Appendix 11.4

Hydromorphology Assessment Part 3

Annex 11.4.3 - Hydromorphological Catchment Assessment - 117

Catchment No.	117
Catchment Name	

Channel Nature	Nature of water course	Drain
	Size of water course	Other

Quantitative Spatial Elements	Catchment Area (km^2)	No Data
	Average slope in catchment (°)	No Data
	% Catchment over 750m (for snow melt risk)	0

WFD classification	Water, flows and levels	Good
	Physical condition	Good
	Overall ecological status	Moderate

Geology	Majority Bedrock (see Drawing 11.4.3.1 a and b Catchment 117)	Gaick Psammite formation-Psammite	resistant to weathering, impermeable
	Is an alluvial fan present at or near the crossing?	No	

Environmental designations (see Drawing 11.4.3.1 c, Catchment 117)	Ramsar	No	
	SAC	No	
	SPA	No	
	SSSI	No	

Sediment source and supply - Catchment Scale	Changes in slope and channel confinement	See Drawing 11.4.3.2, Catchment 117	
	Is peat present in the catchment	No	
	Is there a bog burst risk	No	
	Current valley side or terrace erosion	No	
	Potential valley side or terrace erosion	No	
	Hill slope failures (including peat slides and debris flows and slides)	No	
	Hill slope failures coupled to channel	No	
	Vertical incision present in catchment	No	
	Bank erosion/lateral migration	No	
	Unvegetated bars	No	
	Wooded/forested areas in catchment	No	
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 117)	No	
	Comment on sediment source potential in catchment	Limited	
	Comment on sediment supply potential to crossing	Limited	

Morphology and Process-Reach upstream of crossing	Channel morphology	Plane bed	
	Predominant sediment size	Fines and some cobbles	
	Unvegetated bars	No	
	Vertical incision	Low	Incision of drain possible led to failure of drain banks but now seem stabilised
	Deposition	None	
	Lateral migration/bank erosion	Low	Previous failure of drain banks evident due to incision but now stabilised
	Presence and nature of infrastructure (Map 1d)	None	
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 117)	-	
	Channel realignment	Drain has captured hillslope drainage	

Morphology and Process-At crossing	Channel morphology	Engineered	
	Predominant sediment size	Large gravel with fine drape u/s of	
	Estimated discharge at 1:200 event (m^3/s)	1.4	
	Unvegetated bars	No	
	Vertical incision	None	
	Deposition	Low	Small culvert exit appears choked with sediment
	Lateral migration/bank erosion	None	
	Damaged/unstable drains or armouring	None	

Morphology and Process-Reach downstream of crossing	Channel morphology	Plane bed	
	Predominant sediment size	fine	
	Unvegetated bars	No	
	Vertical incision	None	
	Deposition	None	
	Lateral migration/bank erosion	None	
	Presence and nature of infrastructure (Map 1d)	Yes	Railway
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 117)	Railway	Channel realigned to join others to pass under railway at one single point.
	Channel realignment	Yes	See above

Summary behaviour	Very little happening . Cut drains u/s of crossing have previously incised to a certain degree, probably with some bank failure but appear to have completely stabilised. Small amounts of large gravel are deposited u/s of the culvert where the drains drop to below road level, but the armouring here seems mostly intact. D/s of the small culvert has become choked with fine sediment, which appears to be the most significant issue here, but this crossing could probably actually be downgraded.

Annex 11.4.3 - Hydromorphological Catchment Assessment - 118

Catchment No.	118
Catchment Name	-

Channel Nature	Nature of water course	Natural
	Size of water course	Minor

Quantitative Spatial Elements	Catchment Area (km^2)	No Data
	Average slope in catchment (°)	No Data
	% Catchment over 750m (for snow melt risk)	No Data

WFD classification	Water, flows and levels	Good
	Physical condition	Good
	Overall ecological status	Moderate

Geology	Majority Bedrock (see Drawing 11.4.3.1 a and b Catchment 118)	Gaick Psammite formation-Psammite	resistant to weathering, impermeable
	Is an alluvial fan present at or near the crossing?	No	

Environmental designations (see Drawing 11.4.3.1 c, Catchment 118)	Ramsar	No	
	SAC	No	
	SPA	No	
	SSSI	No	

Sediment source and supply - Catchment Scale	Changes in slope and channel confinement	See Drawing 11.4.3.2, Catchment 118	
	Is peat present in the catchment	No	
	Is there a bog burst risk	No	
	Current valley side or terrace erosion	No	
	Potential valley side or terrace erosion	No	
	Hill slope failures (including peat slides and debris flows and slides)	No	
	Hill slope failures coupled to channel	No	
	Vertical incision present in catchment	Yes	Limited amount
	Bank erosion/lateral migration	No	
	Unvegetated bars	No	
	Wooded/forested areas in catchment	No	
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 118)	Yes	Rough 4x4 track in upper catchment
	Comment on sediment source potential in catchment	4x track in upper catchment may generate some run-off and sediment to upper headwaters, but limited.	
	Comment on sediment supply potential to crossing	Likely. Steep and short channel so likely to deliver sediment. Evidenced by gravel deposited u/s of culvert.	

Morphology and Process-Reach upstream of crossing	Channel morphology	Engineered	
	Predominant sediment size	-	
	Unvegetated bars	No	
	Vertical incision	None	
	Deposition	None	
	Lateral migration/bank erosion	None	
	Presence and nature of infrastructure (Map 1d)	No	
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 118)	No	
	Channel realignment	Yes	Natural channel incorporated into drain

Morphology and Process-At crossing	Channel morphology	Engineered	
	Predominant sediment size	Gravel	
	Estimated discharge at 1:200 event (m^3/s)	1.4	
	Unvegetated bars	No	
	Vertical incision	None	
	Deposition	Low	
	Lateral migration/bank erosion	None	
	Damaged/unstable drains or armouring	Yes	U/s of culvert engineered drains seems intact. D/s of culvert substantial scour appears to have occurred at end of concrete apron, undermining the apron.

Morphology and Process-Reach downstream of crossing	Channel morphology	Plane bed	
	Predominant sediment size	Large gravel	
	Unvegetated bars	Yes	Incipient
	Vertical incision	Medium	Scour after concrete apron
	Deposition	Low	
	Lateral migration/bank erosion	Low	
	Presence and nature of infrastructure (Map 1d)	Yes	Railway
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 118)	Railway	Channel realigned to join others to pass under railway at one single point.
	Channel realignment	Yes	See above

Summary behaviour	Channel steep but stable u/s of culvert with engineered sections near culvert intact and gravel seems to be delivered from natural bed activities further u/s and deposited where gradient drops at culvert entrance. D/s of culvert exit is a concrete apron. At the end of this concrete apron the channel has scoured back and begun to undermine the apron, so there are opportunities for improvement here.

Annex 11.4.3 - Hydromorphological Catchment Assessment - 119

Catchment No.	119
Catchment Name	-

Channel Nature	Nature of water course	Natural
	Size of water course	Minor

Quantitative Spatial Elements	Catchment Area (km^2)	No Data
	Average slope in catchment (°)	No Data
	% Catchment over 750m (for snow melt risk)	No Data

WFD classification	Water, flows and levels	Good
	Physical condition	Good
	Overall ecological status	Moderate

Geology	Majority Bedrock (see Drawing 11.4.3.1 a and b Catchment 119)	Gaick Psammite formation-Psammite	resistant to weathering, impermeable
	Is an alluvial fan present at or near the crossing?	No	

Environmental designations (see Drawing 11.4.3.1 c, Catchment 119)	Ramsar	No	
	SAC	No	
	SPA	No	
	SSSI	No	

Sediment source and supply - Catchment Scale	Changes in slope and channel confinement	See Drawing 11.4.3.2, Catchment 119	
	Is peat present in the catchment	No	
	Is there a bog burst risk	No	
	Current valley side or terrace erosion	No	
	Potential valley side or terrace erosion	No	
	Hill slope failures (including peat slides and debris flows and slides)	No	
	Hill slope failures coupled to channel	No	
	Vertical incision present in catchment	No	
	Bank erosion/lateral migration	No	
	Unvegetated bars	No	
	Wooded/forested areas in catchment	No	
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 119)	No	
	Comment on sediment source potential in catchment	Limited	
	Comment on sediment supply potential to crossing	No evidence of sediment delivery to culvert	

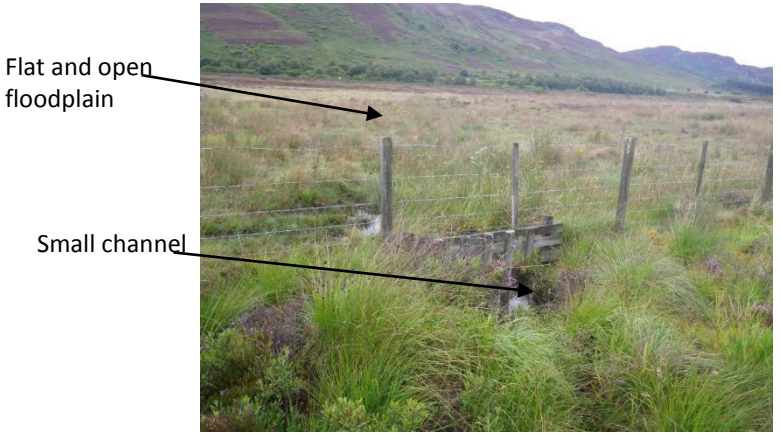
Morphology and Process-Reach upstream of crossing	Channel morphology	Engineered	
	Predominant sediment size	-	
	Unvegetated bars	No	
	Vertical incision	None	
	Deposition	None	
	Lateral migration/bank erosion	None	
	Presence and nature of infrastructure (Map 1d)	No	
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 119)	No	
	Channel realignment	No	

Morphology and Process-At crossing	Channel morphology	Engineered	
	Predominant sediment size	-	
	Estimated discharge at 1:200 event (m^3/s)	1.4	
	Unvegetated bars	No	
	Vertical incision	None	
	Deposition	None	
	Lateral migration/bank erosion	None	
	Damaged/unstable drains or armouring	Yes	Limited amount of damage to cascade - blocks loosened and possible scour at base (but difficult to see)

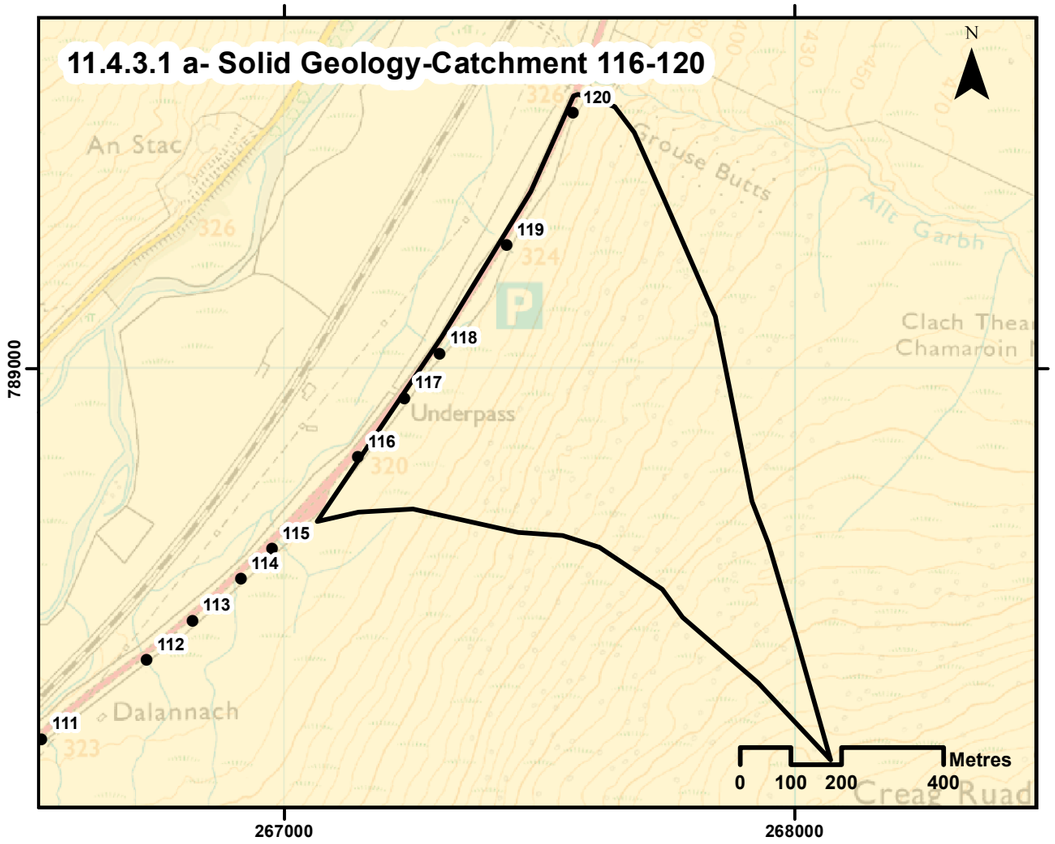
Morphology and Process-Reach downstream of crossing	Channel morphology	Plane bed	
	Predominant sediment size	fine	
	Unvegetated bars	No	
	Vertical incision	Low	
	Deposition	None	
	Lateral migration/bank erosion	None	
	Presence and nature of infrastructure (Map 1d)	None	
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 119)	Railway	Channel realigned to join others to pass under railway at one single point.
	Channel realignment	Yes	See above

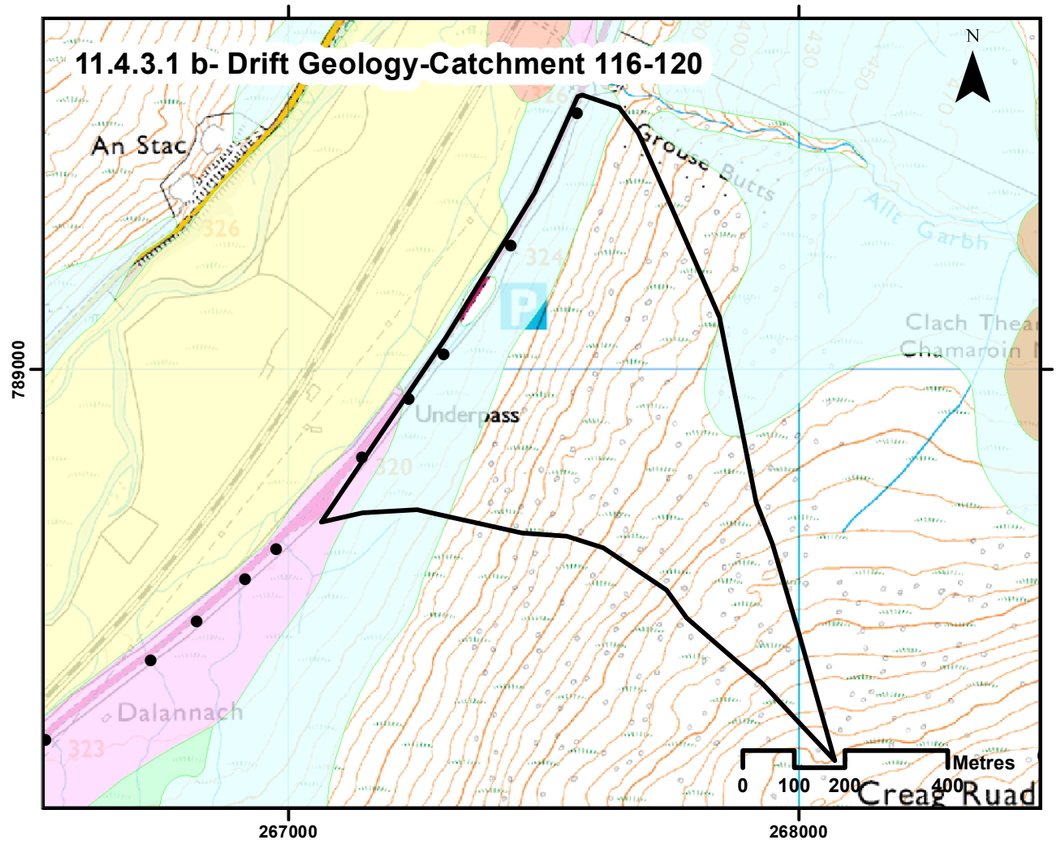
Summary behaviour	Little happening at this crossing, except that there may be opportunities to improve the substantial 2m drop u/s of the culvert and there is limited damage to the cascade d/s of the culvert and possible scour at its base. Relatively low priority.

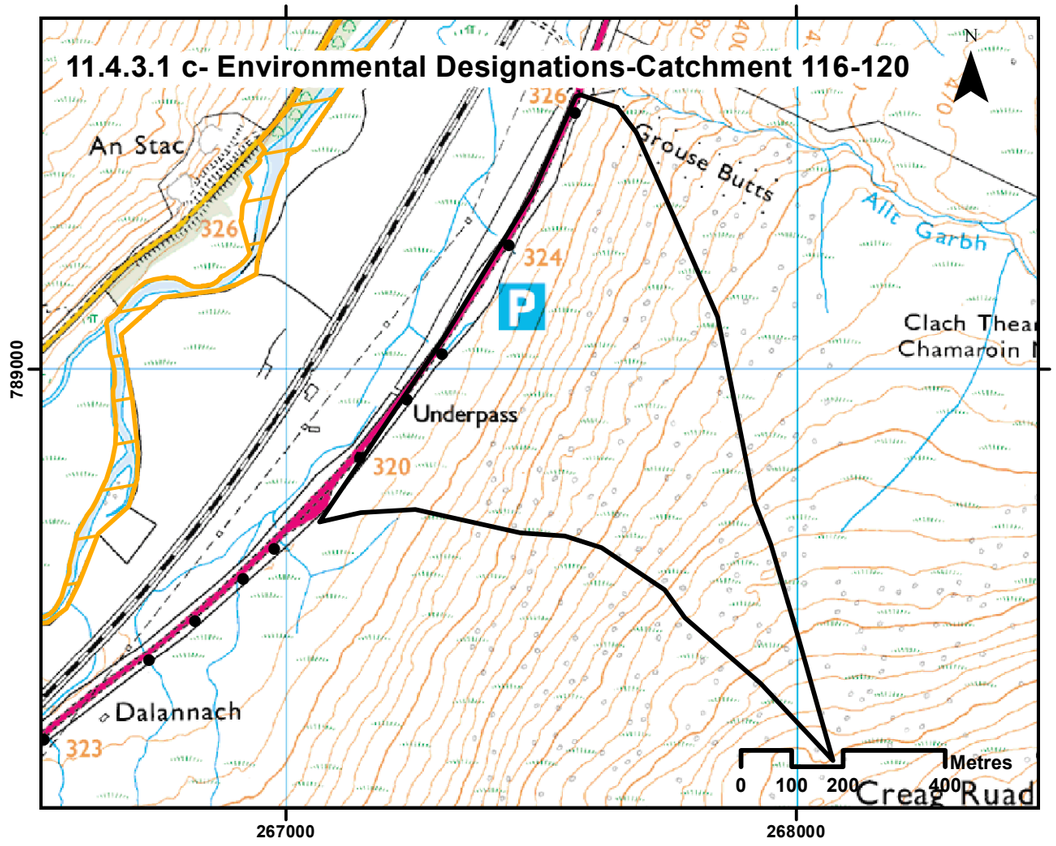
Photograph 11.4.3.106- Upstream to cascade

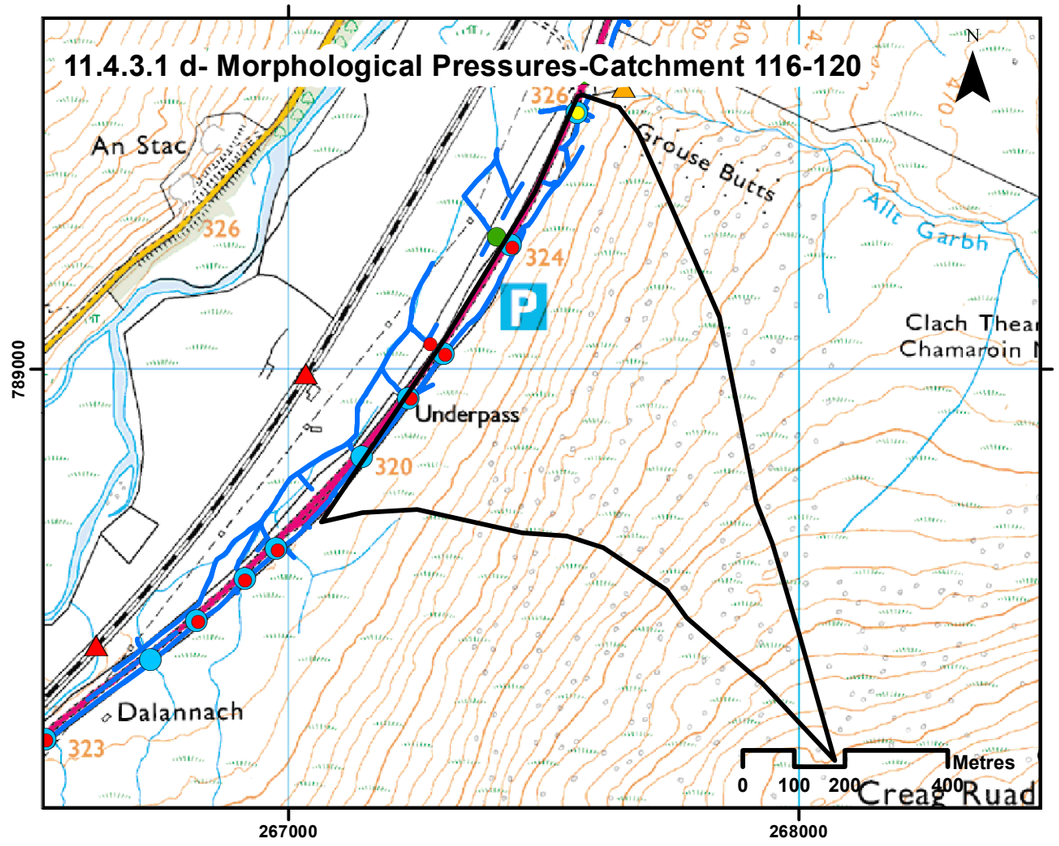


Photograph 11.4.3.107-Downstream









Legend

General
- Crossing Location
- Catchment Area

Solid Geology
- Gaick Psammite Formation - Psammite

Drift Geology
- Peat
- Glaciofluvial Ice Contact Deposits
- Gaick Plateau Moraine Formation
- Hummocky Glacial Deposits
- Ardverikie Till Formation - Diamicton
- Glaciofluvial Sheet Deposits
- Alluvium
- River Terrace Deposits
- Alluvial Fan Deposits
- Head
- Talus - Rock Fragments
- Talus Cone

Environmental Designations
- Special Area of Conservation
- Railway Bridge
- Road Bridge
- Track/Footbridge
- Culvert
- Cascade
- Step in Bed
- Catchpit
- Drainage Ditch

REV	SUIT	DATE	DESCRIPTION	BY	APP

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PROJECT 8 DALWHINNIE TO CRUBENMORE EIA

Drawing 11.4.3.1
Catchment116- 120 Catchment Overview

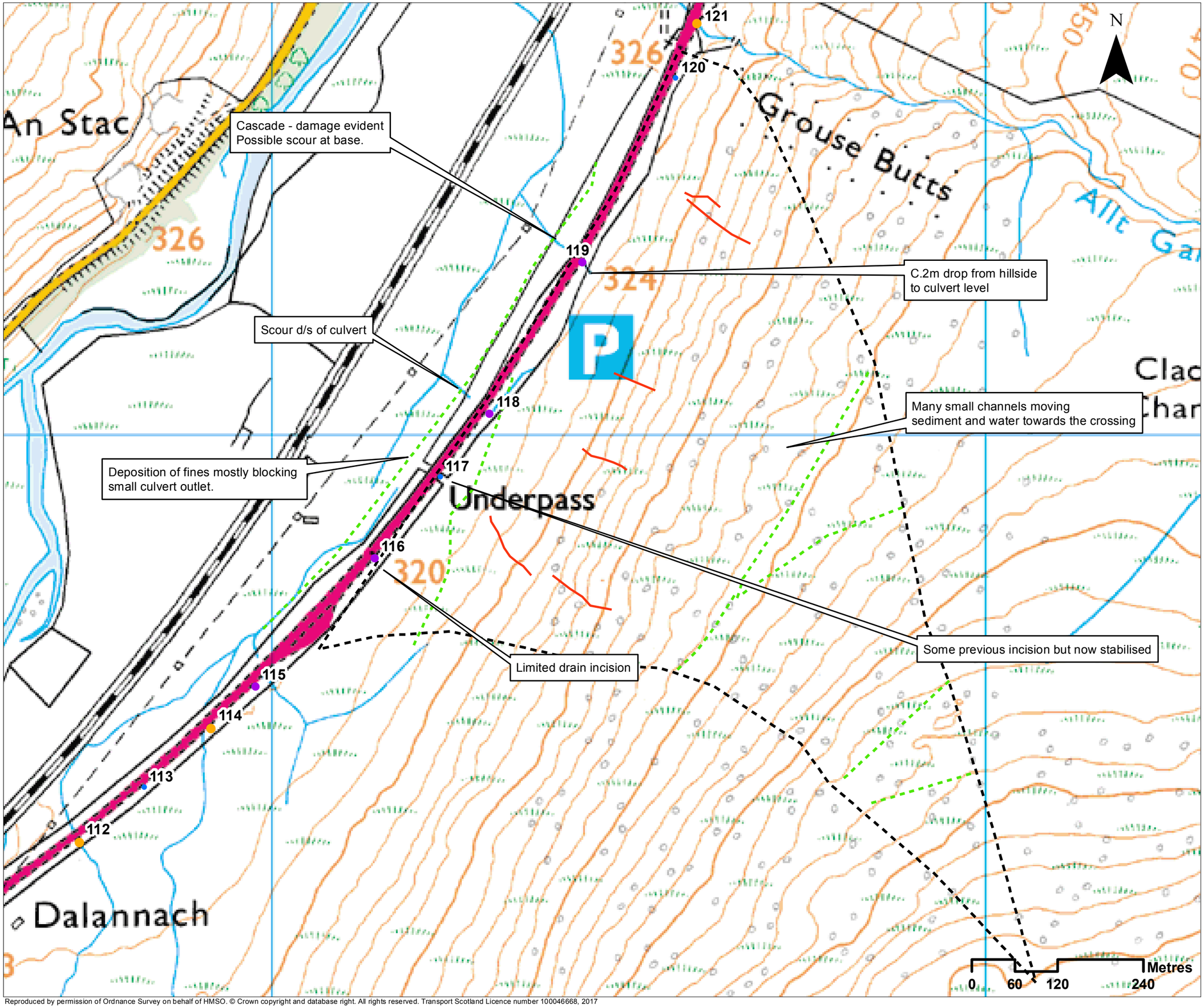
DESIGN:	DRAWN:	CHK:	APP:
EL	EV	EL	EL

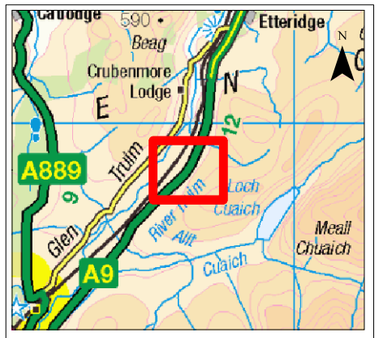
DATE: 12/07/2017

PROJ: 495298

DWG: A9P08-CFJ-EWE-X_ZZZZZ_ZZ-DR-EN-0001

SHEET:	REVISION:	SUITABILITY:
1 of 1	C01	A3





Legend

- Major crossing
- Minor crossing
- Other crossing
- Break in slope
- Incision
- Crossing catchment

REV	SUIT	DATE	DESCRIPTION	BY	APP

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TRANSPORT SCOTLAND CONSULTING ALBA

A9 DUALLING PERTH TO INVERNESS Dalnaglaise to Crubenmore

PROJECT 8 DALWHINNIE TO CRUBENMORE EIA

DRAWING 11.4.3.2.
Catchment 116-120 Baseline Assessment

DESIGN:	DRAWN:	CHK:	APP:
EL	AB	EL	EL

DATE: 11/07/2017

PROJ: 495298

DWG: A9P08-CFJ-EWE-X_ZZZZZ_ZZ-DR-EN-0002

SHEET:	REVISION:	SUITABILITY:
1 of 1	C01	A3

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Annex 11.4.3 - Hydromorphological Catchment Assessment - 121

Catchment No.	121
Catchment Name	Allt Garbh

Channel Nature	Nature of water course	Natural
	Size of water course	Major

Quantitative Spatial Elements	Catchment Area (km^2)	2.7
	Average slope in catchment (°)	9
	% Catchment over 750m (for snow melt risk)	0

WFD classification	Water, flows and levels	Good
	Physical condition	Good
	Overall ecological status	Moderate

Geology	Majority Bedrock (see Drawing 11.4.3.1 a and b Catchment 121)	Gaick Psammite formation-Psammite	resistant to weathering, impermeable
	Is an alluvial fan present at or near the crossing?		

Environmental designations (see Drawing 11.4.3.1 c, Catchment 121)	Ramsar	No	
	SAC	No	
	SPA	No	
	SSSI	No	

Sediment source and supply - Catchment Scale	Changes in slope and channel confinement	See Drawing 11.4.3.2, Catchment 121	
	Is peat present in the catchment	No	
	Is there a bog burst risk	No	
	Current valley side or terrace erosion	Yes	High sediment source potential, will be transported directly to crossing
	Potential valley side or terrace erosion	Yes	High sediment source potential, will be transported directly to crossing
	Hill slope failures (including peat slides and debris flows and slides)	yes-many debris flows within catchment	High sediment source potential, but distant from crossing and not coupled with the channel
	Hill slope failures coupled to channel	No	
	Vertical incision present in catchment	Channel naturally incised	Low sediment source potential
	Bank erosion/lateral migration	No	Low sediment source potential
	Unvegetated bars	No	Low sediment source potential
	Wooded/forested areas in catchment	No	Low source of floating debris
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 121)		
	Comment on sediment source potential in catchment	High sediment source potential from upper catchment from debris flows, shallow slides and valley side erosion in Till and Alluvial fan deposits	
	Comment on sediment supply potential to crossing	Lots of channels to transport sediment short distance from hill side to main channel Short area of reduced slope upstream of crossing will increase deposition here, reducing speed of transport from hillside to crossing, but sediment will remain here for future transport Channel becomes steep and confined towards crossing, funnelling sediment downstream Crossing is then on a flatter location (area of deposition)	

Morphology and Process-Reach upstream of crossing	Channel morphology	Bedrock	
	Predominant sediment size	Boulder	
	Unvegetated bars	None	
	Vertical incision	None	
	Deposition	Low	
	Lateral migration/bank erosion	Low	
	Presence and nature of infrastructure (Map 1d)	None	
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 121)	NA	
	Channel realignment	yes	straightened at crossing

Morphology and Process-At crossing	Channel morphology	Plane bed	
	Predominant sediment size	Boulder	
	Estimated discharge at 1:200 event (m^3/s)	11.6	
	Unvegetated bars	Some	Available sediment at the crossing
	Vertical incision	Med	Reduced by presence of Reno mattress, but this has been reworked indicating excess energy
	Deposition	High	Lots of available sediment
	Lateral migration/bank erosion	Low	Single area of bank erosion at the crossing
	Damaged/unstable drains or armouring	No	

Morphology and Process-Reach downstream of crossing	Channel morphology	Cascade	
	Predominant sediment size	Boulder	
	Unvegetated bars	Yes	Lots of available sediment
	Vertical incision	Med	Concentrated just downstream of the crossing
	Deposition	High	
	Lateral migration/bank erosion	None	
	Presence and nature of infrastructure (Map 1d)	Railway crossing	
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 121)	Impounding flows and fixing channel	Increase deposition upstream
	Channel realignment	yes	straightened at crossing

Summary behaviour	High sediment source and supply potential to the crossing from valley side erosion, upstream of a very steep channel Upstream channel is bedrock so relatively stable vertically, though there is some potential for lateral migration Crossing is on a reduced slope- High deposing potential Downstream incision caused by scour from the crossing Low risk of upstream incision- bedrock Med risk for bypassing crossing- erosion on left bank side upstream High risk of blocking High risk of undermining crossing

Photograph 11.4.3.108- Upstream to crossing

Photograph 11.4.3.109-Channel

Photograph 11.4.3.110- Downstream

Photograph 11.4.3.111- Area of scour

Photograph 11.4.3.112-Upstream

Photograph 11.4.3.113- Downstream

Photograph 11.4.3.114- Upstream

Photograph 11.4.3.115- Downstream under crossing

Photograph 11.4.3.116- Upstream to bedrock channel

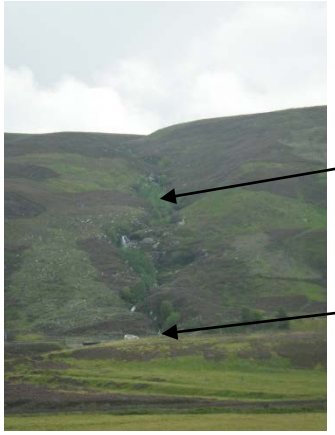
Photograph 11.4.3.117 – Downstream to crossing

Photograph 11.4.3.118- Left bank

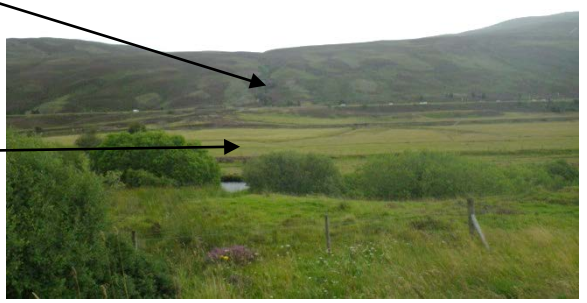
Photograph 11.4.3.119-Left bank

Photograph 11.4.3.120 – Downstream of crossing- steep sided channel

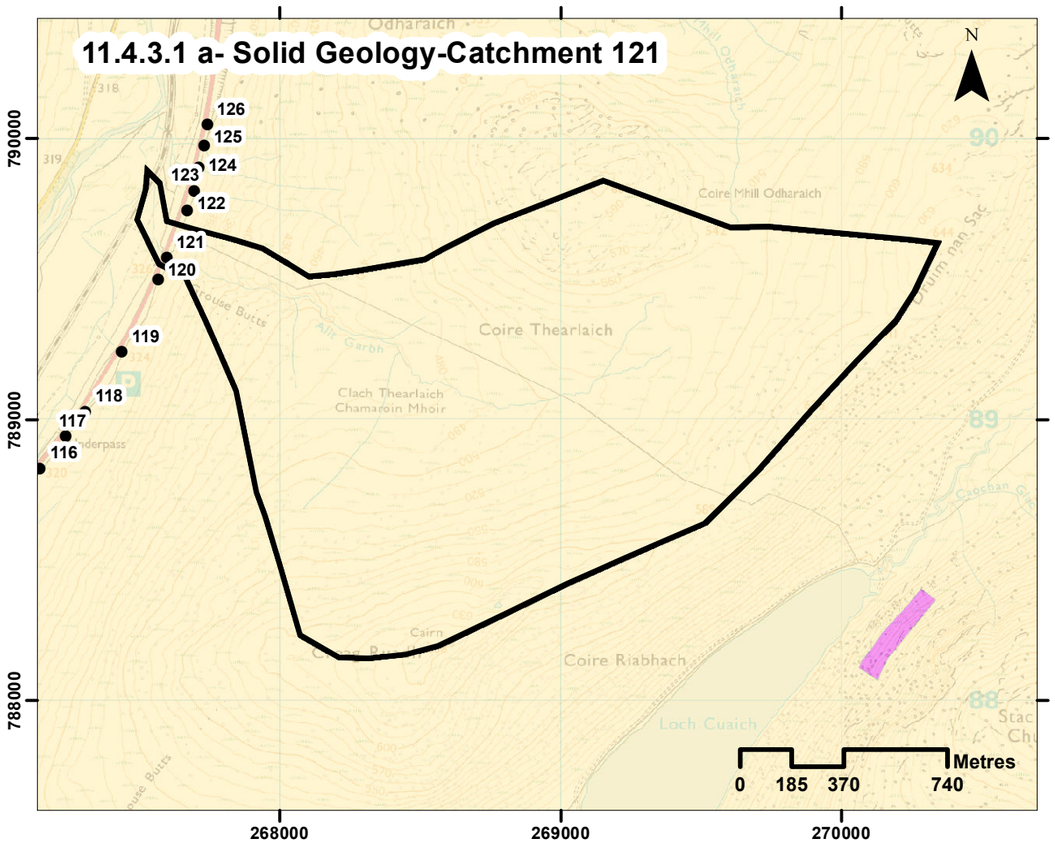
Photograph 11.4.3.121-Gabions

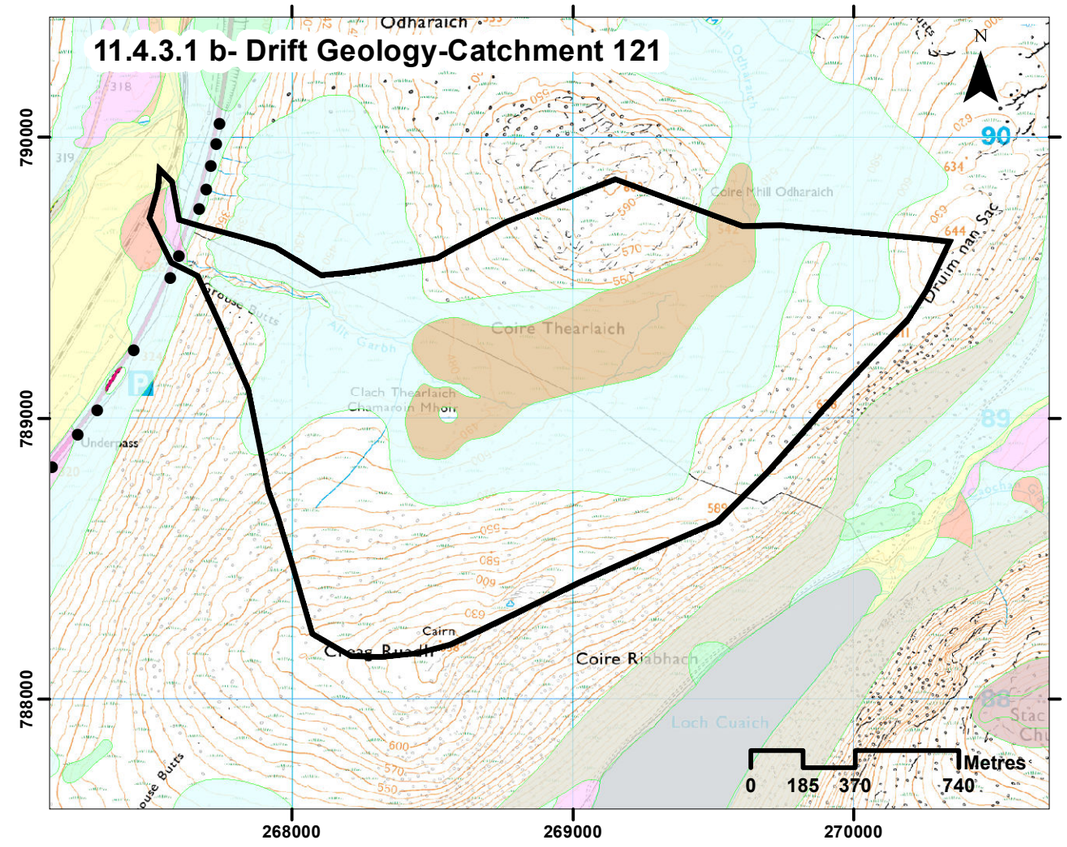


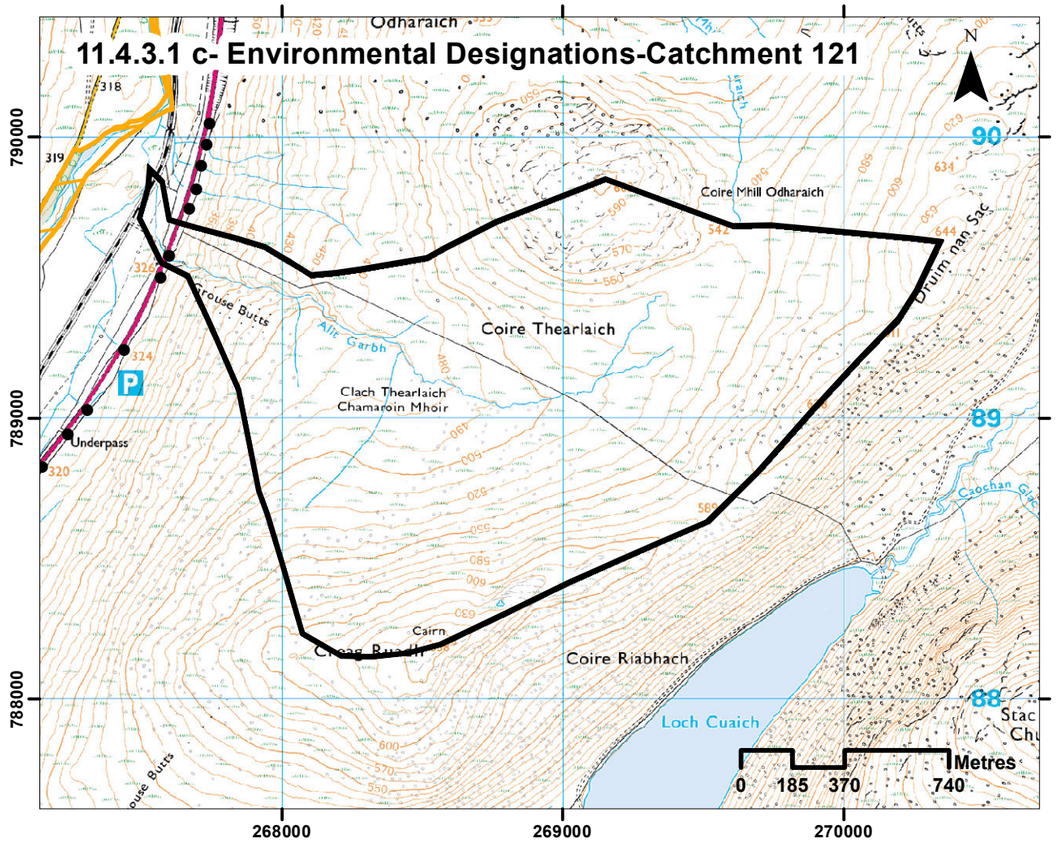
Photograph 11.4.3.122- Steep narrow catchment

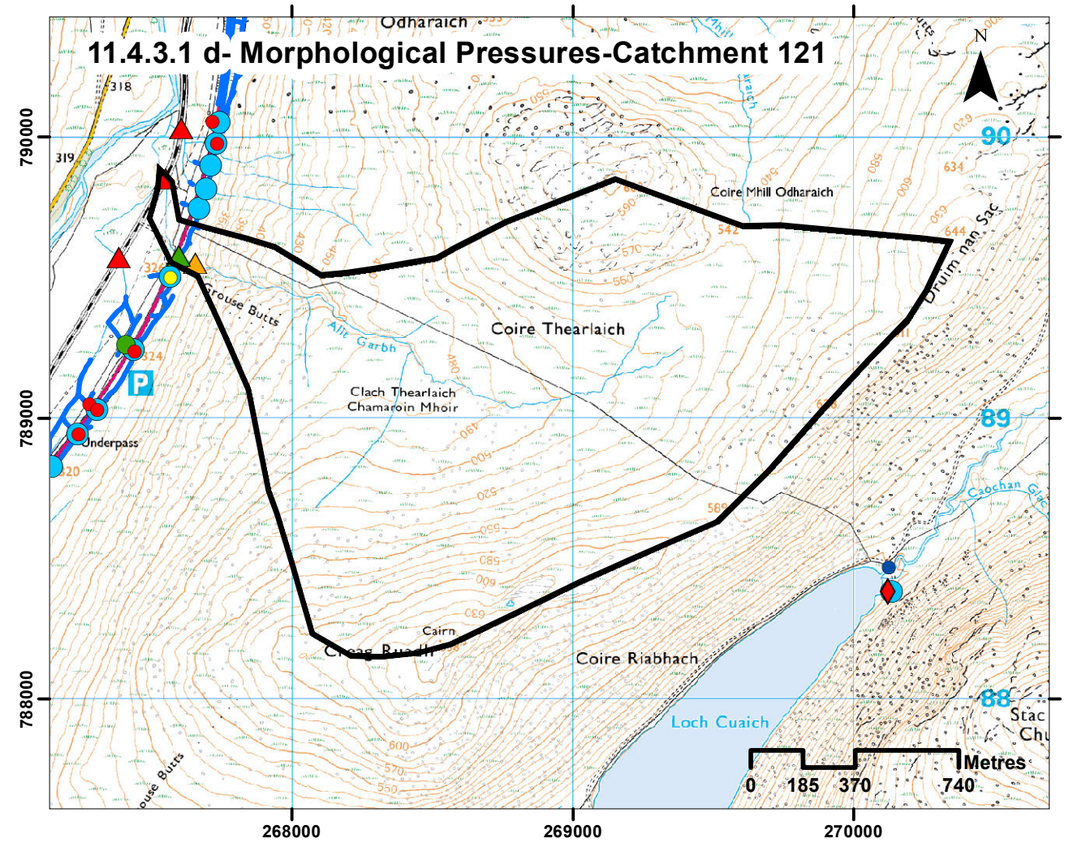


Photograph 11.4.3.123- Catchment









Legend

General
- Crossing location

Solid Geology
- Gaick Psammite Formation - Psammite

Drift Geology
- Peat
- Glaciofluvial Ice Contact Deposits
- Gaick Plateau Moraine Formation
- Hummocky Glacial Deposits
- Ardverikie Till Formation - Diamicton
- Glaciofluvial Sheet Deposits
- Alluvium
- River Terrace Deposits
- Alluvial Fan Deposits
- Head
- Talus - Rock Fragments
- Talus Cone

Environmental Designations
- Special Area of Conservation

Morphological Pressures
- Railway Bridge
- Road Bridge
- Track/Footbridge
- Culvert
- Cascade
- Step in Bed
- Catchpit
- Ford
- Dam or Weir
- Drainage Ditch

REV	SUIT	DATE	DESCRIPTION	BY	APP

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PROJECT 8 DALWHINNIE TO CRUBENMORE EIA

Drawing 11.4.3.1 Catchment 121 Catchment Overview

DESIGN:	DRAWN:	CHK:	APP:
EL	EV	EL	EL

DATE: 20/07/2017

PROJ: 495298

DWG: A9P08-CFJ-EWE-X_ZZZZZ_ZZ-DR-EN-0001

SHEET:	REVISION:	SUITABILITY:
1 of 1	C01	A3

Slope reduces at crossing leading to deposition

Steeper confined channel
will funnel sediment downstream

Extensive valley side erosion
adding sediment to the channel

Reduced slope
Deposition and sediment transport

Steep upper catchment supplying sediment to channels

Coire Mhill Odharaich

Coire Thearlaich

Clach Thearlaich

Chamaroin Mhoir

Creag Ruadh

Coire Riabhach

Loch Cuaich

Grouse Butts

Underpass

Cairn

Allt Garbh

Odharaich

Druim nan S

N

Metres
0 125 250 500

Legend

- Major crossing
- Minor crossing
- Other crossing
- Coupled debris flow
- Debris flow
- Valley side erosion
- Unvegetated bar
- Break in slope
- Crossing catchment

REV	SUIT	DATE	DESCRIPTION	BY	APP

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PROJECT 8 DALWHINNIE TO CRUBENMORE EIA

DRAWING 11.4.3.2.
Catchment 121 Baseline Assessment

DESIGN:	DRAWN:	CHK:	APP:
EL	AB	EL	EL

DATE: 11/07/2017

PROJ: 495298

DWG: A9P08-CFJ-EWE-X_ZZZZZ_ZZ-DR-EN-0002

SHEET:	REVISION:	SUITABILITY:
1 of 1	C01	A3

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Annex 11.4.3 - Hydromorphological Catchment Assessment - 123

Catchment No.	123
Catchment Name	-

Channel Nature	Nature of water course	Natural
	Size of water course	Minor

Quantitative Spatial Elements	Catchment Area (km^2)	0.2
	Average slope in catchment (°)	10
	% Catchment over 750m (for snow melt risk)	0

WFD classification	Water, flows and levels	Good
	Physical condition	Good
	Overall ecological status	Moderate

Geology	Majority Bedrock (see Drawing 11.4.3.1 a and b Catchment 123)	Gaick Psammite formation-Psammite	resistant to weathering, impermeable
	Is an alluvial fan present at or near the crossing?	No	

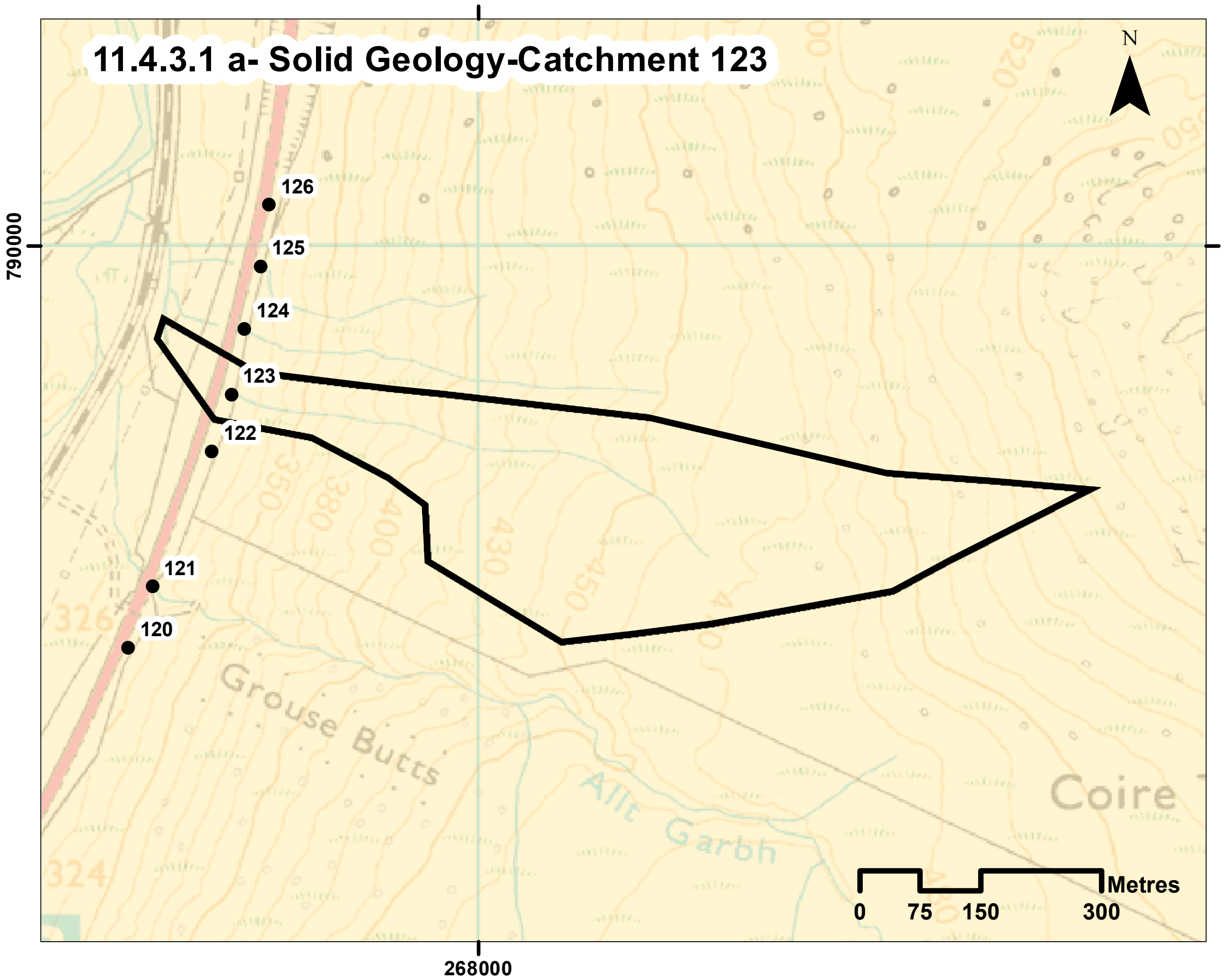
Environmental designations (see Drawing 11.4.3.1 c, Catchment 123)	Ramsar	No	
	SAC	No	
	SPA	No	
	SSSI	No	

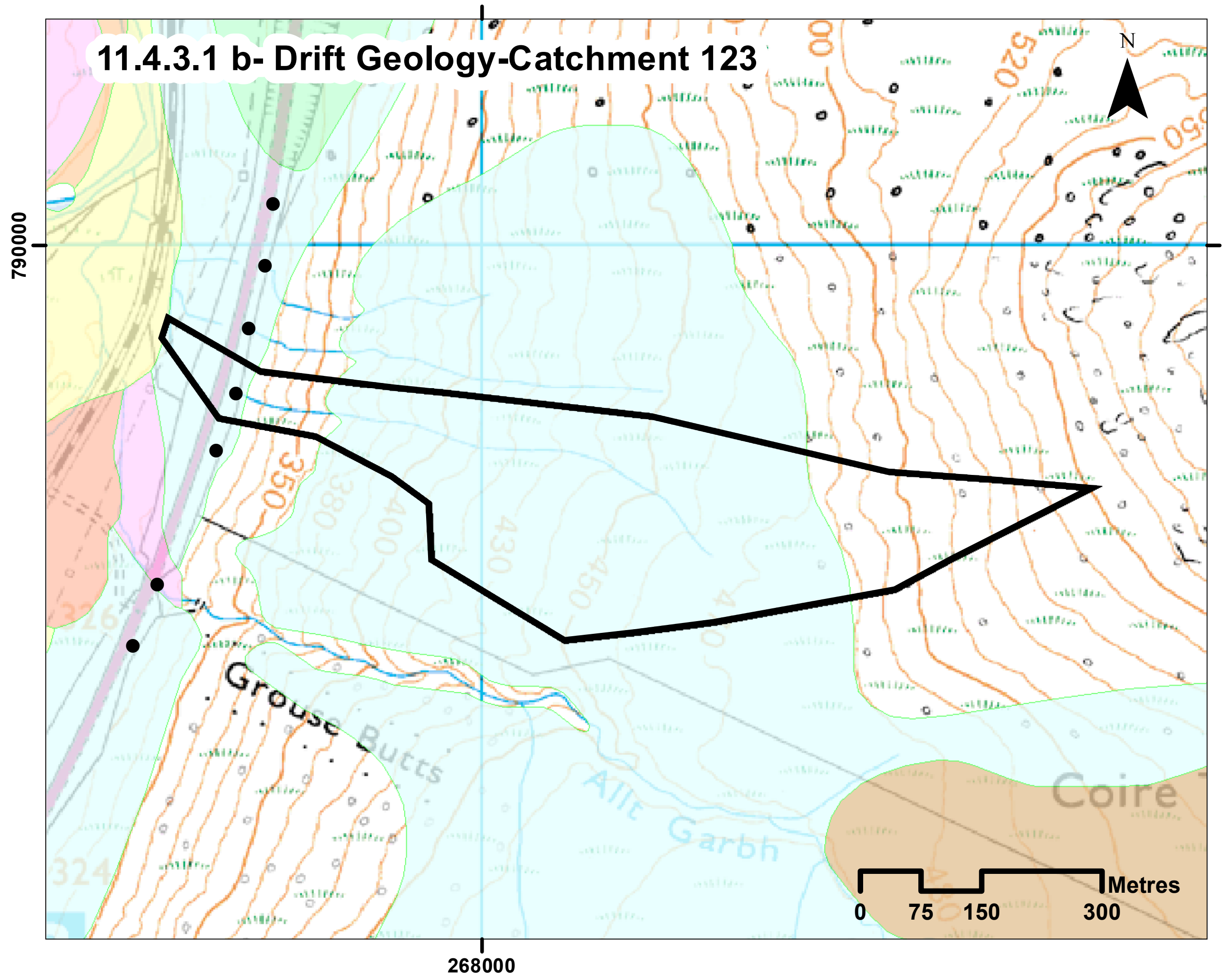
Sediment source and supply - Catchment Scale	Changes in slope and channel confinement	See Drawing 11.4.3.2, Catchment 123	
	Is peat present in the catchment	Yes	Limited amount possible in headwaters
	Is there a bog burst risk	No	
	Current valley side or terrace erosion	No	
	Potential valley side or terrace erosion	Yes	600m
	Hill slope failures (including peat slides and debris flows and slides)	No	
	Hill slope failures coupled to channel	No	
	Vertical incision present in catchment	No	
	Bank erosion/lateral migration	No	
	Unvegetated bars	No	
	Wooded/forested areas in catchment	No	
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 123)	No	
	Comment on sediment source potential in catchment	Catchment seems mostly stable at the moment with incision limited to immediately u/s of the crossing. However any base level changes (e.g. further cutting into hillslope) may accelerate this and confinement of channel with very limited flood plain may lead to coupled hillslope failures	
	Comment on sediment supply potential to crossing	High, if the sources are created, as catchment is steep with high supply potential and opportunities for deposition within the catchment are limited.	

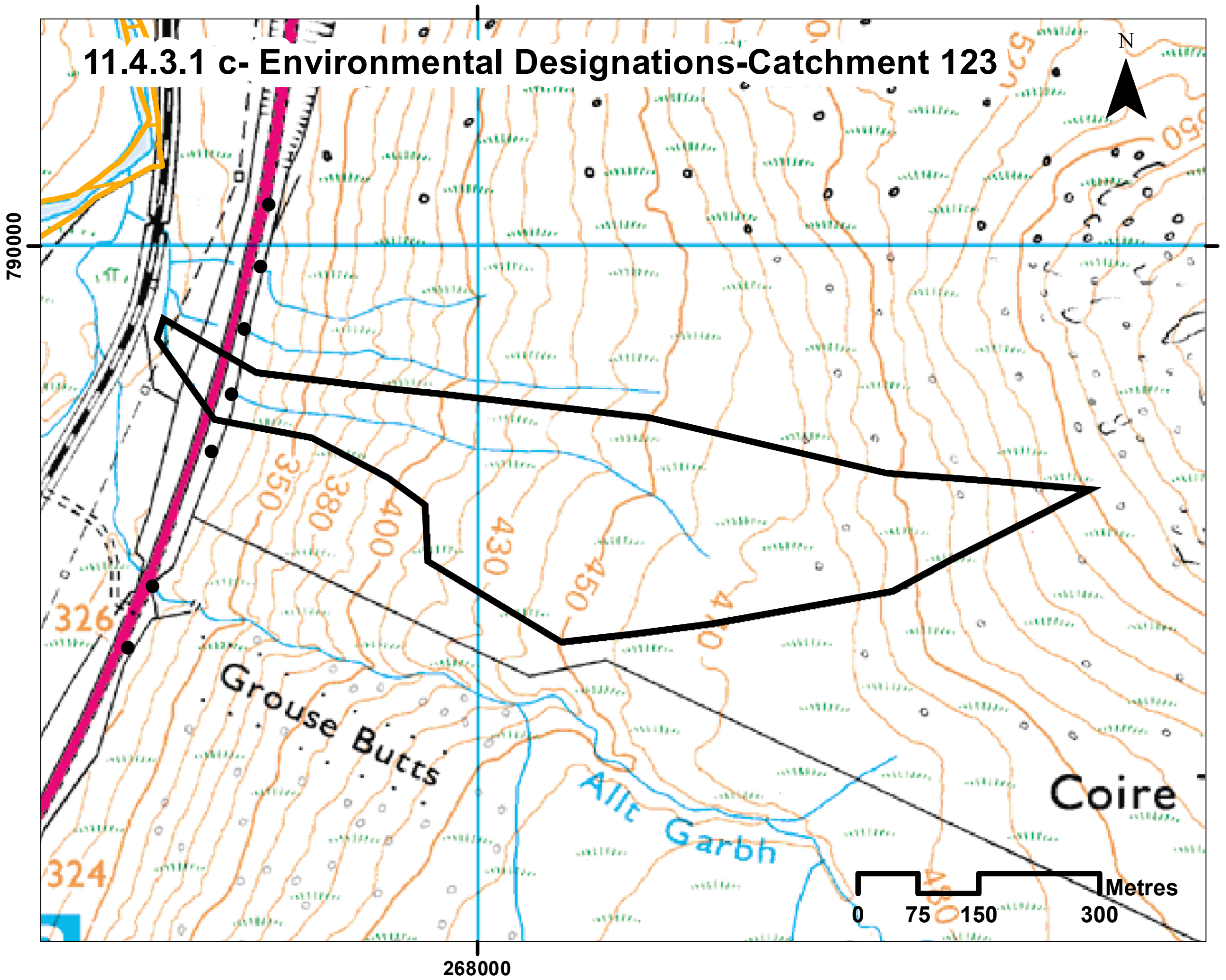
Morphology and Process-Reach upstream of crossing	Channel morphology	Cascade	
	Predominant sediment size	Large Gravel and Cobble	
	Unvegetated bars	No	
	Vertical incision	Medium	
	Deposition	Low	
	Lateral migration/bank erosion	Low	
	Presence and nature of infrastructure (Map 1d)	No	
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 123)	No	
	Channel realignment	No	

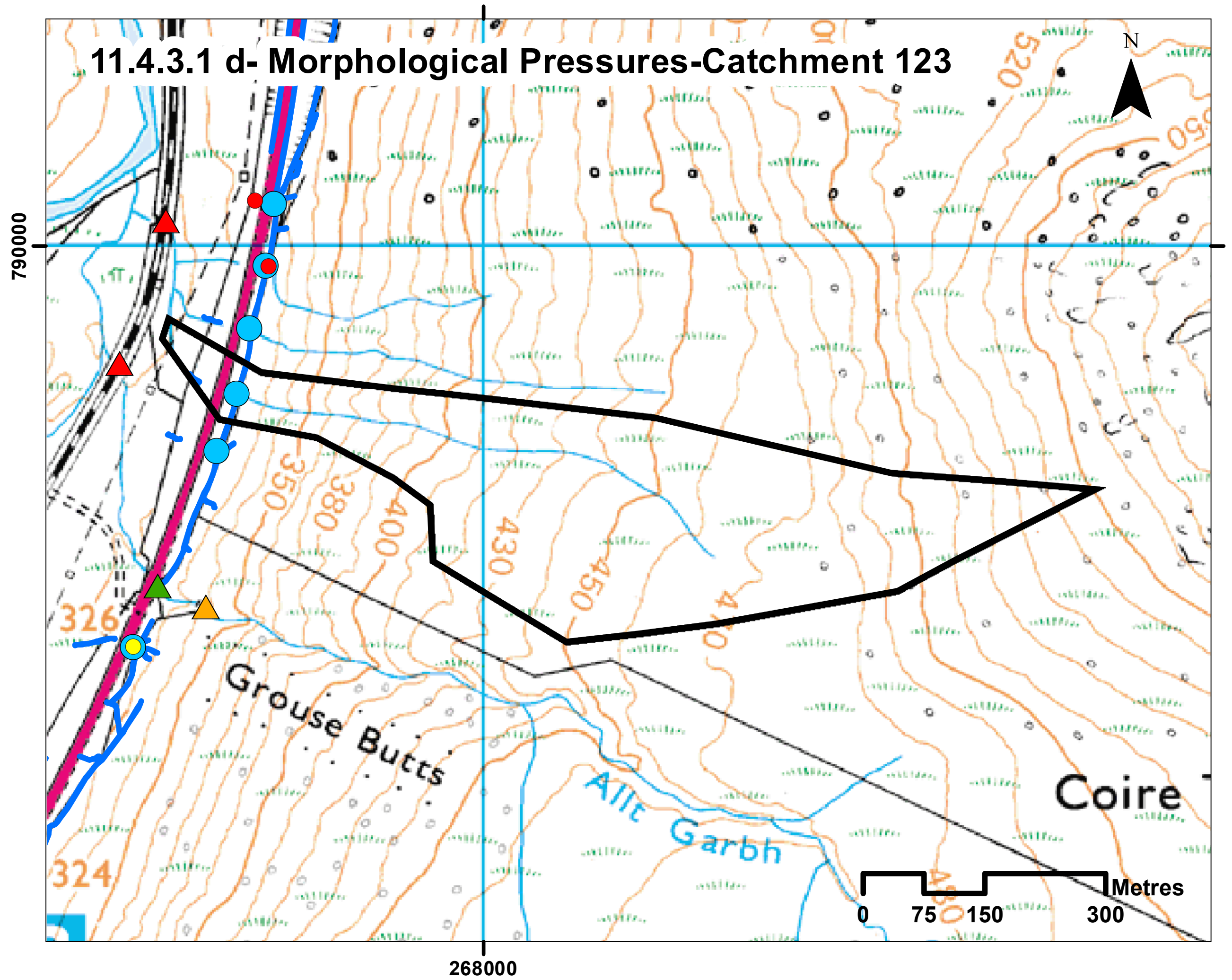
Morphology and Process-At crossing	Channel morphology	Engineered	
	Predominant sediment size	Cobble	
	Estimated discharge at 1:200 event (m^3/s)	0.6	
	Unvegetated bars	Yes	at outflow of culvert - deposited sediment forming bar
	Vertical incision	Low	
	Deposition	Medium	at outflow of culvert - deposited sediment forming bar
	Lateral migration/bank erosion	Low	
	Damaged/unstable drains or armouring	Yes	Evidence of paving slabs torn up u/s of crossing

Morphology and Process-Reach downstream of crossing	Channel morphology	Plane bed	
	Predominant sediment size	Cobble	
	Unvegetated bars	No	
	Vertical incision	Medium	Incision may have occurred previously (during big events?) but vegetation encroaching on channel indicates that the channel is mostly stable at present.
	Deposition	Low	
	Lateral migration/bank erosion	Low	
	Presence and nature of infrastructure (Map 1d)	Yes	
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 123)	Railway	Channel probably realigned to join others to pass under railway at one single point.
	Channel realignment	Yes	See above
Summary behaviour	This is a long, narrow and steep catchment which for most of it's length is well confined by valley slopes. Vertical incision likely to generate sediment through erosion of the valley slide toes and subsequent coupled hillslope failures. Incision appears to have occurred immediately u/s of the crossing and is generating coarse sediment which is being transported through the crossing and being deposited at the d/s end of the culvert where gradient reduces. Evidence of ripped up paving slaps (armouring) both u/s and d/s of the culvert indicates that this a high energy channel. Suggest careful design needed to avoid creating increased energy profile and therefore more incision and sediment generation.		









Legend

General

- Crossing location

Solid Geology

- Gaick Psammite Formation - Psammite

Drift Geology

- Peat
- Glaciofluvial Ice Contact Deposits
- Gaick Plateau Moraine Formation
- Hummocky Glacial Deposits
- Ardverikie Till Formation - Diamicton
- Glaciofluvial Sheet Deposits
- Alluvium
- River Terrace Deposits
- Alluvial Fan Deposits
- Head
- Talus - Rock Fragments
- Talus Cone

Environmental Designations

- Special Area of Conservation

Morphological Pressures

- Railway Bridge
- Road Bridge
- Track/Footbridge
- Culvert
- Step in Bed
- Catchpit
- Drainage Ditch

REV	SUIT	DATE	DESCRIPTION	BY	APP

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PROJECT 8 DALWHINNIE TO CRUBENMORE EIA

Drawing 11.4.3.1 Catchment 123 Catchment Overview

DESIGN: EL	DRAWN: EV	CHK: EL	APP: EL

DATE: 20/07/2017

PROJ: 495298

DWG: A9P08-CFJ-EWE-X_ZZZZZ_ZZ-DR-EN-0001

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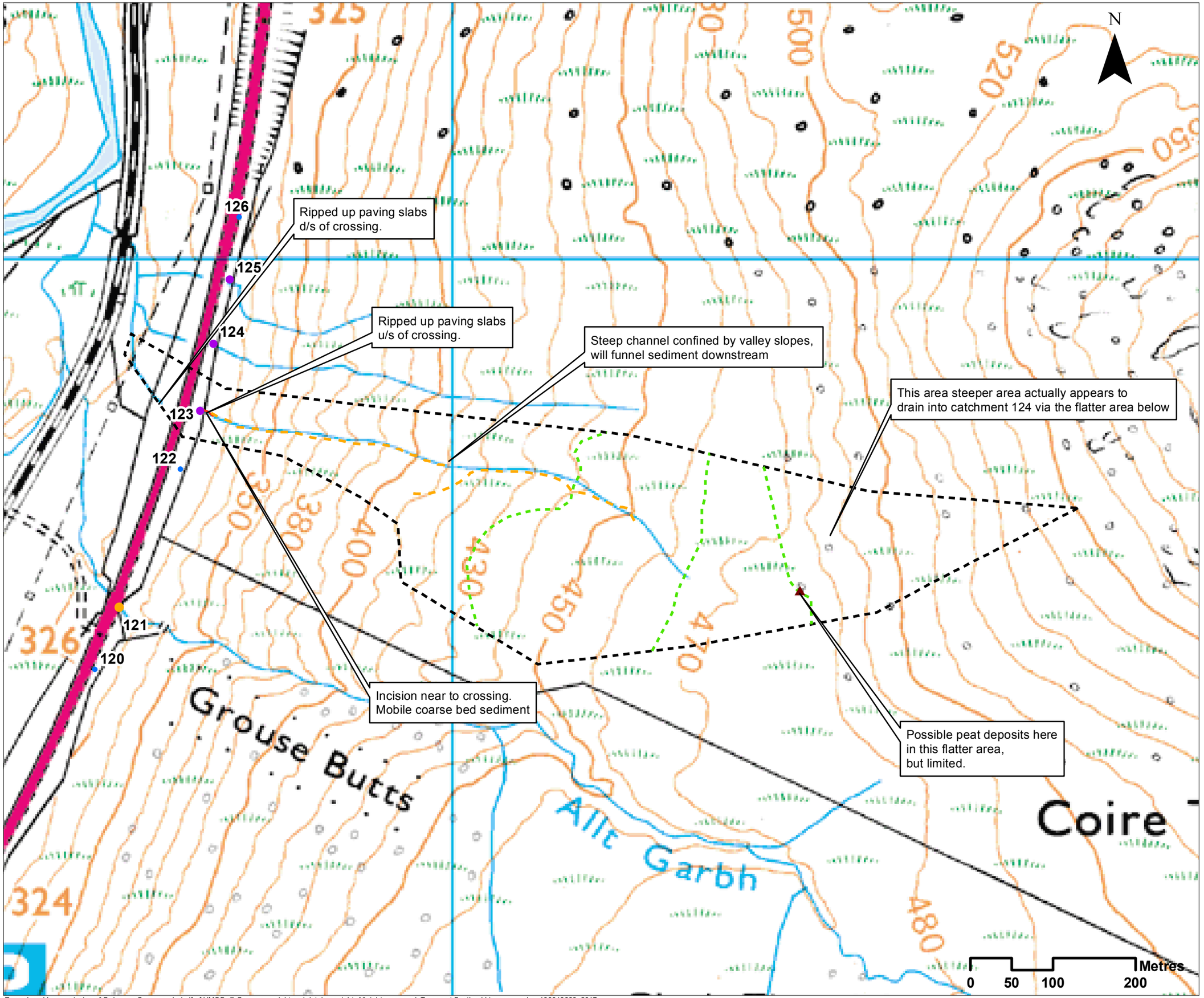

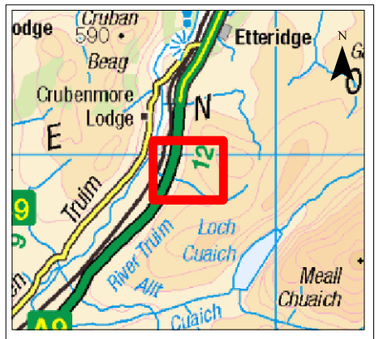

Legend

- Major crossing
- Minor crossing
- Other crossing
- Peat
- Break in slope
- Incision
- Potential valley side erosion
- Crossing catchment

REV	SUIT	DATE	DESCRIPTION	BY	APP

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TRANSPORT SCOTLAND / CONAIDHEAL ALBA

A9 DUALLING PERTH TO INVERNESS / Dualleadh Peairt gu Inbhir Nis

PROJECT 8 DALWHINNIE TO CRUBENMORE EIA

DRAWING 11.4.3.2.
Catchment 123 Baseline Assessment

DESIGN:	DRAWN:	CHK:	APP:
EL	AB	EL	EL

DATE: 11/07/2017

PROJ: 495298

DWG: A9P08-CFJ-EWE-X_ZZZZZ_ZZ-DR-EN-0002

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Annex 11.4.3 - Hydromorphological Catchment Assessment - 124

Catchment No.	124
Catchment Name	-

Channel Nature	Nature of water course	Natural
	Size of water course	Minor

Quantitative Spatial Elements	Catchment Area (km^2)	0.1
	Average slope in catchment (°)	11.8
	% Catchment over 750m (for snow melt risk)	0

WFD classification	Water, flows and levels	Good
	Physical condition	Good
	Overall ecological status	Moderate

Geology	Majority Bedrock (see Drawing 11.4.3.1 a and b Catchment 124)	Gaick Psammite formation-Psammite	resistant to weathering, impermeable
	Is an alluvial fan present at or near the crossing?	No	

Environmental designations (see Drawing 11.4.3.1 c, Catchment 124)	Ramsar	No	
	SAC	No	
	SPA	No	
	SSSI	No	

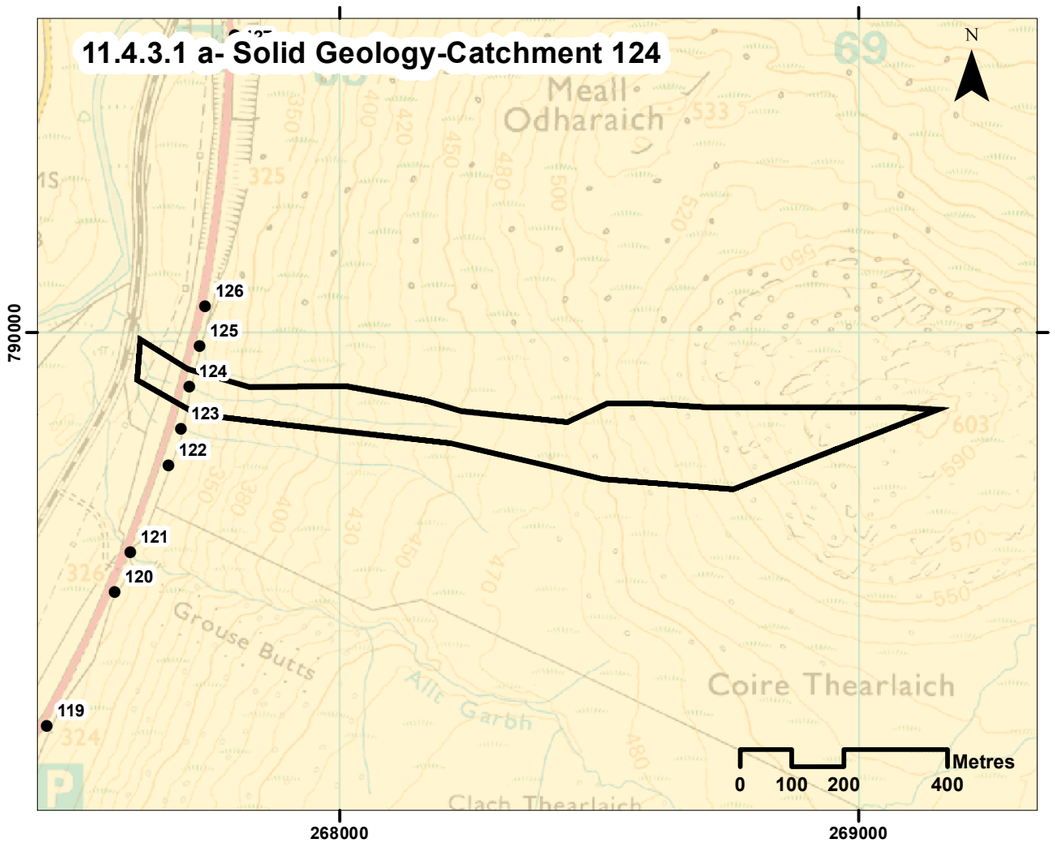
Sediment source and supply - Catchment Scale	Changes in slope and channel confinement	See Drawing 11.4.3.2, Catchment 124	
	Is peat present in the catchment	Yes	Indicated in very uppermost part of catchment in watershed area, but very limited.
	Is there a bog burst risk	No	No
	Current valley side or terrace erosion	Yes	Erosion of valley sides evident in mid catchment where channel incised
	Potential valley side or terrace erosion	Yes	In incised channel
	Hill slope failures (including peat slides and debris flows and slides)	No	
	Hill slope failures coupled to channel	No	
	Vertical incision present in catchment	Yes	On steeper slope into main Truim valley
	Bank erosion/lateral migration	No	
	Unvegetated bars	No	
	Wooded/forested areas in catchment	No	
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 124)	No	
	Comment on sediment source potential in catchment	Sediment in channel bed appears mobile and likely supply is from erosion of incised channel valley sides in mid catchment	
	Comment on sediment supply potential to crossing	Channel is steep all the way to the crossing so high potential for sediment transfer to crossing	

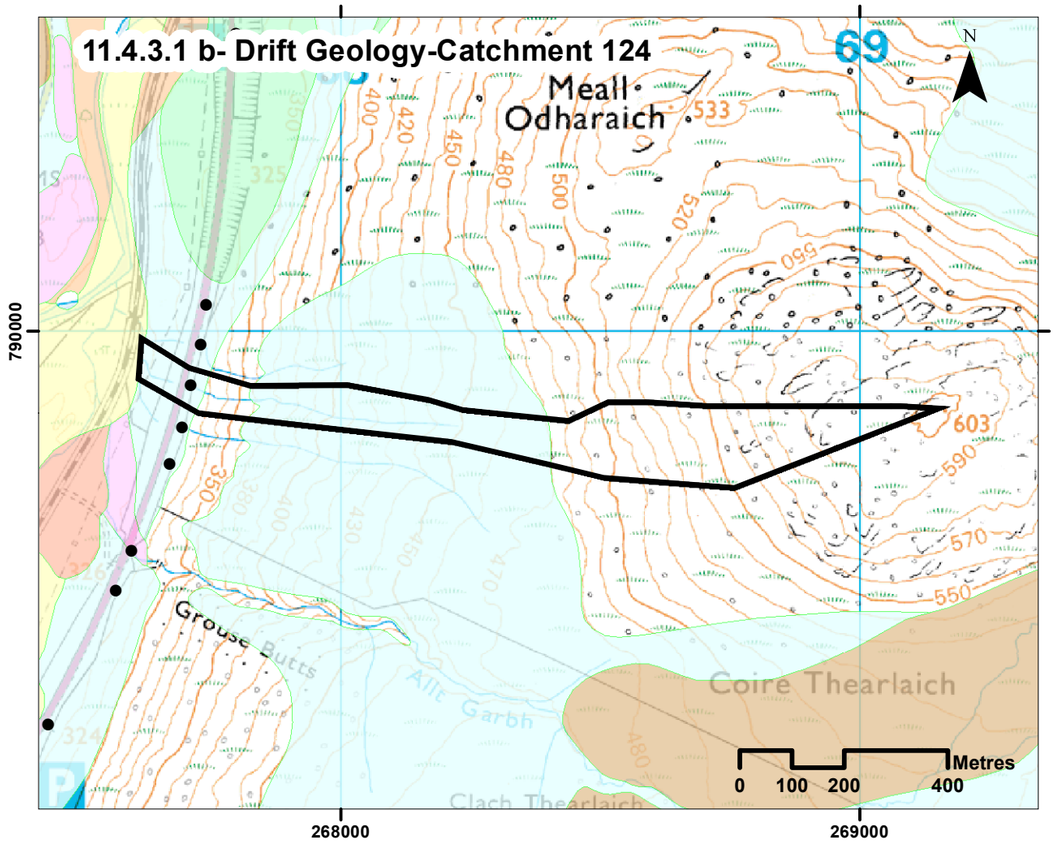
Morphology and Process-Reach upstream of crossing	Channel morphology	Cascade	
	Predominant sediment size	Gravel-cobble	
	Unvegetated bars	No	
	Vertical incision	Low	Incision reduces towards crossing
	Deposition	Medium	
	Lateral migration/bank erosion	Low	
	Presence and nature of infrastructure (Map 1d)	No	
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 124)	No	
	Channel realignment	No	

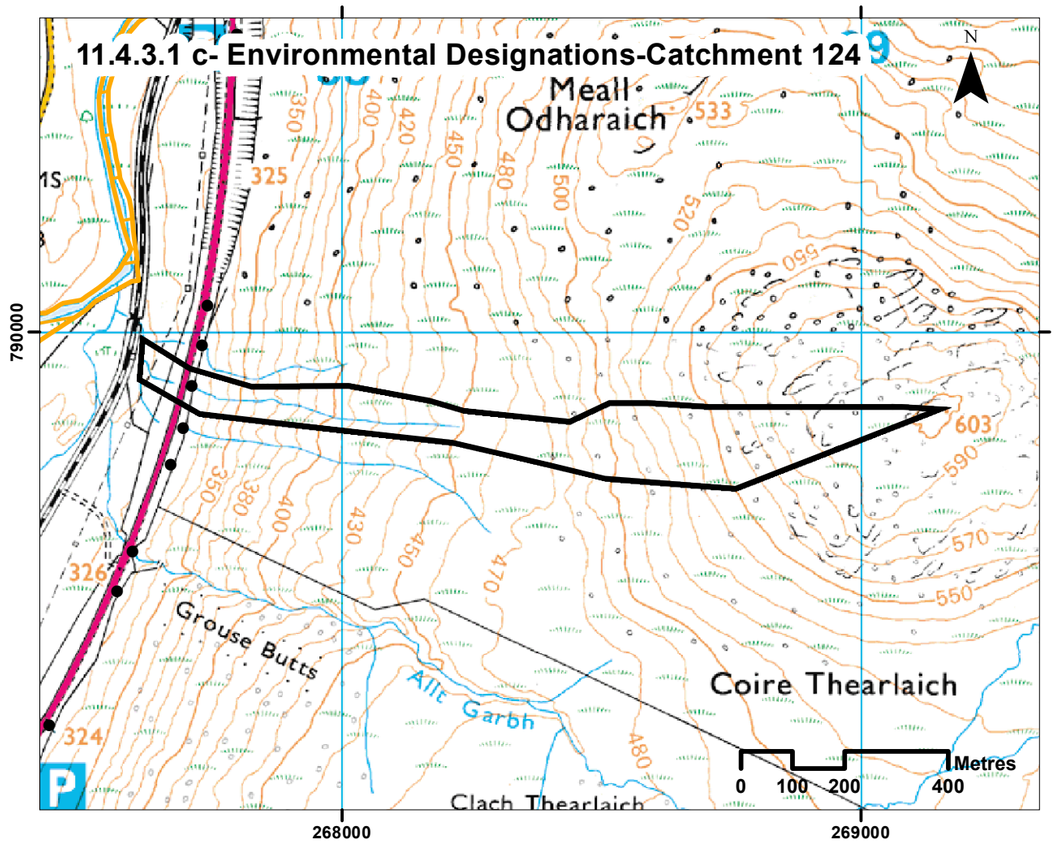
Morphology and Process-At crossing	Channel morphology	Engineered	Pipe culvert
	Predominant sediment size	Small cobble	
	Estimated discharge at 1:200 event (m^3/s)	0.5	
	Unvegetated bars	No	
	Vertical incision	None	
	Deposition	Medium	Coarse material deposited at culvert entrance where gradient reduces
	Lateral migration/bank erosion	Low	
	Damaged/unstable drains or armouring	No	

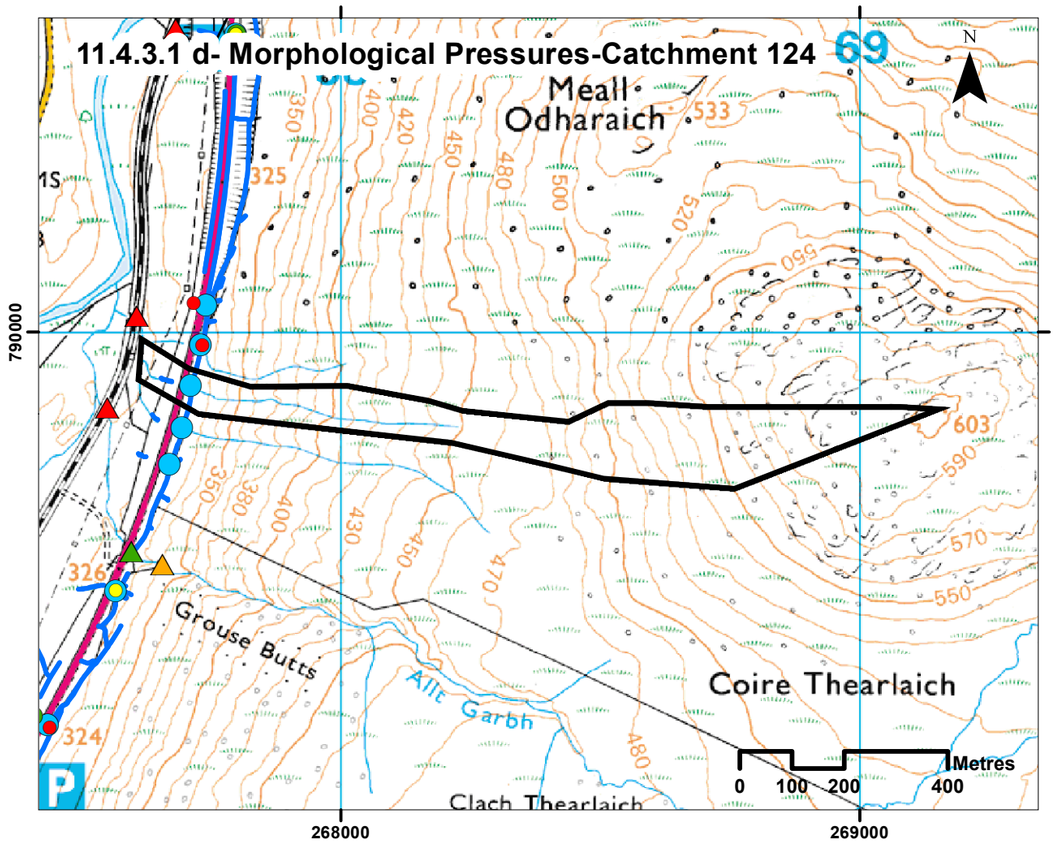
Morphology and Process-Reach downstream of crossing	Channel morphology	Plane bed	
	Predominant sediment size	Pebble-cobble	
	Unvegetated bars	No	
	Vertical incision	Medium	Channel incised into slope below road
	Deposition	Medium	Coarse material deposited in fan at confluence with channel that collects flow to go under railway bridge
	Lateral migration/bank erosion	Low	
	Presence and nature of infrastructure (Map 1d)	No	
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 124)	No	
	Channel realignment	Yes	Captured by channel d/s of road designed to take flow of this channel and 123 and 125 through one single railway culvert

Summary behaviour	Channels don't fully form in catchment until downslope edge of flatter 'bench' in the mid-catchment. Downstream/slope of this the channel has incised (like its neighbours) creating a very narrow and steep lower catchment until the road crossing. Sediment appears to be generated from this vertically incised section and is deposited immediately u/s of the crossing when gradient reduces. Crossing is a relatively small aperture pipe culvert through an embankment which is built across the valley this channel has incised, indicating high flows are probably substantially restricted. D/s of the road the channel is incised until gradient reduces at confluence with cross-cutting channel which takes flow of 124 and its neighbours through one railway crossing. Between the end of the incised section and the confluence there is a fan-like deposit of coarse material visible in the aerial photos.









Legend

General
- Crossing location

Solid Geology
- Gaick Psammite Formation - Psammite

Drift Geology
- Peat
- Glaciofluvial Ice Contact Deposits
- Gaick Plateau Moraine Formation
- Hummocky Glacial Deposits
- Ardverikie Till Formation - Diamicton
- Glaciofluvial Sheet Deposits
- Alluvium
- River Terrace Deposits
- Alluvial Fan Deposits
- Head
- Talus - Rock Fragments
- Talus Cone

Environmental Designations
- Special Area of Conservation

Morphological Pressures
- Railway Bridge
- Road Bridge
- Track/Footbridge
- Culvert
- Cascade
- Step in Bed
- Catchpit
- Drainage Ditch
- Power Lines

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TRANSPORT SCOTLAND CEUMCHAIS ALBA

A9 DUALLING PERTH TO INVERNESS Dàilleadh Peairt gu Inbhir Nis

PROJECT 8 DALWHINNIE TO CRUBENMORE EIA

Drawing 11.4.3.1 Catchment 124 Catchment Overview

DESIGN:	DRAWN:	CHK:	APP:
EL	EV	EL	EL

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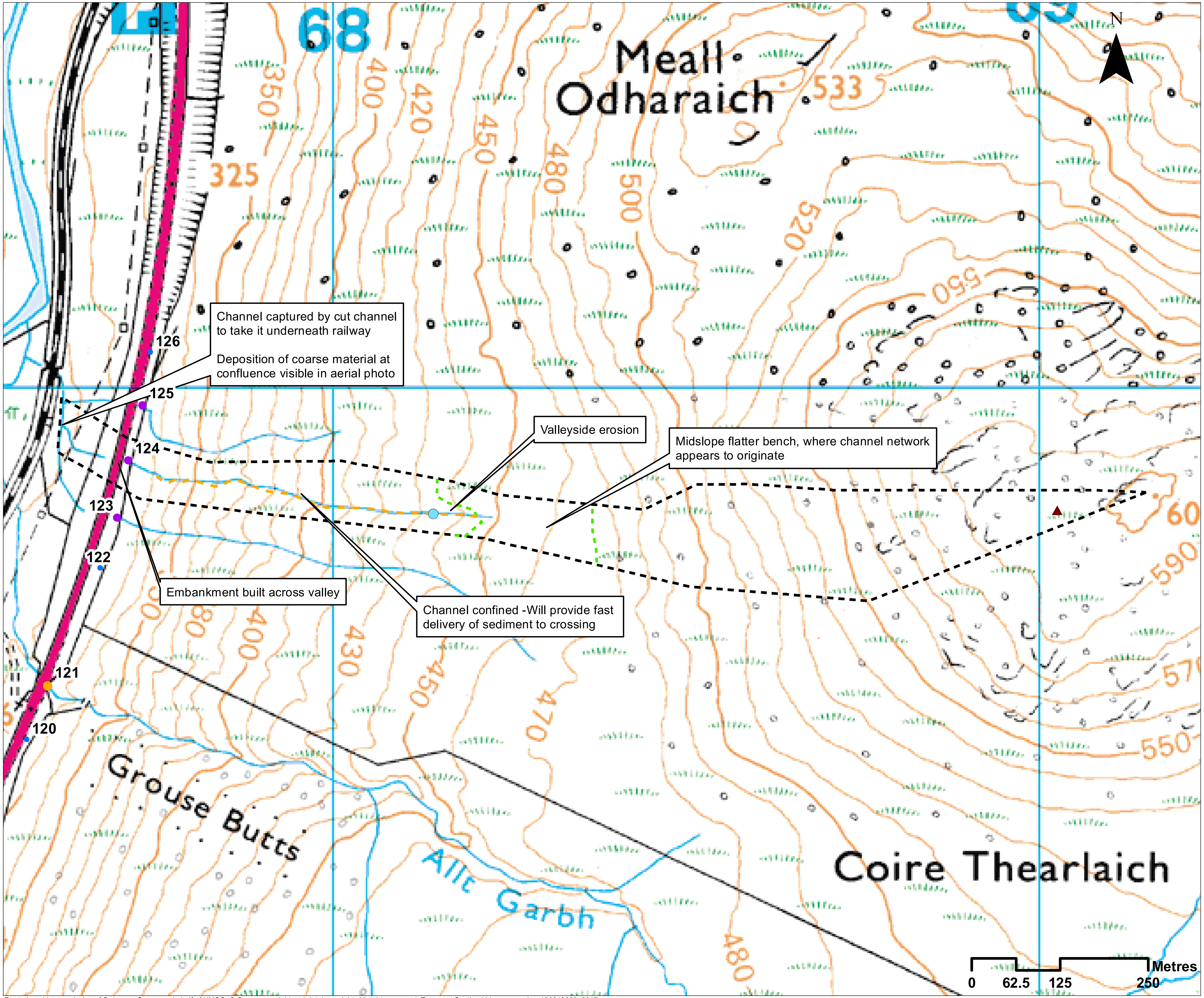

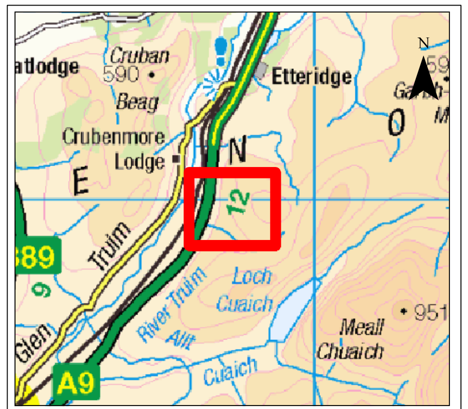

Legend

- Major crossing
- Minor crossing
- Other crossing
- Peat
- Valley side erosion
- Break in slope
- Potential valley side erosion
- Crossing catchment

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PROJECT 8 DALWHINNIE TO CRUBENMORE EIA

DRAWING 11.4.3.2.
Catchment 124 Baseline Assessment

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DWG: A9P08-CFJ-EWE-X_ZZZZZ_ZZ-DR-EN-0002

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1 of 1	C01	A3

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Annex 11.4.3 - Hydromorphological Catchment Assessment - 125

Catchment No.	125
Catchment Name	-

Channel Nature	Nature of water course	Natural
	Size of water course	Minor

Quantitative Spatial Elements	Catchment Area (km^2)	0.2
	Average slope in catchment (°)	11.8
	% Catchment over 750m (for snow melt risk)	0

WFD classification	Water, flows and levels	Good
	Physical condition	Good
	Overall ecological status	Moderate

Geology	Majority Bedrock (see Drawing 11.4.3.1 a and b Catchment 125)	Gaick Psammite formation-Psammite	resistant to weathering, impermeable
	Is an alluvial fan present at or near the crossing?	No	

Environmental designations (see Drawing 11.4.3.1 c, Catchment 125)	Ramsar	No	
	SAC	No	
	SPA	No	
	SSSI	No	

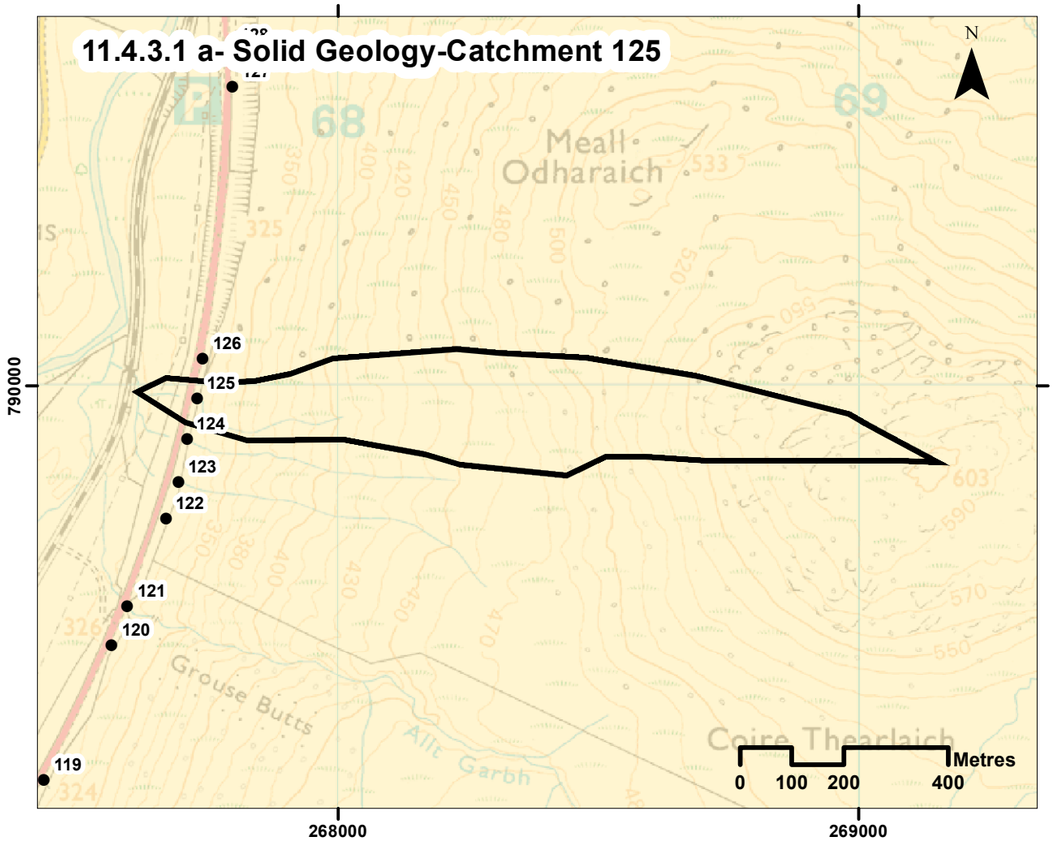
Sediment source and supply - Catchment Scale	Changes in slope and channel confinement	See Drawing 11.4.3.2, Catchment 125	
	Is peat present in the catchment	No	
	Is there a bog burst risk	No	
	Current valley side or terrace erosion	Yes	1
	Potential valley side or terrace erosion	Yes	0.17
	Hill slope failures (including peat slides and debris flows and slides)	Yes	Vegetated over
	Hill slope failures coupled to channel	No	
	Vertical incision present in catchment	Yes	Vertical incision leading to slope failure on right bank u/s of crossing
	Bank erosion/lateral migration	No	
	Unvegetated bars	No	
	Wooded/forested areas in catchment	No	
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 125)	None	
	Comment on sediment source potential in catchment	Eroding till valley sides potential to supply fines and coarse material	
	Comment on sediment supply potential to crossing	High - Eroding valley side immediately upstream of crossing. Steep channel will deliver sediment to crossing	

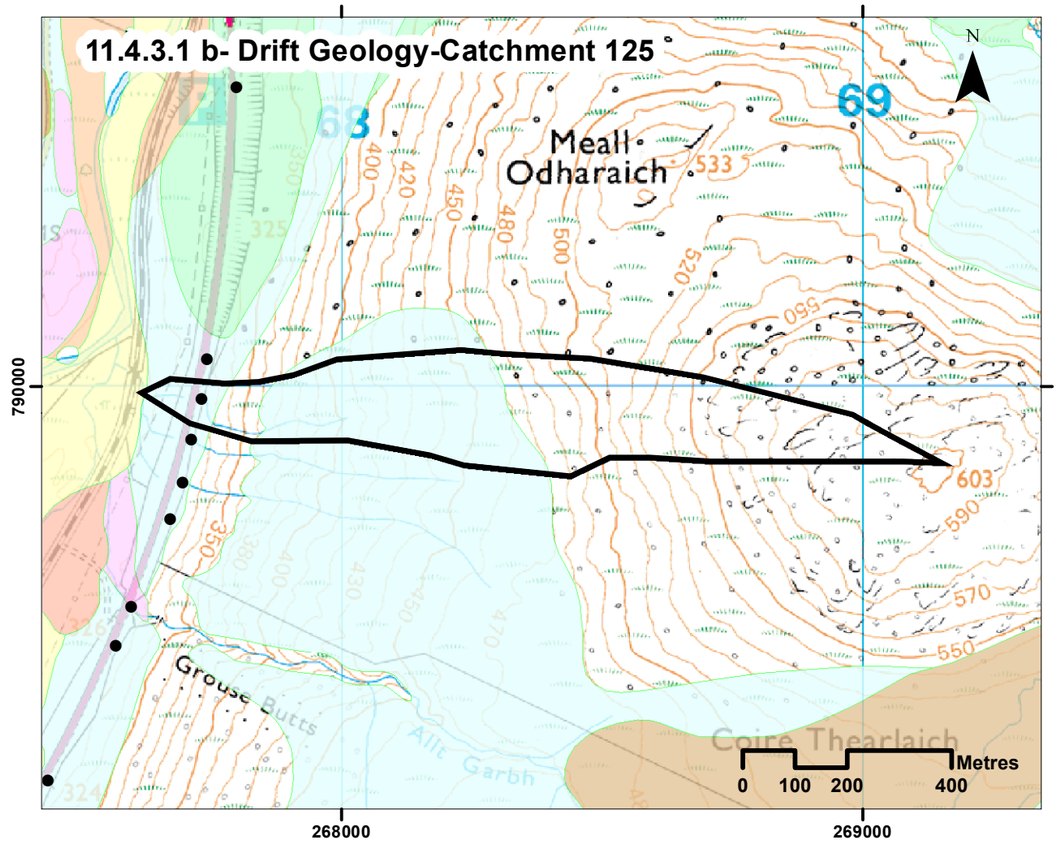
Morphology and Process-Reach upstream of crossing	Channel morphology	Cascade	
	Predominant sediment size	Coarse	
	Unvegetated bars	No	
	Vertical incision	High	
	Deposition	Low	
	Lateral migration/bank erosion	High	
	Presence and nature of infrastructure (Map 1d)	No	
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 125)	No	
	Channel realignment	Yes	Not evident from historic maps, but must be to achieve one of the two near 90° bends just u/s of crossing

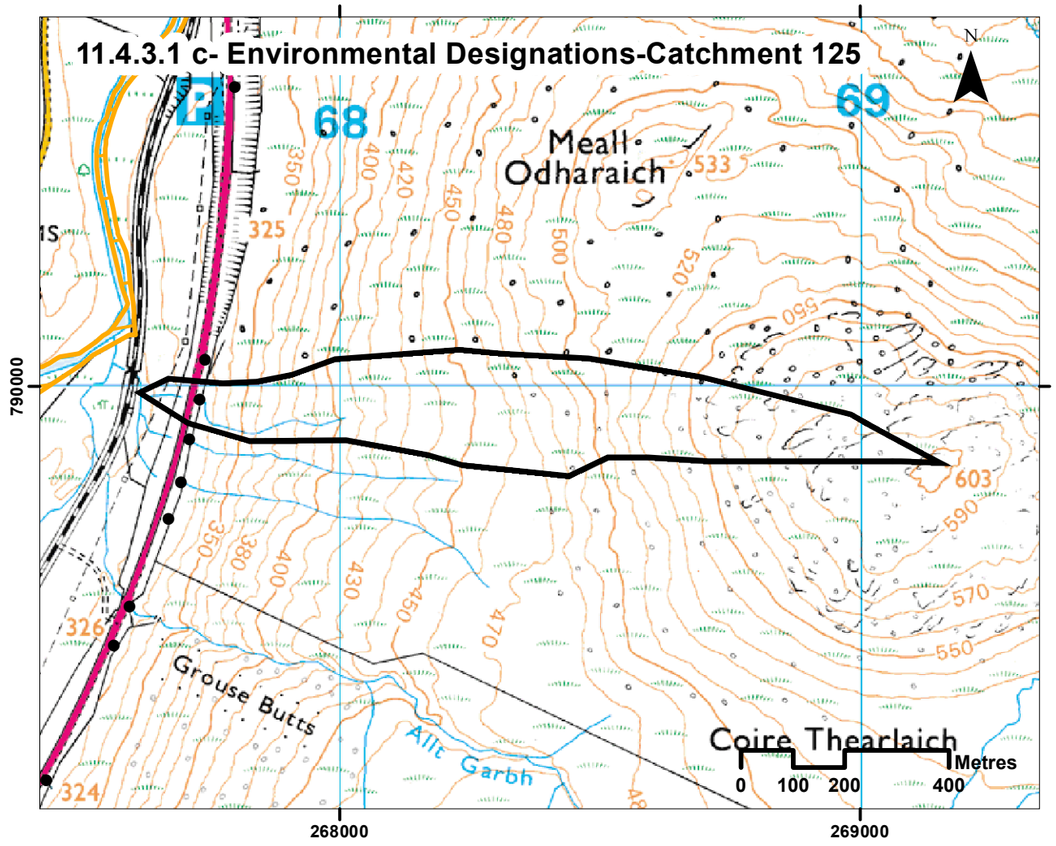
Morphology and Process-At crossing	Channel morphology	Cascade	
	Predominant sediment size	Coarse	
	Estimated discharge at 1:200 event (m^3/s)	0.7	
	Unvegetated bars	None	
	Vertical incision	Low	
	Deposition	Low	
	Lateral migration/bank erosion	Low	
	Damaged/unstable drains or armouring	No	

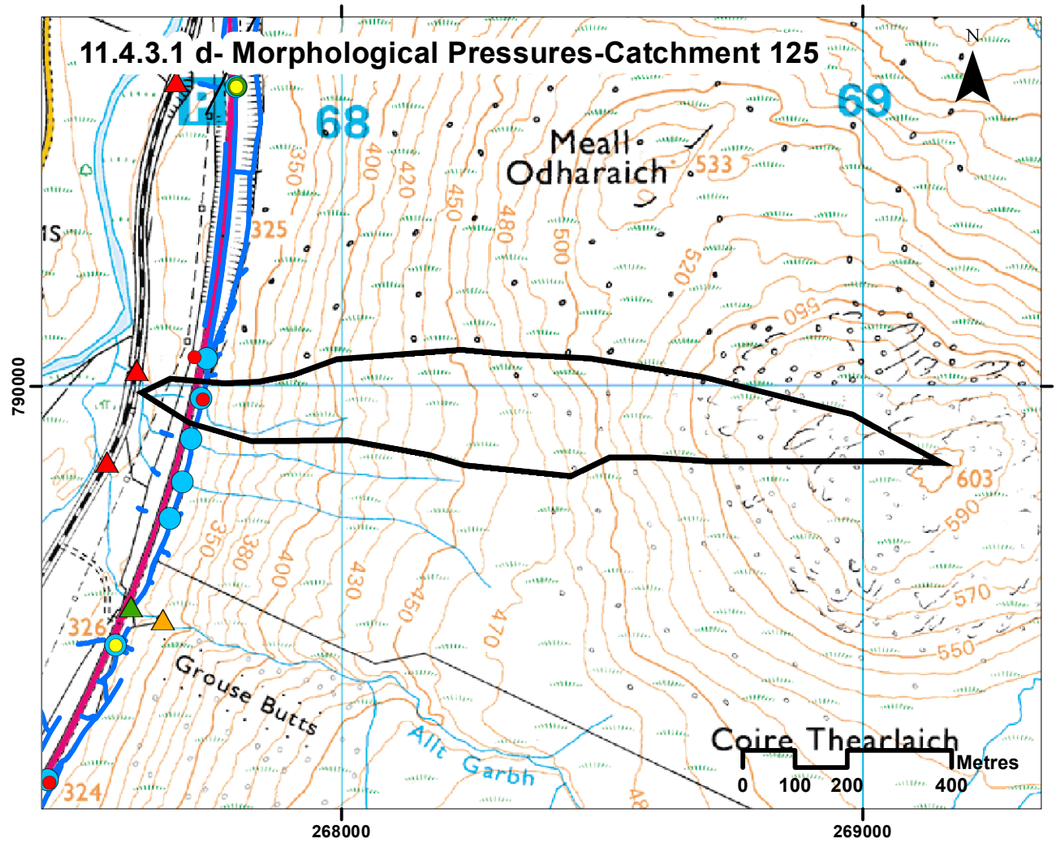
Morphology and Process-Reach downstream of crossing	Channel morphology	Cascade	
	Predominant sediment size	Coarse (gravel-cobble)	
	Unvegetated bars	No	
	Vertical incision	High	
	Deposition	Low	
	Lateral migration/bank erosion	Low	
	Presence and nature of infrastructure (Map 1d)	No	
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 125)	No	
	Channel realignment	Yes	Captured by another tributary coming in from the left bank to go under the railway

Summary behaviour	Some realignment undertaken to take watercourse through the crossing. Evidence of valley side erosion upstream and vertical incision downstream









Legend

General
- Crossing location

Solid Geology
- Gaick Psammite Formation - Psammite

Drift Geology
- Peat
- Glaciofluvial Ice Contact Deposits
- Gaick Plateau Moraine Formation
- Hummocky Glacial Deposits
- Ardverikie Till Formation - Diamicton
- Glaciofluvial Sheet Deposits
- Alluvium
- River Terrace Deposits
- Alluvial Fan Deposits
- Head
- Talus - Rock Fragments
- Talus Cone

Environmental Designations
- Special Area of Conservation

Morphological Pressures
- Railway Bridge
- Road Bridge
- Track/Footbridge
- Culvert
- Cascade
- Step in Bed
- Catchpit
- Drainage Ditch
- Power Lines

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TRANSPORT SCOTLAND CONNECTING ALBA

A9 DUALLING PERTH TO INVERNESS Dualleadh Pheairt gu Inbhir Nis

PROJECT 8 DALWHINNIE TO CRUBENMORE EIA

Drawing 11.4.3.1 Catchment 125 Catchment Overview

DESIGN:	DRAWN:	CHK:	APP:
EL	EV	EL	EL

DATE: 20/07/2017

PROJ: 495298

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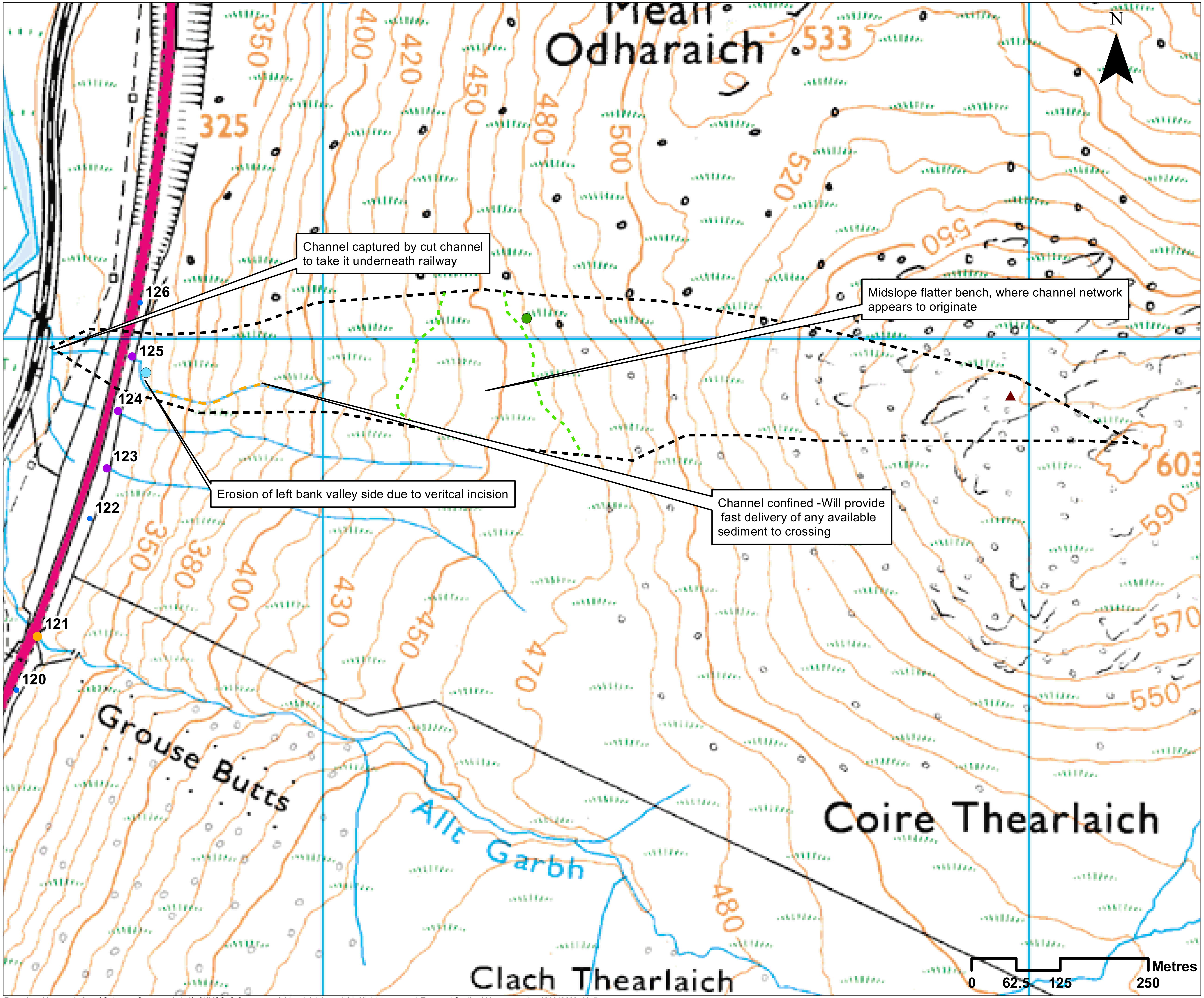

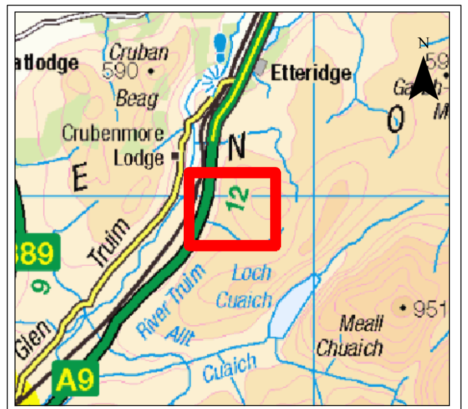

Legend

- Major crossing
- Minor crossing
- Other crossing
- Peat
- Debris flow
- Valley side erosion
- Break in slope
- Potential valley side erosion
- Crossing catchment

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PROJECT 8 DALWHINNIE TO CRUBENMORE EIA

DRAWING 11.4.3.2.
Catchment 125 Baseline Assessment

DESIGN:	DRAWN:	CHK:	APP:
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DATE: 11/07/2017
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1 of 1	C01	A3

Annex 11.4.3 - Hydromorphological Catchment Assessment - 126

Catchment No.	126
Catchment Name	-

Channel Nature	Nature of water course	Natural
	Size of water course	Other

Quantitative Spatial Elements	Catchment Area (km^2)	No Data
	Average slope in catchment (°)	No Data
	% Catchment over 750m (for snow melt risk)	No Data

WFD classification	Water, flows and levels	Good
	Physical condition	Good
	Overall ecological status	Moderate

Geology	Majority Bedrock (see Drawing 11.4.3.1 a and b Catchment 126)	Gaick Psammite formation-Psammite	resistant to weathering, impermeable
	Is an alluvial fan present at or near the crossing?	No	

Environmental designations (see Drawing 11.4.3.1 c, Catchment 126)	Ramsar	No	
	SAC	No	
	SPA	No	
	SSSI	No	

Sediment source and supply - Catchment Scale	Changes in slope and channel confinement	See Drawing 11.4.3.2, Catchment 126	
	Is peat present in the catchment	Yes	Limited thin cover possible in headwater
	Is there a bog burst risk	No	
	Current valley side or terrace erosion	No	
	Potential valley side or terrace erosion	No	
	Hill slope failures (including peat slides and debris flows and slides)	Yes	Not coupled with channels and now vegetated
	Hill slope failures coupled to channel	No	
	Vertical incision present in catchment	No	
	Bank erosion/lateral migration	No	
	Unvegetated bars	No	
	Wooded/forested areas in catchment	No	
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 126)	No	
	Comment on sediment source potential in catchment	Limited. Channel development very limited and no exposed sediment evident.	
	Comment on sediment supply potential to crossing	Low	

Morphology and Process-Reach upstream of crossing	Channel morphology	Cascade	
	Predominant sediment size	Gravel	
	Unvegetated bars	No	
	Vertical incision	Medium	
	Deposition	Medium	
	Lateral migration/bank erosion	Low	
	Presence and nature of infrastructure (Map 1d)	No	
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 126)	No	
	Channel realignment	No	

Morphology and Process-At crossing	Channel morphology	Engineered	
	Predominant sediment size	Gravel-cobble	
	Estimated discharge at 1:200 event (m^3/s)	2.6	
	Unvegetated bars	None	
	Vertical incision	Low	
	Deposition	Low	
	Lateral migration/bank erosion	Low	
	Damaged/unstable drains or armouring	Yes	Drain armouring appears to have been ripped up

Morphology and Process-Reach downstream of crossing	Channel morphology	Cascade	
	Predominant sediment size	Cobble	
	Unvegetated bars	No	
	Vertical incision	Medium	
	Deposition	Low	
	Lateral migration/bank erosion	None	
	Presence and nature of infrastructure (Map 1d)	Yes	Railway
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 126)	Yes	Flow has to pass through cut drain to get through railway embankment
	Channel realignment	Yes	Drain cut to take flow southwards to join other channels and pass through a crossing in the railway embankment

Summary behaviour	Only limited channel headwaters u/s of road. Joined by flow from road-parallel drains at crossing. Paving flag armouring appears to have been ripped up and deposited just u/s of culvert. Downstream there is some vertical incision but this might be natural. Cut drain takes flow southwards to join other channels where gradient reduces, so that flow from several channels passes through just one railway crossing. Where the natural channel ends and cut drain begins, there is a small fan of coarse material evident in the aerial photos.

Annex 11.4.3 - Hydromorphological Catchment Assessment - 127

Catchment No.	**127**
Catchment Name	-

Channel Nature	Nature of water course	Drain
	Size of water course	Other

Quantitative Spatial Elements	Catchment Area (km^2)	No Data
	Average slope in catchment (°)	No Data
	% Catchment over 750m (for snow melt risk)	No Data

WFD classification	Water, flows and levels	Good
	Physical condition	Good
	Overall ecological status	Moderate

Geology	Majority Bedrock (see Drawing 11.4.3.1 a and b Catchment 127)	Gaick Psammite formation-Psammite	resistant to weathering, impermeable
	Is an alluvial fan present at or near the crossing?	No	

Environmental designations (see Drawing 11.4.3.1 c, Catchment 127)	Ramsar	No	
	SAC	No	
	SPA	No	
	SSSI	No	

Sediment source and supply - Catchment Scale	Changes in slope and channel confinement	See Drawing 11.4.3.2, Catchment 127	
	Is peat present in the catchment	Yes	Small possible deposit in upper catchment
	Is there a bog burst risk	No	
	Current valley side or terrace erosion	No	
	Potential valley side or terrace erosion	No	
	Hill slope failures (including peat slides and debris flows and slides)	Yes	Not coupled with channels and now vegetated
	Hill slope failures coupled to channel	No	
	Vertical incision present in catchment	No	
	Bank erosion/lateral migration	No	
	Unvegetated bars	No	
	Wooded/forested areas in catchment	No	
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 127)	No	
	Comment on sediment source potential in catchment	Looks limited. Some possible shallow translational (peat?) failure scars	
	Comment on sediment supply potential to crossing	Limited	

Morphology and Process-Reach upstream of crossing	Channel morphology	Engineered	Channel starts as two drains above cutting which capture hillslope drainage and bring them to a cascade, which descends the cutting to road level, where the flow enters a road parallel drain for c.160m.
	Predominant sediment size	-	no sediment present in road-parallel drain
	Unvegetated bars	No	
	Vertical incision	None	
	Deposition	None	
	Lateral migration/bank erosion	None	
	Presence and nature of infrastructure (Map 1d)	Cascade	c. 160m south of crossing
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 127)	No	
	Channel realignment	Yes	Natural channel appears to have been present here on 1902 six inch map, but road cutting has cut off the channel's headwaters.

Morphology and Process-At crossing	Channel morphology	Engineered	
	Predominant sediment size	Gravels	
	Estimated discharge at 1:200 event (m^3/s)	2.6	
	Unvegetated bars	No	
	Vertical incision	None	
	Deposition	Low	Some deposition of gravel in catch pit and in culvert.
	Lateral migration/bank erosion	None	
	Damaged/unstable drains or armouring	Yes	At cascade further up there is limited damage - dislodging of blocks.

Morphology and Process-Reach downstream of crossing	Channel morphology	Plane bed	
	Predominant sediment size	None visible	
	Unvegetated bars	No	
	Vertical incision	Medium	Possible scour pool visible in aerial photo
	Deposition	Low	
	Lateral migration/bank erosion	Medium	Possible scour pool visible in aerial photo
	Presence and nature of infrastructure (Map 1d)	Yes	Railway
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 127)	Yes	Channel restricted in route it can follow to pass under railway crossing c.70m d/s of culvert exit
	Channel realignment	No	Channel appears to be in original place d/s of road

Summary behaviour	Headwaters of original channel have been removed by the cutting through which the road runs. Drainage is now captured above cutting by cross-slope drains which actually drop to road level via a cascade which descends the cutting 160m to the south of the crossing. The channel turns abruptly to the north once at road level and flows northwards to crossing 127. At the u/s end of the culvert (in the catch pit) and within the culvert there is a small amount of small gravel deposited. D/s of the culvert, the channel seems to follow it's original alignment, but the aerial photos indicate a possible scour pool where engineering measures stop. D/s of this, c. 70m d/s of the road crossing, the channel passes under the railway. Possible opportunity to remove some of the sharp unnatural turns in the channel.

Annex 11.4.3 - Hydromorphological Catchment Assessment - 128

Catchment No.	128
Catchment Name	-

Channel Nature	Nature of water course	Natural
	Size of water course	Other

Quantitative Spatial Elements	Catchment Area (km^2)	No Data
	Average slope in catchment (°)	No Data
	% Catchment over 750m (for snow melt risk)	No Data

WFD classification	Water, flows and levels	Good
	Physical condition	Good
	Overall ecological status	Moderate

Geology	Majority Bedrock (see Drawing 11.4.3.1 a and b Catchment 128)	Gaick Psammite formation-Psammite	resistant to weathering, impermeable
	Is an alluvial fan present at or near the crossing?	No	

Environmental designations (see Drawing 11.4.3.1 c, Catchment 128)	Ramsar	No	
	SAC	No	
	SPA	No	
	SSSI	No	

Sediment source and supply - Catchment Scale	Changes in slope and channel confinement	See Drawing 11.4.3.2, Catchment 128	
	Is peat present in the catchment	Yes	Small possible deposit in upper catchment
	Is there a bog burst risk	No	
	Current valley side or terrace erosion	No	
	Potential valley side or terrace erosion	No	
	Hill slope failures (including peat slides and debris flows and slides)	Yes	Not coupled with channels and now vegetated
	Hill slope failures coupled to channel	No	
	Vertical incision present in catchment	No	
	Bank erosion/lateral migration	No	
	Unvegetated bars	No	
	Wooded/forested areas in catchment	No	
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 128)	No	
	Comment on sediment source potential in catchment	Limited	
	Comment on sediment supply potential to crossing	Limited - seems to be little sediment in catch pit	

Morphology and Process- Reach upstream of crossing	Channel morphology	Engineered	Drains and cascade
	Predominant sediment size	Angular large gravel/small cobble	Generated from damage to cascade
	Unvegetated bars	No	
	Vertical incision	None	
	Deposition	Low	
	Lateral migration/bank erosion	None	
	Presence and nature of infrastructure (Map 1d)	Yes	Cascade
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 128)	Yes	Generating sediment, limiting energy reaching crossing.
	Channel realignment	Yes	In cutting so must have been realigned

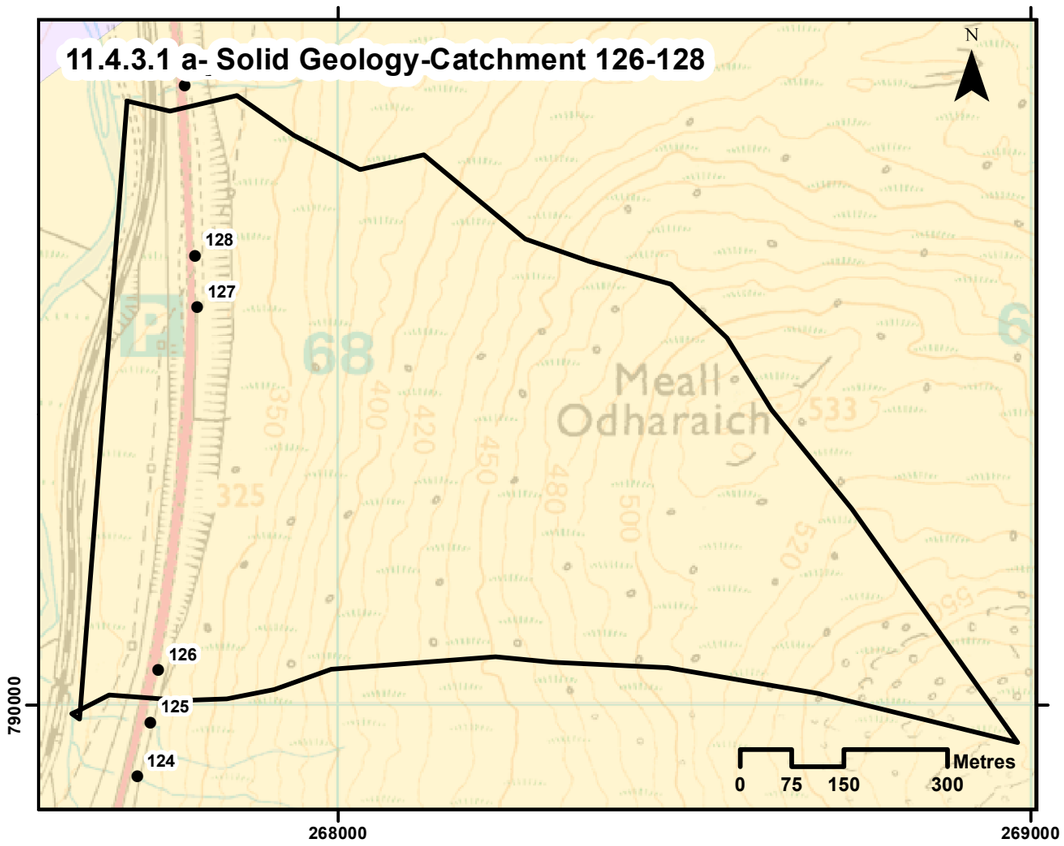
Morphology and Process- At crossing	Channel morphology	Engineered	Pipe culvert
	Predominant sediment size	Gravel	accumulated in catch pit
	Estimated discharge at 1:200 event (m^3/s)	2.6	
	Unvegetated bars	No	
	Vertical incision	None	
	Deposition	Low	
	Lateral migration/bank erosion	None	
	Damaged/unstable drains or armouring	Yes	Limited damage to cascade steps producing coarse angular material

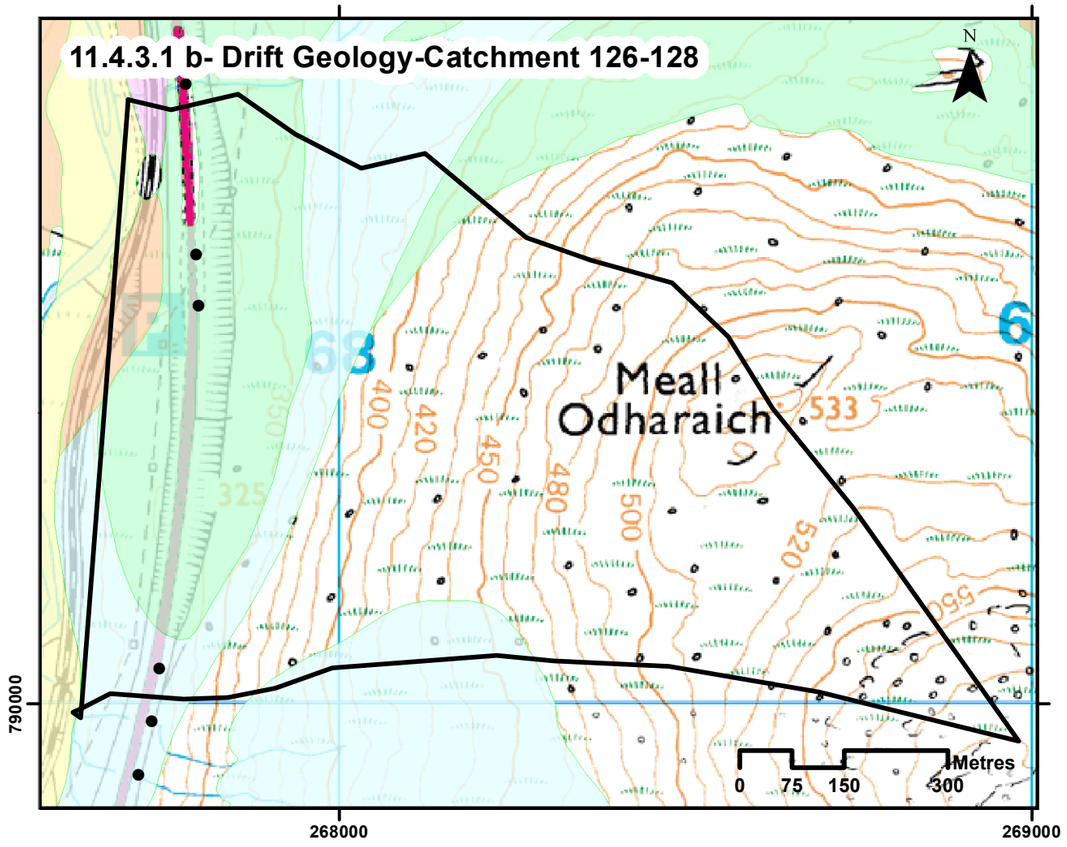
Morphology and Process- Reach downstream of crossing	Channel morphology	Engineered	Cut drain
	Predominant sediment size	Fine	
	Unvegetated bars	No	
	Vertical incision	None	
	Deposition	Low	Fines and organics only. Sluggish
	Lateral migration/bank erosion	None	
	Presence and nature of infrastructure (Map 1d)	Yes	Railway
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 128)	Yes	Channel in cut drain and joins 127 to pass under railway
	Channel realignment	Yes	See above

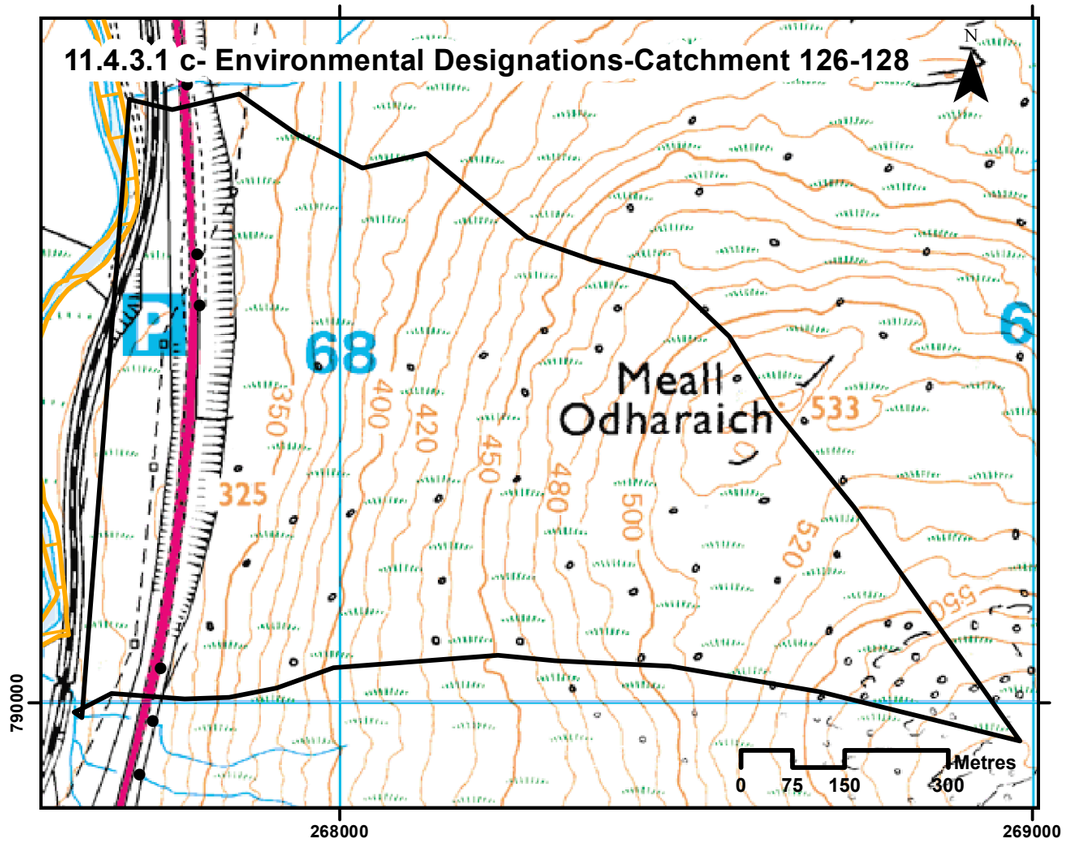
Summary behaviour	Channel upslope appears to have once been natural in aerial photos, but is joined at cutting crest by cross slope drains which collect hillslope drainage. Channel descends cutting in stepped, armoured cascade which has suffered damage at some of the steps. This has resulted in dislodged armour. Little sediment appears to, however, be delivered to the crossing with only some fine gravel in the catch pit. The culvert entrance at the time of the survey does not appear to be blocked at all. D/s of the culver the channel is in a cut drain and flow appears sluggish and the channel is mostly vegetated. There is a confluence with channel 127 u/s of the railway. Channel 127 is incised slightly so there is a possibility that, if flow in channel 128 were to increase, the drain could cut back and incise, but this is unlikely.

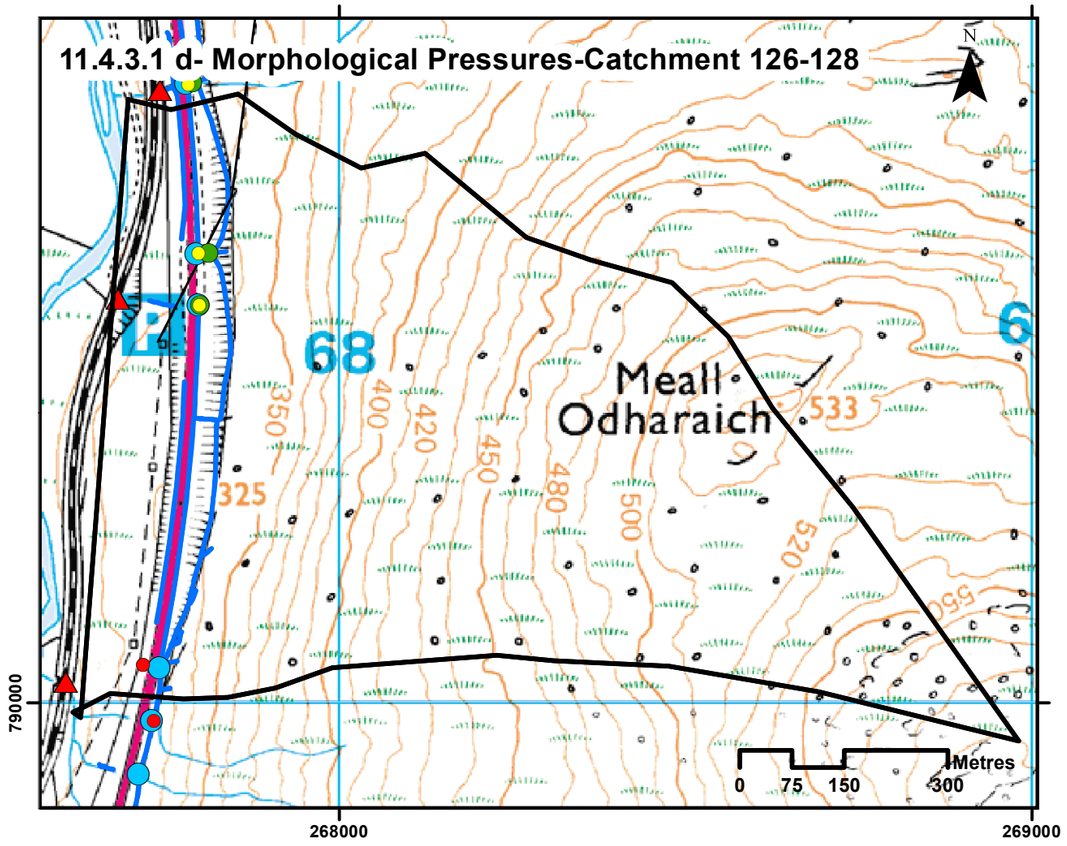
Photograph 11.4.3.124- Cascade upstream of crossing

Photograph 11.4.3.125- Downstream- low slope and unconstrained channel









Legend

General
- Crossing Location
- Catchment Area

Solid Geology
- Gaick Psammite Formation - Psammite

Drift Geology
- Peat
- Glaciofluvial Ice Contact Deposits
- Gaick Plateau Moraine Formation
- Hummocky Glacial Deposits
- Ardverikie Till Formation - Diamicton
- Glaciofluvial Sheet Deposits
- Alluvium
- River Terrace Deposits
- Alluvial Fan Deposits
- Head
- Talus - Rock Fragments
- Talus Cone

Environmental Designations
- Special Area of Conservation

Morphological Pressures
- Railway bridge
- Culvert
- Cascade
- Step in bed
- Catchpit
- Drainage ditch
- Power lines

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TRANSPORT SCOTLAND
A9 DUALLING PERTH TO INVERNESS

PROJECT 8 DALWHINNIE TO CRUBENMORE EIA

Drawing 11.4.3.1 Catchment 126-128 Catchment Overview

DESIGN:	DRAWN:	CHK:	APP:
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DATE: 14/07/2017

PROJ: 495298

DWG: A9P08-CFJ-EWE-X_ZZZZZ_ZZ-DR-EN-0001

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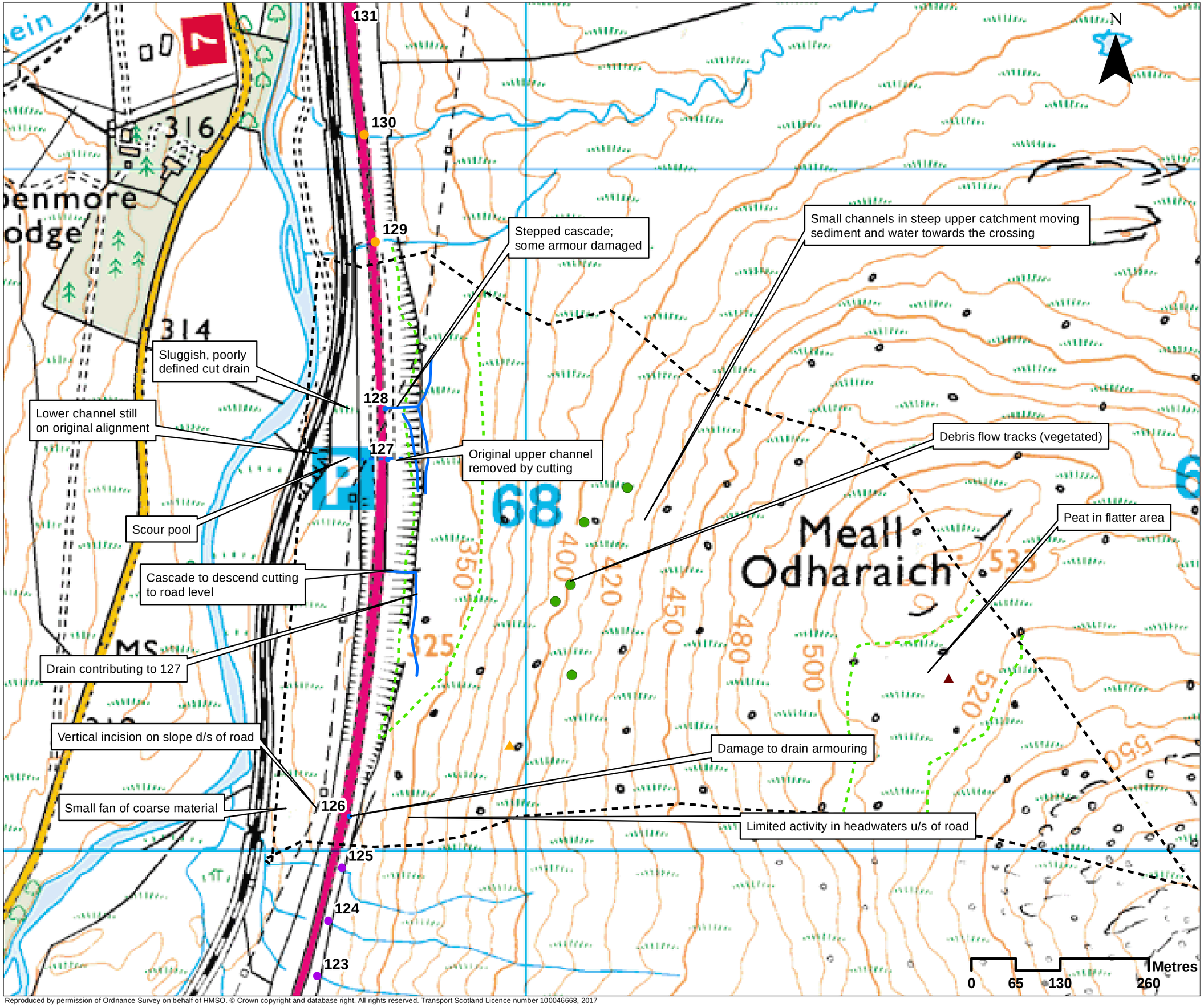

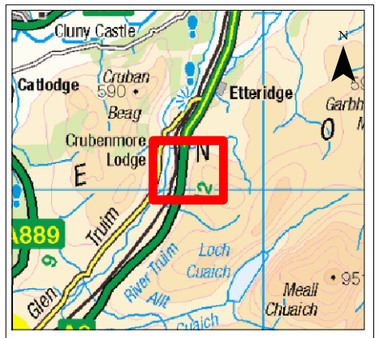

Legend

- Major crossing
- Minor crossing
- Other crossing
- Peat
- Peat slide
- Debris flow
- Break in slope
- Contemporary channel
- Original channel
- Crossing catchment

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PROJECT 8 DALWHINNIE TO CRUBENMORE EIA

DRAWING 11.4.3.2.
Catchment 126-128 Baseline Assessment

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DATE: 14/07/2017

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1 of 1	C01	A3

Annex 11.4.3 - Hydromorphological Catchment Assessment - 129

Catchment No.	**129**
Catchment Name	-

Channel Nature	Nature of water course	Natural
	Size of water course	Major

Quantitative Spatial Elements	Catchment Area (km^2)	0.1
	Average slope in catchment (°)	11
	% Catchment over 750m (for snow melt risk)	0

WFD classification	Water, flows and levels	Good
	Physical condition	Good
	Overall ecological status	Moderate

Geology	Majority Bedrock (see Drawing 11.4.3.1 a and b Catchment 129)	Gaick Psammite formation-Psammite	resistant to weathering, impermeable
	Is an alluvial fan present at or near the crossing?	No	

Environmental designations (see Drawing 11.4.3.1 c, Catchment 129)	Ramsar	No	
	SAC	Yes	**River Spey** - Atlantic salmon, freshwater pearl mussel, otter, sea lamprey NB only at confluence with the Truim
	SPA	No	
	SSSI	No	

Sediment source and supply - Catchment Scale	Changes in slope and channel confinement	See Drawing 11.4.3.2, Catchment 129	
	Is peat present in the catchment	No	
	Is there a bog burst risk	No	
	Current valley side or terrace erosion	No	
	Potential valley side or terrace erosion	No	
	Hill slope failures (including peat slides and debris flows and slides)	Yes	
	Hill slope failures coupled to channel	No	
	Vertical incision present in catchment	No	
	Bank erosion/lateral migration	No	
	Unvegetated bars	No	
	Wooded/forested areas in catchment	Yes	Trees in valley u/s and d/s of road and railway crossings. None in wider catchment.
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 129)	No	
	Comment on sediment source potential in catchment	Limited - well vegetated throughout but there are numerous boulders located around the catchment, indicating possible ready supply of coarse material below vegetation.	
	Comment on sediment supply potential to crossing	Limited by supply but steepness means that in flood conditions large sediment could be come easily mobilised with little opportunity for deposition.	

Morphology and Process-Reach upstream of crossing	Channel morphology	Bedrock	Cascade cut into bedrock
	Predominant sediment size	-	
	Unvegetated bars	No	
	Vertical incision	None	
	Deposition	Low	
	Lateral migration/bank erosion	Low	
	Presence and nature of infrastructure (Map 1d)	Bedrock cascade	Required for channel to descend cutting to road level
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 129)	No	
	Channel realignment	Yes	Vertical realignment to get to road level

Morphology and Process-At crossing	Channel morphology	Bedrock	Pipe culvert
	Predominant sediment size	None	
	Estimated discharge at 1:200 event (m^3/s)	0.5	
	Unvegetated bars	None	
	Vertical incision	None	
	Deposition	None	
	Lateral migration/bank erosion	None	
	Damaged/unstable drains or armouring	None	

Morphology and Process-Reach downstream of crossing	Channel morphology	Plane bed	
	Predominant sediment size	Cobble (angular)	
	Unvegetated bars	No	
	Vertical incision	Low	
	Deposition	Low	
	Lateral migration/bank erosion	None	
	Presence and nature of infrastructure (Map 1d)	Yes	Railway and associated cascade and bank retention/protection (gabion baskets). Plus engineered bed at railway crossing. Plus fence retaining debris u/s of railway
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 129)	Yes	Fence retaining debris is creating step. In poor condition and as well as possibly creating nick point, this structure may fail, delivering debris to railway crossing.
	Channel realignment	No	Channel likely to be in original position d/s of road and railway, but not shown on historic maps.
Summary behaviour	Channel is natural u/s of road cutting, but descends road cutting via a cascade cut into the bedrock. This seems to be operating effectively and there is no debris build-up u/s of the crossing. D/s of the crossing, there appears to be a mobile bed of coarse angular sediment, increasingly coarse towards railway bridge although this may be emplaced specifically. D/s of the road there is a low wooden dam and fence which is retaining debris. This is in poor condition and could release sediment suddenly if it fails and cause an u/s wave of erosion. The fall from the road to the railway is very steep and straight and will have high levels of energy which need to be designed for in any new crossings.		

Photograph 11.4.3.126- Downstream

Photograph 11.4.3.127- Upstream

Photograph 11.4.3.128- Upstream

Photograph 11.4.3.129

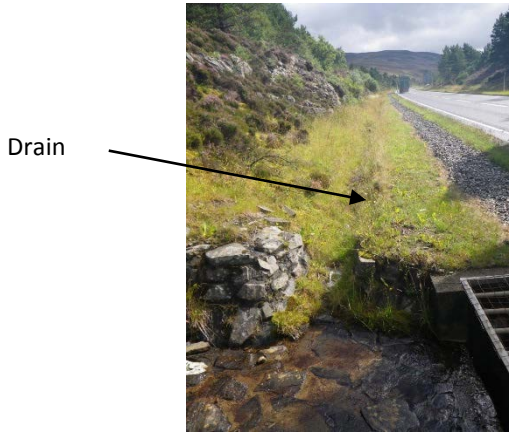
Photograph 11.4.3.130-
Upstream embankment

Photograph 11.4.3.131-
Looking down embankment

Photograph 11.4.3.132-Downstream to catchpit

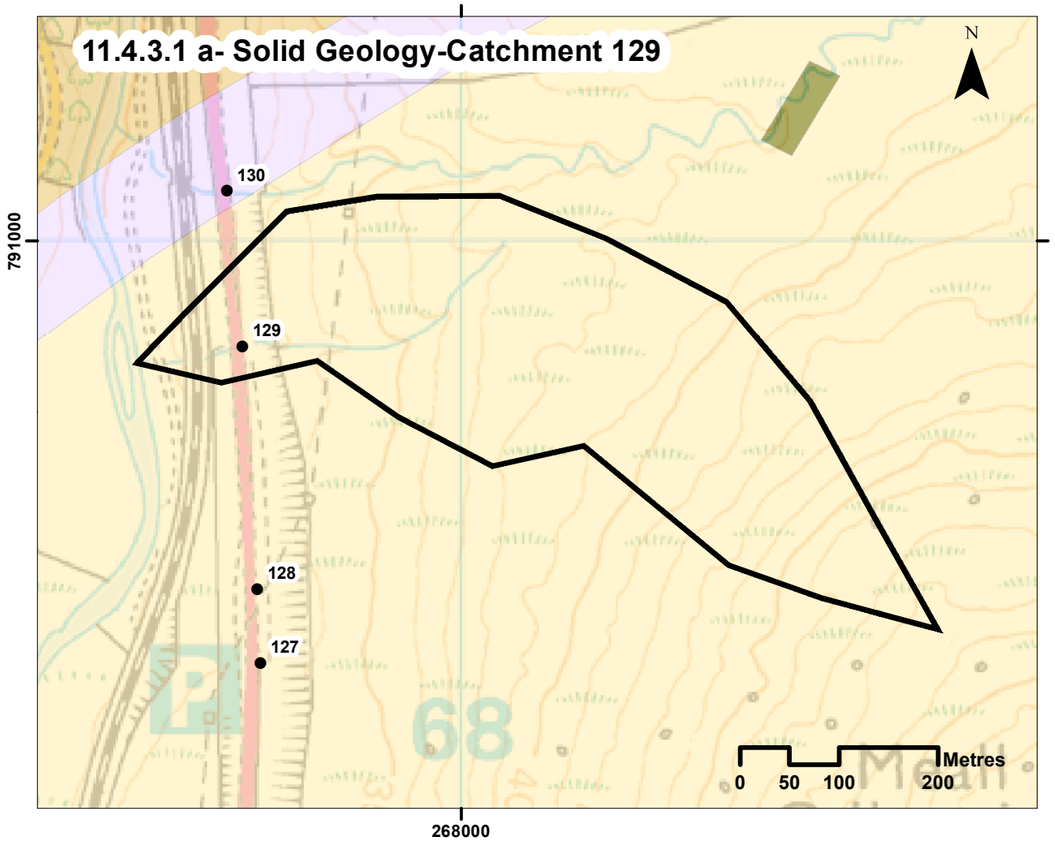
Photograph 11.4.3.133

Photograph 11.4.3.134

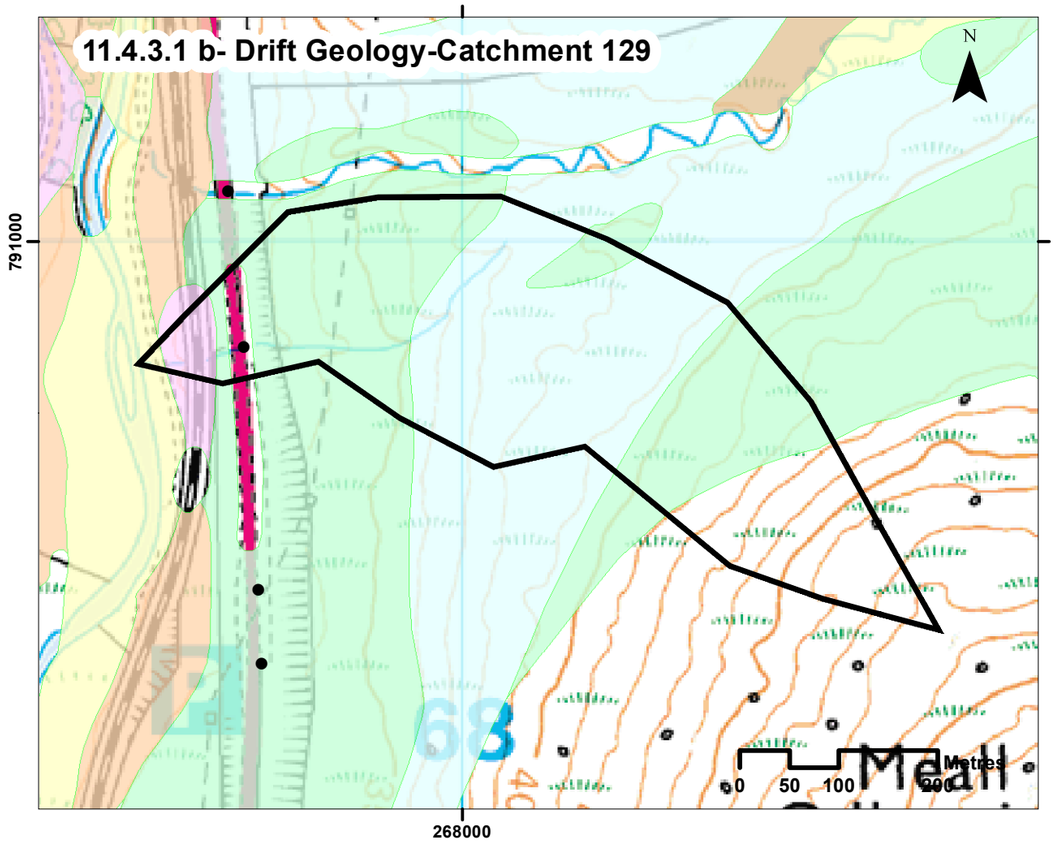


Photograph 11.4.3.135

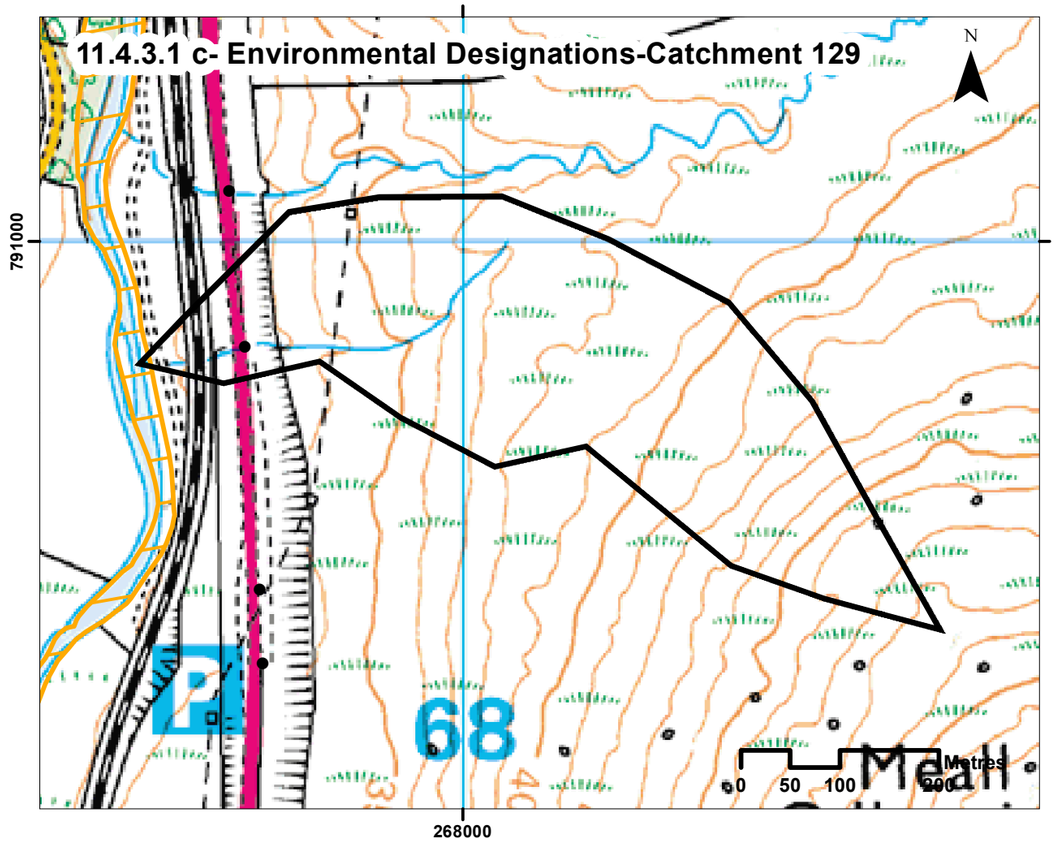
11.4.3.1 a- Solid Geology-Catchment 129



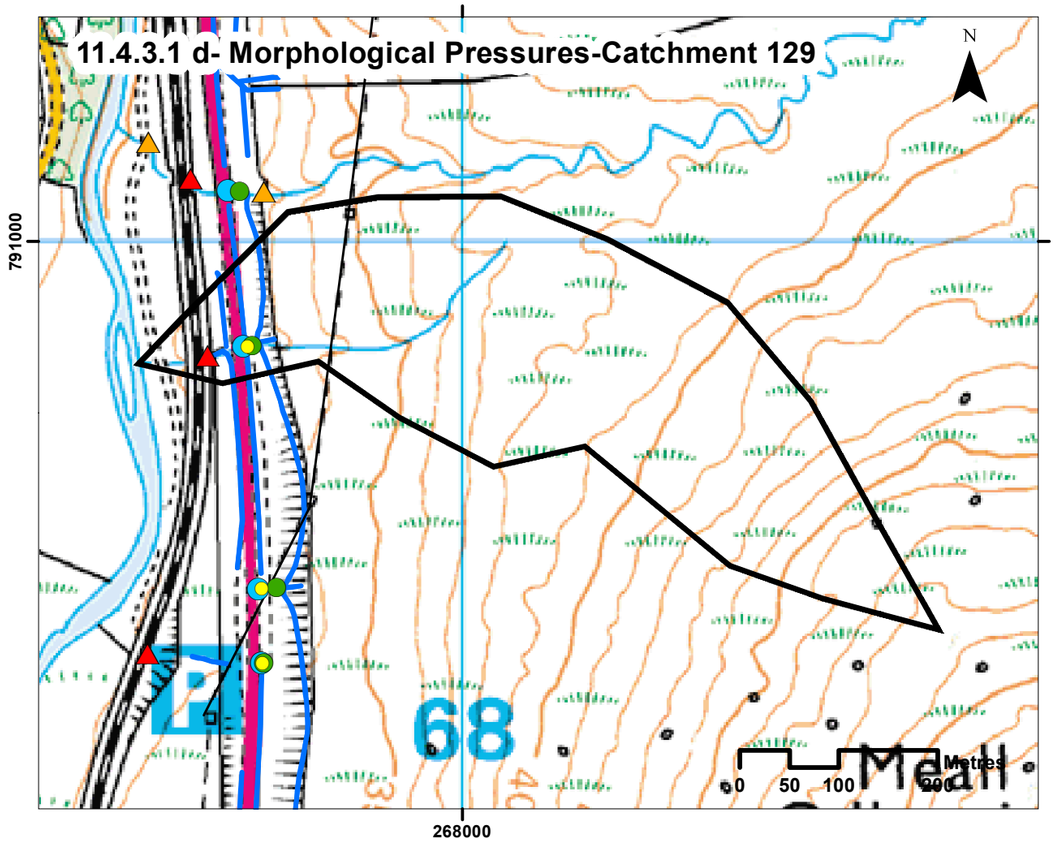
11.4.3.1 b- Drift Geology-Catchment 129



11.4.3.1 c- Environmental Designations-Catchment 129



11.4.3.1 d- Morphological Pressures-Catchment 129



Legend

General
- Crossing location

Solid Geology
- Gaick Psammite Formation - Psammite

Drift Geology
- Peat
- Glaciofluvial Ice Contact Deposits
- Gaick Plateau Moraine Formation
- Hummocky Glacial Deposits
- Ardverikie Till Formation - Diamicton
- Glaciofluvial Sheet Deposits
- Alluvium
- River Terrace Deposits
- Alluvial Fan Deposits
- Head
- Talus - Rock Fragments
- Talus Cone

Environmental Designations
- Special Area of Conservation

Morphological Pressures
- Railway Bridge
- Track/Footbridge
- Culvert
- Cascade
- Catchpit
- Drainage Ditch
- Power Lines

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PROJECT 8 DALWHINNIE TO CRUBENMORE EIA

Drawing 11.4.3.1 Catchment 129 Catchment Overview

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DATE: 20/07/2017

PROJ: 495298

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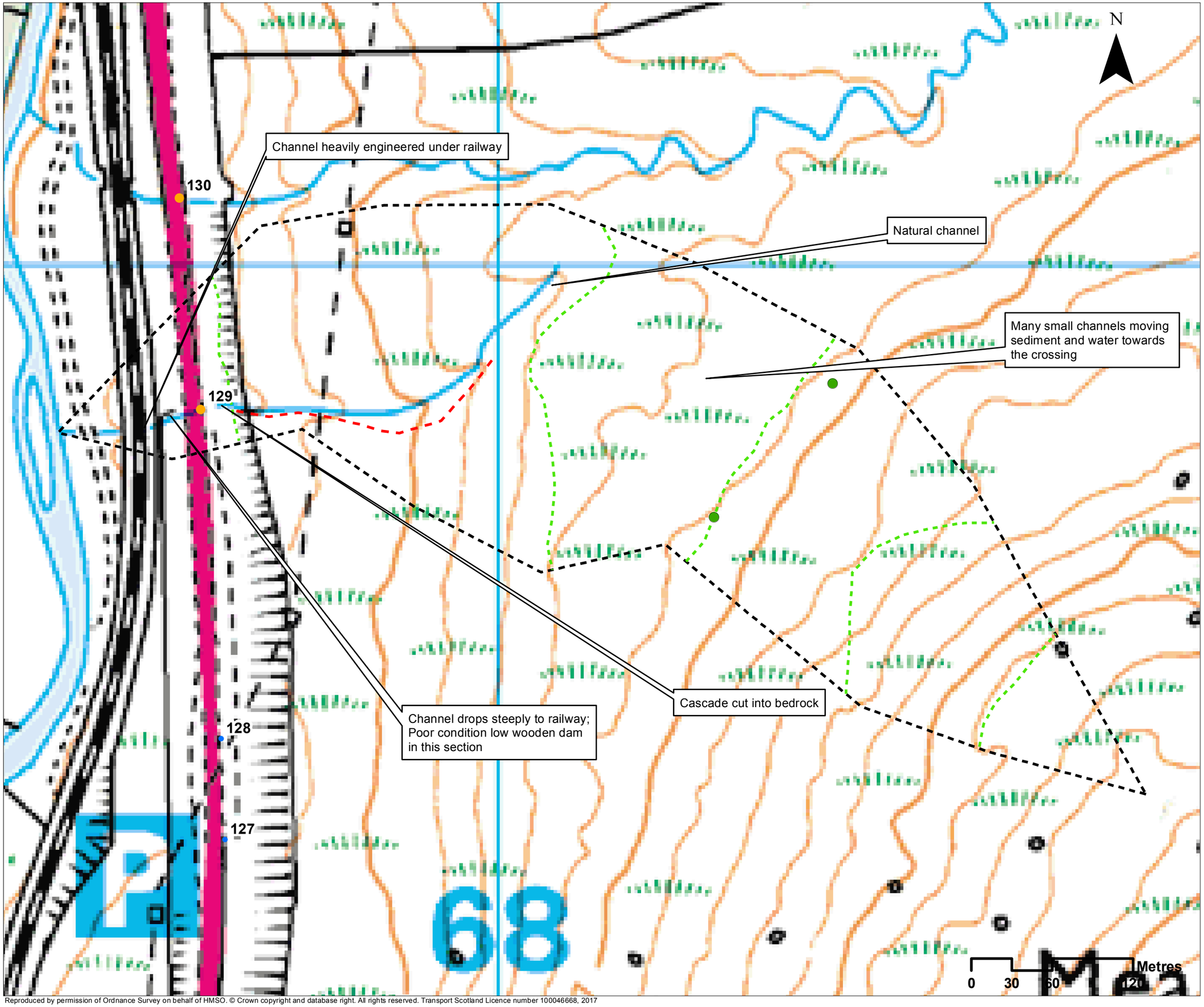

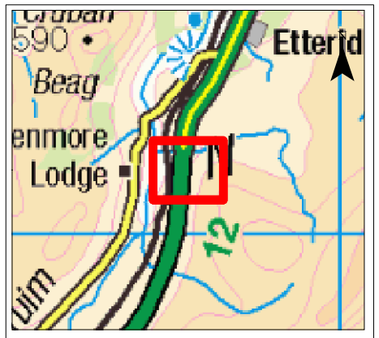

Legend

- Major crossing
- Other crossing
- Debris flow
- Break in slope
- Terrace
- Crossing catchment

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TRANSPORT SCOTLAND CONSULTING ALBA

A9 DUALLING PERTH TO INVERNESS Dalwhinnie to Crubenmore

PROJECT 8 DALWHINNIE TO CRUBENMORE EIA

DRAWING 11.4.3.2.
Catchment 129 Baseline Assessment

DESIGN:	DRAWN:	CHK:	APP:
EL	AB	EL	EL

DATE: 11/07/2017

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Annex 11.4.3 - Hydromorphological Catchment Assessment - 130

Catchment No.	130
Catchment Name	Allt na Ceàrdaich (Allt a' Mhill Odharaich in upper catchment)

Channel Nature	Nature of water course	Natural
	Size of water course	Major

Quantitative Spatial Elements	Catchment Area (km^2)	3.3
	Average slope in catchment (°)	7.5
	% Catchment over 750m (for snow melt risk)	0

WFD classification	Water, flows and levels	Good
	Physical condition	Good
	Overall ecological status	Moderate

Geology	Majority Bedrock (see Drawing 11.4.3.1 a and b Catchment 130)	Gaick Psammite formation-Psammite	resistant to weathering, impermeable
	Is an alluvial fan present at or near the crossing?	No	

Environmental designations (see Drawing 11.4.3.1 c, Catchment 130)	Ramsar	No	
	SAC	No	
	SPA	No	
	SSSI	No	

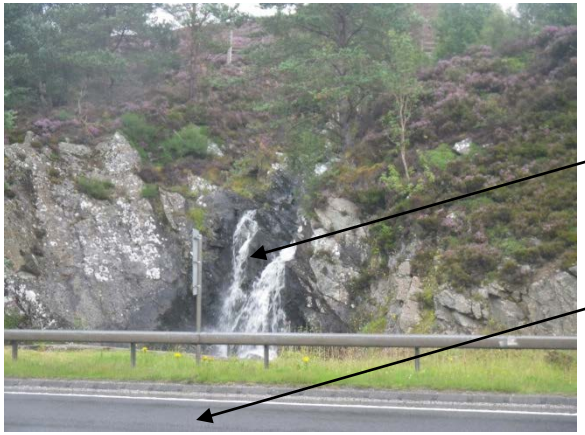
Sediment source and supply - Catchment Scale	Changes in slope and channel confinement	See Drawing 11.4.3.2, Catchment 130	
	Is peat present in the catchment	Yes	
	Is there a bog burst risk	Yes	But low as possible peaty areas are valley mires
	Current valley side or terrace erosion	Yes	Mostly revegetated but not wholly unrecent.
	Potential valley side or terrace erosion	Yes	Throughout terraced section. C. 400m
	Hill slope failures (including peat slides and debris flows and slides)	Yes	Not coupled
	Hill slope failures coupled to channel	No	
	Vertical incision present in catchment	Yes	In incised gorge
	Bank erosion/lateral migration	Yes	In incised gorge
	Unvegetated bars	Yes	There are some, but they are limited in number and extent to lower catchment
	Wooded/forested areas in catchment	Yes	Some trees near channel u/s of road. More wooded d/s of railway
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 130)	Yes	Wooden bridge
	Comment on sediment source potential in catchment	High - In terraced section, outsides of bends are eroding the valley side, likely to produce lots of sediment of various grades from till slopes.	
	Comment on sediment supply potential to crossing	High - some sediment may be deposited if eroded from valley sides, but this is likely to be mobilised at high flows and increasingly steep channel (as far as road and railway crossings) is likely to mean sediment mobilised is transported to Truim main valley.	

Morphology and Process-Reach upstream of crossing	Channel morphology	Cascade	Steep natural cascade channel. Waterfall noted on historic maps, but likely to have been modified to be even steeper bedrock cascade when road cutting constructed
	Predominant sediment size	Gravel-Cobble and bedrock	
	Unvegetated bars	No	
	Vertical incision	Medium	
	Deposition	Low	
	Lateral migration/bank erosion	Low	
	Presence and nature of infrastructure (Map 1d)	Yes	Wooden bridge
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 130)	No	Bridge in poor condition, but seems to be well above channel so not influencing. If collapses, could lead to debris dam.
	Channel realignment	Yes	Possibly some vertical realignment with construction of crossing, but channel probably follows same plan/horizontal alignment.

Morphology and Process-At crossing	Channel morphology	Engineered	Concrete bed. Very steep, spillway-like
	Predominant sediment size	None visible	
	Estimated discharge at 1:200 event (m^3/s)	10.4	
	Unvegetated bars	No	
	Vertical incision	None	
	Deposition	None	
	Lateral migration/bank erosion	None	
	Damaged/unstable drains or armouring	No	Seems to be in good condition

Morphology and Process-Reach downstream of crossing	Channel morphology	Engineered	Engineered to d/s of railway, then becomes plane bed
	Predominant sediment size	-	
	Unvegetated bars	Yes	D/s of railway
	Vertical incision	Low	Difficult to see d/s of railway
	Deposition	Low	Difficult to see d/s of railway
	Lateral migration/bank erosion	Low	Difficult to see d/s of railway
	Presence and nature of infrastructure (Map 1d)	Yes	Railway
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 130)	Yes	Very limited options for realignment as short distance and steep between road and railway
	Channel realignment	No	D/s of road the channel seems to be on original alignment. Although the georeferenced historic maps indicates there is an offset, this is unlikely to be real as it also occurs in the unaltered natural channel well u/s of the road.

Summary behaviour	Channel rises c. 3.5km u/s of crossing in Coire Mill Odharaich and falls relatively steeply to mid catchment flatter area likely to have valley mire deposits of peat. D/s of this, the channel enters a wandering section where incision has occurred (probably over Holocene timescale) possibly in response to down cutting in the Truim main valley. In this section the outsides of the meander bends are eroding the valley sides which have the potential to deliver large amounts of sediment to the channel. This sediment is likely to be easily transported in flood conditions as the channel steepens and straightens with limited opportunities for deposition before the crossing as the channel nears the main Truim valley. Little deposition is evident at the crossing and the engineered bed of the crossing under the road is very steep still, as is the engineered bed under the railway immediately d/s. It is possible that the channel is quite active d/s of the railway crossing, but this is not possible to tell from either set of field photographs or aerials due to tree cover. Suggest further inspection checks this side of the railway looks to see the nature of the channel and deposition to understand the actual sediment delivery to the lowest reaches of this channel and the Truim. Suggest careful design is needed to ensure sediment is efficiently transported through both road and railway and continues to be moved through lower channel in flood conditions.



Photograph 11.4.3.136

Photograph 11.4.3.137 - Downstream

Photograph 11.4.3.138 – Upstream to crossing exit

Photograph 11.4.3.139 – Downstream under railway crossing

Photograph 11.4.3.140

Photograph 11.4.3.141-Bedrock channel upstream of crossing

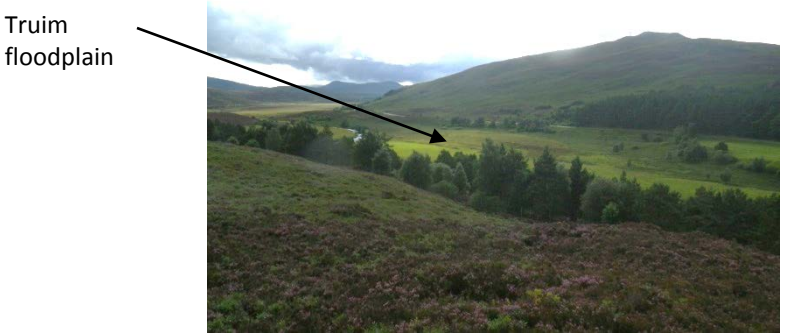
Photograph 11.4.3.142- Upstream of crossing

Photograph 11.4.3.143 - Bridge crossing channel

Photograph 11.4.3.144 - Downstream

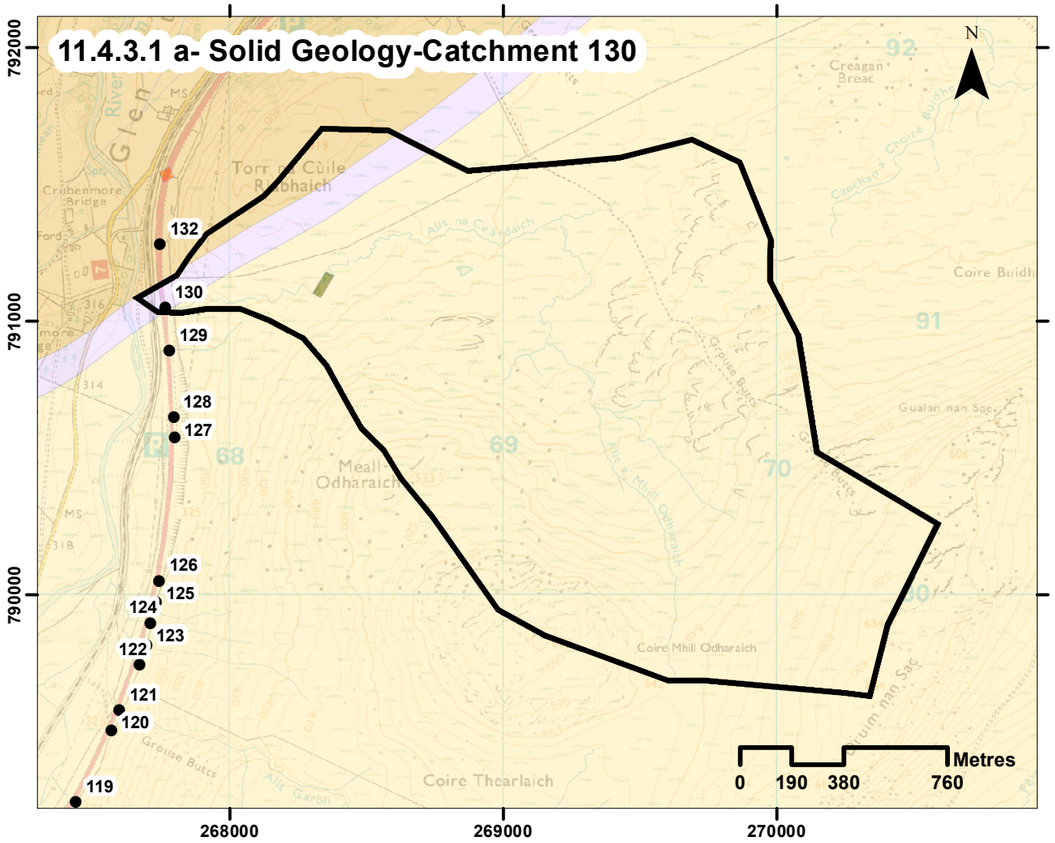
Photograph 11.4.3.145 – Upstream- Steep catchment

Photograph 11.4.3.146- Catchment looking south

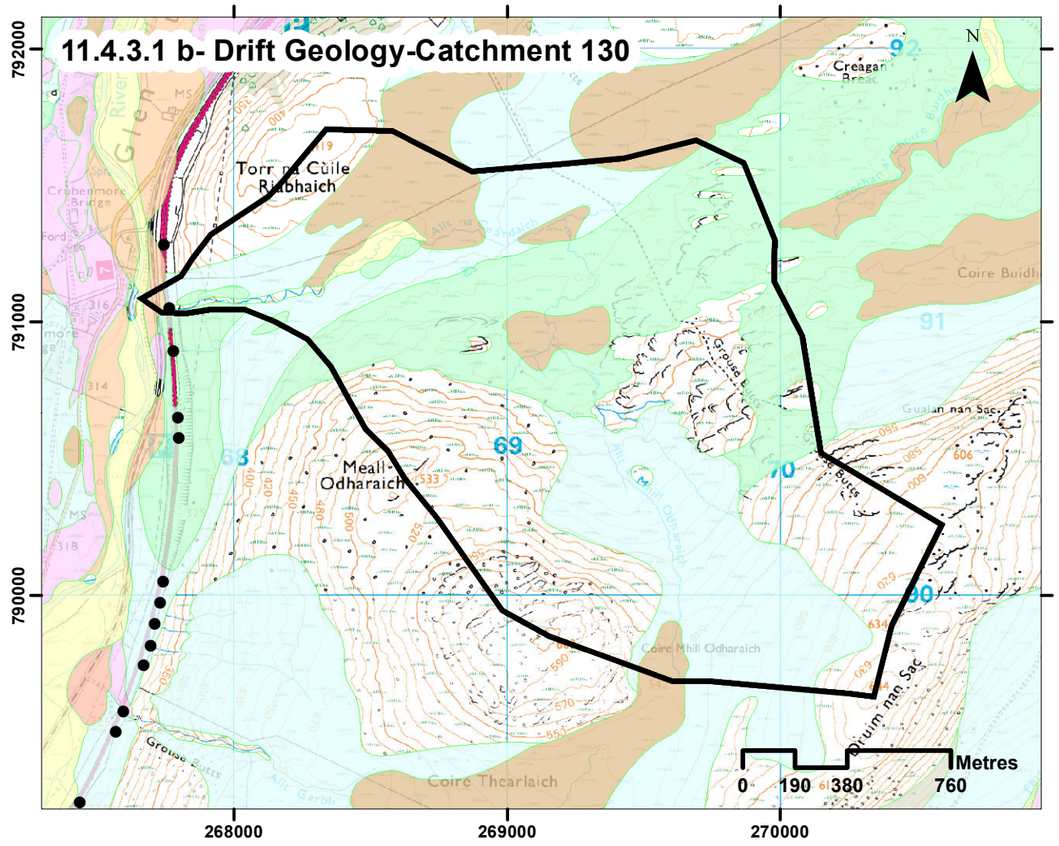


Photograph 11.4.3.147- Catchment

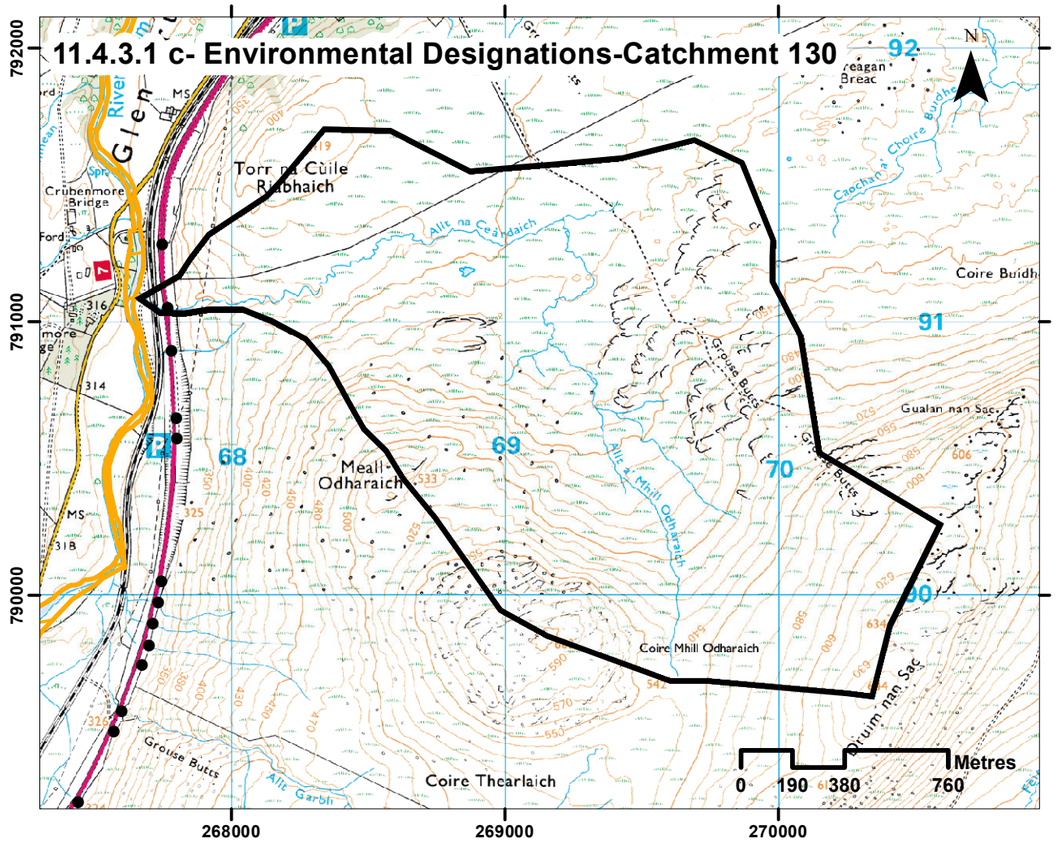
11.4.3.1 a- Solid Geology-Catchment 130



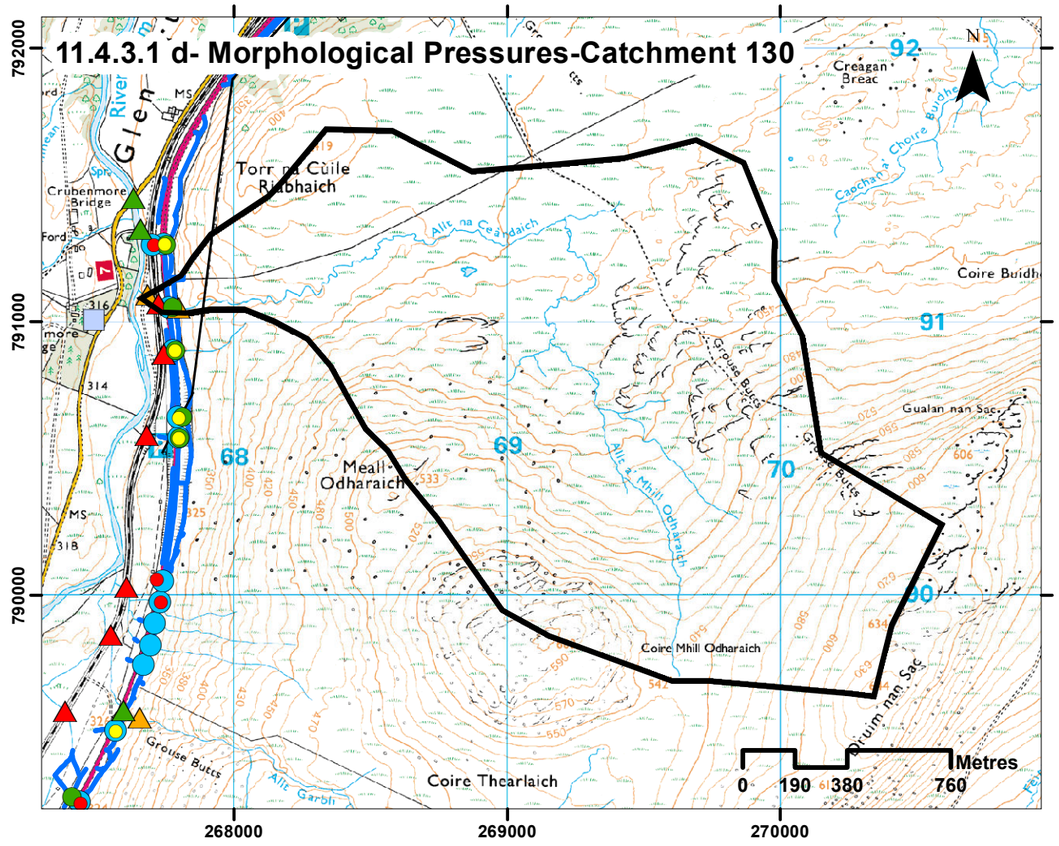
11.4.3.1 b- Drift Geology-Catchment 130



11.4.3.1 c- Environmental Designations-Catchment 130



11.4.3.1 d- Morphological Pressures-Catchment 130



Legend

General

- Crossing Location
- Catchment Area

Solid Geology

- Falls Of Phones Semipelite Formation - Semipelite, Gneissose
- Gaick Psammite Formation - Psammite
- Loch Laggan Psammite Formation - Psammite, Micaceous
- Scottish Highland Siluro-Devonian Calc-Alkaline Minor Intrusion Suite-Lamprophyres

Drift Geology

- Peat
- Glaciofluvial Ice Contact Deposits
- Gaick Plateau Moraine Formation
- Hummocky Glacial Deposits
- Ardverikie Till Formation - Diamicton
- Glaciofluvial Sheet Deposits
- Alluvium
- River Terrace Deposits
- Alluvial Fan Deposits
- Head
- Talus - Rock Fragments
- Talus Cone

Environmental Designations

- Special Area of Conservation

Morphological Pressures

- Railway Bridge
- Road Bridge
- Track/Footbridge
- Culvert
- Cascade
- Step in Bed
- Catchpit
- Abstraction Location
- Drainage Ditch
- Power Lines

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TRANSPORT SCOTLAND CONBHAIG ALBA

A9 DUALLING PERTH TO INVERNESS Dalwhinnie to Crubenmore

PROJECT 8 DALWHINNIE TO CRUBENMORE EIA

Drawing 11.4.3.1 Catchment 130 Catchment Overview

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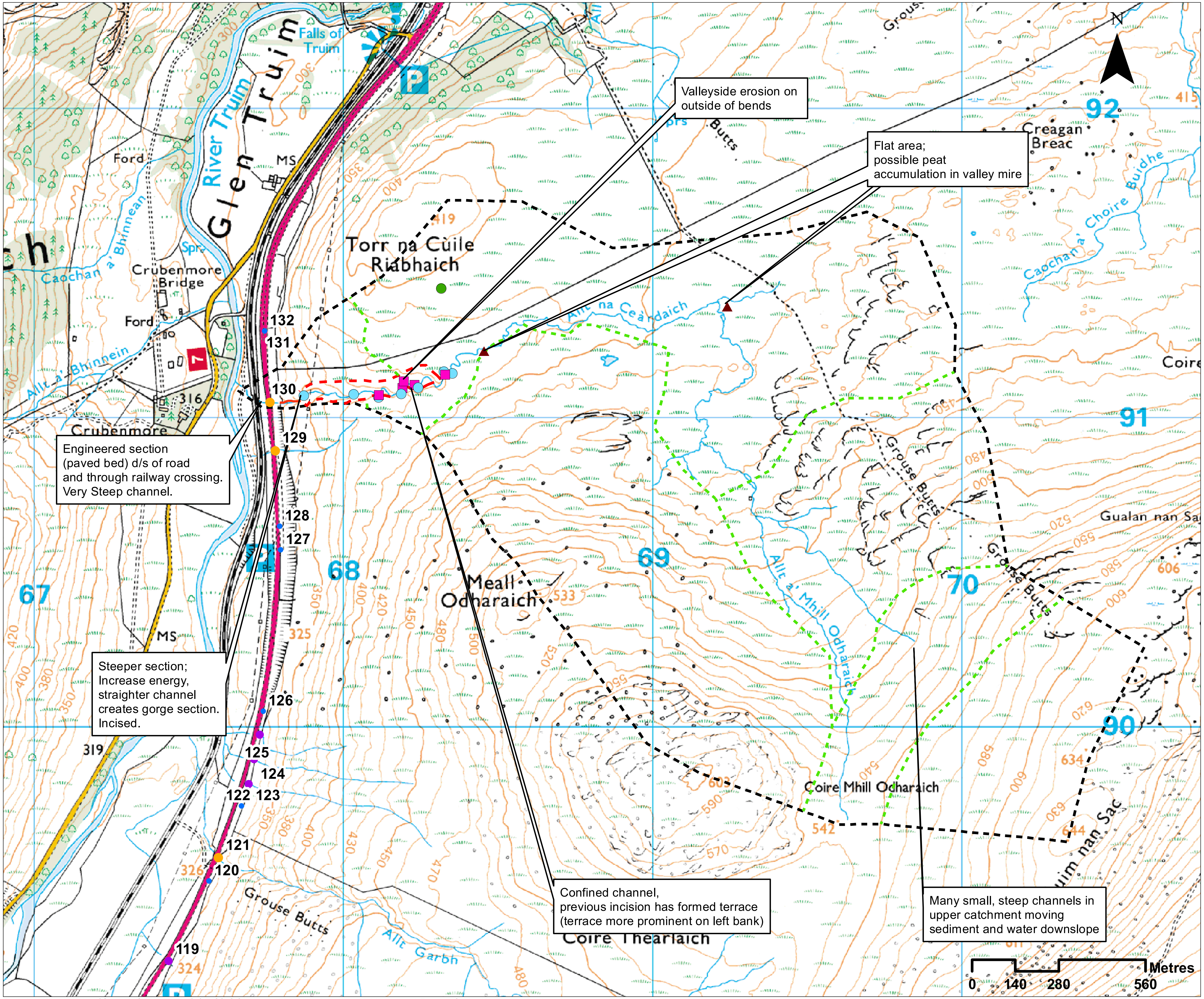

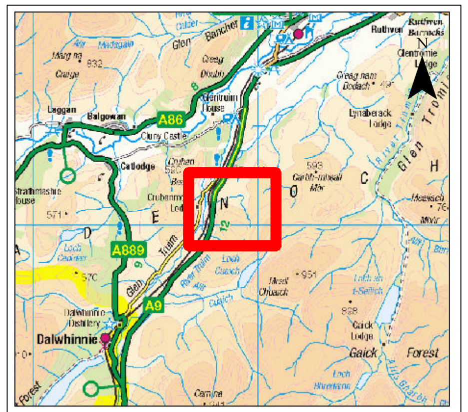

Legend

- Major crossing
- Minor crossing
- Other crossing
- Peat
- Debris flow
- Valley side erosion
- Unvegetated bar
- Break in slope
- Terrace
- Incision
- Crossing catchment

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TRANSPORT SCOTLAND — A9 DUALLING PERTH TO INVERNESS

PROJECT 8 DALWHINNIE TO CRUBENMORE EIA

DRAWING 11.4.3.2.
Catchment 130 Baseline Assessment

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DWG: A9P08-CFJ-EWE-X_ZZZZZ_ZZ-DR-EN-0002

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Annex 11.4.3 - Hydromorphological Catchment Assessment - Truim

Catchment No. / Catchment Name	Truim

Channel Nature	Nature of water course	Natural
	Size of water course	Major

Quantitative Spatial Elements	Catchment Area (km^2)	131
	Average slope in catchment (°)	
	% Catchment over 750m (for snow melt risk)	

WFD classification	Water, flows and levels	Good
	Physical condition	Good
	Overall ecological status	Good (River Truim from source to Allt Cuaich) Moderate (River Truim-lower catchment)

Geology	Majority Bedrock (see Drawing 11.4.3.1 a and b Catchment Truim)	Gaick Psammite formation-Psammite	resistant to weathering, impermeable
	Is an alluvial fan present at or near the crossing?	N/A	

Environmental designations (see Drawing 11.4.3.1 c, Catchment Truim)	Ramsar	No	
	SAC	Yes	**Drumochter Hills** - Acidic scree, alpine and subalpine heaths, blanket bog, dry heaths, montane acid grasslands , mountain willow scrub, plants in crevices on acid rocks, species-rich grassland with mat-grass in upland areas, tall herb communities, wet heathland with cross-leaved heath. **River Spey** - Atlantic salmon, freshwater pearl mussel, otter, sea lamprey
	SPA	Yes	**Drumochter Hills -** Dotterel breeding, merlin breeding
	SSSI	Yes	**Drumochter Hills -** Breeding bird assemblage, **fluvial geomorphology of Scotland**, montane assemblage, vascular plant assemblage

Sediment source and supply - Catchment Scale	Changes in slope and channel confinement	See Drawing 11.4.3.2, Catchment Truim	
	Is peat present in the catchment	Yes	
	Is there a bog burst risk	Yes	Within catchment, but not with a direct impact on the Truim
	Current valley side or terrace erosion	Yes	
	Potential valley side or terrace erosion	Yes	
	Hill slope failures (including peat slides and debris flows and slides)	Yes	
	Hill slope failures coupled to channel	Yes	
	Vertical incision present in catchment	Yes	
	Bank erosion/lateral migration	Yes	Currently impacting on the road
	Unvegetated bars	Yes	Through main channel
	Wooded/forested areas in catchment	Yes	
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment Truim)	There are extensive sediment sources within the Truim catchment, fro the steep slopes and these are delivered to the Truim from the steep tributaries. Some of this supply is currently reduced getting to the Truim by the undersized culverts, catchment pits etc. that form the A9, and by the SSE and Hydro power scheme.	

Morphology and Process	Channel morphology	Wandering	Varied channel form and process, typical of the river type
	Predominant sediment size	Gravels	
	Unvegetated bars	Yes	
	Vertical incision	Medium	
	Deposition	High	
	Lateral migration/bank erosion	High	At time at or close to the toe of the road embankment and railway embankment
	Presence and nature of infrastructure (Map 1d)	Railway and Road, several bridges and culverts over tributaries. Aqueduct taking flow from catchment	
	Impact of infrastructure	Altering discharge and sediment inputs to the Truim, casing a change in the natural process, including channel narrowing	
	Channel realignment	Yes	Between the road and the railway in several locations

Infrastructure type (see Drawing 11.4.3.1 d, Catchment Truim)

Summary behaviour	The Truim is an active channel, migrating laterally across its flood plain, however it has a number of pressures that are limiting the rate of this natural change. 22% of the River Truim catchment is regulated by a hydropower scheme initiated in the 1930's, and extended in the 1940's and 50's with most of the water abstracted going into Loch Ericht in the Tay catchment. Loch an t-Seilich has a compensation flow of 1.263m3/s released continuously down through the fish pass on the dam, with flows above this diverted to Loch Cuaich or spilled, and a flow of 0.684m3/s is released continuously down the Truim at Dalwhinnie through the fish pass on the intake (Enviro Centre, 2008). All of the bed load is trapped behind the diversion dams has historically been removed for the river system and stockpiled (Gilvear, 2004). As well as the Hydropower scheme the flow and sediment supply of the Truim are also impacted by the tributary crossings of the A9 and the Railway, where these are undersized and reducing flow and sediment supply to the main channel. There are also areas of bank protection along the channel to protect the railway and road embankments from erosion, as well as locations where bank protection may be required in the near future. Despite these pressures the morphology of the channel is varied and as expected for a channel of this type. There is little bank protection fixing the channel, and there is good channel floodplain connectivity.

Infrastructure type (see Drawing 11.4.3.1 d, Catchment Truim)

River Spey SAC

Drumochter Hills- SAC, SPA and SSSI

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Legend

- Crossing catchment

Environmental Designations

- Special Site of Scientific Interest
- Special Area of Conservation
- Special Protection Area

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TRANSPORT SCOTLAND

A9 DUALLING PERTH TO INVERNESS Dalwhinnie to Crubenmore

PROJECT 8 DALWHINNIE TO CRUBENMORE EIA

Drawing 11.4.3.1b Truim Solid Geology

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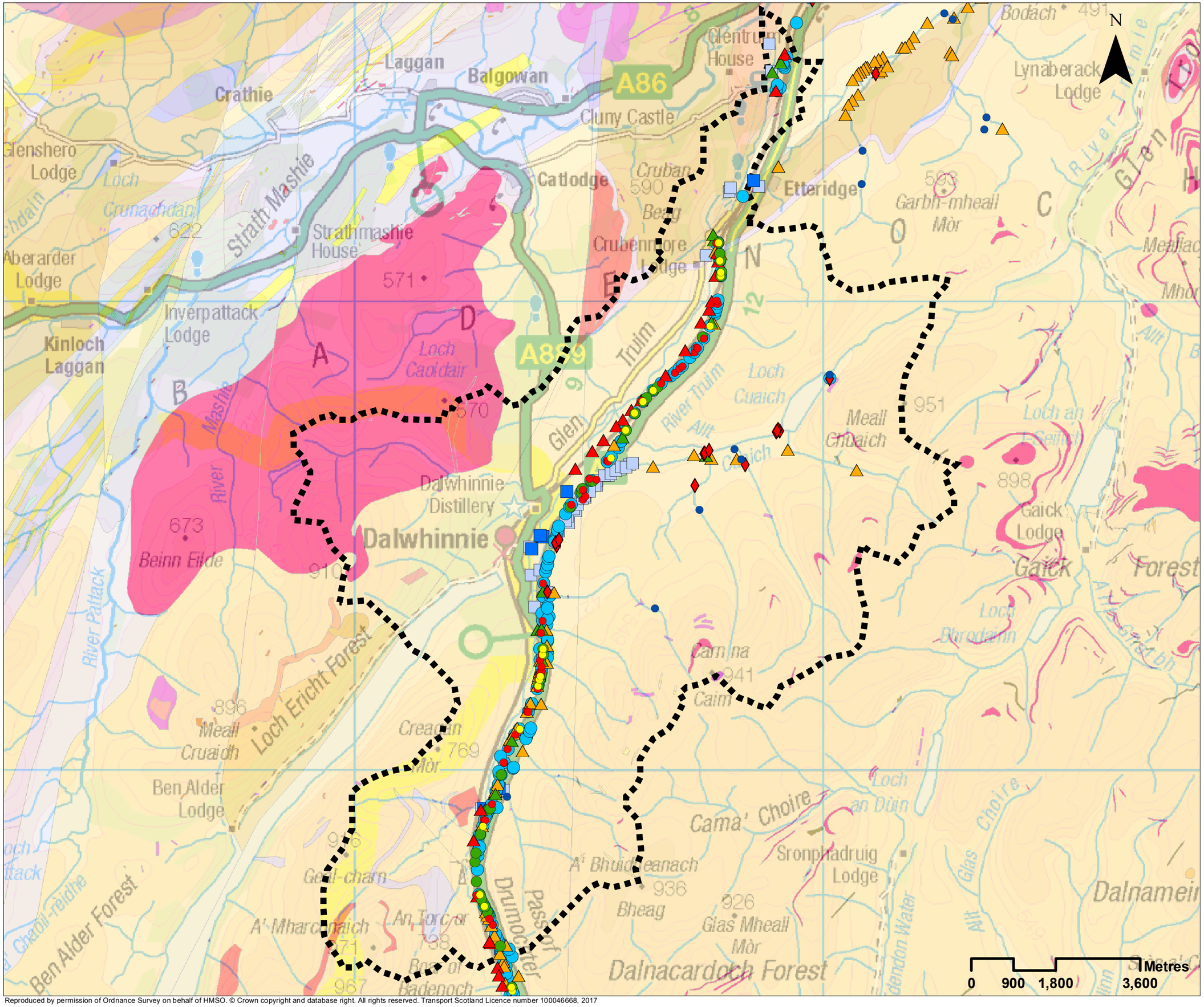

Legend

- Railway Bridge
- Road Bridge
- Track/Footbridge
- Culvert
- Cascade
- Step in Bed
- Catchpit
- Ford
- Dam or Weir
- Discharge Location
- Abstraction Location
- Crossing catchment

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Drawing 11.4.3.1b Truim Solid Geology

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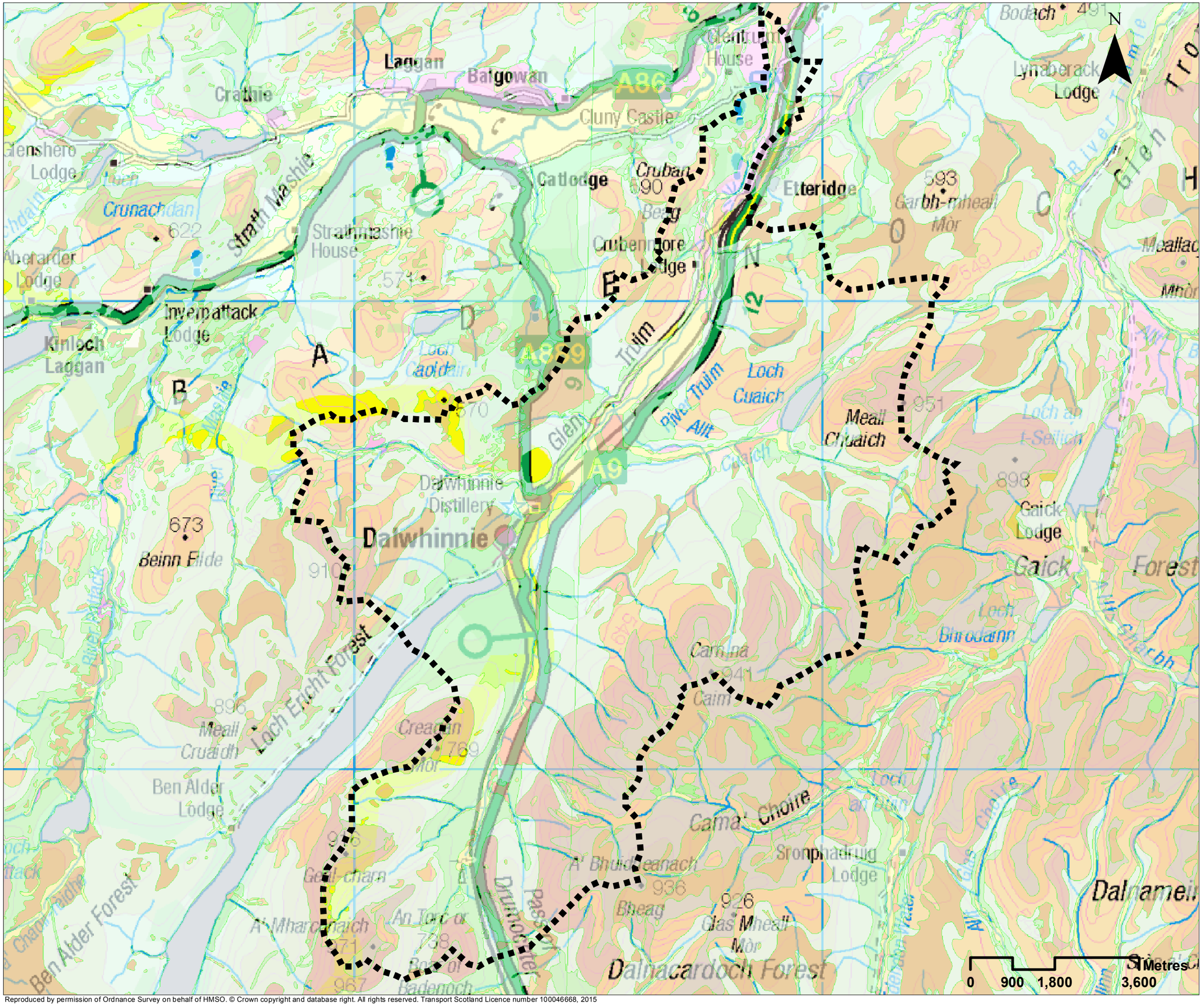

Legend

Crossing catchment

Drift Geology

- Peat
- Glaciofluvial Ice Contact Deposits
- Gaick Plateau Moraine Formation
- Hummocky Glacial Deposits
- Ardverikie Till Formation - Diamicton
- Glaciofluvial Sheet Deposits
- Alluvium
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- Head
- Talus - Rock Fragments
- Talus Cone

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TRANSPORT SCOTLAND

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Drawing 11.4.3.1b Truim Solid Geology

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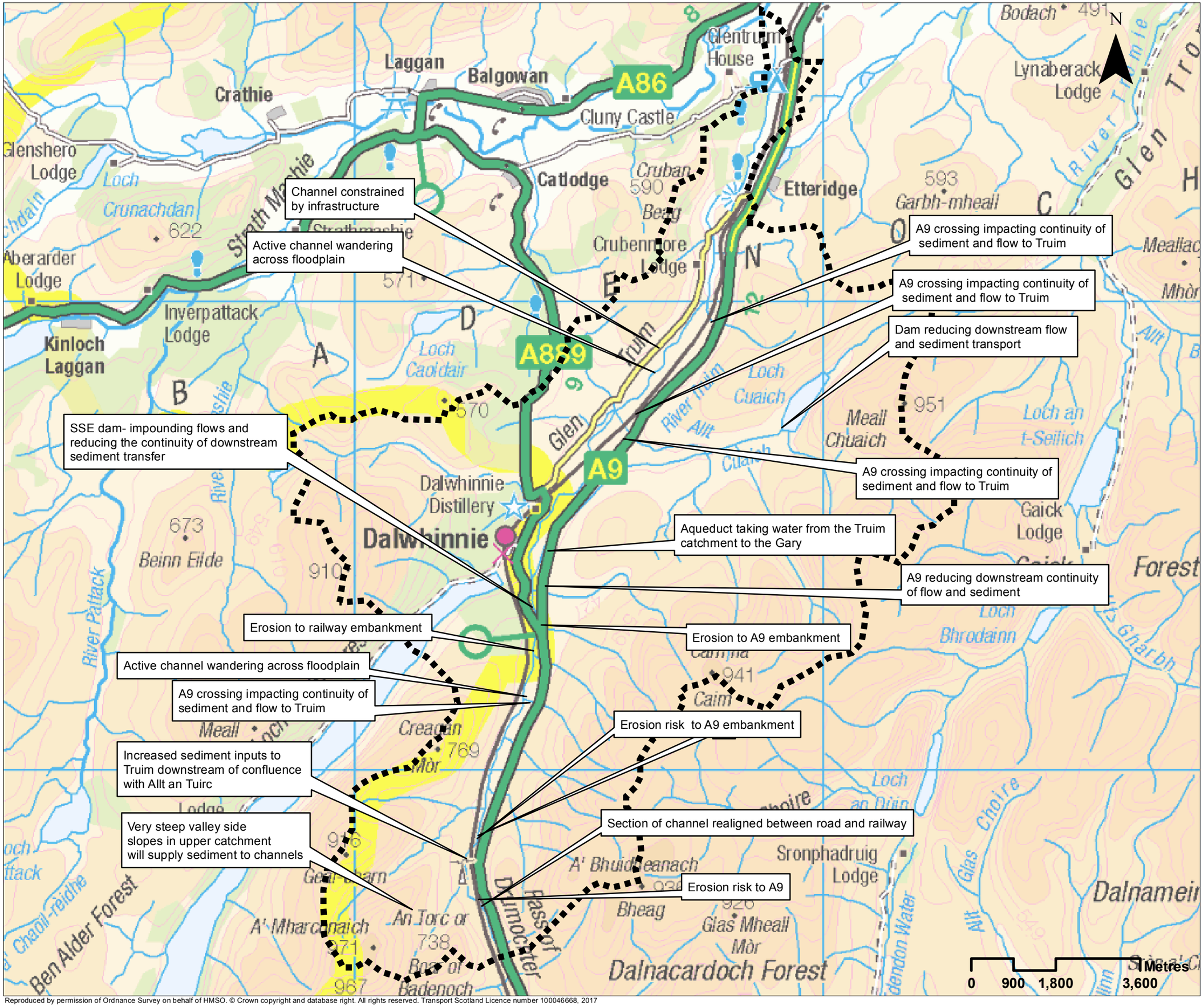

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Catchment

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DRAWING 11.4.3.2.
River Truim Baseline Assessment

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