9, the constrained river system means the channel was less likely to be able to adjust, and has less room to re-work the gravel bars. The channel here was still predominantly a stable transfer system, with some minor deposition.

P1040617 – View immediately downstream of railway bridge, erosion (likely poaching) on the RHB (NGR 2897 8227)

P1040945 – Bedrock channel leading into Carrbridge (NGR 2906 8230)

Watercourse Name	**Allt nan Ceatharnach – upstream of existing A9**
Crossing References	**DS-WC-048**
Primary function	**Transfer**
Primary process	**Stable**
Description	

The watercourse flowed through a narrow wooded corridor and was considered to be moderately steep. The channel possessed a wandering planform, although generally the course was restricted either side by the railway and the B938 embankments, the embankment on the LHB being very steep. The channel underneath the railway and A9 was lined with concrete on the bed and banks.

The bed material comprised coarse substrate, such as boulders, cobbles and gravels, although mostly obscured by high flows. There did appear to be some sands in the pools and bedrock downstream towards the crossings. The banks were sandy earth soils with gravel.

The survey began with a 2.0m+ high waterfall (limiting the extent of the survey through the middle section), and elsewhere there was a good range of high energy flows, including cascades, broken and unbroken standing waves over the boulder formations and fallen trees. However there were higher flows than considered normal at the time of the survey. Some bank erosion was noted on the LHB, but mostly appeared quite stable. Terraces on the RHB suggest the channel had previously shifted its course, but there was little evidence to suggest this process was ongoing.

P1040564 – View upstream of waterfall in the distance and railway embankment on the left (RHB) comprising a vertical wall of stone; flows are highly energetic (NGR 2891 8234)

P1040573 – View downstream underneath railway bridge and concrete bed and banks (NGR 2892 8233)

Watercourse Name	**Allt nan Ceatharnach – downstream of existing A9**
Crossing References	**DS-WC-048**
Primary function	**Transfer**
Primary process	**Stable**
Description	

Downstream of the A9 the Allt nan Ceatharnach, although still contained with a wooded corridor, was less constrained both sides and had more space in which to flow. As such the channel planform was markedly more sinuous, having a meandering course. The channel was well fenced off as the landscape evolved towards a more open rough grassland, which was used for grazing on the RHB. The channel was still modified around the crossings, there was also a ford and footbridge close to Dalrachney Beag. Downstream of here the woodland disappeared and the channel now flowed through an open grazing field.

The bed substrates (where visible) were still coarse, although fewer bedrock and boulders, and the banks much the same as upstream. Flows were still energetic but with fewer boulders interacting they were primarily rippled, with an occasional chute and standing broken waves.

There was some erosion and minor deposition. A relic channel was also obvious downstream near the confluence with the River Dulnain, however there was few suggestion that any active fluvial processes were operating beyond a stable transfer.

P1040584 – View upstream towards existing A9 crossing and surrounding woodland (NGR 2891 8230)

P1040603 – Further downstream the woodland was replaced with open grassland and much more uniform channel (NGR 2893 8225)

Watercourse Name	**Bogbain Burn – downstream of existing A9**
Crossing References	**N/A – not crossed by existing or proposed A9**
Primary function	**Unknown**
Primary process	**Unknown**
Description	

The watercourse (see Figure A10.1.2g) was not initially surveyed as part of the hydromorphology survey having been screened out as it was considered offline and not directly affected (i.e. crossed by the A9). It has been subsequently screened in to account for potential impacts from the Black Mount Northbound junction embankment which may increase the confinement of the channel.

The channel is a tributary to Allt nan Ceatharnach, but is not itself directly affected by the existing A9. It has been however significantly affected by the railway and other roads, having been crossed a dozen times over a 2km distance. The planform has clearly been realigned and straightened, but does possess diverse and dynamic morphological features (see below) as it flows through a dense woodland.

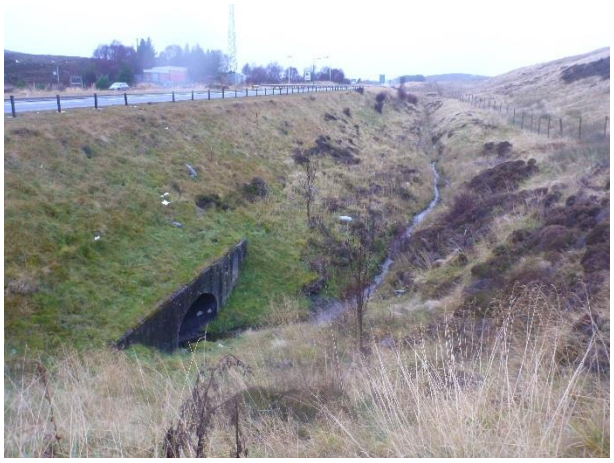
There are few signs of stability, but the overall dominant processes is uncertain without further walkover information.

Watercourse Name	**Allt Slochd Mhuic**
Crossing References	**DS-WC-056, DS-WC-057, DS-WC-058, DS-WC-059, DS-WC-060, DS-WC-061 and DS-WC-062**
Primary function	**Transfer**
Primary process	**Stable**
Description	

Heavily modified and artificial channel which has been realigned and protected likely during the construction of the railway and/or existing A9 alignment. The channel has been realigned either sides of the A9, crossing over twice and running parallel along the railway. The channel flowed through a series of culverts and was bank protected along much of its surveyed course. Downstream of the A9 the channel was contained with a concrete lined uniform channel which was constrained parallel to the A9.

The bed substrate where not artificial (i.e. concrete) comprised some bedrock and boulders, but primarily gravels and cobbles and fine silt at the margins (likely from road runoff). As the gradient decreases towards the railway the presence of fines increase. The banks, again where not artificial, were mainly earth and vegetated with rough grasses.

The flows were mainly rippled, some cascades over boulders and some very small steps. Overall there was no erosion and little deposition, except for some fine sediment on the bed. The channel did not possess the capacity to undertake any fluvial activity and was mostly a stable transfer.



P1040955 – The channel has been realigned and constrained into a narrow artificial valley through a series of culverts (NGR 2836 8256)

P1040970 – Channel between the railway and A9 was lined with gabion and stone wall protection through two culverts (NGR 2837 8254)

P1040973 – Downstream of the A9 the channel was contained within a concrete lined uniform channel with a very steep gradient (NGR 2838 8253)

4. Watercourse Sensitivity Classification

4.1.1. Based on the classification criteria outlined above (see Table 2-2) the sensitivity classifications and justification for each watercourse is summarised in Table 4-1 below.

Table 4-1 Watercourse sensitivity summary classifications

Watercourse name	Sensitivity	Justification
Allt an Fheàrna	Medium	The watercourse around The Proposed Scheme crossing has shown itself to possess a diverse range of morphological processes and features (including large gravel deposits, steps, large wood and bank erosion). It has been historically modified (straightened) and is constrained underneath and alongside the existing A9. *WFD water body: Allt an Fearna – u/s Loch Alvie (23126). Overall Status classified at Poor status (due to fish barriers), Hydromorphology classified as Good.*
Allt Chriochaidh	Medium	Channel possesses a diverse range of morphological forms and processes, with the downstream reaches shown to be able to partially laterally adjust the planform. Modifications are significant, but limited to the existing A9 crossing.
Caochan Ruadh	Medium	The channel has been historically modified around the existing crossing and along the upper reaches, but does possess some geomorphic diversity, particularly upstream with a steep step-pool bedrock system evident.
Ballinluig Burn	Low	Modified and constrained watercourse, with uniform flows (heavily vegetated in-channel) and little morphological diversity evident.
Allt na Criche (Lynwilg)	Medium	Morphologically diverse in the upper reaches, with large gravel bars. Significantly modified adjacent to Lynwilg properties (gabion bank protection) and through the existing A9 and railway crossing (straightened and widened). However, there are signs of recovery underneath the A9 as the channel is shown to be narrowing through deposition of coarse substrate.
Aviemore Burn	Medium	Diverse watercourse throughout with a good range of flows and morphological features, however significantly constrained through recently constructed housing estate and existing crossings.
Unnamed Drain	Low	Channel may possess some morphological diversity, but overall is significantly constrained and modified through the housing estate including being culverted for much of its lower length leading into Aviemore Burn, upstream of the A9.
The Shieling / Easter Aviemore Burn	Medium	Some lengths possess diverse morphology especially in the upper reaches with step sequences common and clean coarse gravel substrate. However, overall the watercourse has historically been modified for residential and agricultural drainage purposes. Minor fine sediment deposition was noted on the downstream reaches were flow energy reduced.
Allt na Criche (Granish)	Medium	Although largely unmodified (except for the existing A9 crossing) morphological diversity was confined to localised lengths. The presence of boulders and large wood in the

Watercourse name	Sensitivity	Justification
		watercourse did create more dynamic flows, but overall some fine sediment deposition along the bed was noted.
Southern Avie Lochan Burn	Medium	Vast variety of morphological features, including high energy step-pool system in the upstream and meandering planform in the downstream. Heavily modified over short distance around existing A9 crossing.
Northern Avie Lochan Burn	Medium	A variety of morphological features, including step-pool system and meandering planform likely to exist upstream. Heavily modified around existing A9 crossing. Likely to possess the potential to be a dynamic system, but no signs of instability from photographs.
Unnamed Drain	Low	Uniform ephemeral channel with no evidence of significant hydromorphological processes occurring (recommend to scope out).
Allt Cnapach	Medium	Good range of flows and dynamic morphological features, but significantly modified in the downstream reaches. Few active morphological processes occurring and some fine sediment deposition was noted in the downstream reaches (including poaching downstream).
Feith Mhor	Medium	Some incision (knickpoints) evident in the upper reaches resulting in a series of steps, but on the whole flows were uniform around the A9 crossing. The channel lacked energy to recover from historic modifications downstream. *WFD water body: River Dulnain – Feith Mhor (23113). Overall Status classified at Poor status (due to fish barriers), Hydromorphology classified as Good.*
River Dulnain	High	Significant and highly active gravel bed river channel, with a dynamic and diverse range of morphological features, including large gravel bars. The river channel has been significantly modified underneath the A9 and through Carrbridge. *WFD water body: River Dulnain – Lower Catchment (23106). Overall Status and Hydromorphology classified at Good status.*
Allt nan Ceatharnach	High	Very active, steep river channel although modified and constrained in sections due to existing river crossings and agricultural drainage. Watercourse and bedrock features form a dynamic range of flows. *WFD water body: River Dulnain – Allt nan Ceatharnach (23112). Overall Status and Hydromorphology classified at Good status.*
Bogbain Burn	Medium	Heavily modified around the Highway Mainline Railway, but mapping and photographic evidence suggests natural meandering upstream, with diverse and dynamic flow patterns likely, including a coarse cobble/gravel substrate and some woody debris from adjacent woodland, but overall stable.
Allt Slochd Mhuic	Low	Heavily modified channel culverted several times and lined with concrete over long lengths.

5. Potential Impacts

5.1. The Proposed Scheme Options

5.1.1. There are three proposed mainline options ("The Proposed Scheme Options") and a total of 13 junction options. Because of the large number of permutations in combinations of mainline options and junction options, these are considered separately. The Proposed Scheme Options are outlined in Table 5-1.

Table 5-1 The Proposed Scheme Options

Option Number	Description
Mainline Options	
Mainline Alignment Option 1	Southbound widening for entire route
Mainline Alignment Option 1A	Predominantly northbound widening (southbound widening through sections 2, 6a, 10 and 11)
Mainline Alignment Option 2	Mainline Option 1 with hybrid widening to south of Aviemore (differs through sections 2, 3a and 3b)
Junction Options	
Aviemore South Junction Option A02	Half Cloverleaf (Quadrants 1 and 4) – *applicable to all Mainline Alignment Options*
Aviemore South Junction Option A09	Diamond Left-Right Stagger with Ghost Island – *applicable to all Mainline Alignment Options*
Aviemore South Junction Option A18	Diamond Left-Right Stagger with B9152 Realigned – *applicable to all Mainline Alignment Options*
Granish Junction Option C18	Diamond (including underbridge and involving northbound mainline widening) – *applicable to Mainline Alignment Option 2*
Granish Junction Option C21	Half Dumbbell Clover leaf (including underbridge and involving northbound mainline widening) – *applicable to Mainline Alignment Option 2*
Granish Junction Option C31	Diamond (including underbridge and involving southbound mainline widening) – *applicable to Mainline Alignment Options 1 and 1A*
Granish Junction Option C34	Half Dumbbell Clover leaf (including underbridge and involving southbound mainline widening) – *applicable to Mainline Alignment Options 1 and 1A*
Black Mount Junction Option D02	Diamond with Left Right Stagger (including overbridge and involving northbound mainline widening) – *applicable to Mainline Alignment Option 2*
Black Mount Junction Option D03	Restricted Movements – Half Diamond (North Facing Slips) (including overbridge and involving southbound mainline widening) – *applicable to Mainline Alignment Options 1 and 1A*
Black Mount Junction Option D07	Half Cloverleaf Quadrants 2 and 4 (including overbridge and involving northbound mainline widening) – *applicable to Mainline Alignment Option 2*
Black Mount Junction Option D12	Diamond with Left Right Stagger (including overbridge and involving southbound mainline widening) – *applicable to Mainline Alignment Options 1 and 1A*

Option Number	Description
Black Mount Junction Option D13	Restricted Movements – Half Diamond (North Facing Slips) (including overbridge and involving northbound mainline widening) – *applicable to Mainline Alignment Option 2*
Black Mount Junction Option D51	Half Cloverleaf Quadrants 2 and 4 (including overbridge and involving southbound mainline widening – *applicable to Mainline Alignment Options 1 and 1A*

5.2. Magnitude of Impacts

5.2.1. The Proposed Scheme Options have been assessed without specific details of crossing structures and so the worst case scenario has been assumed. A number of assumptions have been made including:

- Where a potential new crossing is identified, it has been assumed a closed culvert structure will be installed as a worst case scenario.
- All affected existing structures will be replaced with like-for-like.
- Any potential new crossing structure will result in a moderate impact due to loss of part of the existing watercourse feature, regardless of existing sensitivity value.
- Any encroachment by The Proposed Scheme road embankment on a watercourse planform will result in an extension to the culvert length and likely replacement of culvert.
- All watercourse crossings (extended or new) will require some form of bank protection at the entrance and exit.
- All watercourse crossings (extended or new) will require minor realignments to the upstream and downstream profile.
- Any potential major realignments (>10m in length) have been identified separately and will automatically result in a major impact regardless of existing sensitivity value.
- All magnitude of impacts have been assessed without mitigation.

5.2.2. The magnitude of impacts for each option are summarised in Table 5-2. The table lists each watercourse and its sensitivity from Table 4-1. For each mainline and junction option the table outlines broadly the following impacts:

- **Realignment** – Any obvious realignment (likely >10m in length); although it should be noted that SEPA requires a simple licence application for "*All diversions, realignment, flood by-pass channels and culverting for land gain on rivers ≤3m wide*" and a complex licence for those >3m wide.
- **New crossing** – A completely new crossing over a river.
- **Extend crossing** – An extension (and replacement) of an existing culvert on the A9 or existing minor roads.
- **Other** – Any other obvious direct impact on the watercourse not captured above.
- **No impact** – No obvious impact likely as a result of The Proposed Scheme.

5.2.3. The Proposed Scheme Options have also been assessed in terms of type of impact, i.e. whether they result in an adverse or a beneficial impact. Any impact which may result in a new or extended culvert is considered to be adverse, all other impacts are considered on a case-by-case basis.

Table 5-2 Magnitude of impacts

Name	Sensitivity	Option	Realignment	New crossing	Extended crossing	Other	No impact	Impact	Type	Overall significance of impact(s)	Notes
Allt an Fheàrna	**Medium**	Mainline Alignment Option 1	Y		Y			Major	Adverse	Large	Coincidence with road embankment on downstream (east) side - existing construction activities ongoing - precise impact to be confirmed
Allt an Fheàrna	**Medium**	Mainline Alignment Option 1A	Y		Y			Major	Adverse	Large	Same as Mainline Alignment Option 1
Allt an Fheàrna	**Medium**	Mainline Alignment Option 2	Y		Y			Major	Adverse	Large	Same as Mainline Alignment Option 1
Allt Chriochaidh	**Medium**	Mainline Alignment Option 1	Y		Y			Major	Adverse	Large	Likely extension/replacement of existing crossing and realignment at downstream end where embankment coincides with watercourse leading into Loch (DS-WC-003)
Allt Chriochaidh	**Medium**	Mainline Alignment Option 1A	Y		Y			Major	Adverse	Large	Same as Mainline Alignment Option 1
Allt Chriochaidh	**Medium**	Mainline Alignment Option 2	Y		Y			Major	Adverse	Large	Same as Mainline Alignment Option 1
Caochan Ruadh	**Medium**	Mainline Alignment Option 1			Y			Minor	Adverse	Slight	Likely extension/replacement of existing crossing

Name	Sensitivity	Option	Realignment	New crossing	Extended crossing	Other	No impact	Impact	Type	Overall significance of impact(s)	Notes
Caochan Ruadh	**Medium**	Mainline Alignment Option 1A			Y			Minor	Adverse	Slight	Same as Mainline Alignment Option 1- slightly larger footprint
Caochan Ruadh	**Medium**	Mainline Alignment Option 2			Y			Minor	Adverse	Slight	Same as Mainline Alignment Option 1
Ballinluig Burn	**Low**	Mainline Alignment Option 1			Y			Minor	Adverse	Neutral	Likely extension/replacement of existing crossing
Ballinluig Burn	**Low**	Mainline Alignment Option 1A			Y			Minor	Adverse	Neutral	Same as option 1 - slightly larger footprint
Ballinluig Burn	**Low**	Mainline Alignment Option 2			Y			Minor	Adverse	Neutral	Same as Mainline Alignment Option 1
Allt na Criche (Lynwilg)	**Medium**	Mainline Alignment Option 1			Y			Minor	Adverse	Slight	Likely extension/replacement of existing crossing
Allt na Criche (Lynwilg)	**Medium**	Mainline Alignment Option 1A			Y			Minor	Adverse	Slight	Same as Mainline Alignment Option 1
Allt na Criche (Lynwilg)	**Medium**	Mainline Alignment Option 2			Y			Minor	Adverse	Slight	Same as Mainline Alignment Option 1
Aviemore Burn	**Medium**	Mainline Alignment Option 1			Y			Minor	Adverse	Slight	Likely extension/replacement of existing crossing

Name	Sensitivity	Option	Realignment	New crossing	Extended crossing	Other	No impact	Impact	Type	Overall significance of impact(s)	Notes
Aviemore Burn	**Medium**	Mainline Alignment Option 1A			Y			Minor	Adverse	Slight	Same as Mainline Alignment Option 1
Aviemore Burn	**Medium**	Mainline Alignment Option 2			Y			Minor	Adverse	Slight	Same as Mainline Alignment Option 1
Unnamed Drain	**Low**	Mainline Alignment Option 1					Y	Negligible	Adverse	Neutral	Impacts are likely to be negligible given it is not crossed and upstream of Aviemore Burn.
Unnamed Drain	**Low**	Mainline Alignment Option 1A				Y		Minor	Adverse	Neutral	At this location the road embankment is quite close to the existing outlet into Aviemore Burn, the exact location cannot be established but there is a possibility this connection will need to be moved
Unnamed Drain	**Low**	Mainline Alignment Option 2					Y	Negligible	Adverse	Neutral	Same as Mainline Alignment Option 1
The Shieling / Easter Aviemore Burn	**Medium**	Mainline Alignment Option 1			Y			Moderate	Adverse	Moderate	Likely extension/replacement of existing crossing
The Shieling / Easter Aviemore Burn	**Medium**	Mainline Alignment Option 1A			Y			Moderate	Adverse	Moderate	Same as Mainline Alignment Option 1
The Shieling / Easter Aviemore Burn	**Medium**	Mainline Alignment Option 2			Y			Moderate	Adverse	Moderate	Same as Mainline Alignment Option 1

Name	Sensitivity	Option	Realignment	New crossing	Extended crossing	Other	No impact	Impact	Type	Overall significance of impact(s)	Notes
Allt na Criche (Granish)	**Medium**	Mainline Alignment Option 1			Y			Minor	Adverse	Slight	Likely extension/replacement of existing crossing
Allt na Criche (Granish)	**Medium**	Mainline Alignment Option 1A			Y			Minor	Adverse	Slight	Same as Mainline Alignment Option 1
Allt na Criche (Granish)	**Medium**	Mainline Alignment Option 2			Y			Minor	Adverse	Slight	Same as Mainline Alignment Option 1
Allt na Criche (Granish)	**Medium**	Granish Junction Option C18		Y				Moderate	Adverse	Moderate	Although the footprint provided does not coincide with the watercourse, it is likely to need extending to meet with the forest track to the west
Allt na Criche (Granish)	**Medium**	Granish Junction Option C21	Y	Y				Major	Adverse	Large	Coincidence with junction; uncertain impact on watercourse. It will require a new crossing as a minimum, but also may require significant realignment
Allt na Criche (Granish)	**Medium**	Granish Junction Option C31	Y	Y				Major	Adverse	Large	Same as Granish Junction Option C21
Allt na Criche (Granish)	**Medium**	Granish Junction Option C34	Y	Y				Major	Adverse	Large	Same as Granish Junction Option C21
Southern Avie Lochan Burn	**Medium**	Mainline Alignment Option 1			Y			Minor	Adverse	Slight	Likely extension/replacement of existing crossing

Name	Sensitivity	Option	Realignment	New crossing	Extended crossing	Other	No impact	Impact	Type	Overall significance of impact(s)	Notes
Southern Avie Lochan Burn	**Medium**	Mainline Alignment Option 1A			Y			Minor	Adverse	Slight	Same as Mainline Alignment Option 1
Southern Avie Lochan Burn	**Medium**	Mainline Alignment Option 2			Y			Minor	Adverse	Slight	Same as Mainline Alignment Option 1
Northern Avie Lochan Burn	**Medium**	Mainline Alignment Option 1			Y			Minor	Adverse	Slight	Likely extension/replacement of existing crossing
Northern Avie Lochan Burn	**Medium**	Mainline Alignment Option 1A			Y			Minor	Adverse	Slight	Same as Mainline Alignment Option 1
Northern Avie Lochan Burn	**Medium**	Mainline Alignment Option 2			Y			Minor	Adverse	Slight	Same as Mainline Alignment Option 1
Unnamed Drain - Screened out	**Low**	Mainline Alignment Option 1									Not assessed
Unnamed Drain - Screened out	**Low**	Mainline Alignment Option 1A									Not assessed
Unnamed Drain - Screened out	**Low**	Mainline Alignment Option 2									Not assessed
Allt Cnapach	**Medium**	Mainline Alignment Option 1			Y			Minor	Adverse	Slight	Likely extension/replacement of existing crossing

Name	Sensitivity	Option	Realignment	New crossing	Extended crossing	Other	No impact	Impact	Type	Overall significance of impact(s)	Notes
Allt Cnapach	**Medium**	Mainline Alignment Option 1A	Y		Y			Major	Adverse	Large	May require realignment (>10m) to tie-in with replacement/extended culvert
Allt Cnapach	**Medium**	Mainline Alignment Option 2			Y			Minor	Adverse	Slight	Same as Mainline Alignment Option 1
Feith Mhor	**Medium**	Mainline Alignment Option 1			Y			Minor	Adverse	Slight	Likely extension/replacement of existing crossing
Feith Mhor	**Medium**	Mainline Alignment Option 1A			Y			Minor	Adverse	Slight	Same as Mainline Alignment Option 1
Feith Mhor	**Medium**	Mainline Alignment Option 2			Y			Minor	Adverse	Slight	Same as Mainline Alignment Option 1
River Dulnain	**High**	Mainline Alignment Option 1				Y		Minor	Adverse	Slight/Moderate	Assumed replacement or extension of similar open span structure requiring minimal works to the watercourse and banks
River Dulnain	**High**	Mainline Alignment Option 1A				Y		Minor	Adverse	Slight/Moderate	Same as Mainline Alignment Option 1
River Dulnain	**High**	Mainline Alignment Option 2				Y		Minor	Adverse	Slight/Moderate	Same as Mainline Alignment Option 1

Name	Sensitivity	Option	Realignment	New crossing	Extended crossing	Other	No impact	Impact	Type	Overall significance of impact(s)	Notes
Allt nan Ceatharnach	**High**	Mainline Alignment Option 1				Y		Minor	Adverse	Slight/Moderate	Assumed replacement or extension of similar open span structure requiring minimal works to the watercourse and banks
Allt nan Ceatharnach	**High**	Mainline Alignment Option 1A				Y		Minor	Adverse	Slight/Moderate	Same as Mainline Alignment Option 1
Allt nan Ceatharnach	**High**	Mainline Alignment Option 2				Y		Minor	Adverse	Slight/Moderate	Same as Mainline Alignment Option 1
Allt nan Ceatharnach	**High**	Black Mount Junction Option D02				Y		Negligible	Adverse	Neutral	Black Mount - headwaters - no direct impact, but in close proximity to Bogbain Burn a tributary of Allt Ruighe Magaig
Allt nan Ceatharnach	**High**	Black Mount Junction Option D03				Y		Negligible	Adverse	Neutral	Same as Black Mount Junction Option D02
Allt nan Ceatharnach	**High**	Black Mount Junction Option D07				Y		Negligible	Adverse	Neutral	Same as Black Mount Junction Option D02
Allt nan Ceatharnach	**High**	Black Mount Junction Option D12				Y		Negligible	Adverse	Neutral	Same as Black Mount Junction Option D02
Allt nan Ceatharnach	**High**	Black Mount				Y		Negligible	Adverse	Neutral	Same as Black Mount Junction Option D02

Name	Sensitivity	Option	Realignment	New crossing	Extended crossing	Other	No impact	Impact	Type	Overall significance of impact(s)	Notes
		Junction Option D13									
Allt nan Ceatharnach	**High**	Black Mount Junction Option D51				Y		Negligible	Adverse	Neutral	Same as Black Mount Junction Option D02
Bogbain Burn	**Medium**	Mainline Alignment Option 1					Y	Negligible	Adverse	Neutral	No impact from Mainline Option
Bogbain Burn	**Medium**	Mainline Alignment Option 1A					Y	Negligible	Adverse	Neutral	Same as Mainline Alignment Option 1
Bogbain Burn	**Medium**	Mainline Alignment Option 2					Y	Negligible	Adverse	Neutral	Same as Mainline Alignment Option 1
Bogbain Burn	**Medium**	Black Mount Junction Option D02					Y	Negligible	Adverse	Neutral	No direct impact from Junction Option
Bogbain Burn	**Medium**	Black Mount Junction Option D03					Y	Negligible	Adverse	Neutral	Same as Black Mount Junction Option D02
Bogbain Burn	**Medium**	Black Mount Junction Option D07					Y	Negligible	Adverse	Neutral	Same as Black Mount Junction Option D02

Name	Sensitivity	Option	Realignment	New crossing	Extended crossing	Other	No impact	Impact	Type	Overall significance of impact(s)	Notes
Bogbain Burn	**Medium**	Black Mount Junction Option D12					Y	Negligible	Adverse	Neutral	Same as Black Mount Junction Option D02
Bogbain Burn	**Medium**	Black Mount Junction Option D13					Y	Negligible	Adverse	Neutral	Same as Black Mount Junction Option D02
Bogbain Burn	**Medium**	Black Mount Junction Option D51					Y	Negligible	Adverse	Neutral	Same as Black Mount Junction Option D02
Allt Slochd Mhuic	**Low**	Mainline Alignment Option 1	Y		Y			Major	Adverse	Slight / Moderate	Coincidence with carriageway footprint; impact on watercourse uncertain due to complex planform and multiple existing crossings
Allt Slochd Mhuic	**Low**	Mainline Alignment Option 1A	Y		Y			Major	Adverse	Slight / Moderate	Same as Mainline Alignment Option 1
Allt Slochd Mhuic	**Low**	Mainline Alignment Option 2	Y		Y			Major	Adverse	Slight / Moderate	Same as Mainline Alignment Option 1

6. Summary Recommendations

6.1. Potential Mitigation Options

6.1.1. No specific mitigation has been proposed which would allow the residual impacts to be assessed at this stage. Instead the following section will identify some potential mitigation options which could be used to offset some of the impacts identified in Table 5-2. General guidance can be found in SEPA's practical guide to the CAR[viii].

Watercourse crossings

Bridges

6.1.2. Single span bridges are the preferred type of crossing as noted in SEPA's guidance on river crossings[ix]. This has the least impact on the natural fluvial regime, maintaining existing in-stream and bank side habitats. Sediment transport and migration of aquatic species can be maintained. Structures with in-stream supports may be appropriate, but only for very wide rivers. Similarly, the majority of the in-stream and bank side habitats can be maintained, although careful consideration is required for the affect the supports may have on the bed (e.g. scour) and may block debris.

Culverts (extended and new)

6.1.3. If a clear span structure is not possible, or economically viable, a closed culvert is likely to be required. Culverts are common along many of the UK's road and rail networks, as well as forming large parts of the river networks underneath urban environments. Depending on their age they often have artificial hard beds, may be oversized to allow flood flows and extend for long lengths. Vegetation growth through the culvert is limited to only the hardiest of species and they can prevent natural fluvial/sedimentary processes (including sediment transport) and create a barrier for the movement of fish and other wildlife. They can also block debris and create flood risk if not properly designed.

6.1.4. Good practice culvert design should consider the following:

- Depressed invert set slightly below the existing bed level. This allows space for natural bed substrates to be imported to form the bed level. The culvert design should maintain the natural bed profile within the channel, in terms of bank to bank channel width, channel gradients and substrates where possible.
- Except where specifically stated, a 'buffer' zone would be created up and downstream of culverts to allow for the creation of habitats which would both enhance the watercourse, and incorporate features such as pools to allow fish to rest before entering the culvert. The overall culvert design should not in any way impede fish passage up and downstream.
- Although each culvert should be considered separately, it is likely that some sort of bed and bank protection would be required upstream at transition between the watercourse and culvert. Hard bank and bed protection should be avoided where possible. Rip-rap and boulders are more preferable than gabions.
- Appropriate inlet and outlet structures should be provided in order to dissipate energy and reduce risk of erosion, e.g. through use of artificial scour pools and/or a continuous substrate layer through the culvert and open watercourse.

6.1.5. SEPA's Good Practice Guidelines and position statement[x] provides further information, as does guidance from the DMRB and also from CIRIA[xi].

6.1.6. Culverts will lead to a loss of open river channel. It may be appropriate to compensate for this loss by extending the length of the watercourse elsewhere (if unnaturally straight) or alternatively, providing other wetland features, such as scrapes, meander cut-offs and backwaters. These features positively add to the biodiversity value of the watercourse.

River realignments/diversions

6.1.7. Many of the new or extended crossings may require some adjustment of the river planform to align the existing watercourse through the proposed culvert or bridge. These realignments may be relatively short, however it is still important to ensure they are properly designed by a qualified fluvial geomorphologist to safeguard their long-term stability. Badly designed realignments can increase and decrease sediment movements, resulting in instability through erosion or deposition. This is even more important for major realignments (>10m) where the functioning of the watercourse needs to be maintained over a longer distance and potential instability can have much greater impacts to the structures and the river system as a whole.

6.1.8. As a minimum, realignments should be designed on a like-for-like basis. The following key considerations should be accounted for in any design:

- **Bed gradient** - Maintaining the existing bed gradient would ensure the continuity of the existing sediment regime. Too low and substrate may begin to deposit, blocking culvert entrances and/or reducing flood flow capacity, this also reduce sediment supply downstream. Too steep and bank erosion or bed incision may begin to occur increasing sediment supply downstream (potentially depositing within culverts). If the design of the road requires a change of the bed gradient mitigation such as step-pools or bed-checks may be necessary or sediment traps.
- **Cross-section** - The design of an appropriate low flow channel would also ensure the continuity of the existing sediment transport regime. A two-stage or multiple-stage cross-section can provide a wide range of benefits and preserve the existing low flow processes, allowing for natural adjustment and improve system resilience to low flow events. The multiple stage cross-section also encourages a range of habitats to form and provision of flood flow capacity whilst ensuring a low flow channel is maintained.
- **Planform** - The planform should reflect the existing channel where possible or restore historical planforms where the existing channel has been artificially modified.
- **Boundary conditions** - Existing substrates should be collected, stored (without contamination) and reinstated. Where not possible the proposed substrates should be matched to local material. The suitability of substrates should be considered using empirical observations made by a qualified geomorphologist, as well sediment transport calculations (where deemed appropriate) and local sources.
- Other mitigation features such as woody material (known as wood debris), margin gravel bars, vegetation and riffle-pools can also further enhance and restore natural processes to the watercourse in appropriate locations.

Bank protection

6.1.9. Bank protection may be required as part of The Proposed Scheme. Where possible this should be formed of naturally occurring materials, stone (e.g. rip-rap) and/or locally sourced hardwood. If the channel requires more engineered solutions it should be sympathetic to the local landscape and habitats, and used in combination with a planting scheme to improve the aesthetics.

6.1.10. SEPA's guidance on bank protection provides further information[xii]. The role of vegetation for channel stability should also not be underestimated and consultation with the landscape architect should be undertaken at the earliest opportunity.

Temporary works

6.1.11. Temporary works should also be considered from the outset to minimise any direct or indirect impact on the watercourse. The design of any temporary diversion should also consider the items list above, especially if intended to be in situ for a long period of time. Temporary channels can have lasting impacts on the watercourse environment, such as the increase in fine sediment supply downstream and/or incision leading to instability migrating upstream.

6.2. Potential Opportunities

6.2.1. SEPA's guidance on river crossings[xiii] identifies the need to explore opportunities for potential improvements when upgrading or replacing an existing crossing. This includes providing fish and mammal passage where a crossing forms a barrier. The local district salmon fishery board and local fisheries trusts can advise on fish populations present (native as well as non-native) and any potential impacts of removing or improving an existing barrier. This is particularly relevant to water bodies River Dulnain-Feith Mhor (23113) and Allt na Fearna [sic] – upstream Loch Alvie (23126) where the overall WFD status is Poor because of the obstacles to fish migration.

Figure 6-1 Existing cascade at Southern Avie Lochan Burn (P1040794)

6.2.2. Where an old structure is being replaced consideration should be given to removing it and constructing a new environmentally improved structure next to it. Although there may be exceptions to this, such as where the structure is required for access, or where they have some historical or local significance. Historic Environment Scotland and The Highland Council planning department can be consulted in this regard. Many older structures are incompatible with current design criteria, e.g. hard beds without depressed inverts (see Figure 6-1), fish barriers or where the existing structure is in a poor/worsening condition.

6.2.3. Elsewhere historic modifications to the channel planform/profile, e.g. straightening, dredging or disconnection from the floodplain by embankments, may be improved as result of the scheme.

6.3. Further Investigation at DMRB Stage 3 Assessment

6.3.1. A more detailed assessment of the impacts can be undertaken at DMRB Stage 3, once the preferred scheme option has been determined. Potential mitigation can then be recommended for each potential crossing and realignment, which would then allow the residual impacts to be identified.

6.3.2. Further site work is not anticipated at Stage 3, however this will depend on the nature of any future design iterations.

6.3.3. A preliminary WFD compliance assessment should be undertaken to ensure there is no deterioration on water body status for those main water bodies identified in Table 3-2. This will require consultation with SEPA to discuss and agree design criteria t and feed this into the design at the earliest opportunity.

7. Conclusion

7.1.1. The majority of the watercourses were classified as Low to Medium sensitivity, primarily due to the existing modifications observed during this investigation. The River Dulnain and Allt nan Ceatharnach were classified as High due to their water body being classified as 'Good', despite also being historically modified.

7.1.2. The Southern Avie Lochan Burn was screened out following the walkover. Three watercourses were subsequently added into the assessment subsequent to the walkover, these were Unnamed Drain through Milton which had not been located during the site visit, Northern Avie Lochan Burn and Bogbain Burn which was added due to potential hydrological impacts.

7.1.3. For the majority of watercourses the overall significance of the potential (adverse) impacts of the proposed mainline option is Slight to Moderate. This is primarily due to the Low to Medium sensitivity of watercourses and/or the Low to Moderate magnitude of impact, such as extensions/replacement of existing watercourse crossings.

7.1.4. Allt an Fheàrna and Allt Chriochaidh were considered to have Large adverse impacts for all mainline options, as was Option 1A for Allt Cnapach. This was because of the potential for a significant realignment of the watercourses.

7.1.5. Only Allt na Criche (Granish), Allt nan Ceatharnach and Bogbain Burn are affected by the proposed junction options, although the potential impacts to Allt nan Ceatharnach and Bogbain are limited were likely to only have indirect impacts. The potential impact to Allt na Criche is uncertain, but are likely to at least require a new crossing if not a significant realignment to the burn resulting in Moderate to Large adverse impact.

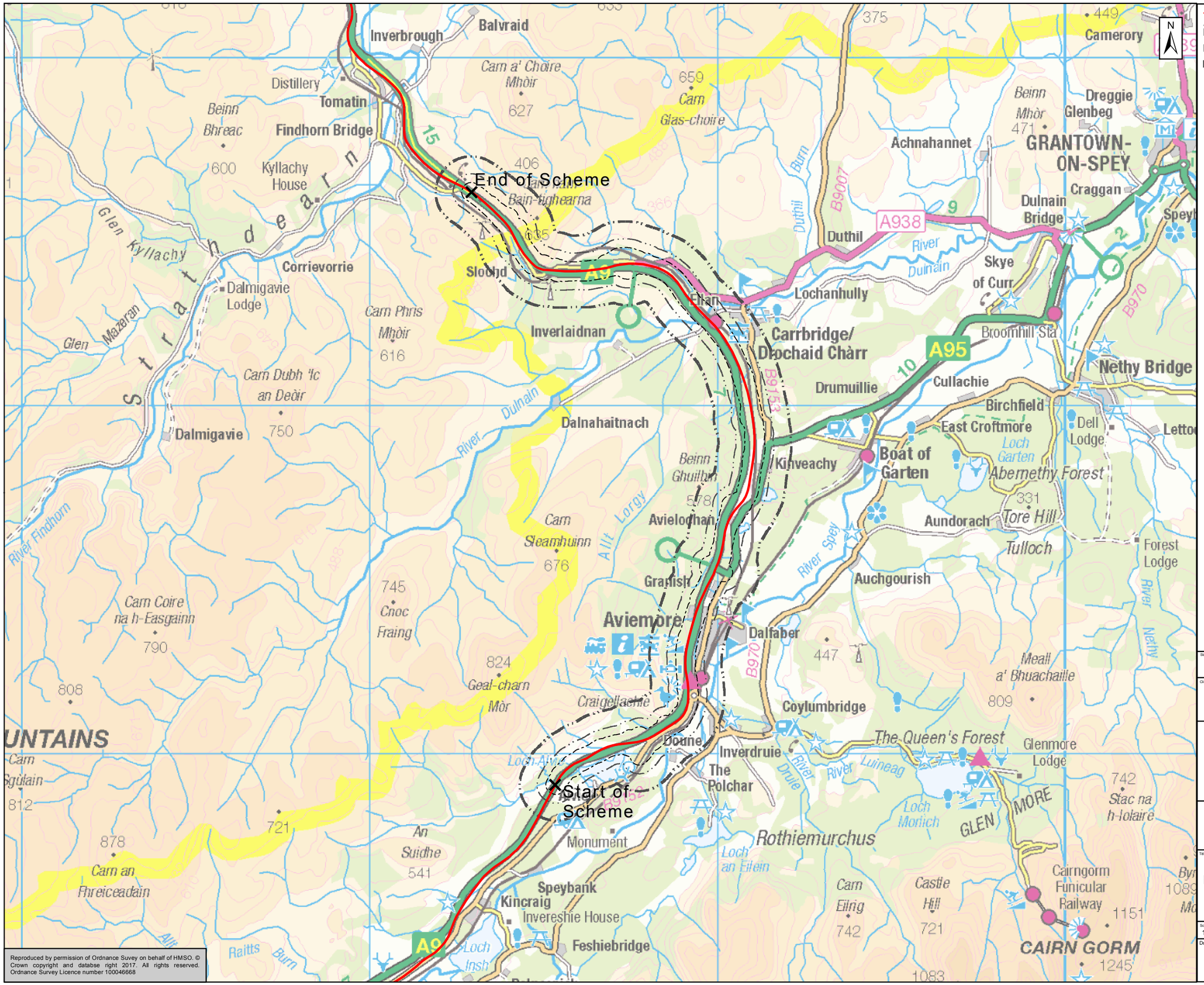
7.1.6. Regardless of the significance of the impacts all works should be compliant with the WFD and no scheme element should be designed whereby it prohibits the achievement of good status in the future. As stated above, a WFD compliance assessment would be undertaken at the earliest opportunity in DMRB Stage 3 Assessment.

7.1.7. The summary of the overall significance of impacts is shown in Table 7-1.

Table 7-1 Summary of overall significance of impact

Watercourse name	Mainline Options			Junction Options												
	Mainline Alignment Option 1	Mainline Alignment Option 2	Mainline Alignment Option 1A	Aviemore South Junction Option A02	Aviemore South Junction Option A09	Aviemore South Junction Option A18	Granish Junction Option C18	Granish Junction Option C21	Granish Junction Option C31	Granish Junction Option C34	Black Mount Junction Option D02	Black Mount Junction Option D03	Black Mount Junction Option D07	Black Mount Junction Option D12	Black Mount Junction Option D13	Black Mount Junction Option D51
Allt an Fheàrna	Large	Large	Large													
Allt Chriochaidh	Large	Large	Large													
Caochan Ruadh	Slight	Slight	Slight													
Ballinluig Burn	Neutral	Neutral	Neutral													
Allt na Criche (Lynwilg)	Slight	Slight	Slight													
Aviemore Burn	Slight	Slight	Slight													
Unnamed Drain	Neutral	Neutral	Neutral													
The Shieling / Easter Aviemore Burn	Moderate	Moderate	Moderate													
Allt na Criche (Granish)	Slight	Slight	Slight				Moderate	Large	Large	Large						
Southern Avie Lochan Burn	Slight	Slight	Slight													
Northern Avie Lochan Burn	Slight	Slight	Slight													
Unnamed Drain - Screened out																
Allt Cnapach	Slight		Large													
Feith Mhor	Slight	Slight	Slight													
River Dulnain	Slight/ Moderate	Slight/ Moderate	Slight/ Moderate													
Allt nan Ceatharnach	Slight/ Moderate	Slight/ Moderate	Slight/ Moderate								Neutral	Neutral	Neutral	Neutral	Neutral	Neutral
Bogbain Burn	Neutral	Neutral	Neutral								Neutral	Neutral	Neutral	Neutral	Neutral	Neutral
Allt Slochd Mhuic	Slight / Moderate	Slight / Moderate	Slight / Moderate													

Annex A. Figures



Status	Suitability
FINAL	B

Client: TRANSPORT SCOTLAND / CÒMHDHAIL ALBA

A9 DUALLING PERTH TO INVERNESS Dalraddy to Slochd

ATKINS mouchel

Title: Figure A10.1.1 Fluvial Geomorphology Study Area Sheet 1 of 1

Scale	Drawn	Checked	Approved	Authorised
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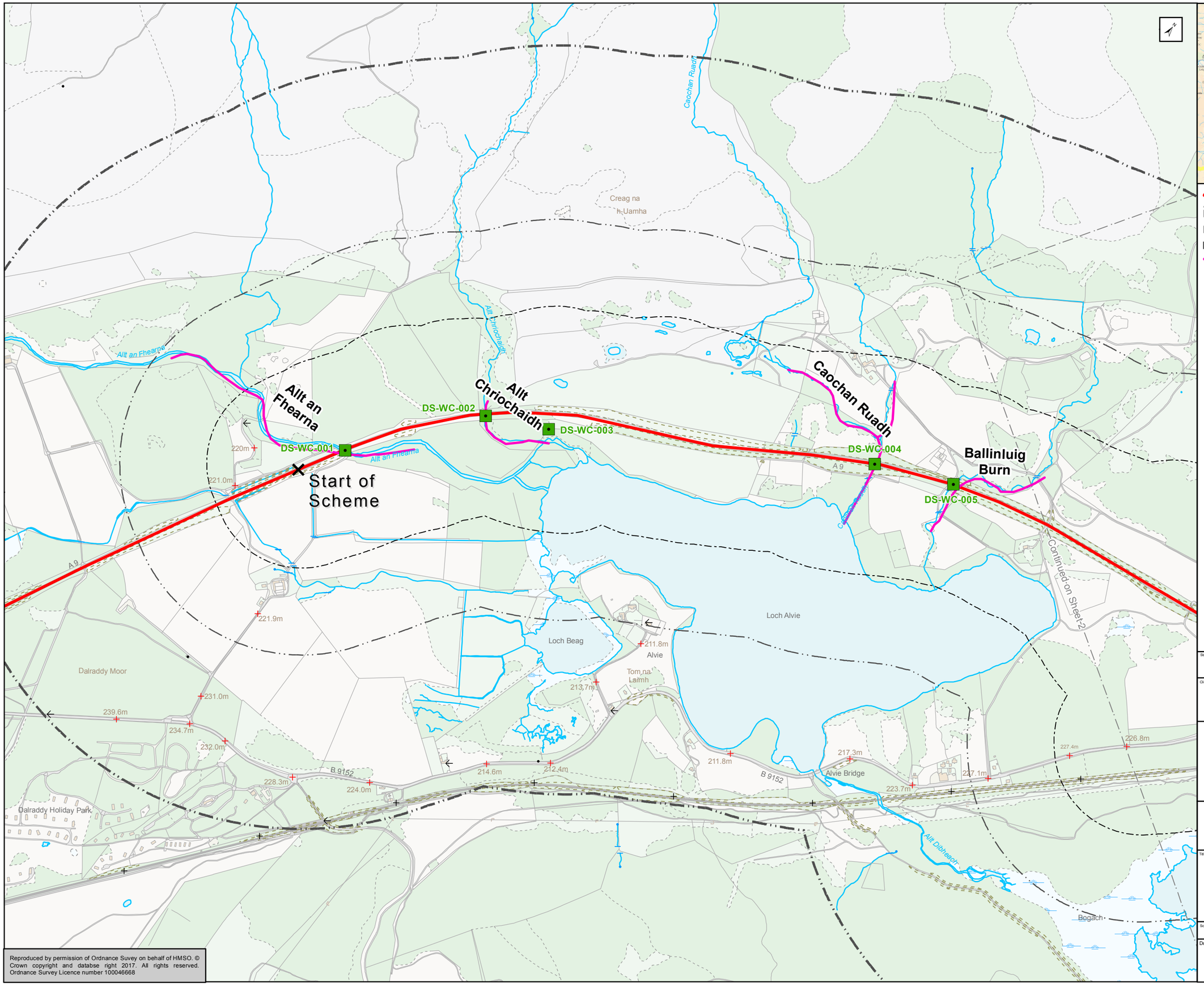

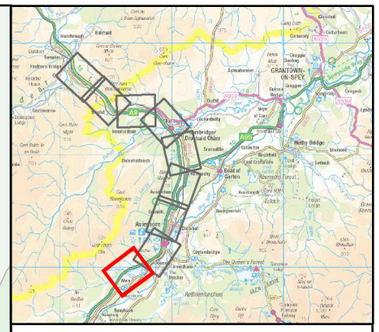

- Existing A9
- 250m Study Area
- 500m Study Area
- 1km Study Area
- Walkover Survey Extents
- Crossing Locations - Surveyed
- Crossing Locations - Not Surveyed

Kilometres
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Status	Suitability
FINAL	B

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A9 DUALLING PERTH TO INVERNESS
Dalraddy to Slochd

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Title

Figure A10.1.2a Watercourse Survey Extent and Crossing Locations Sheet 1 of 9

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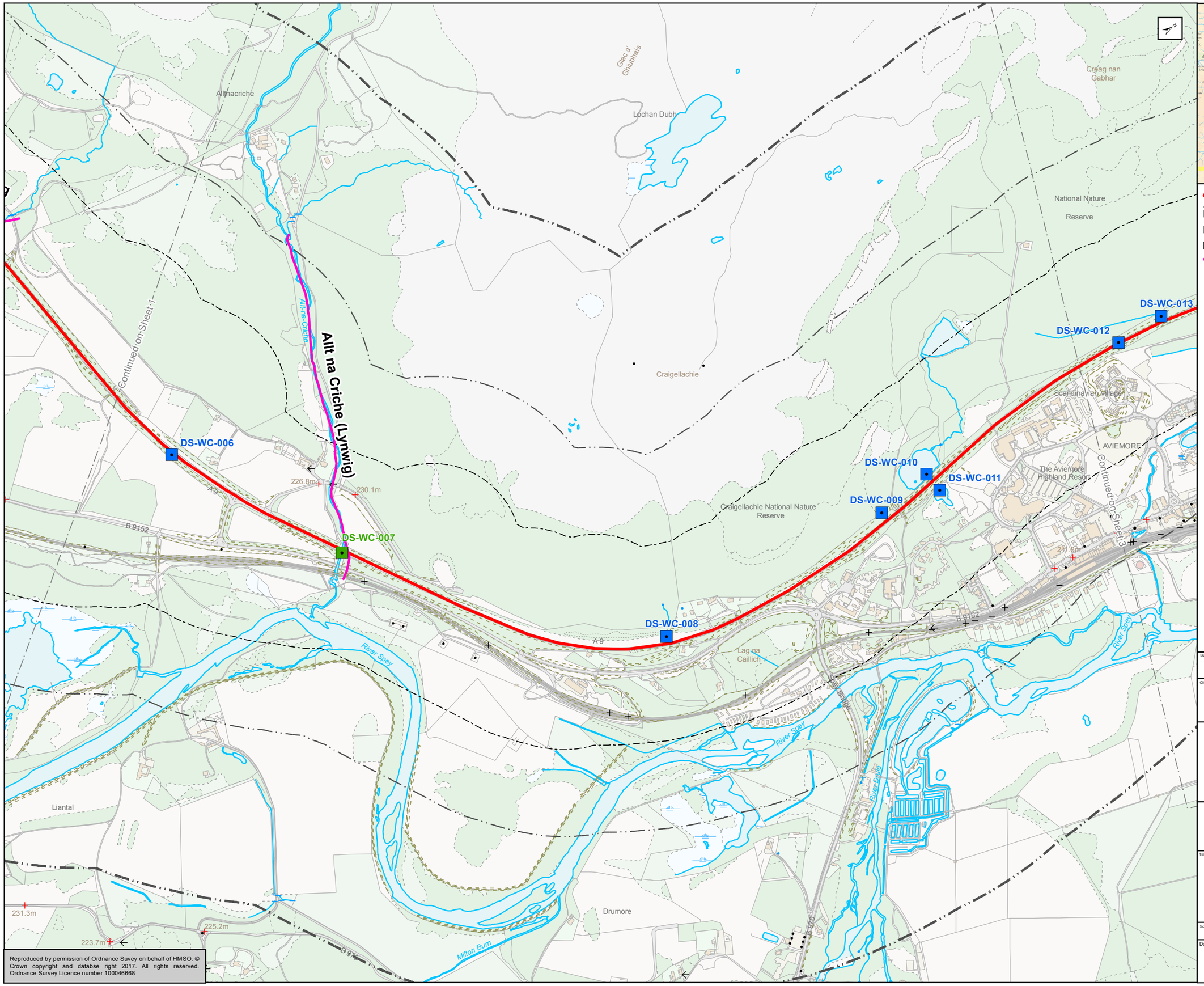

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A9 DUALLING PERTH TO INVERNESS Dalraddy to Slochd

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Title: Figure A10.1.2b Watercourse Survey Extent and Crossing Locations Sheet 2 of 9

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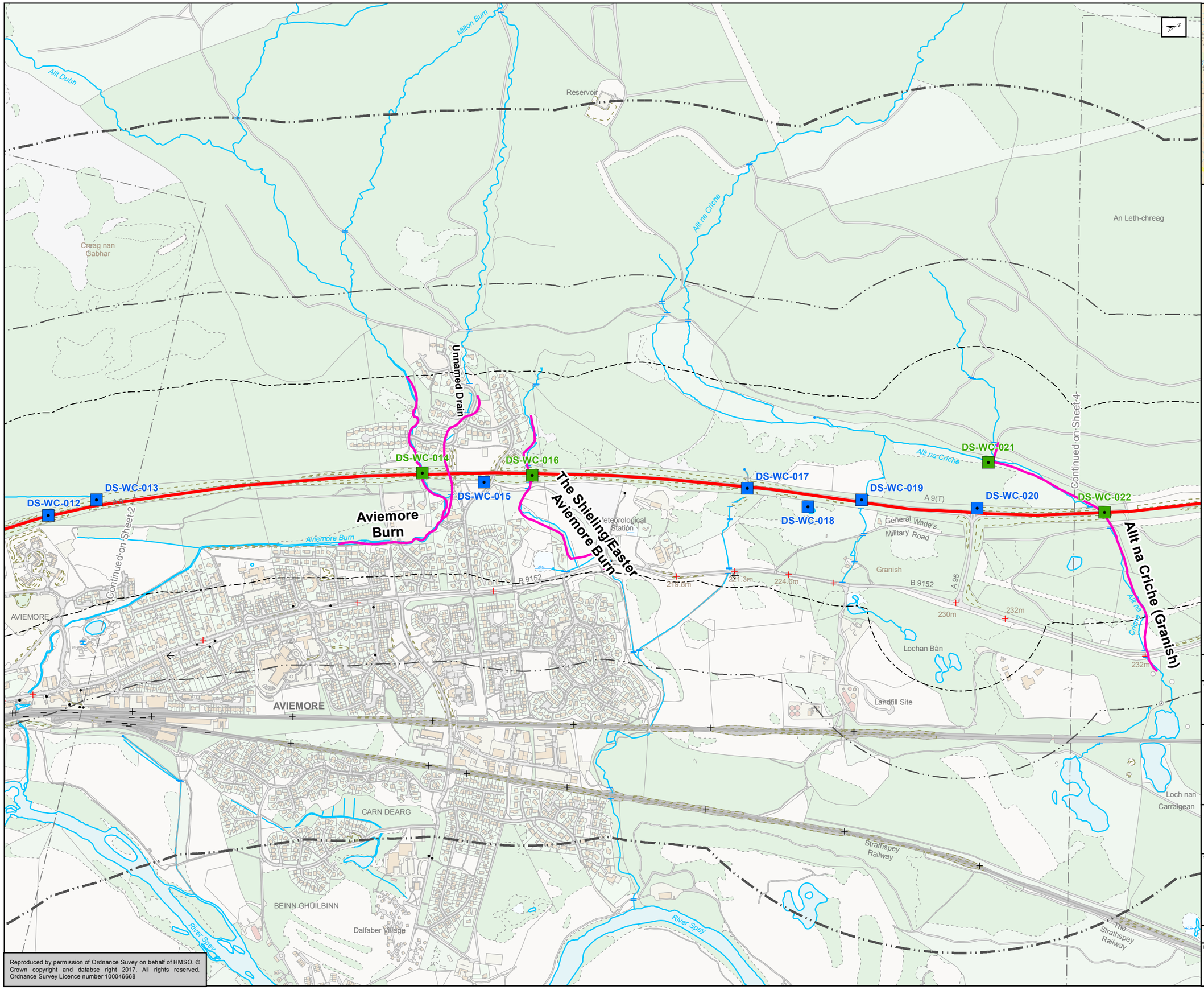

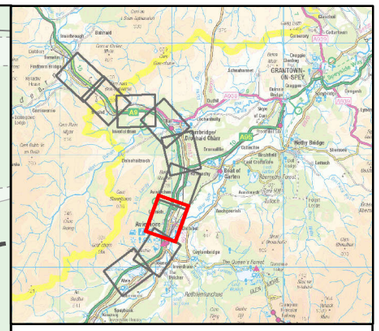

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Status	Suitability
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Client: TRANSPORT SCOTLAND / CÒMHDHAIL ALBA

A9 DUALLING PERTH TO INVERNESS Dalraddy to Slochd

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Title: Figure A10.1.2c Watercourse Survey Extent and Crossing Locations Sheet 3 of 9

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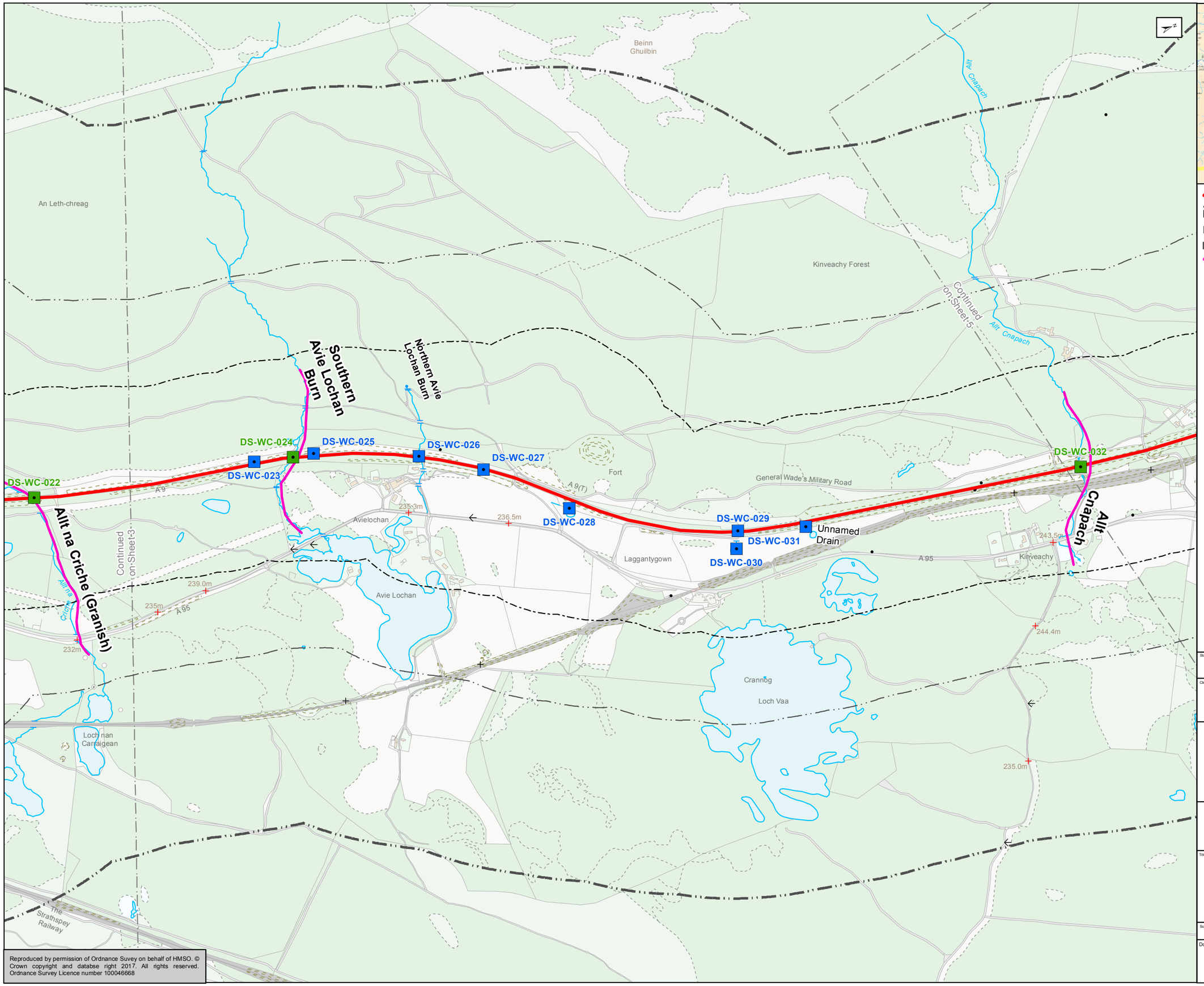

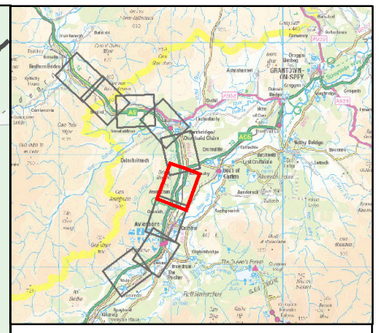

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Status	Suitability
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Client: TRANSPORT SCOTLAND / CÒMHDHAIL ALBA

A9 DUALLING PERTH TO INVERNESS Dalraddy to Slochd

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Title: Figure A10.1.2d Watercourse Survey Extent and Crossing Locations Sheet 4 of 9

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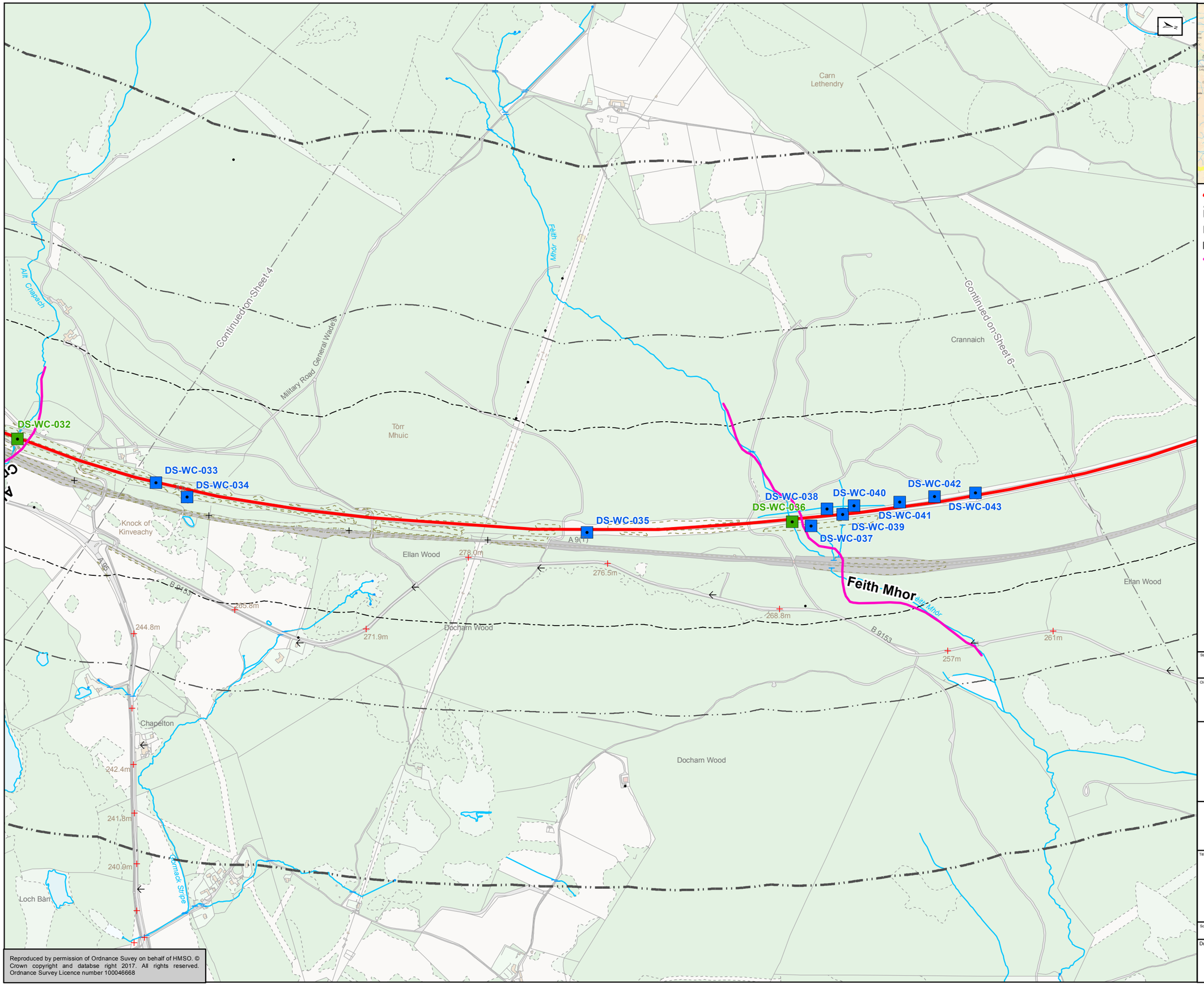

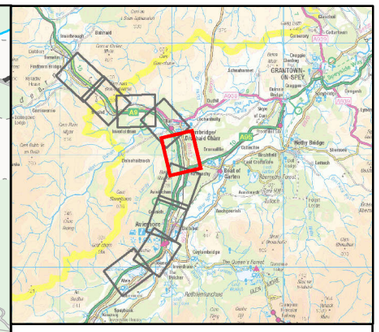

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Status: FINAL
Suitability: B

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Dalraddy to Slochd

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Title:
Figure A10.1.2e
Watercourse Survey Extent and Crossing Locations
Sheet 5 of 9

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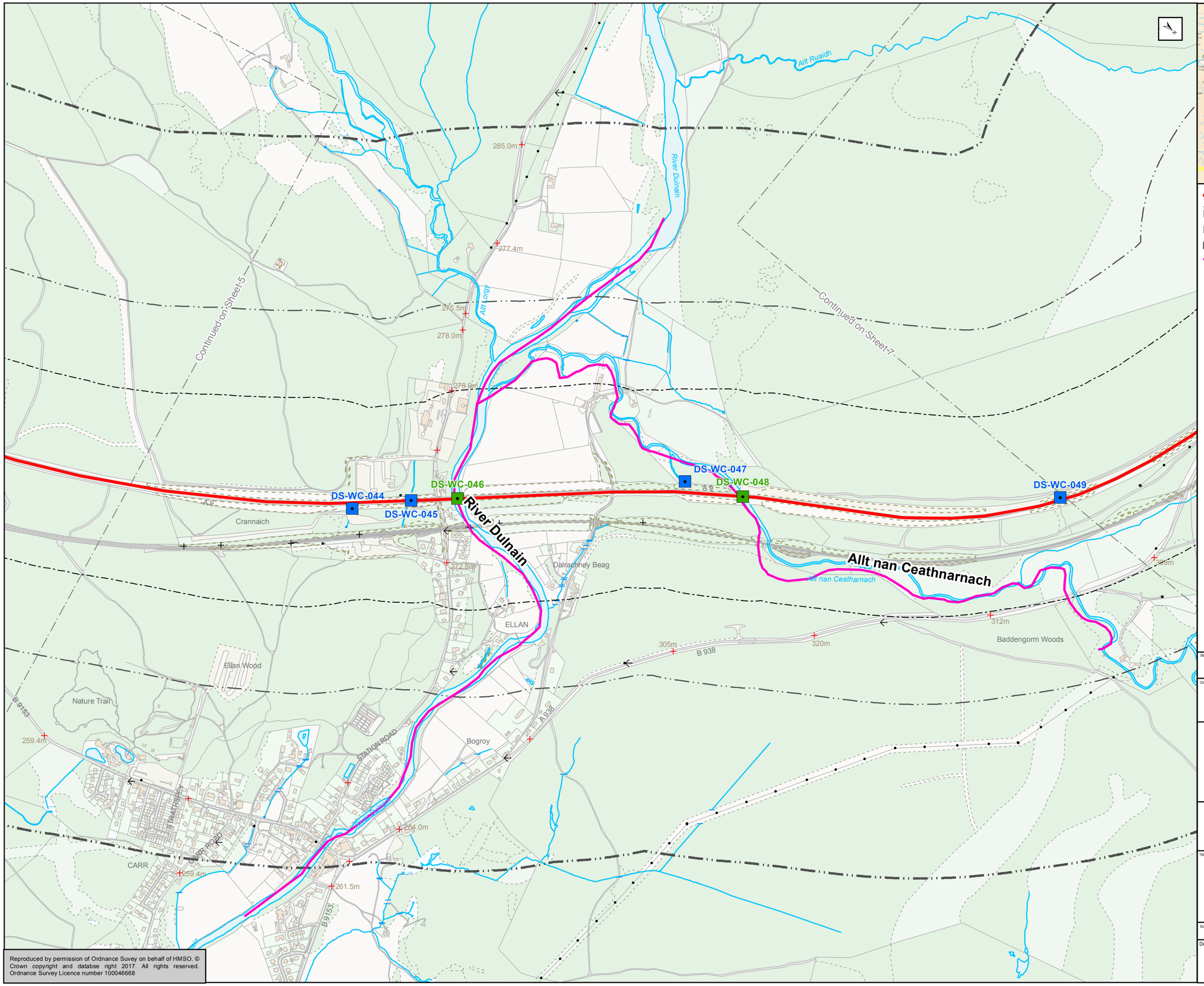

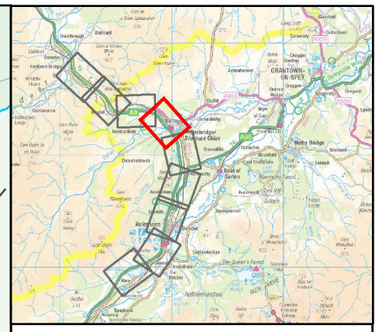

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Status	Suitability
FINAL	B

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A9 DUALLING PERTH TO INVERNESS Dalraddy to Slochd

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Title: Figure A10.1.2f Watercourse Survey Extent and Crossing Locations Sheet 6 of 9

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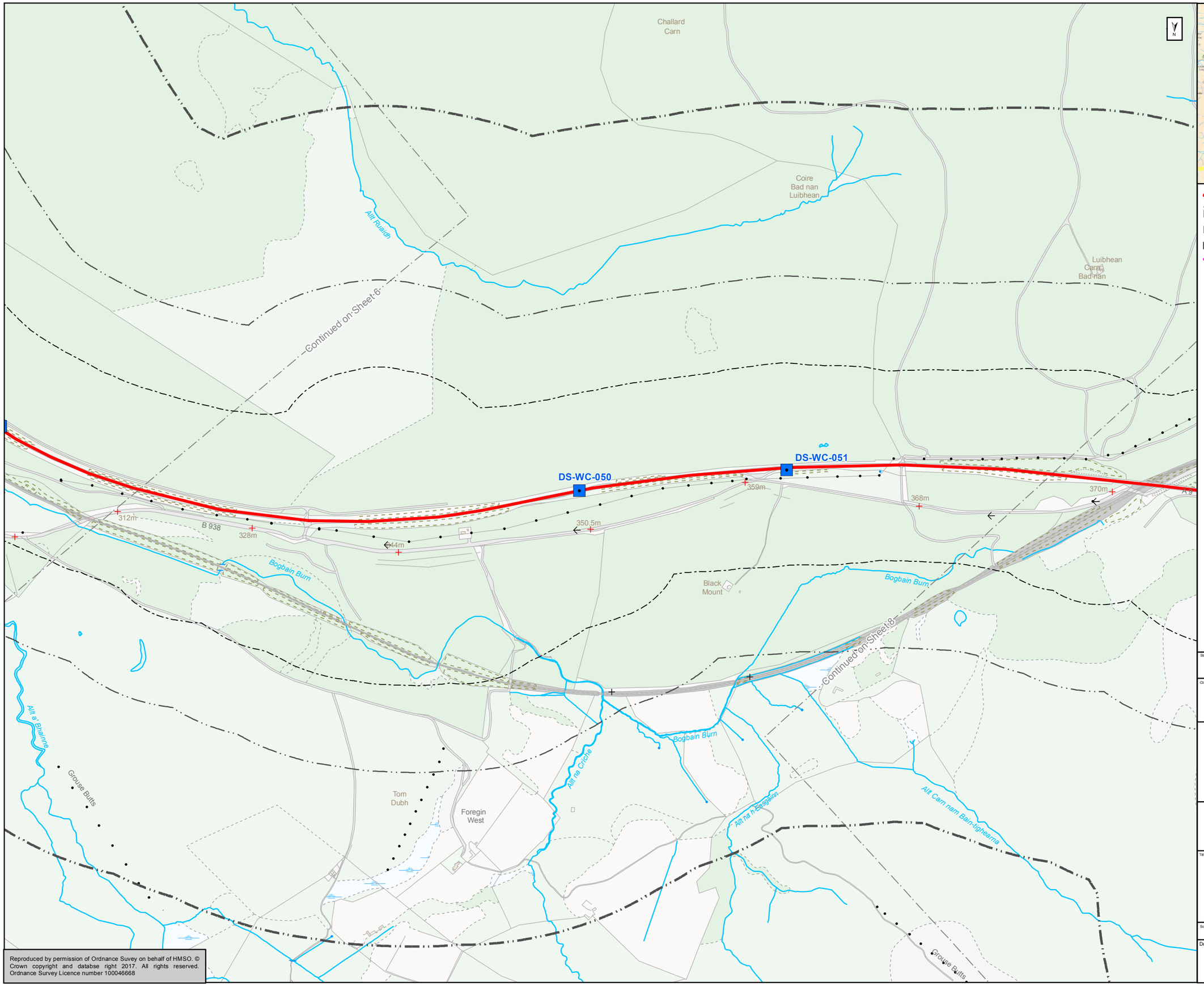

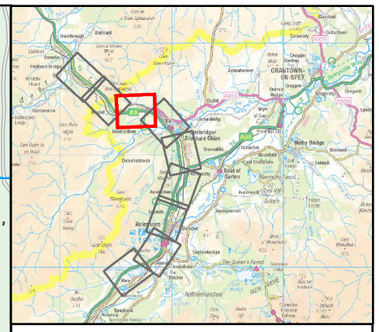

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Crossing Locations - Not Surveyed

Kilometres
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Status: FINAL
Suitability: B

Client: TRANSPORT SCOTLAND / CÒMHDHAIL ALBA

A9 DUALLING PERTH TO INVERNESS
Dalraddy to Slochd

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Title:
Figure A10.1.2g
Watercourse Survey Extent and Crossing Locations
Sheet 7 of 9

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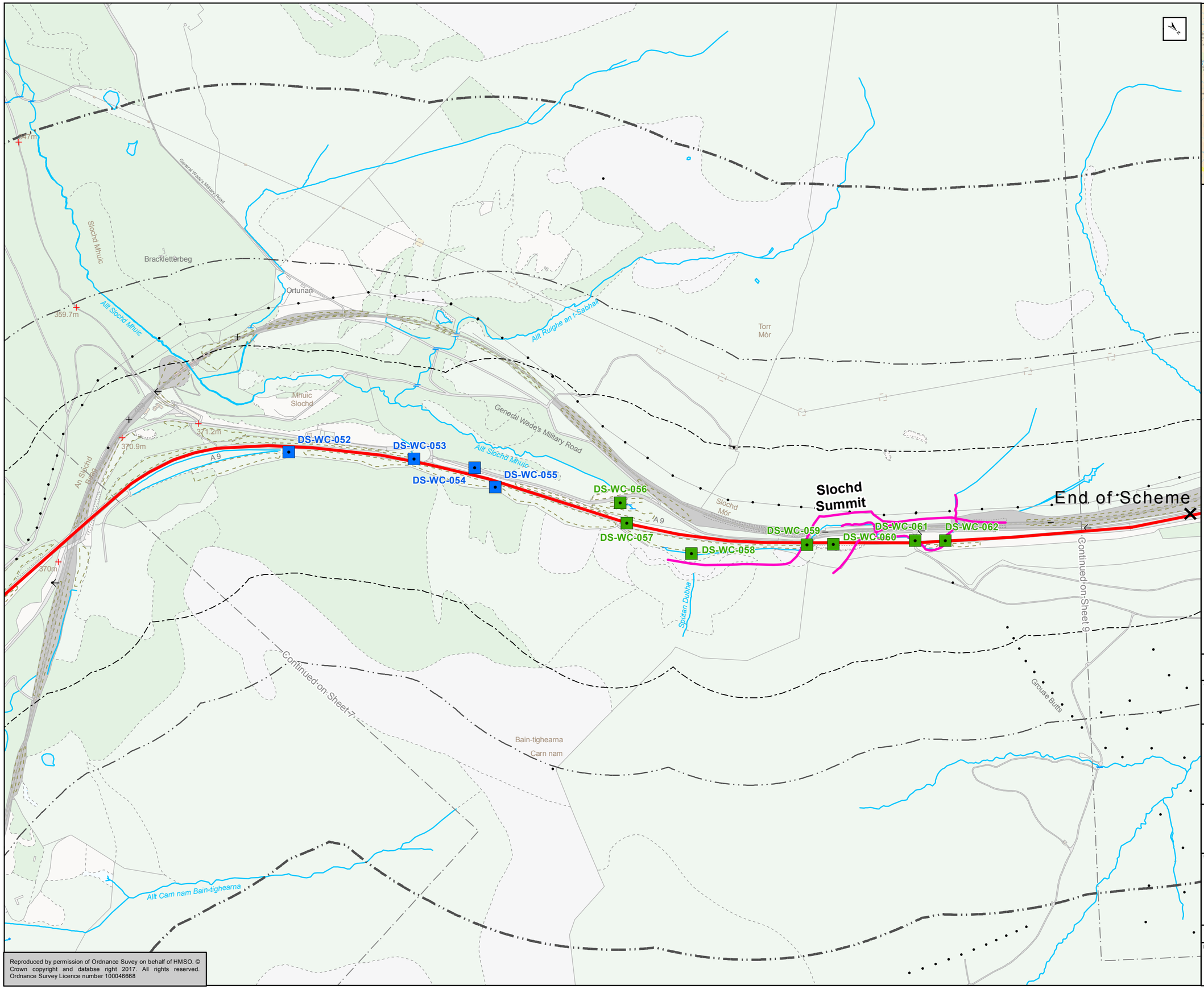

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Crossing Locations - Not Surveyed

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Status: FINAL
Suitability: B

Client: TRANSPORT SCOTLAND / CÒMHDHAIL ALBA

A9 DUALLING PERTH TO INVERNESS
Dalraddy to Slochd

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Title:
Figure A10.1.2h
Watercourse Survey Extent and Crossing Locations
Sheet 8 of 9

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