Appendix 11.4

Hydromorphology Assessment Part 2

Annex 11.4.4 Hydromorphology Catchment Baselines

Annex 11.4.3 - Hydromorphological Catchment Assessment - -3

Catchment No.	**-3**
Catchment Name	**-**

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

Quantitative Spatial Elements	Catchment Area (km^2)	1.04
	Average slope in catchment (°)	10.3
	% Catchment over 750m (for snow melt risk)	12

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

Geology	Majority Bedrock (see Drawing 11.4.3.1 a and b Catchment -3)	Gaick Psammite formation-Psammite	Resistant to weathering, impermeable
	Is an alluvial fan present at or near the crossing	No	

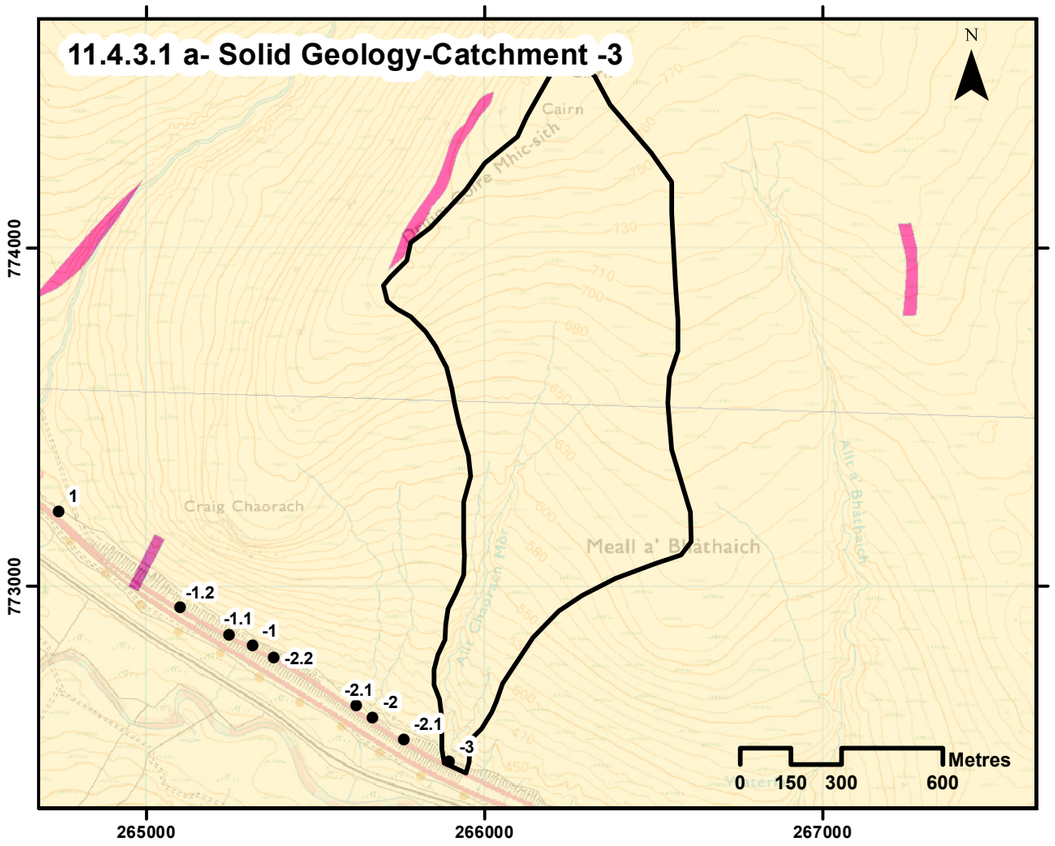
Environmental designations (see Drawing 11.4.3.1 c, Catchment -3)	Ramsar	None	
	SAC	None	
	SPA	None	
	SSSI	None	

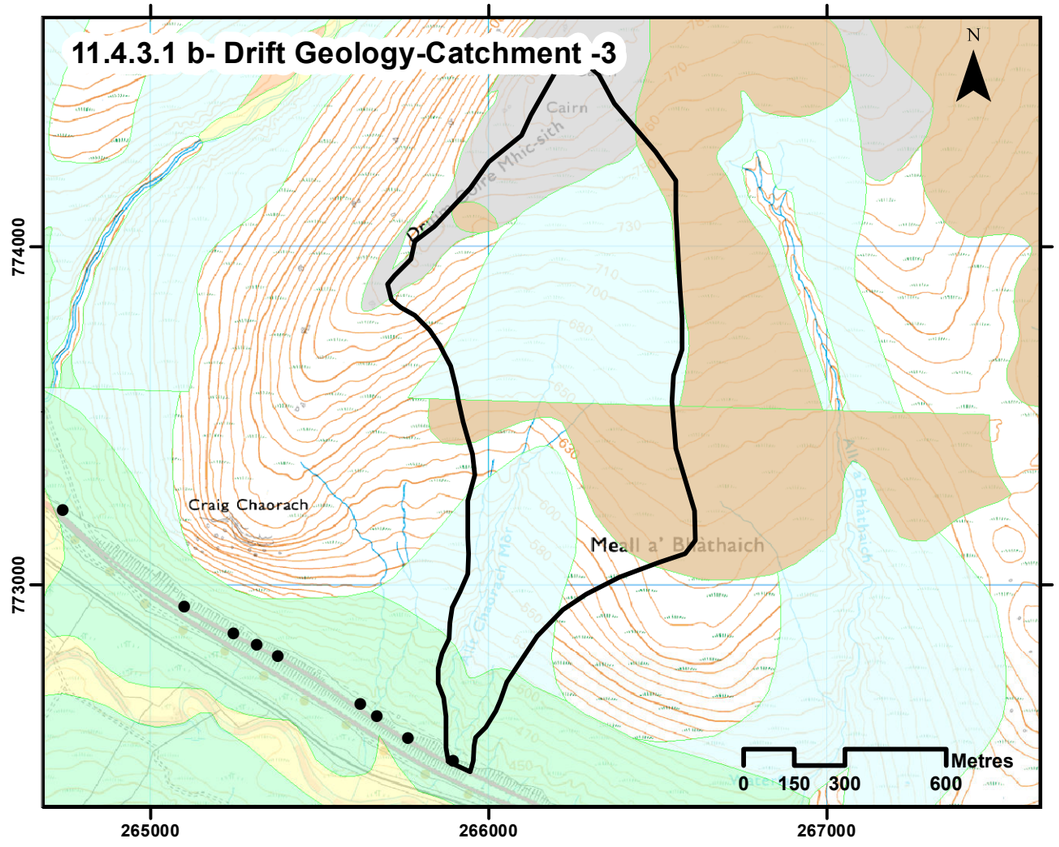
Sediment source and supply - Catchment Scale	Changes in slope and channel confinement	See Figure 11.4.3.2 - steep catchment, confined channel and no floodplain, funnel sediment downstream, deposition occurring near crossing	
	Is peat present in the catchment?	Yes	In middle section of catchment
	Is there a bog burst risk?	Yes	Low likelihood of occurrence but possible from peat in middle section of catchment. If it does occur, steep catchment indicates high likelihood of it reaching the crossing
	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	In lower catchment
	Hill slope failures coupled to channel	Yes	
	Vertical incision present in catchment	Yes	Likely sediment supply from incision in catchment
	Bank erosion/lateral migration	Yes	Minor
	Unvegetated bars	Yes	Particularly in lower catchment
	Wooded/forested areas in catchment	No	
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment -3)	Road crossing, Masonry railway bridge.	Some incision Fixing bed and bank positions
	Comment on sediment source potential in catchment	Steep slopes have potential to generate sediment, and currently show signs of valley erosion and slope failures in lower catchment. High potential for valley side erosion close to crossing due to confined nature of channel	
	Comment on sediment supply potential to crossing	Steep confined channel will quickly transport sediment to the crossing	

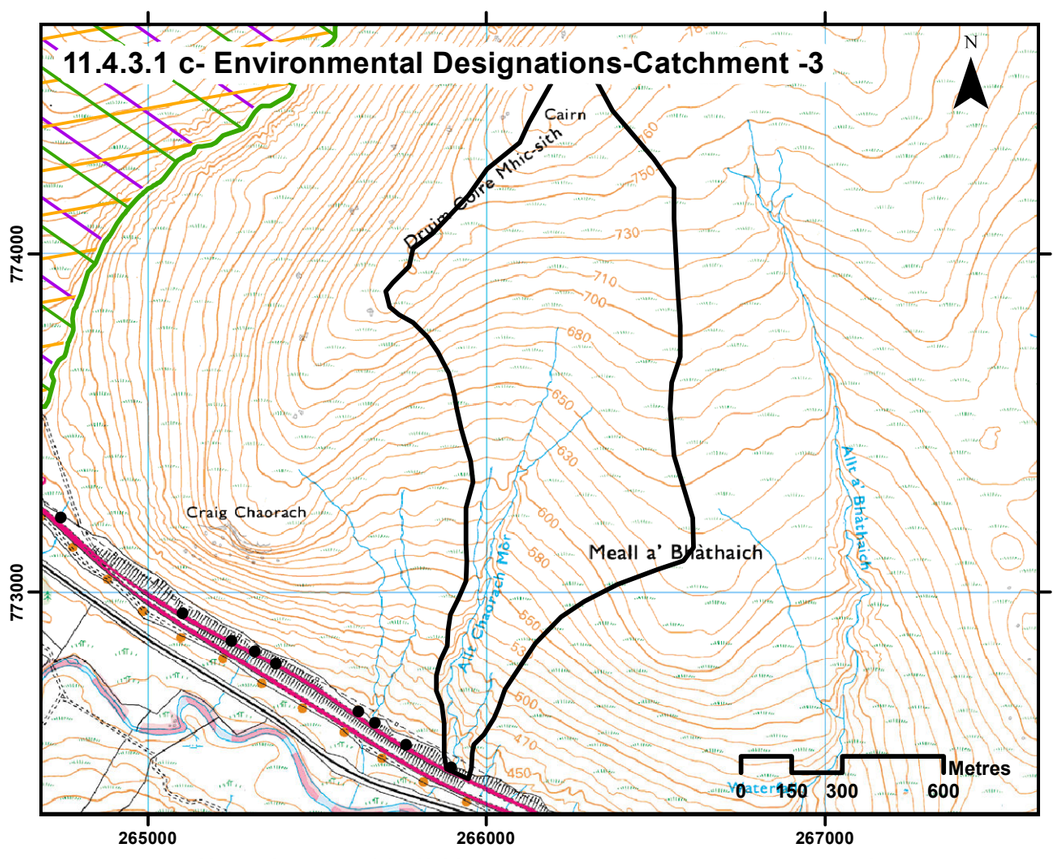
Morphology and Process- Reach upstream of crossing	Channel morphology	Cascade	
	Predominant sediment size	Boulder and cobble	
	Unvegetated bars	Yes	
	Vertical incision	High	
	Deposition	High	High sediment supply from valley erosion and hillside failures, much carried downstream to crossing where deposition is greater
	Lateral migration/bank erosion	Medium	Due to vertical incision
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment -3)	180mm concrete road drainage pipe.	
	Impact of infrastructure	Some incision. Fixing bed and bank positions	
	Channel realignment	No	

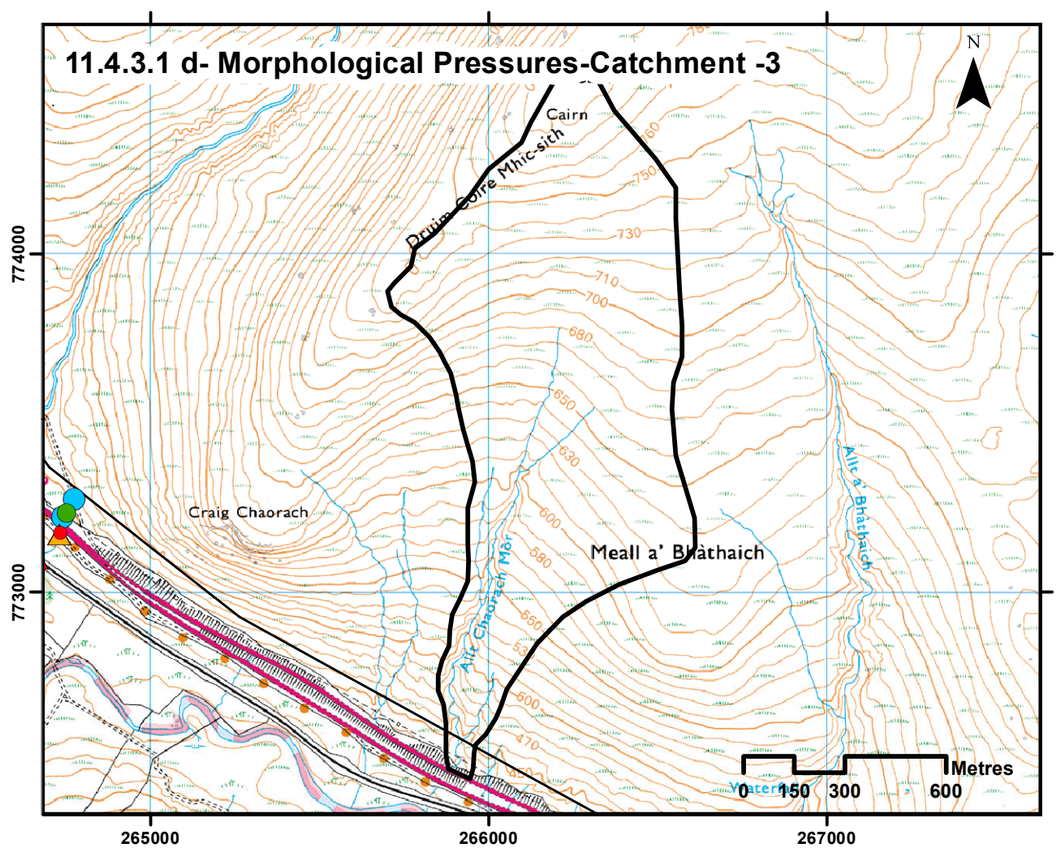
Morphology and Process- At crossing	Channel morphology	Engineered	
	Predominant sediment size	Cobbles and boulders	
	Estimated discharge at 1:200 event (m^3/s)	5.91	
	Unvegetated bars	Yes	
	Vertical incision	Medium	
	Deposition	High	High sediment supply from valley erosion and hillside failures, much carried downstream to crossing where deposition is greater
	Lateral migration/bank erosion	Medium	Due to incision
	Damaged/unstable drains or armouring	No	

Morphology and Process- Reach downstream of crossing	Channel morphology	Plane bed	
	Predominant sediment size	Cobbles and boulders	
	Unvegetated bars	Yes	
	Vertical incision	Low	
	Deposition	High	High deposition upstream and particularly downstream of masonry bridge
	Lateral migration/bank erosion	Low	
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment -3)	Railway crossing masonry bridge, banks and stone block channel (Highland Mainline). Concrete box culvert, headwalls and sidewalls and concrete channel through culvert (road crossing downstream)	
	Impact of infrastructure	Fixing bed level and bank positions	
	Channel realignment	Yes	Straightened upstream of railway crossing
Summary behaviour	High sediment supply of cobbles and boulders from catchment by hillside failures, erosion and vertical incision. The catchment is steep and confined, funnelling sediment downstream, depositing in bars where slope reduces. This currently leaves unvegetated bars close to the crossing with the potential to be mobilized downstream during high flows. Deposition appears greatest both just upstream of the crossing and downstream of the crossing near the HML railway bridge. Bars increase potential of lateral and vertical movement. Catchment susceptible to flashy floods due to snowmelt. There is a high supply of sediment as much of the channel flows through highly erodible hummocky glacial deposits into which the channel has incised. The culvert crossing and armouring appear stable.		









Legend

General
- Crossing Location
- Crossing Catchment

Solid Geology
- Gaick Psammite Formation - Psammite
- North Britain Siluro-Devonian Calc-Alkaline Dyke Suite - Microdiorite

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

Morphological Pressures
- Railway Bridge
- Track/Footbridge
- Culvert
- Cascade
- Step in Bed
- Power Lines

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TRANSPORT SCOTLAND
A9 DUALLING PERTH TO INVERNESS Glen Garry to Dalwhinnie

PROJECT 7 GLEN GARRY TO DALWHINNIE

Drawing 11.4.3.1 Catchment -3 Catchment Overview

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

DATE: 18/07/2017

PROJ: 495298

DWG: A9P07-CFJ-EWE-Z_ZZZZZ_ZZ-DR-EN-0001

SHEET:	REVISION:	SUITABILITY:
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Annex 11.4.3 - Hydromorphological Catchment Assessment - -2

Catchment No.	**-2**
Catchment Name	-

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

Quantitative Spatial Elements	Catchment Area (km^2)	0.25
	Average slope in catchment (°)	13
	% Catchment over 750m (for snow melt risk)	0

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

Geology	Majority Bedrock (see Drawing 11.4.3.1 a and b Catchment -2)	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 -2)	Ramsar	None	
	SAC	None	
	SPA	None	
	SSSI	None	

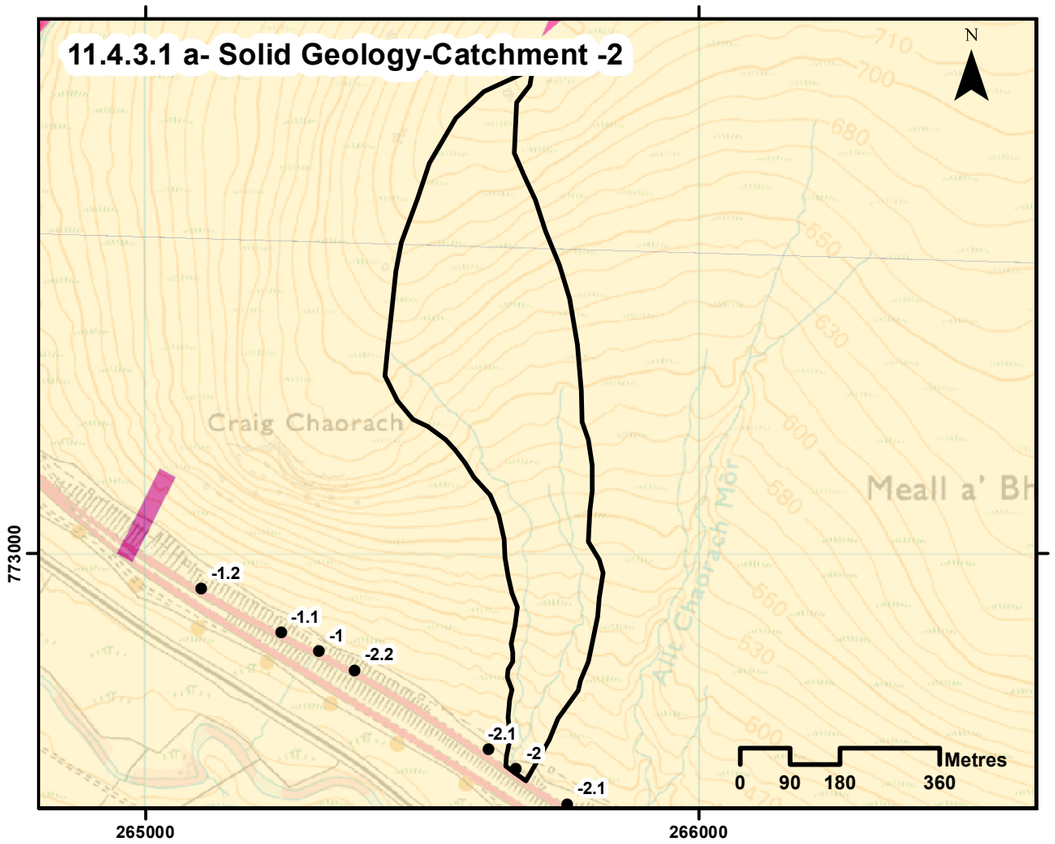
Sediment source and supply - Catchment Scale	Changes in slope and channel confinement	See Figure 11.4.3.2 - steep catchment, confined channel and no floodplain, funnel sediment downstream, high deposition near crossing	
	Is peat present in the catchment?	No	
	Is there a bog burst risk?	No	
	Current valley side or terrace erosion	Yes	Particularly in lower catchment
	Potential valley side or terrace erosion	Yes	
	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	Some potential sediment supply from incision in catchment, in hummocky glacial deposits
	Bank erosion/lateral migration	Yes	Due to incision
	Unvegetated bars	Yes	Particularly in lower catchment
	Wooded/forested areas in catchment	No	
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment -2)	Culvert for road crossing and Highland Mainline railway crossing	Some incision Fixing bed and bank positions
	Comment on sediment source potential in catchment	Medium source potential from incision of channels upstream of crossing	
	Comment on sediment supply potential to crossing	High supply potential (due to steep slope) to crossing if slope failure or excessive erosion were to occur	

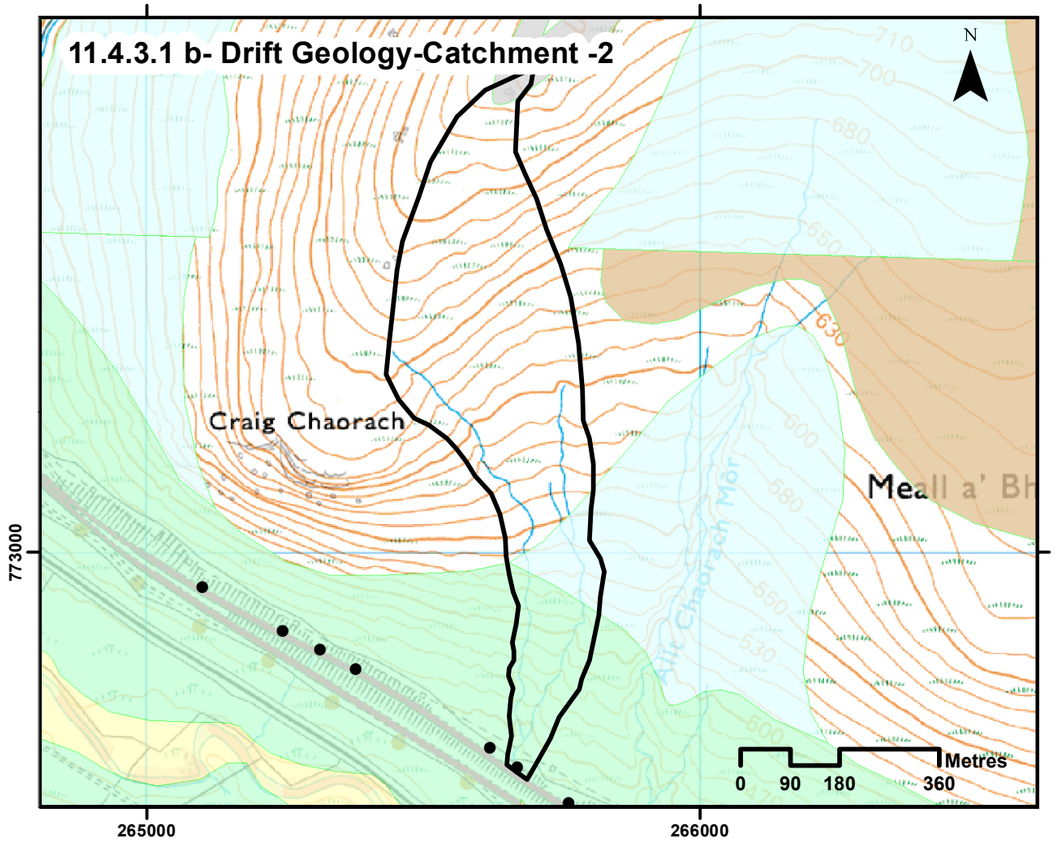
Morphology and Process- Reach upstream of crossing	Channel morphology	Cascade	
	Predominant sediment size	Cobbles and boulder	
	Unvegetated bars	Yes	
	Vertical incision	High	
	Deposition	High	High sediment supply from valley erosion, much carried downstream to before crossing where deposition is greater
	Lateral migration/bank erosion	Medium	Due to vertical incision
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment -2)	None	
	Impact of infrastructure	None	
	Channel realignment	Yes	Masonry sidewalls at box culvert, concrete lined channel. Large upstream step in channel with rectangular notch cut

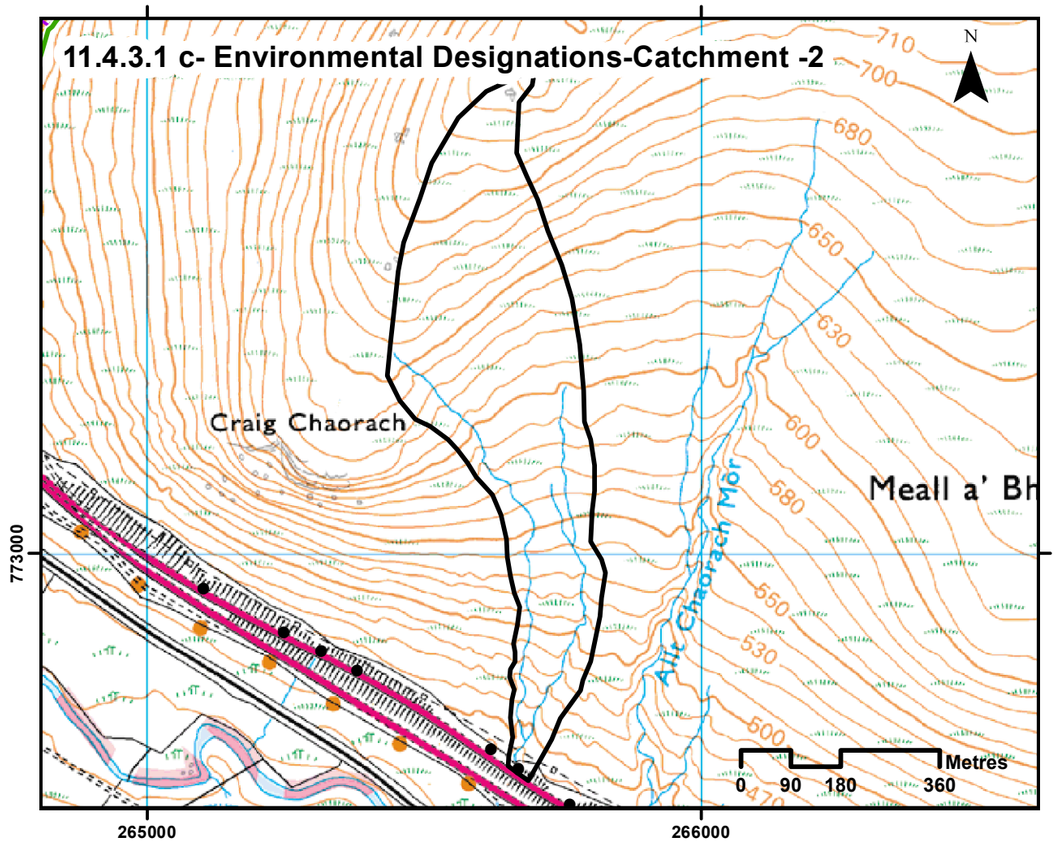
Morphology and Process- At crossing	Channel morphology	Engineered	
	Predominant sediment size	Cobbles and boulders	
	Estimated discharge at 1:200 event (m^3/s)	3.54	
	Unvegetated bars	No	
	Vertical incision	None	Concrete lined channel
	Deposition	None	Sediment appears to be transported downstream, also trapped behind large concrete step in channel.
	Lateral migration/bank erosion	None	Box culvert crossing, concrete lined and masonry sidewalls
	Damaged/unstable drains or armouring	No	

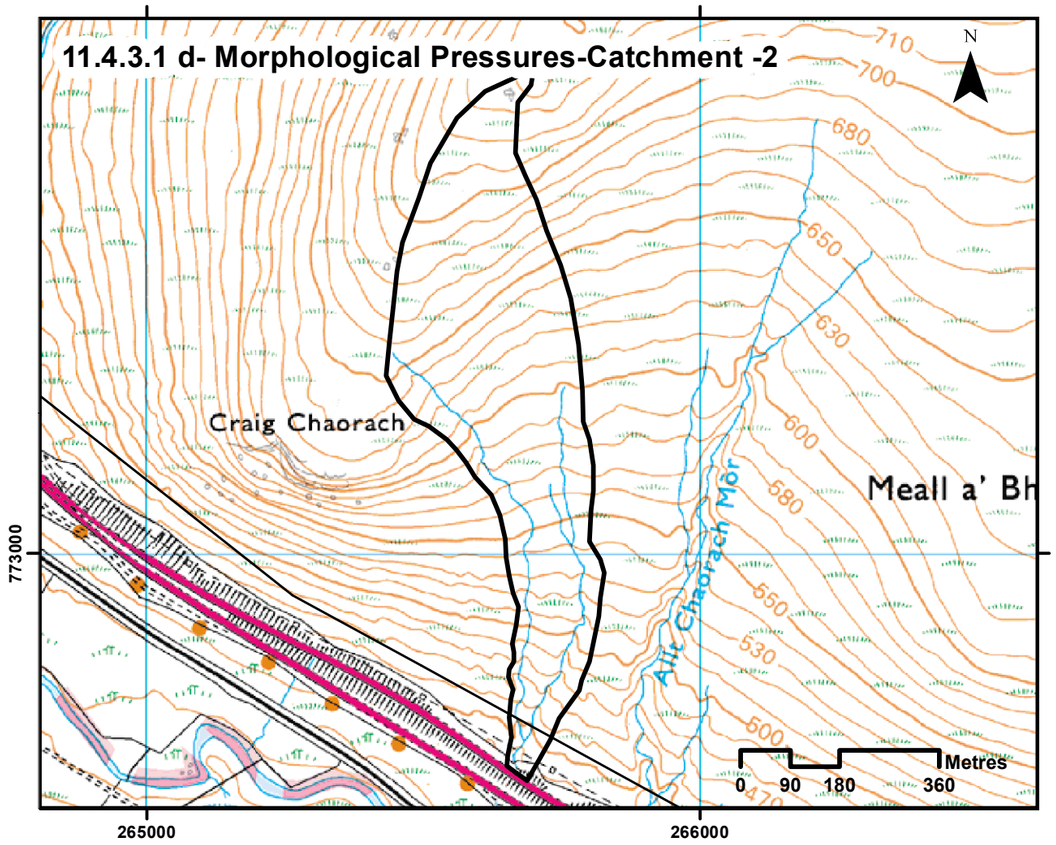
Morphology and Process- Reach downstream of crossing	Channel morphology	Plane bed	
	Predominant sediment size	Cobbles and boulders	
	Unvegetated bars	Yes	Downstream of masonry culvert for rail crossing
	Vertical incision	Low	Concrete slab channel and stone/cobble bank
	Deposition	Medium	Sediment appears to be transported downstream beyond road crossing and is highest at masonry railway crossing
	Lateral migration/bank erosion	None	Gabion baskets at HML culvert, stone and cobble bank
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment -2)	Railway crossing NMV crossing (bridge), footbridge, drainage pipe	
	Impact of infrastructure	Fixing bank positions, potential higher discharge downstream of pipe	
	Channel realignment	Yes	Straightened downstream of culvert

Summary behaviour	High sediment supply from catchment by valley erosion and vertical incision. The catchment is steep and confined, funnelling sediment downstream, depositing in bars where slope reduces. This currently leaves unvegetated bars close to the crossing with the potential to be mobilised downstream during high flows. Deposition appears greatest both just upstream of the crossing and downstream of the crossing near the HML railway bridge. Bars increase potential of lateral and vertical movement downstream. Sediment appears trapped at the large upstream step in the channel in which there is a rectangular notch, leaving the road crossing culvert entrance generally clear of sediment. There is a high supply of sediment as much of the channel flows through highly erodible hummocky glacial deposits into which the channel has incised. The culvert crossing and armouring appear stable.









Legend

General
- Crossing location
- Crossing catchment

Solid Geology
- Gaick Psammite Formation - Psammite
- North Britain Siluro-Devonian Calc-Alkaline Dyke Suite - Microdiorite

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

Morphological Pressures
- Power Lines

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PROJECT 7 GLEN GARRY TO DALWHINNIE

Drawing 11.4.3.1 Catchment -2 Catchment Overview

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Craig Chaorach

Steep, incising channel with no floodplain- will funnel sediment downstream

Deposition of cobbles and formation of unvegetated bars close to crossing

Valley side erosion on steep slopes and incision adding sediment to the channel

Sediment trap upstream of culvert capturing cobbles and boulders

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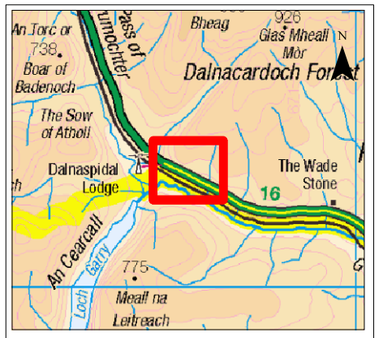

Legend

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

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TRANSPORT SCOTLAND

A9 DUALLING PERTH TO INVERNESS

PROJECT 7 GLEN GARRY TO DALWHINNIE EIA

DRAWING 11.4.3.2. Catchment -2 Baseline Assessment

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DATE: 07/07/2017

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DWG: A9P07-CFJ-EWE-Z_ZZZZZ_ZZ-DR-EN-0002

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1 OF 1	C0	A3

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Annex 11.4.3 - Hydromorphological Catchment Assessment - 1

Catchment No.	**1**
Catchment Name	-

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

Quantitative Spatial Elements	Catchment Area (km^2)	0.17
	Average slope in catchment (°)	17
	% Catchment over 750m (for snow melt risk)	0

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

Geology	Majority Bedrock (see Drawing 11.4.3.1 a and b Catchment 1)	Gaick Psammite formation-Psammite	Resistant to weathering, impermeable
	Is an alluvial fan present at or near the crossing	No	

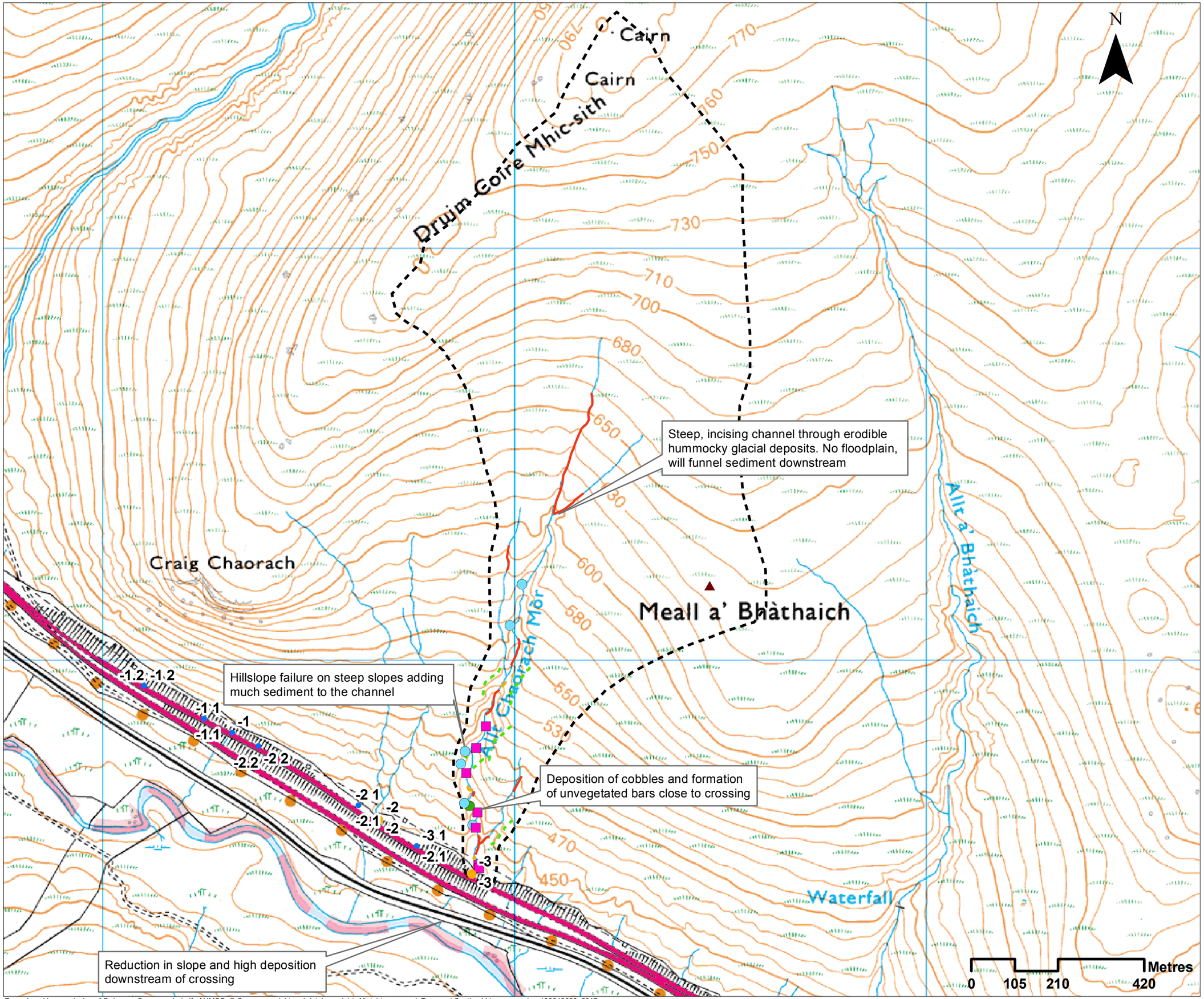
Environmental designations (see Drawing 11.4.3.1 c, Catchment 1)	Ramsar	None	
	SAC	None	
	SPA	None	
	SSSI	None	

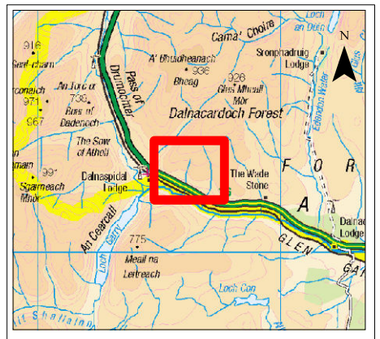
Sediment source and supply - Catchment Scale	Changes in slope and channel confinement	See Drawing 11.4.3.2, Catchment 1	
	Is peat present in the catchment?	No	
	Is there a bog burst risk?	No	
	Current valley side or terrace erosion	No	
	Potential valley side or terrace erosion	No	
	Hill slope failures (including peat slides and debris flows and slides)	No	
	Hill slope failures coupled to channel	No	
	Vertical incision present in catchment	Yes	Some potential sediment supply from incision in catchment
	Bank erosion/lateral migration	No	
	Unvegetated bars	No	
	Wooded/forested areas in catchment	No	
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 1)	Track crossing	Some incision Fixing bed and bank positions
	Comment on sediment source potential in catchment	Low source potential from incision of channels upstream of crossing	
	Comment on sediment supply potential to crossing	High supply potential (due to steep slope) to crossing if slope failure or excessive erosion were to occur	

Morphology and Process- Reach upstream of crossing	Channel morphology	Cascade	
	Predominant sediment size	Cobbles and boulder	
	Unvegetated bars	No	
	Vertical incision	High	
	Deposition	Low	Sediment appears to be transported downstream
	Lateral migration/bank erosion	Medium	Due to vertical incision
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 1)	Culvert where track crosses	
	Impact of infrastructure	Causing incision	
	Channel realignment	Yes	

Morphology and Process- At crossing	Channel morphology	Engineered	
	Predominant sediment size	Cobbles and boulders	
	Estimated discharge at 1:200 event (m^3/s)	0.83	
	Unvegetated bars	No	
	Vertical incision	Medium	
	Deposition	None	Sediment appears to be transported downstream
	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	Cobbles and boulders	
	Unvegetated bars	No	
	Vertical incision	High	
	Deposition	Low	Sediment appears to be transported downstream
	Lateral migration/bank erosion	Low	
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 1)	Railway crossing	
	Impact of infrastructure	Fixing bank positions	
	Channel realignment	Yes	Straightened downstream of railway crossing
Summary behaviour	Channel is vertically unstable and incising, producing and transporting sediment downstream as it adjusts to a more stable bed slope at the crossing and downstream.		





Legend

- Major crossing
- Other crossing
- Peat
- Debris flow
- Valley side erosion
- Unvegetated bar
- Break in slope
- Incision
- Potential valley side erosion
- Valley side erosion
- Crossing Catchment

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PROJECT 7 GLEN GARRY TO DALWHINNIE EIA

DRAWING 11.4.3.2. Catchment -3 Baseline Assessment

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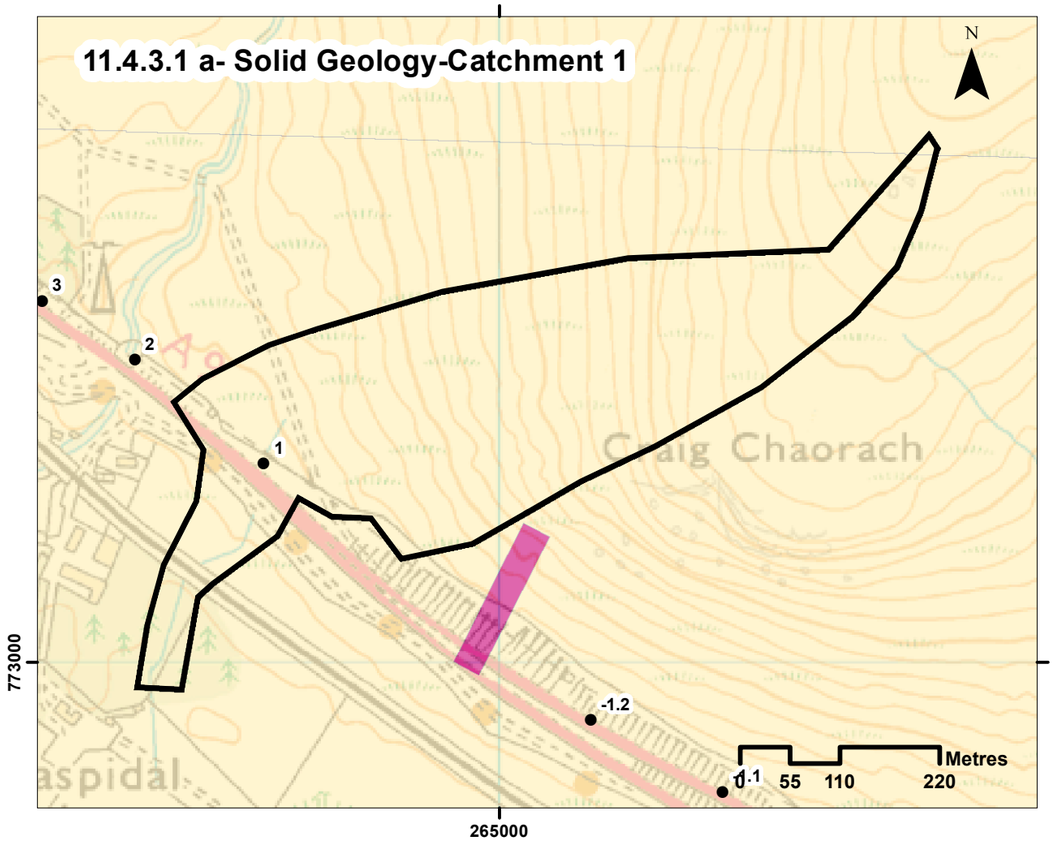
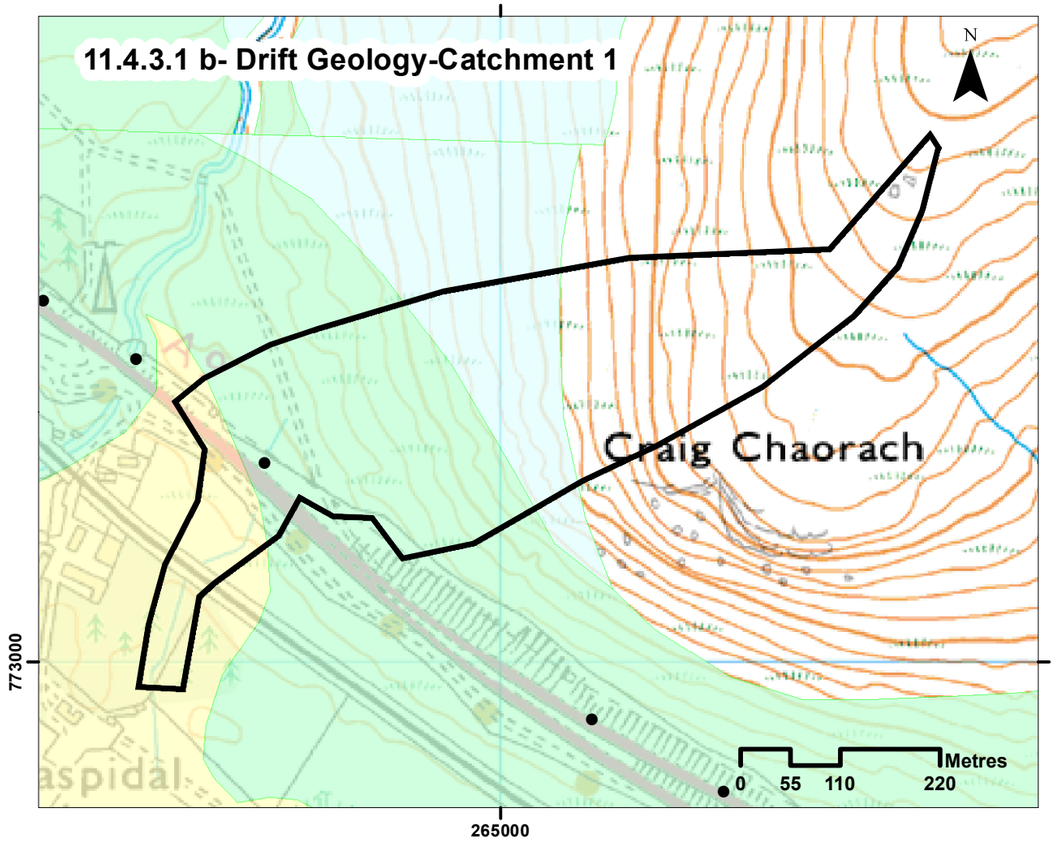
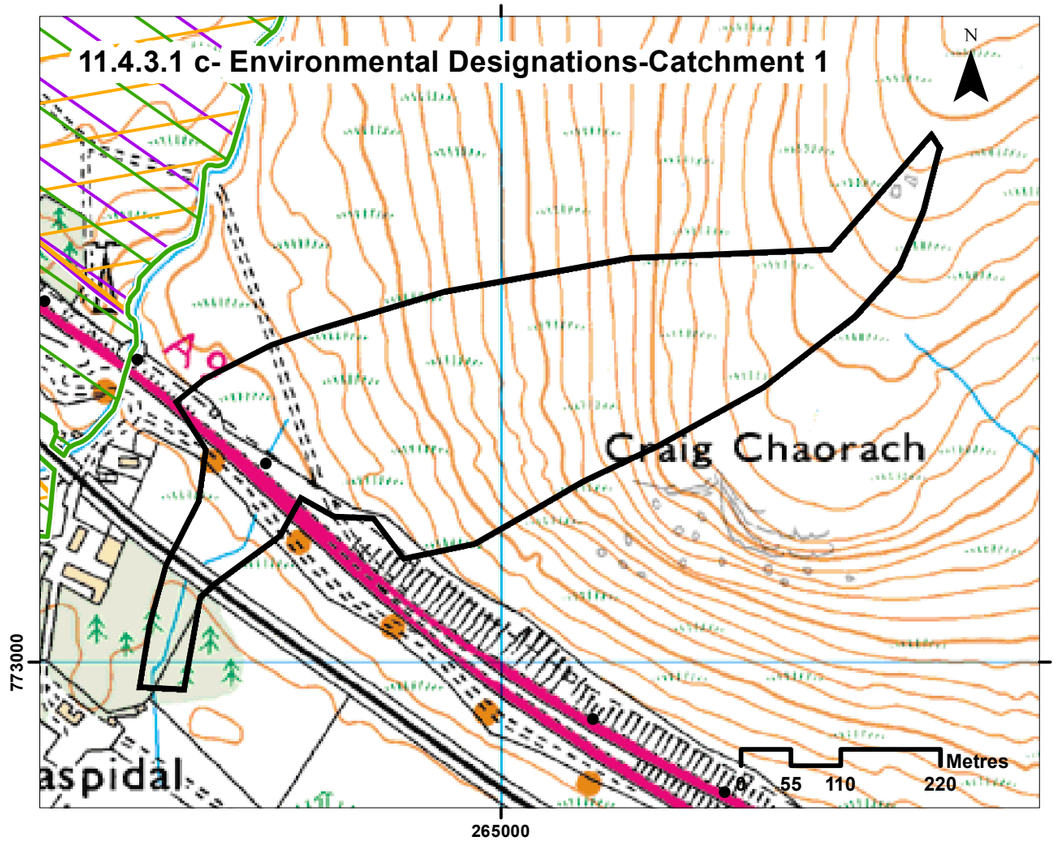
Photograph 11.4.3.1- Erosion upstream of crossing producing excess sediment

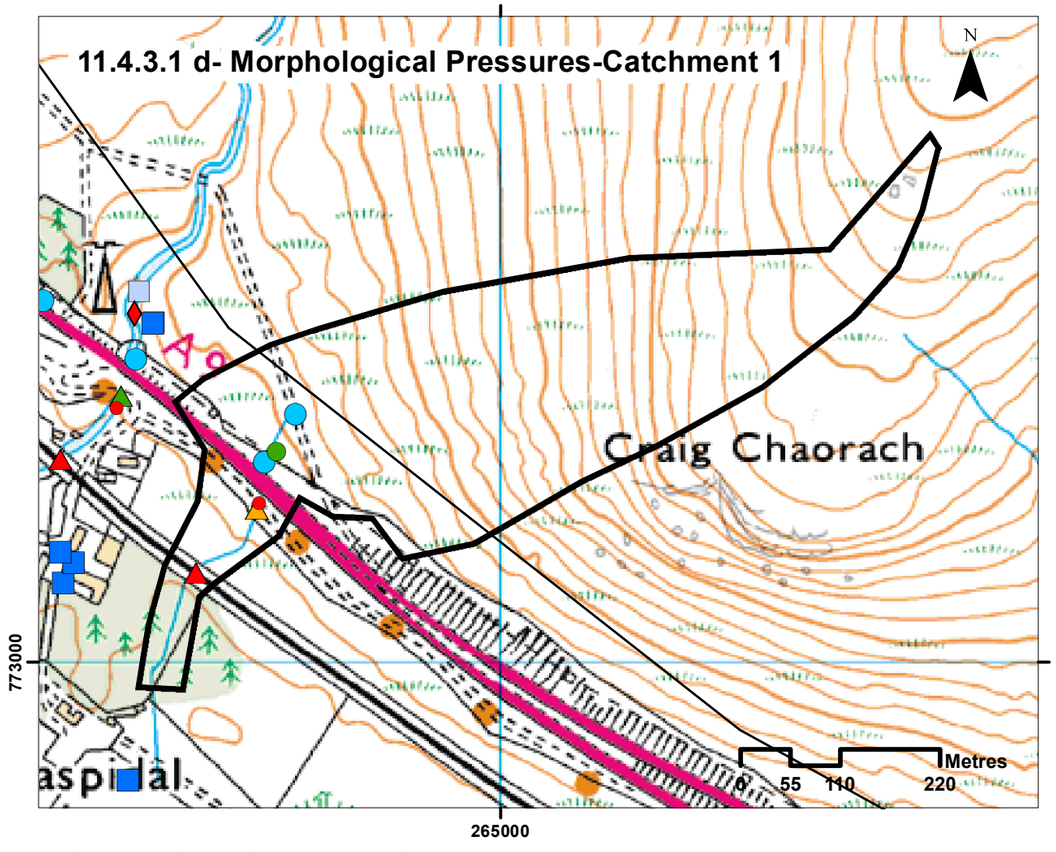
Photograph 11.4.3.2 – Culvert entrance

Photograph 11.4.3.3 Steep valley sides with multiple small channels









Legend

General
- Crossing location
- Catchment Area

Solid Geology
- Gaick Psammite Formation - Psammite
- North Britain Siluro-Devonian Calc-Alkaline Dyke Suite - Microdiorite

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

Morphological Pressures
- Railway Bridge
- Road Bridge
- Track/Footbridge
- Culvert
- Cascade
- Step in Bed
- Dam or Weir
- Discharge Location
- Abstraction Location
- Power Lines

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Drawing 11.4.3.1 Catchment 1 Catchment Overview

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1 of 1	C01	S3

Steep catchment

Steep, confined channel with no floodplain- will funnel sediment downstream

Incision due to previous channel realignment

Channel diversion undersized for high flows resulting in incision and excess sediment production

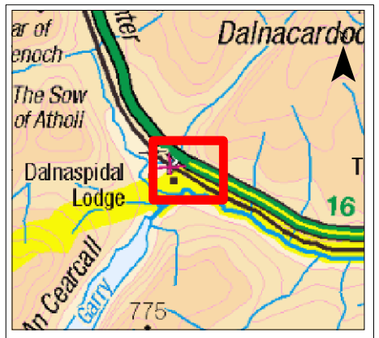
Craig Chaorach

Dalnaspidal Lodge Water Gauge

5
4
3a
3
2
1
-1.2
-1.1
-1
-2.2

N

Metres
0 45 90 180



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 / CÒMHDHAIL ALBA

A9 DUALLING PERTH TO INVERNESS Glen Garry to Dalwhinnie

PROJECT 7 GLEN GARRY TO DALWHINNIE EIA

DRAWING 11.4.3.2. Catchment 1 Baseline Assessment

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

DATE: 07/07/2017

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DWG: A9P07-CFJ-EWE-Z_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 - 2

Catchment No.	**2**
Catchment Name	-

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

Quantitative Spatial Elements	Catchment Area (km^2)	7.2
	Average slope in catchment (°)	15
	% Catchment over 750m (for snow melt risk)	46

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

Geology	Majority Bedrock (see Drawing 11.4.3.1 a and b Catchment 2)	Gaick Psammite formation-Psammite	Resistant to weathering, impermeable
	Is an alluvial fan present at or near the crossing?	No	Active alluvial fan present downstream of railway, but not at crossing

Environmental designations (see Drawing 11.4.3.1 c, Catchment 2)	Ramsar	No	
	SAC	Drumochter Hills	Acidic scree, alpine and subalpine heaths, blanket bog, dry heaths, monntane 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
	SPA	Drumochter Hills	Dotterel breeding, merlin breeding
	SSSI	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 2	
	Is peat present in the catchment?	Yes	Upper catchment - limited extent Floodplain mire in lower catchment d/s of railway crossing
	Is there a bog burst risk?	No	
	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		
	Bank erosion/lateral migration	Yes	
	Unvegetated bars	Yes	
	Wooded/forested areas in catchment	Yes	
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 2)		
	Comment on sediment source potential in catchment	High sediment supply potential available from hillslopes and channel erosion	
	Comment on sediment supply potential to crossing	Steep slopes supply sediment directly to the channel, channel is relatively confined so will deliver sediment to crossing Potential higher magnitude floods due to snow melt	

Morphology and Process- Reach upstream of crossing	Channel morphology	Cascade	
	Predominant sediment size	Boulder	Engineered bed
	Unvegetated bars	None	
	Vertical incision	Low	
	Deposition	Low	
	Lateral migration/bank erosion	Medium	
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 2)	Weir upstream	
	Impact of infrastructure	Reducing downstream sediment transfer to crossing	
	Channel realignment	None	

Morphology and Process- At crossing	Channel morphology	Engineered	
	Predominant sediment size	Boulder	
	Estimated discharge at 1:200 event (m^3/s)	32.63	
	Unvegetated bars	None	
	Vertical incision	None	
	Deposition	Low	
	Lateral migration/bank erosion	None	
	Damaged/unstable drains or armouring	None	

Morphology and Process- Reach downstream of crossing	Channel morphology	Cascade	
	Predominant sediment size	Boulder	
	Unvegetated bars	Yes	
	Vertical incision	High	
	Deposition	High	
	Lateral migration/bank erosion	High	
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 2)	Railway crossing and minor road	
	Impact of infrastructure	Fixing bank position, restricting downstream flows	
	Channel realignment	None	

Summary behaviour	Extensive sediment supply to the channel from the catchment, delivered over time to and through the crossing (during high flow events). Extensive incision downstream of the crossing resulting in a debris fan where the slope reduces. Opportunity to improve hydromorphology by changing engineered bed to synthesised natural bed.

Photograph 11.4.3.4- Crossing exit

Photograph 11.4.3.5-Scour creating step in bed downstream of crossing

Photograph 11.4.3.6 -Incision of channel

Photograph 11.4.3.7 -Upstream of crossing

Photograph 11.4.3.8 -Weir upstream of crossing

Photograph 11.4.3.9 -Upstream entrance to crossing

Photograph 11.4.3.10 -Cascade upstream of weir

Undercut concrete
Upstream of weir

Photograph 11.4.3.11-Looking downstream

Photograph 11.4.3.12- Upstream, Upstream of crossing

Photograph 11.4.3.13 -Drainage into crossing 2

Photograph 11.4.3.14 -Small debris flow

Photograph 11.4.3.15 -Drainage into crossing 2

Photograph 11.4.3.16 Upstream cascade morphology

Photograph 11.4.3.17 downstream to railway crossing

Photograph 11.4.3.18 -Upstream to railway crossing

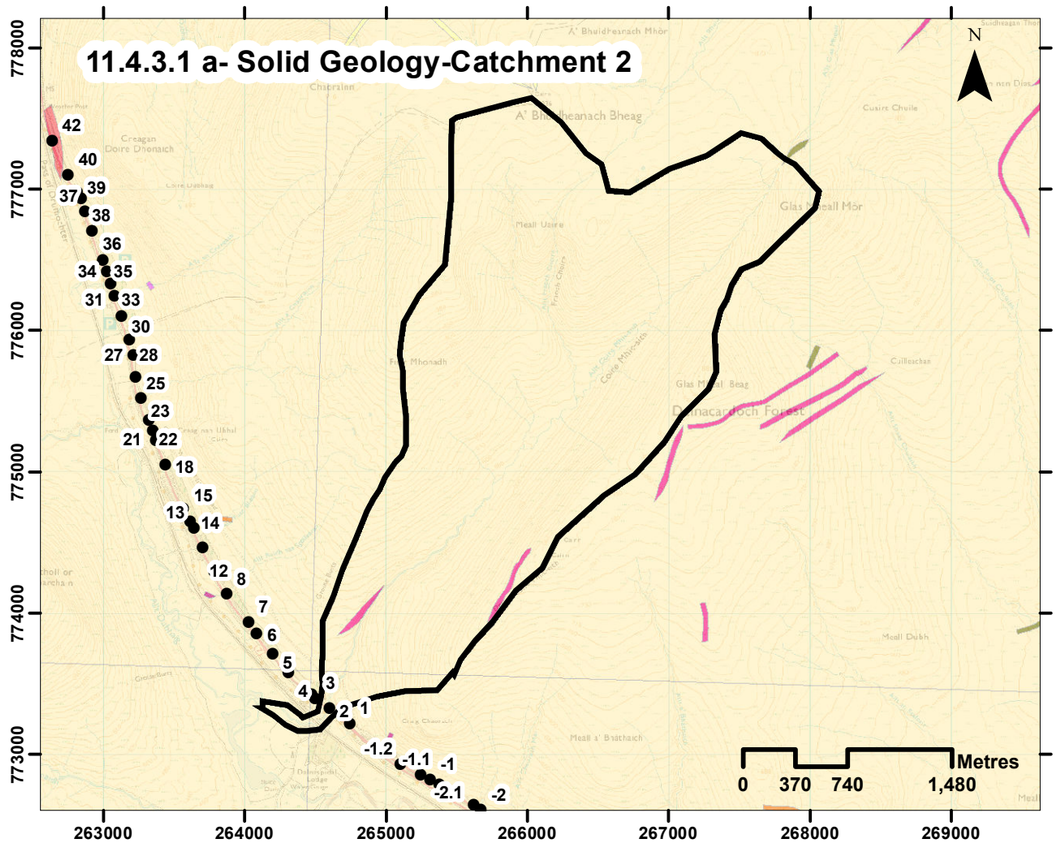
Photograph 11.4.3.19- Erosion of right bank side

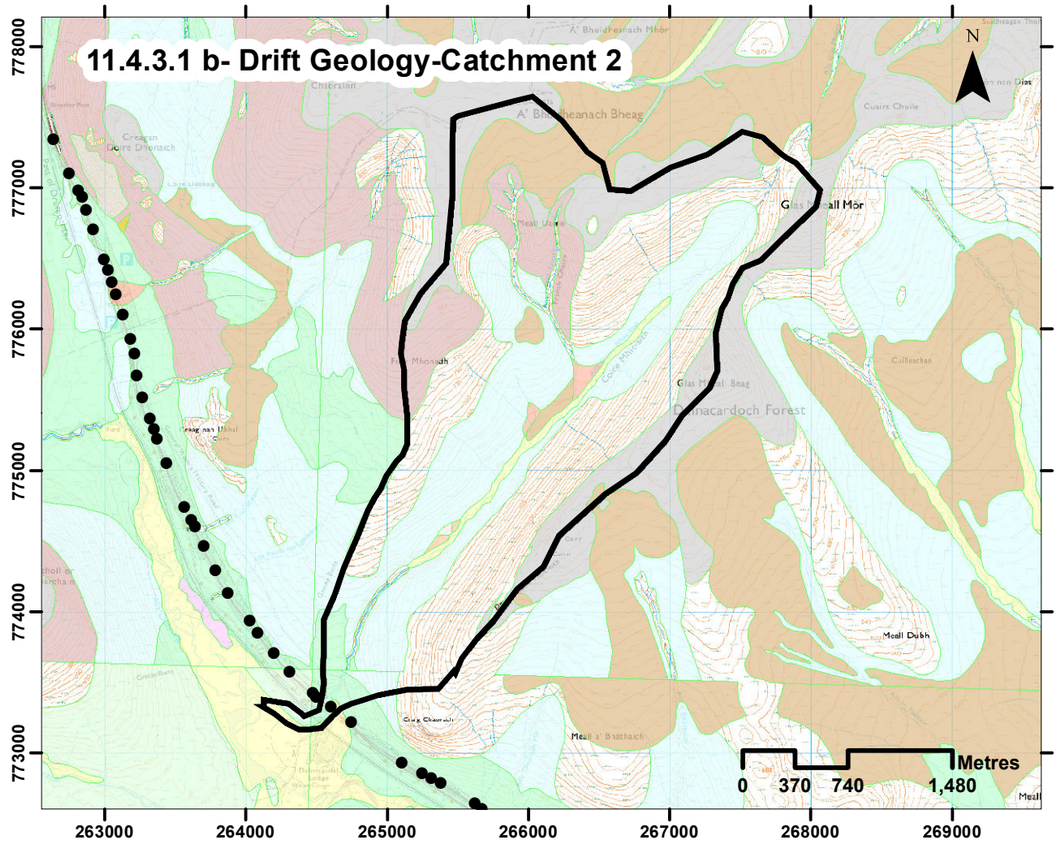
Photograph 11.4.3.20 Downstream

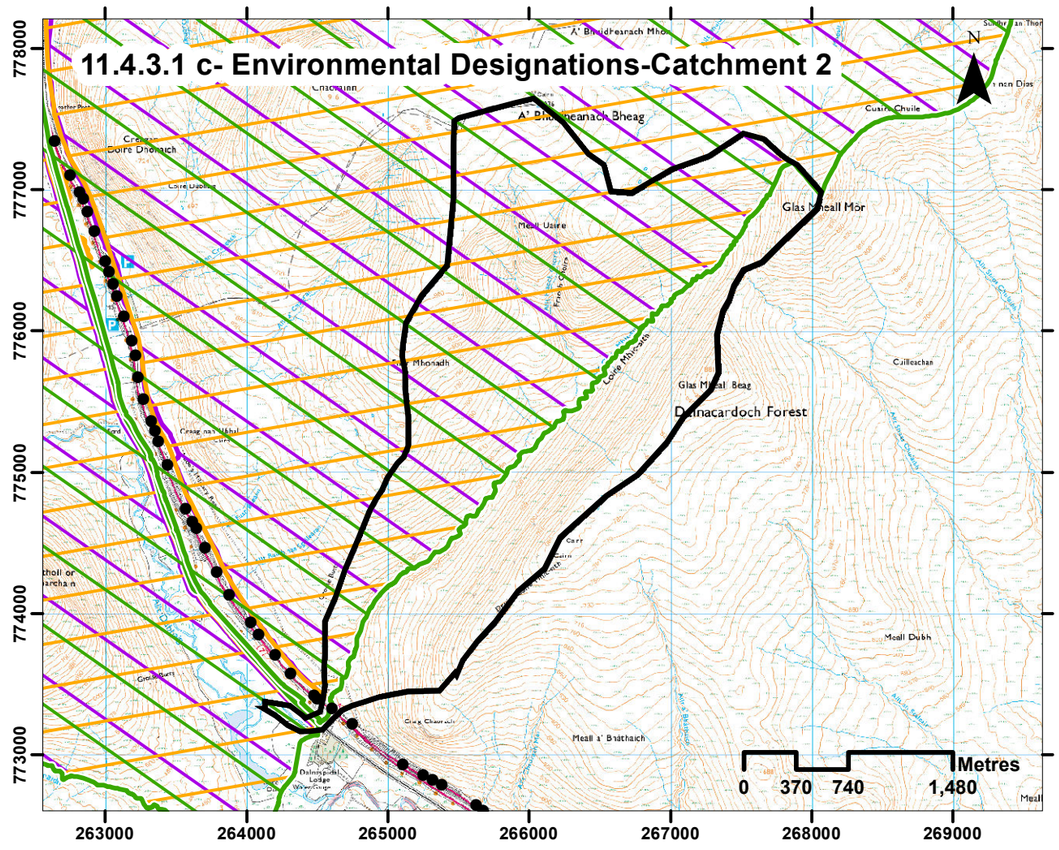
Photograph 11.4.3.21 -Upstream

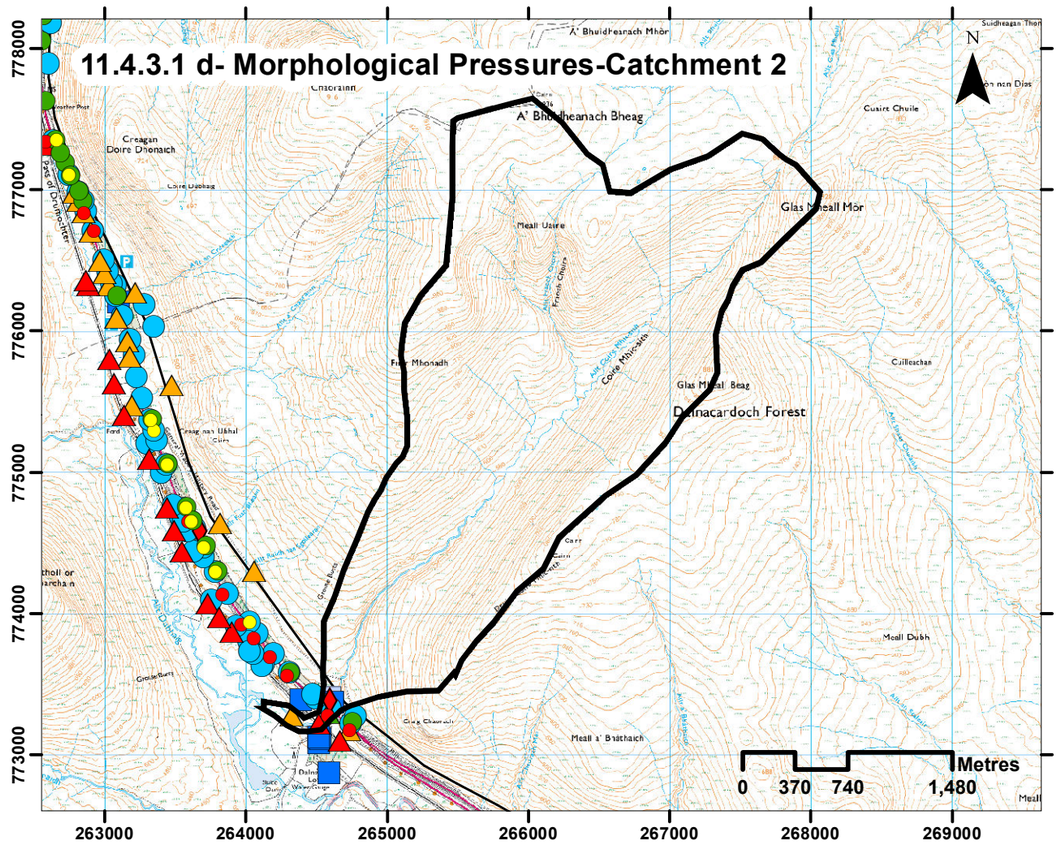
Photograph 11.4.3.22- Downstream deposition, with channel cut through

Photograph 11.4.3.23-Upstream to crossing









Legend

General
- Crossing location

Solid Geology
- Gaick Psammite Formation - Psammite
- Scottish Highland Siluro-Devonian Calc-Alkaline Minor Intrusion Suite-Lamprophyres
- Scottish Highland Siluro-Devonian Calc-Alkaline Minor Intrusion Suite-Microgranite, Porphyritic

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

Morphological Pressures
- Railway Bridge
- Road Bridge
- Track/Footbridge
- Culvert
- Cascade
- Step in Bed
- Catchpit
- Dam or Weir
- Discharge Location
- Abstraction Location
- Power Lines

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TRANSPORT SCOTLAND CONBHAIGH ALBA

A9 DUALLING PERTH TO INVERNESS Glen Garry to Dalwhinnie

PROJECT 7 GLEN GARRY TO DALWHINNIE EIA

Drawing 11.4.3.1 Catchment 2 Catchment Overview

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

DATE: 18/07/2017

PROJ: 495298

DWG: A9P07-CFJ-EWE-Z_ZZZZZ_ZZ-DR-EN-0001

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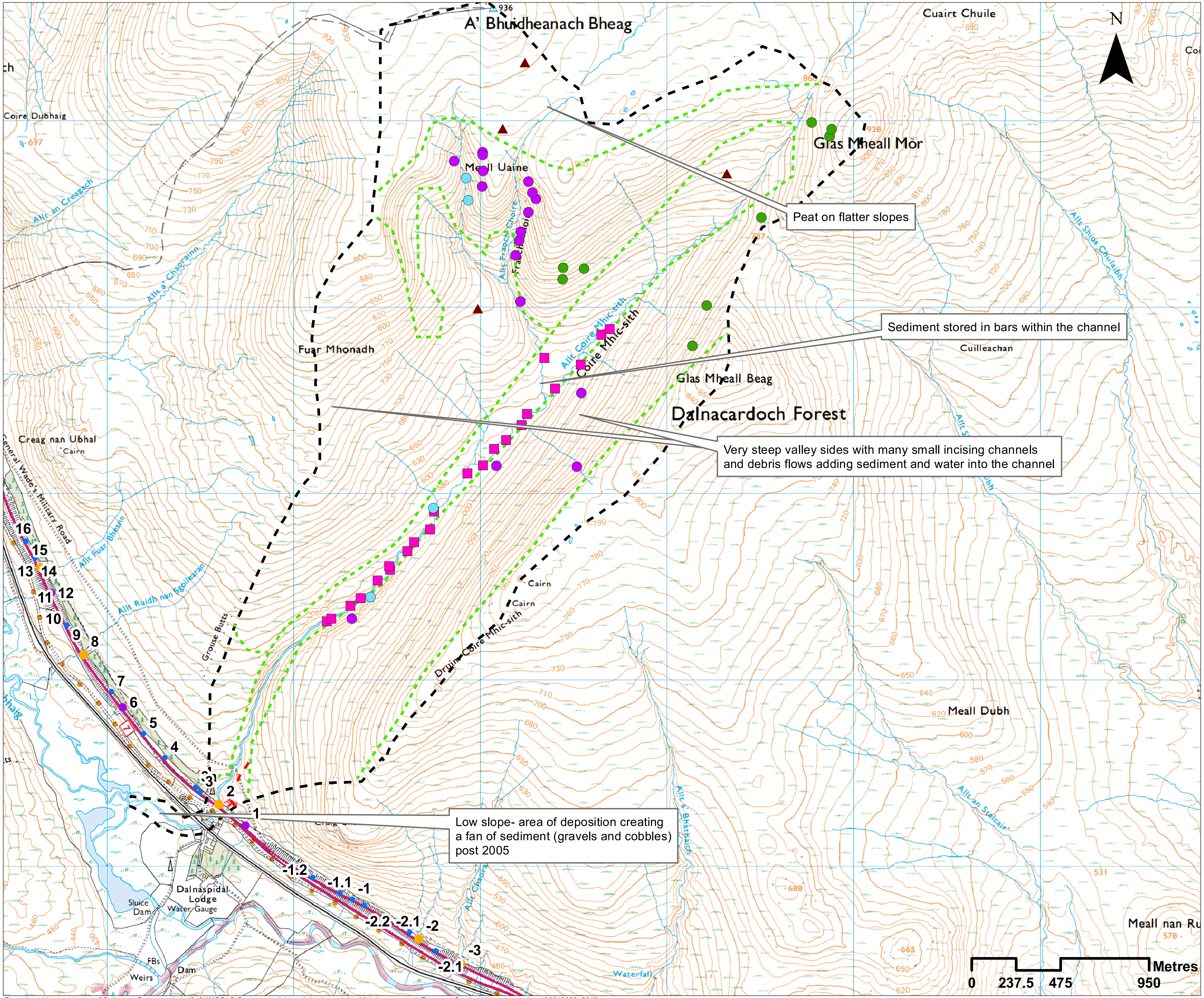

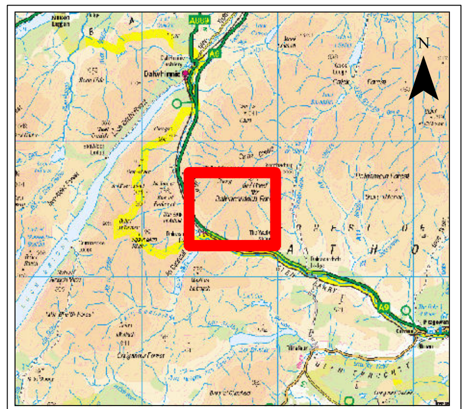

Legend

- Major crossing
- Minor crossing
- Other crossing
- Peat
- Coupled debris flow
- 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 7 GLEN GARRY TO DALWHINNIE EIA

DRAWING 11.4.3.2. Catchment 2 Baseline Assessment

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

PROJ: 495298

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1 OF 1	C01	A3

Annex 11.4.3 - Hydromorphological Catchment Assessment - 4-7

Catchment No.	**4-7**
Catchment Name	**-**

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

Quantitative Spatial Elements	Catchment Area (km^2)	0.6
	Average slope in catchment (°)	9.9
	% Catchment over 750m (for snow melt risk)	0

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

Geology	Majority Bedrock (see Drawing 11.4.3.1 a and b Catchment 4-7)	Gaick Psammite formation-Psammite	Resistant to weathering, impermeable
	Is an alluvial fan present at or near the crossing?	No	

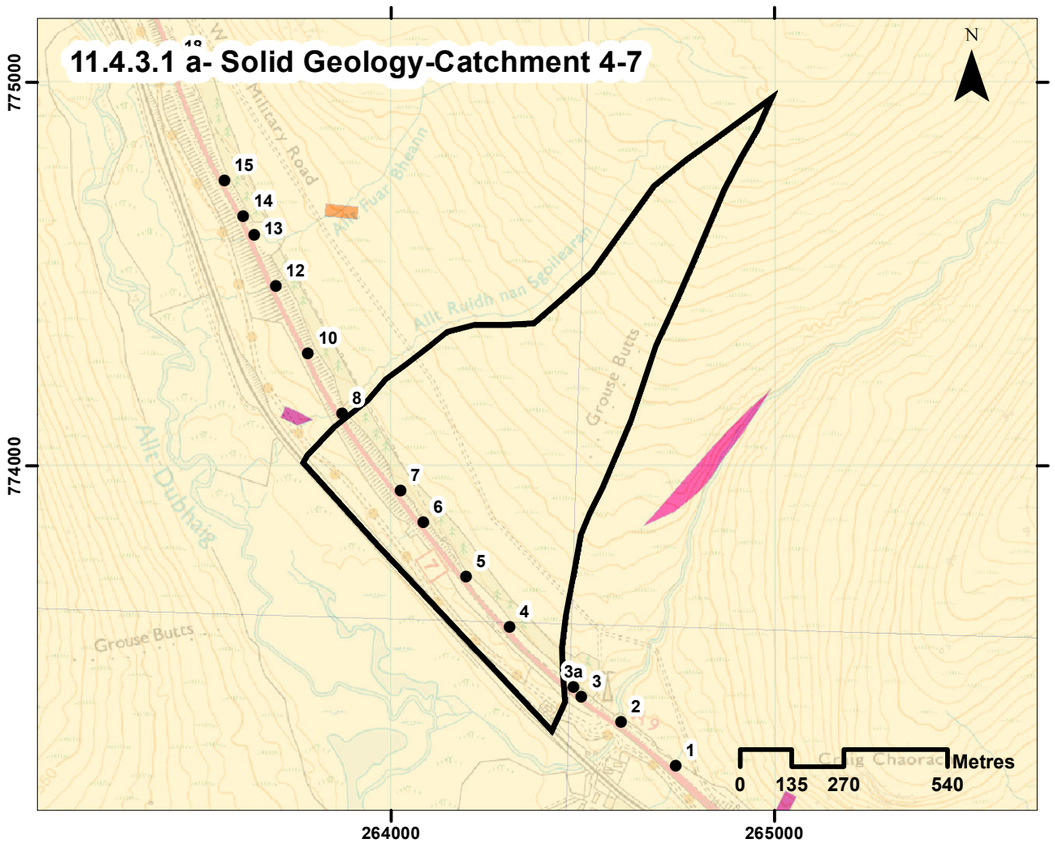
Environmental designations (see Drawing 11.4.3.1 c, Catchment 4-7)	Ramsar	No	
	SAC	Drumochter Hills	Acidic scree, alpine and subalpine heaths, blanket bog, dry heaths, monntane acid grasslands , mountain willow scrub, plants in crevices on acid rocks, species-rich grassland with mat-grass in upland areas, tall herb communities, wet heathland with cross-leaved
	SPA	Drumochter Hills	Dotterel breeding, merlin breeding
	SSSI	Drumochter Hills	Breeding bird assemblage, fluvial geomorphology of Scotland, montane assemblage, vascular plant assemblage

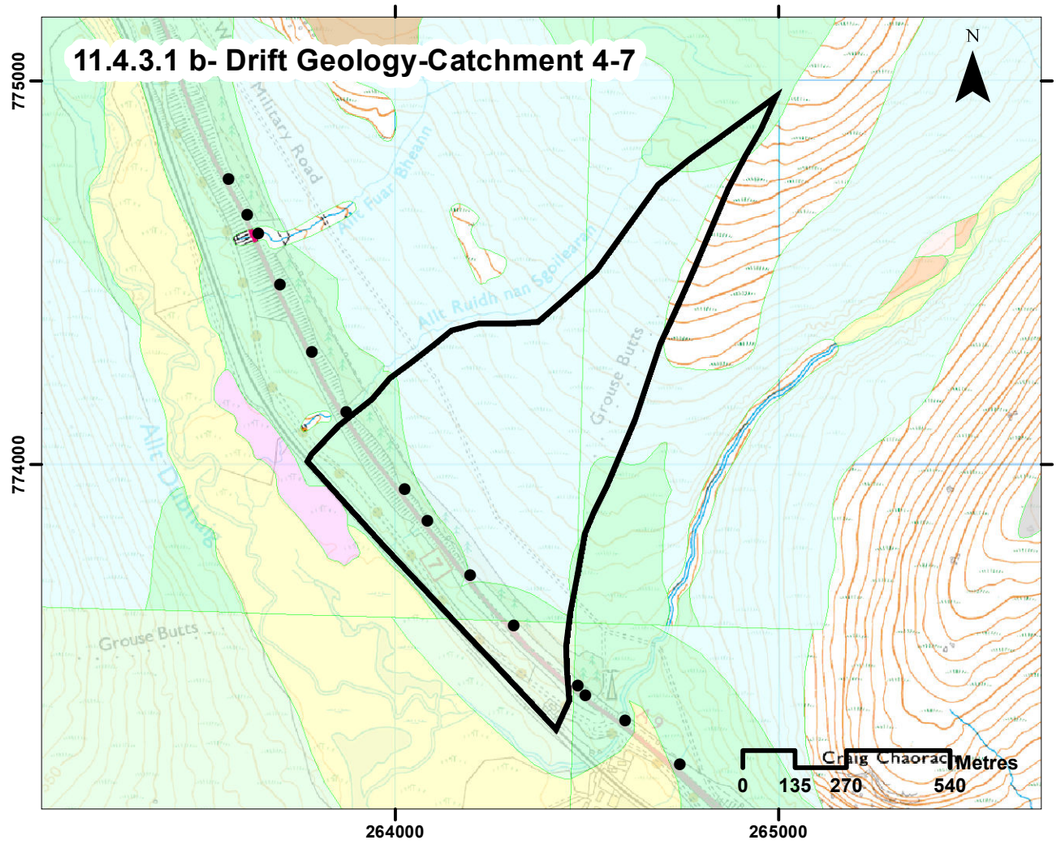
Sediment source and supply - Catchment Scale	Changes in slope and channel confinement	See Drawing 11.4.3.2, Catchment 4-7	
	Is peat present in the catchment?	No	
	Is there a bog burst risk?	No	
	Current valley side or terrace erosion	None	
	Potential valley side or terrace erosion	No	
	Hill slope failures (including peat slides and debris flows and slides)	Yes	
	Hill slope failures coupled to channel	No	
	Vertical incision present in catchment	Yes	
	Bank erosion/lateral migration	No	
	Unvegetated bars	No	
	Wooded/forested areas in catchment	Yes	Some risk of blockage of crossing with woody debris
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 4-7)	Track	Fixing channel bed and bank position
	Comment on sediment source potential in catchment	Some sediment available from small scale incision of the hillside	
	Comment on sediment supply potential to crossing	Steep slopes mean that sediment that enters the channel will be quickly transported downstream	

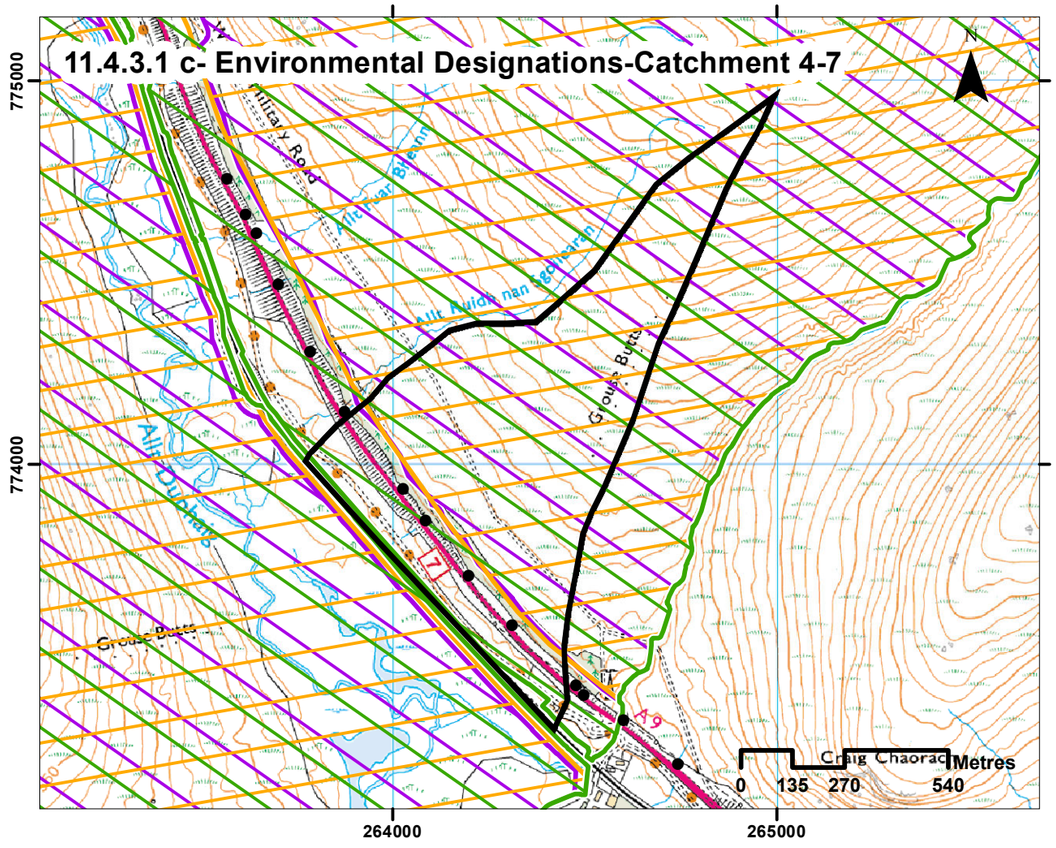
Morphology and Process- Reach upstream of crossing	Channel morphology	Plane bed	Channel generally stable upstream of the crossing- some incision of drains
	Predominant sediment size	Gravels	
	Unvegetated bars	None	
	Vertical incision	Medium	
	Deposition	Low	
	Lateral migration/bank erosion	Low	
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 4-7)	None	
	Impact of infrastructure	None	
	Channel realignment	None	

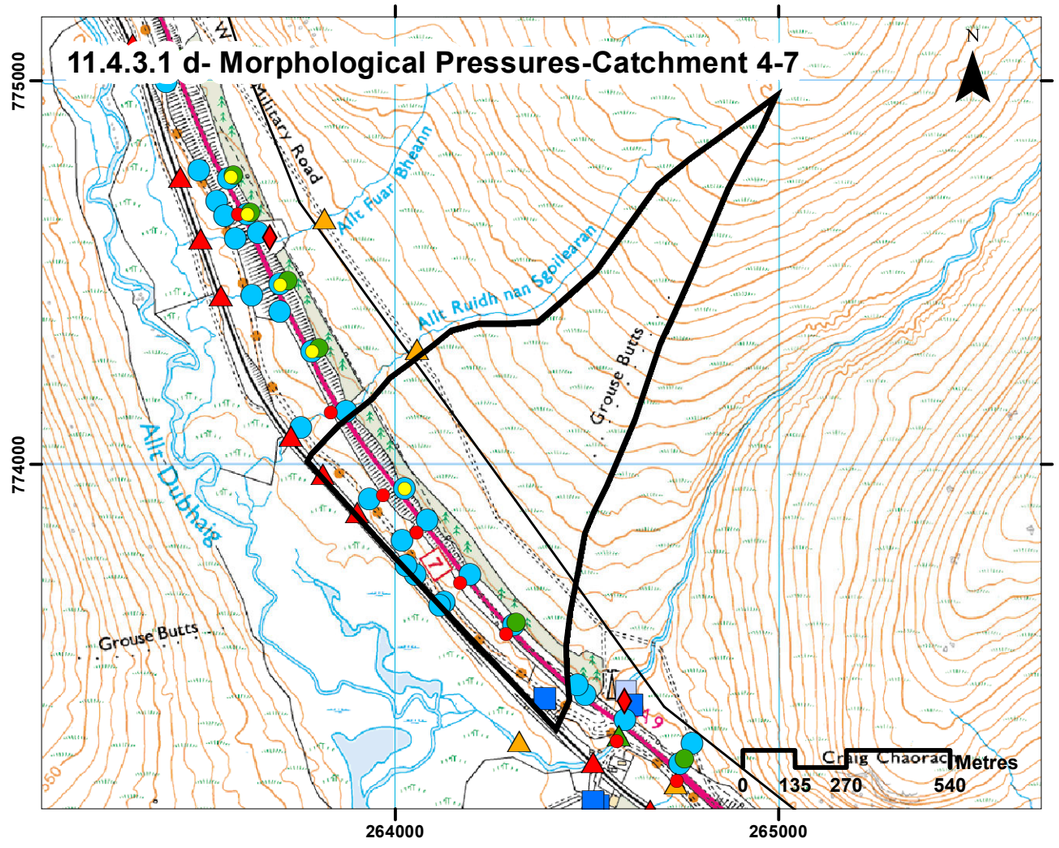
Morphology and Process- At crossing	Channel morphology	Engineered	
	Predominant sediment size	None	
	Estimated discharge at 1:200 event (m^3/s)	3.81	
	Unvegetated bars	None	
	Vertical incision	Low	
	Deposition	Low	
	Lateral migration/bank erosion	Low	
	Damaged/unstable drains or armouring	Yes	Crossings 5 and 7

Morphology and Process- Reach downstream of crossing	Channel morphology	Cascade	
	Predominant sediment size	Boulder	
	Unvegetated bars	None	
	Vertical incision	High	Large scale incision at 5 and 7
	Deposition	Medium	
	Lateral migration/bank erosion	Medium	
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 4-7)	NMU track and railway	
	Impact of infrastructure	Fixing channel bed and banks and creating impoundment at high flow	
	Channel realignment	None	
Summary behaviour	Some sediment input from the catchment. Widespread incision of the channels downstream of the A9 crossings eroding bed and banks and transporting sediment 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 Site of Scientific Interest
- Special Area of Conservation
- Special Protection Area

Morphological Pressures
- Railway Bridge
- Road Bridge
- Track/Footbridge
- Culvert
- Cascade
- Step in Bed
- Catchpit
- Dam or Weir
- Discharge Location
- Abstraction Location
- Power Lines

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A9 DUALLING PERTH TO INVERNESS Glen Garry to Dalwhinnie

PROJECT 7 GLEN GARRY TO DALWHINNIE EIA

Drawing 11.4.3.1 Catchment 4-7 Catchment Overview

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

DATE: 18/07/2017

PROJ: 495298

DWG: A9P07-CFJ-EWE-Z_ZZZZZ_ZZ-DR-EN-0001

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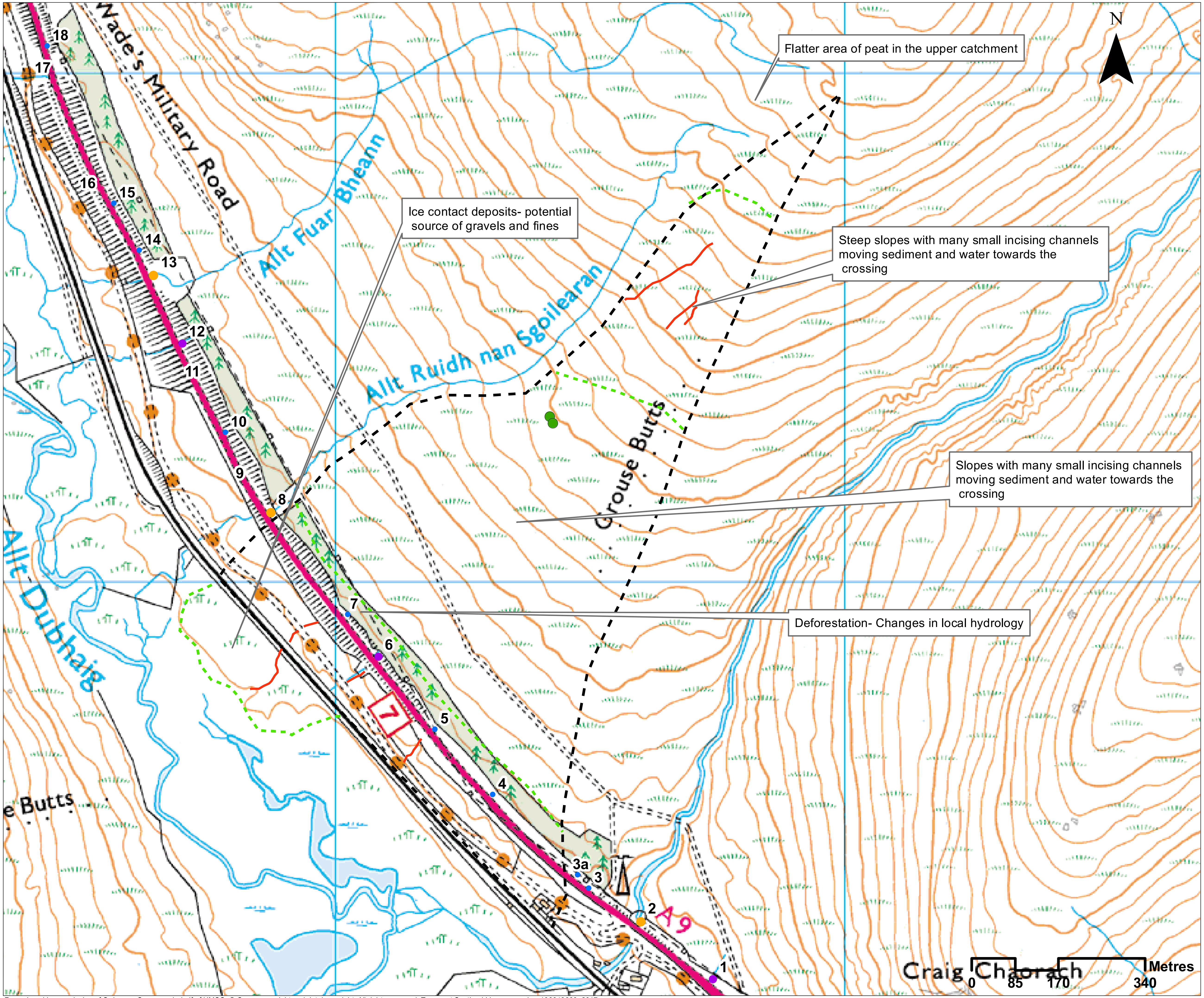

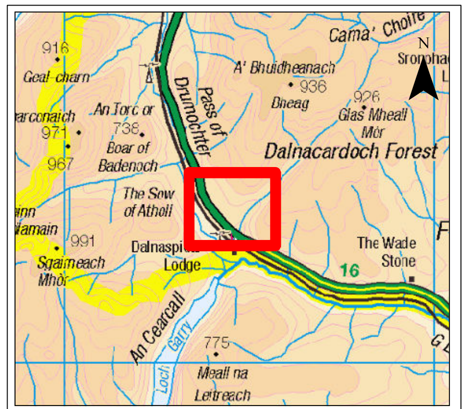

Legend

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

REV	SUIT	DATE	DESCRIPTION	BY	APP

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TRANSPORT SCOTLAND
A9 DUALLING PERTH TO INVERNESS

PROJECT 7 GLEN GARRY TO DALWHINNIE EIA

DRAWING 11.4.3.2. Catchment 4-7 Baseline Assessment

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

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Annex 11.4.3 - Hydromorphological Catchment Assessment - 8

Catchment No.	**8**
Catchment Name	-

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

Quantitative Spatial Elements	Catchment Area (km^2)	0.2
	Average slope in catchment (°)	8.8
	% Catchment over 750m (for snow melt risk)	0

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

Geology	Majority Bedrock (see Drawing 11.4.3.1 a and b Catchment 8)	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 8)	Ramsar	No	
	SAC	Drumochter Hills	Acidic scree, alpine and subalpine heaths, blanket bog, dry heaths, monntane 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
	SPA	Drumochter Hills	Dotterel breeding, merlin breeding
	SSSI	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 8	
	Is peat present in the catchment?	Yes	Uppermost part of catchment
	Is there a bog burst risk?	Yes	Low likelihood of occurrence but possible from peat in uppermost part of catchment. If it does occur, steep catchment indicates high likelihood of it reaching the crossing
	Current valley side or terrace erosion	None	
	Potential valley side or terrace erosion	Yes	
	Hill slope failures (including peat slides and debris flows and slides)	None	
	Hill slope failures coupled to channel	None	
	Vertical incision present in catchment	Yes	
	Bank erosion/lateral migration	Yes	
	Unvegetated bars	None	
	Wooded/forested areas in catchment	None	
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 8)	Track	Fixing bed and bank position, possibly impounding flows
	Comment on sediment source potential in catchment	Steep slopes have potential to generate sediment but currently seem stable. High potential for valley side erosion close to crossing due to confined nature of channel	
	Comment on sediment supply potential to crossing	Steep confined channel will quickly transport sediment to the crossing	

Morphology and Process- Reach upstream of crossing	Channel morphology	Cascade	
	Predominant sediment size	Boulder to sand	
	Unvegetated bars	Small	
	Vertical incision	High	
	Deposition	Medium	
	Lateral migration/bank erosion	High	
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 8)	None	
	Impact of infrastructure	None	
	Channel realignment	None	

Morphology and Process- At crossing	Channel morphology	Engineered	
	Predominant sediment size	None	
	Estimated discharge at 1:200 event (m^3/s)	1.01	
	Unvegetated bars	None	
	Vertical incision	None	
	Deposition	None	
	Lateral migration/bank erosion	None	
	Damaged/unstable drains or armouring	Yes	Incision

Morphology and Process- Reach downstream of crossing	Channel morphology	Cascade	
	Predominant sediment size	Boulder/Cobble	
	Unvegetated bars	None	
	Vertical incision	High	
	Deposition	Medium	
	Lateral migration/bank erosion	High	
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 8)	NMU crossing and Railway crossing	
	Impact of infrastructure	Fixing channel bed and banks, possibly impounding flow	
	Channel realignment	None	

Summary behaviour	Sediment is generated from incision upstream of the crossing- possibly initiated by the crossing. Areas of valley side erosion are present close to the crossing which will also deliver sediment to the crossing. Downstream of the crossing the channel has incised into the slope and the banks are unstable.

Photograph 11.4.3.24-Crossing exit

Photograph 11.4.3.25-Downstream to railway crossing

Photograph 11.4.3.26- Crossing exit

Photograph 11.4.3.27-Downstream bank instability due to channel insision

Flat and open floodplain

Photograph 11.4.3.28- Downstream

Slope drainage entering in concrete channel before crossing

Photograph 11.4.3.29- Upstream

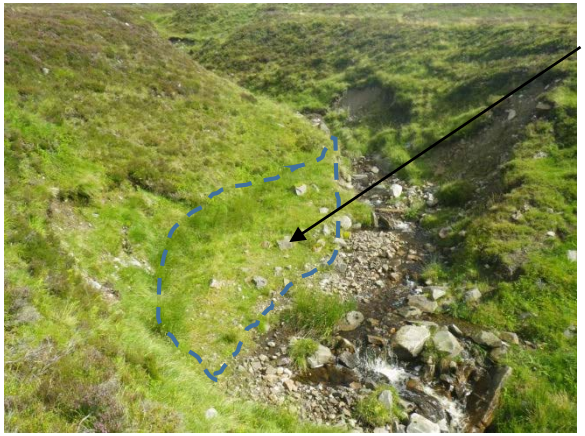
Localised scour at entrance

Photograph 11.4.3.30-Crossing entrance

Photograph 11.4.3.31-Upstream, confined channel

Photograph 11.4.3.32-Steep drain inflow in concrete channel

Photograph 11.4.3.33- Erosion of valley side

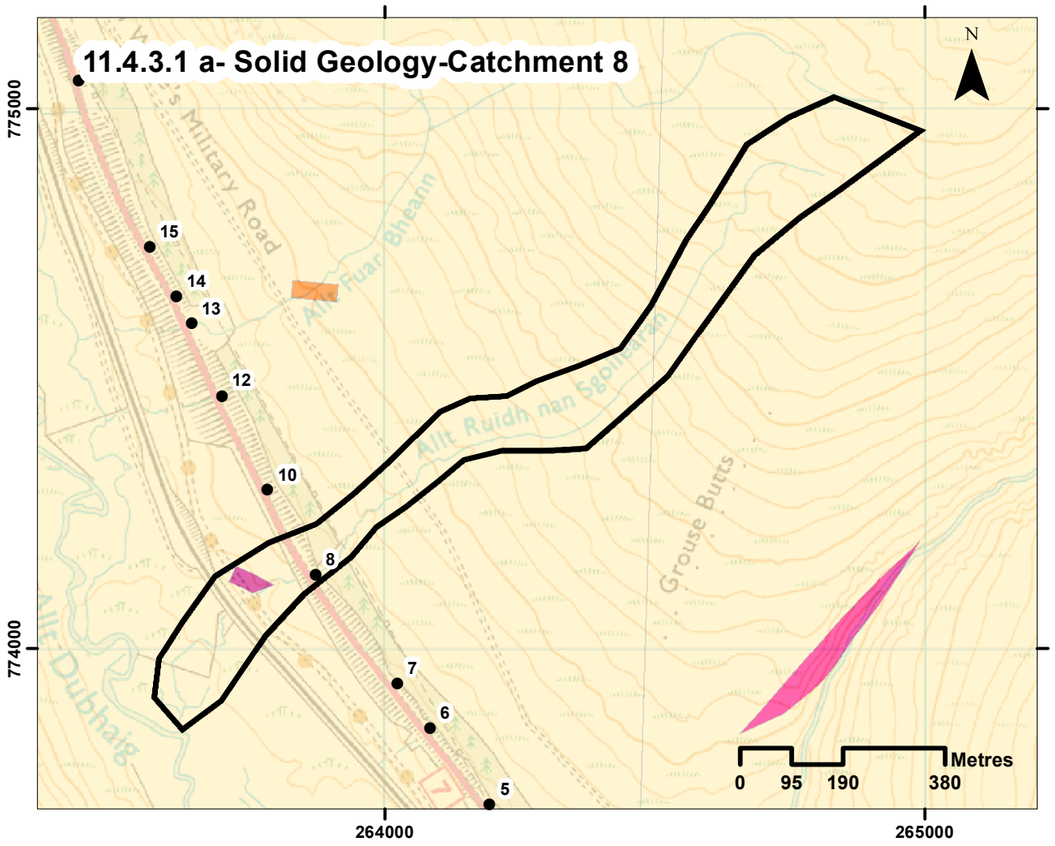


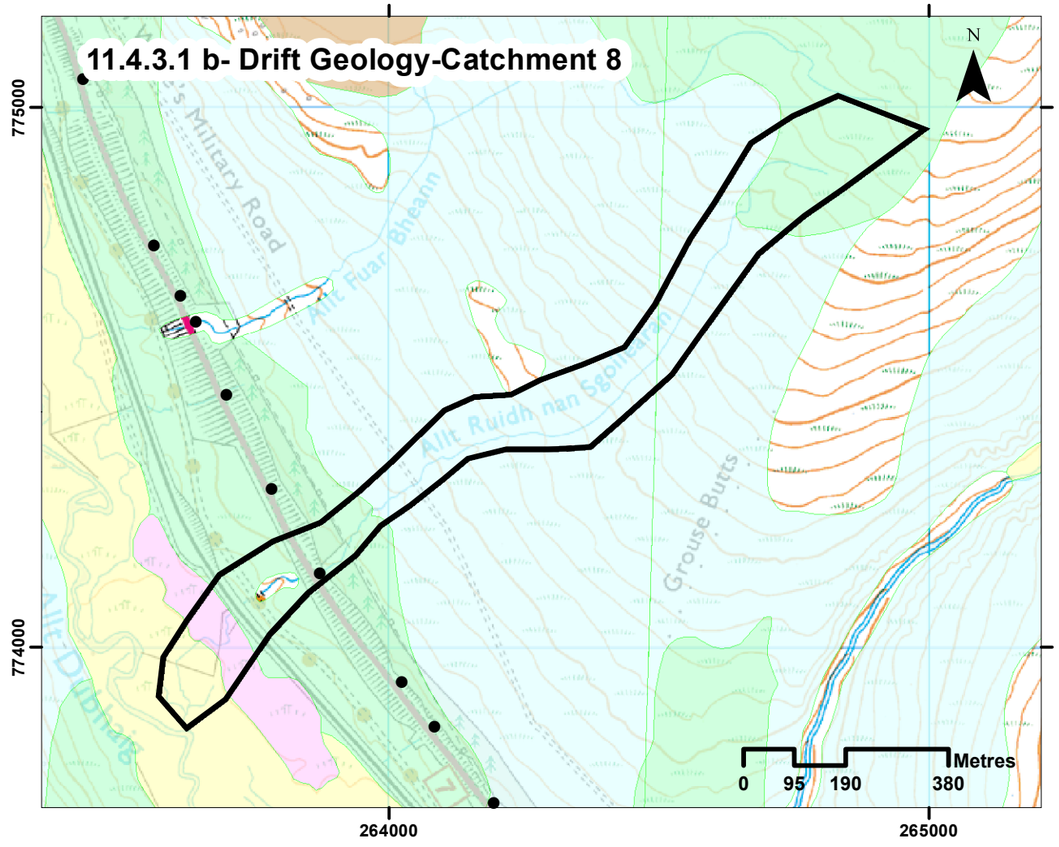
Photograph 11.4.3.34- Upstream, channel incising

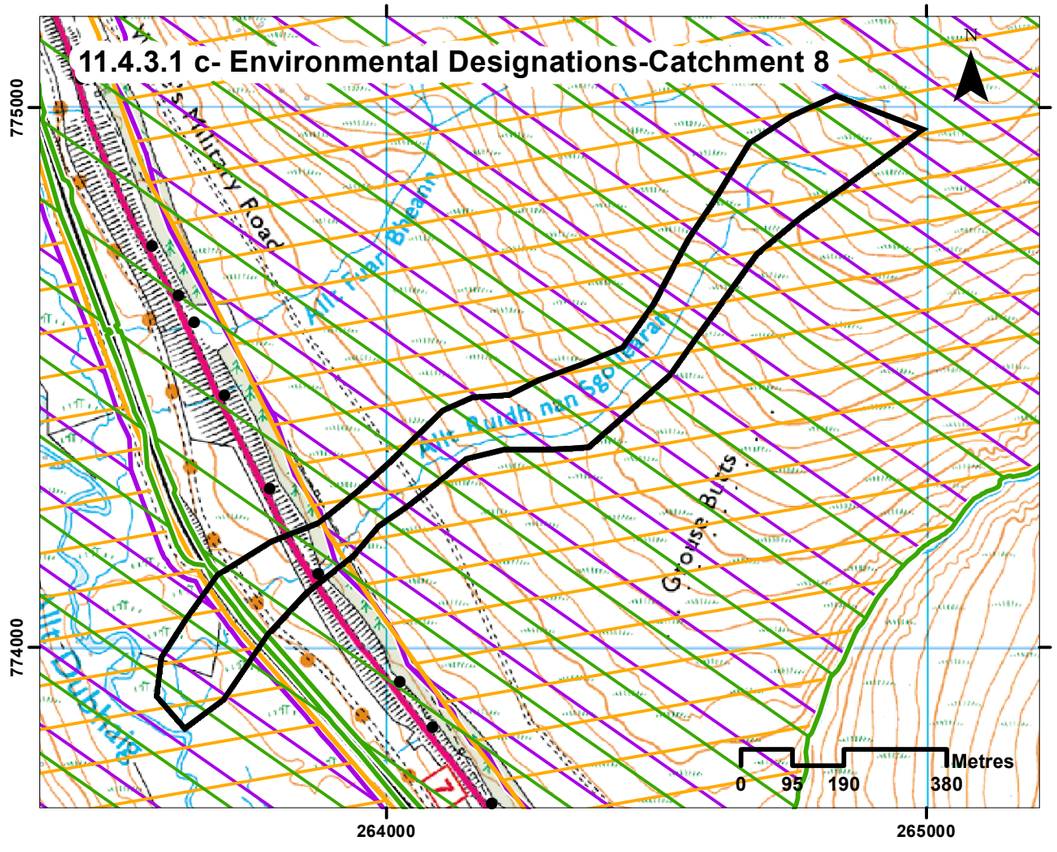
Photograph 11.4.3.35-Upstream, Stable channel

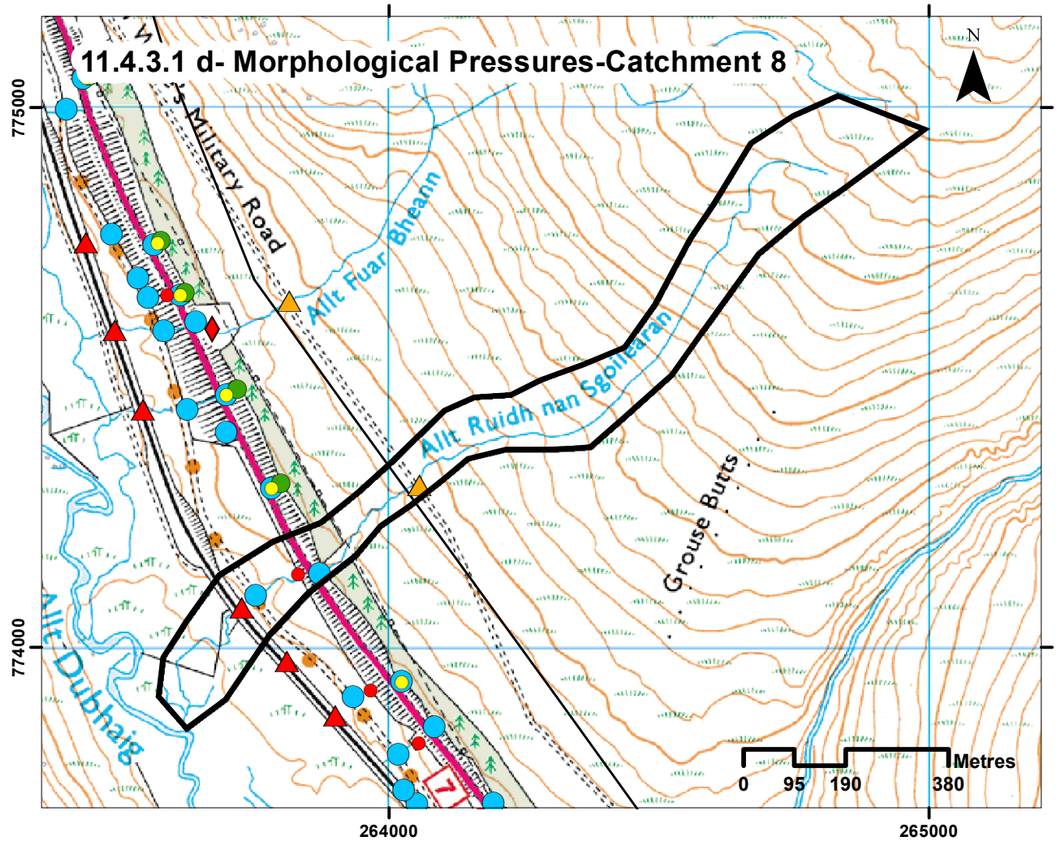
Photograph 11.4.3.36- Incising channel

Photograph 11.4.3.37- Pipe under track









Legend

General
- Crossing location
- Catchment Area

Solid Geology
- Gaick Psammite Formation - Psammite
- North Britain Siluro-Devonian Calc-Alkaline Dyke Suite - Microdiorite

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

Morphological Pressures
- Railway Bridge
- Track/Footbridge
- Culvert
- Cascade
- Step in Bed
- Catchpit
- Dam or Weir
- Power Lines

REV	SUIT	DATE	DESCRIPTION	BY	APP

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TRANSPORT SCOTLAND — A9 DUALLING PERTH TO INVERNESS Glen Garry to Dalwhinnie

PROJECT 7 GLEN GARRY TO DALWHINNIE EIA

Drawing 11.4.3.1 Catchment 8 Catchment Overview

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

DATE: 18/07/2017

PROJ: 495298

DWG: A9P07-CFJ-EWE-Z_ZZZZZ_ZZ-DR-EN-0001

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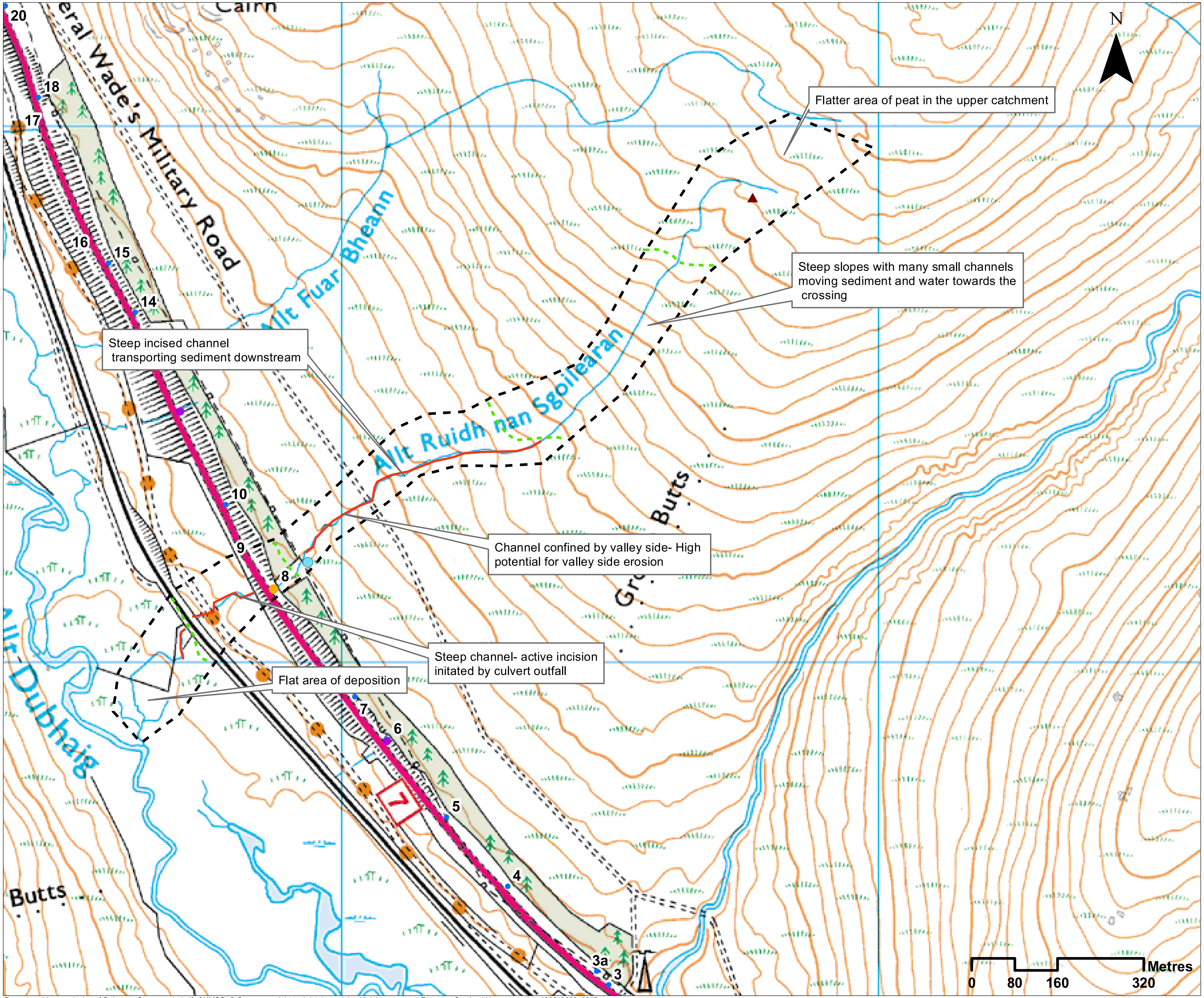
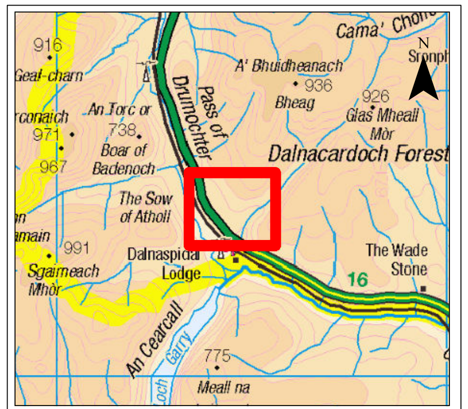
1 of 1	C01	S3





Legend

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

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PROJECT 7 GLEN GARRY TO DALWHINNIE EIA

DRAWING 11.4.3.2. Catchment 8 Baseline Assessment

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

DATE: 07/07/2017

PROJ: 495298

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Annex 11.4.3 - Hydromorphological Catchment Assessment - 10

Catchment No.	**10**
Catchment Name	-

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

Quantitative Spatial Elements	Catchment Area (km^2)	0.36
	Average slope in catchment (°)	11
	% Catchment over 750m (for snow melt risk)	0

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

Geology	Majority Bedrock (see Drawing 11.4.3.1 a and b Catchment 10)	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 10)	Ramsar	No	
	SAC	Drumochter Hills	Acidic scree, alpine and subalpine heaths, blanket bog, dry heaths, monntane 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
	SPA	Drumochter Hills	Dotterel breeding, merlin breeding
	SSSI	Drumochter Hills	Breeding bird assemblage, fluvial geomorphology of Scotland, montane assemblage, vascular plant assemblage

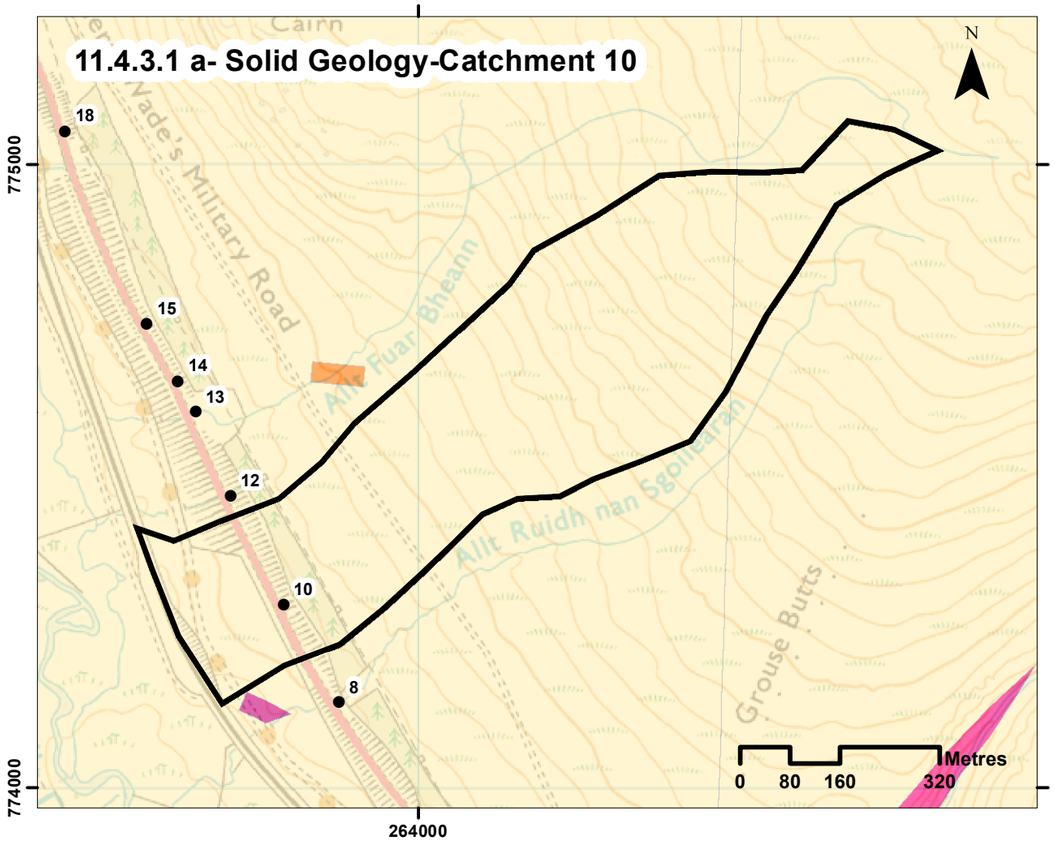
Sediment source and supply - Catchment Scale	Changes in slope and channel confinement	See Drawing 11.4.3.2, Catchment 10	
	Is peat present in the catchment?	Yes	
	Is there a bog burst risk?	Yes	
	Current valley side or terrace erosion	No	
	Potential valley side or terrace erosion	No	
	Hill slope failures (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 10)	Track upstream of crossing	
	Comment on sediment source potential in catchment	Sediment likely to be generated from channels in steep slopes	
	Comment on sediment supply potential to crossing	Erosion of till by the many small channels has potential to supply some sediment to the crossing,	

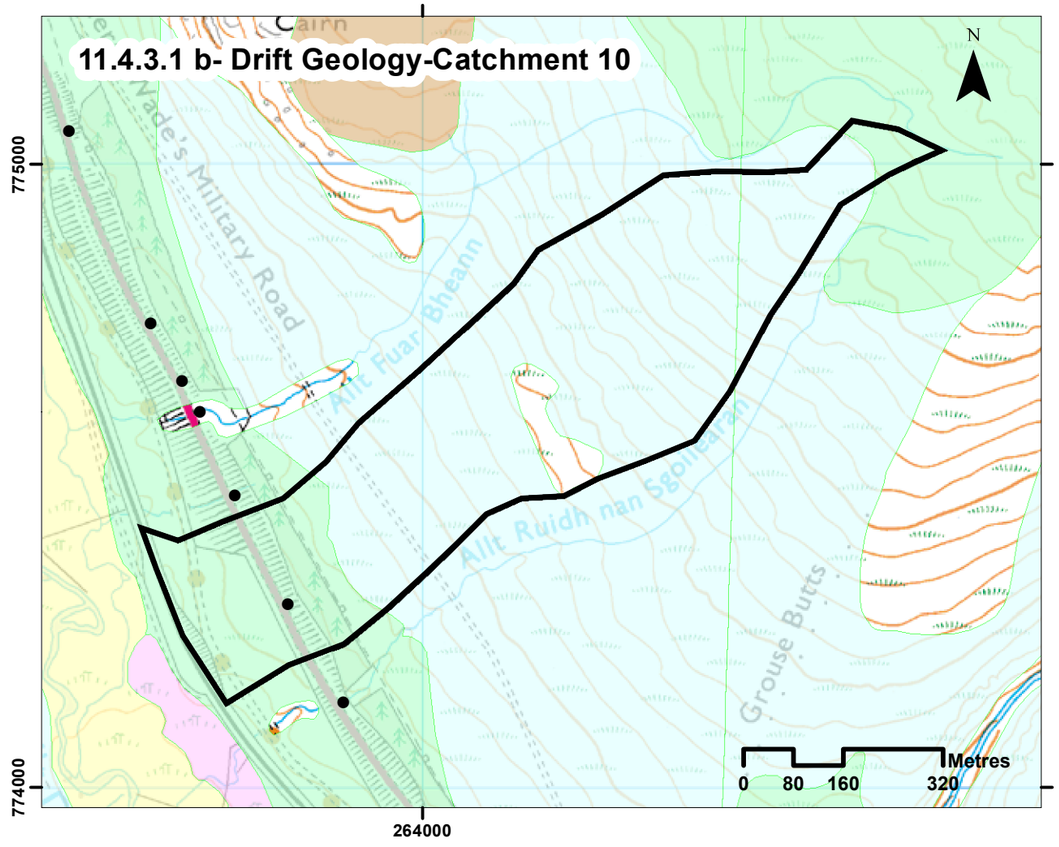
Morphology and Process- Reach upstream of crossing	Channel morphology	Engineered	
	Predominant sediment size	None	
	Unvegetated bars	None	
	Vertical incision	Low	
	Deposition	Low	
	Lateral migration/bank erosion	Low	
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 10)	None	
	Impact of infrastructure	None	
	Channel realignment	None	

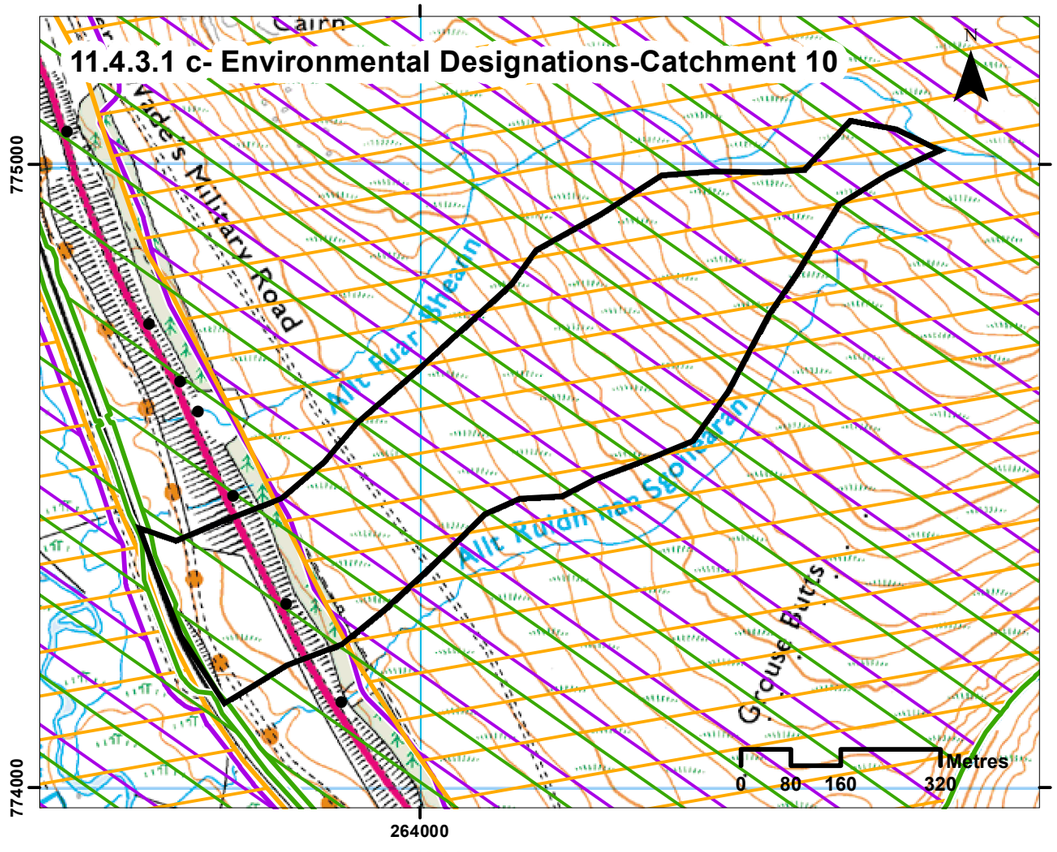
Morphology and Process- At crossing	Channel morphology	Engineered	Steep channelized section upstream of crossing
	Predominant sediment size	Cobble-armouring	
	Estimated discharge at 1:200 event (m^3/s)	1.6	
	Unvegetated bars	None	
	Vertical incision	Low	Some erosion and transport of the slabs used to project the channel
	Deposition	Medium	These slabs are deposited in the crossing catch pit
	Lateral migration/bank erosion	None	
	Damaged/unstable drains or armouring	Yes	

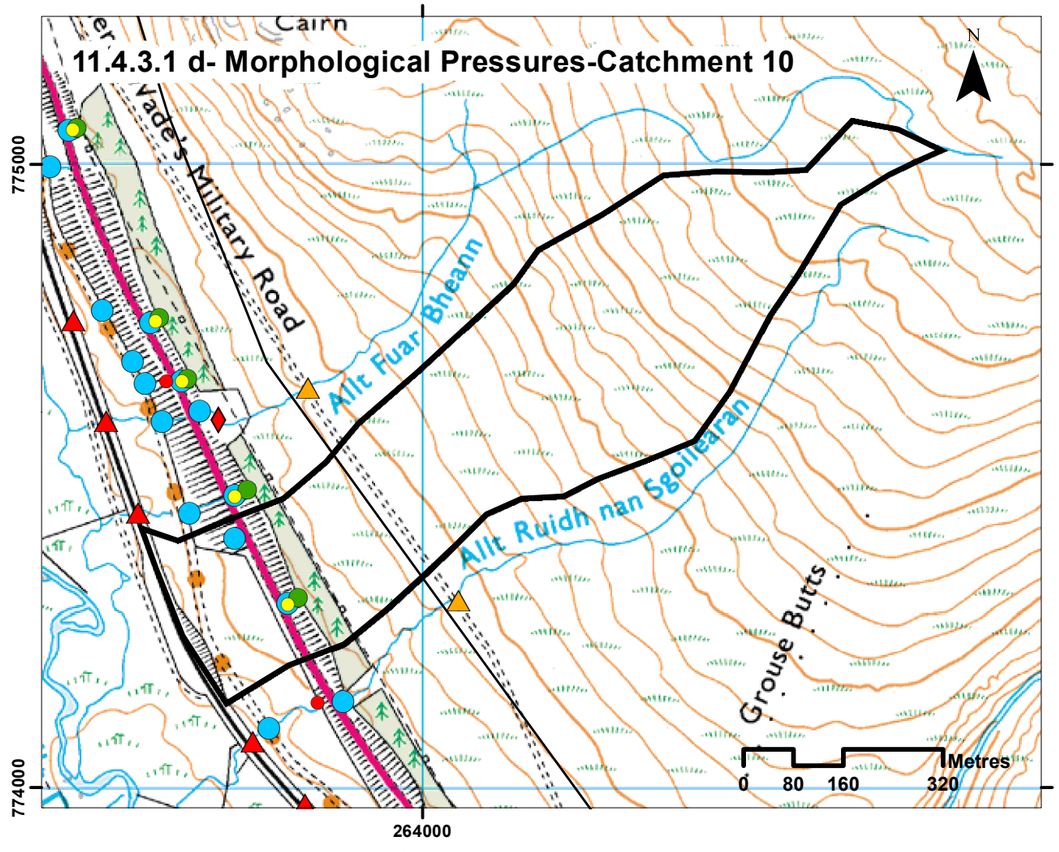
Morphology and Process- Reach downstream of crossing	Channel morphology	Plane bed	
	Predominant sediment size	None	
	Unvegetated bars	None	
	Vertical incision	None	
	Deposition	None	
	Lateral migration/bank erosion	None	
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 10)	NMU path and railway	
	Impact of infrastructure	Fixing bed and banks	
	Channel realignment	None	

Summary behaviour	Some sediment generated from channels on the steep hillside. Current erosion to the cascade and armouring of the crossing and upstream drains due to high energy. This material is then deposited in the crossing catch pit. Risk can be mitigated through design- channel is higher energy than previous channel before road construction.









Legend

General
- Crossing location
- Catchment Area

Solid Geology
- Gaick Psammite Formation - Psammite
- North Britain Siluro-Devonian Calc-Alkaline Dyke Suite - Microdiorite

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

Morphological Pressures
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PROJECT 7 GLEN GARRY TO DALWHINNIE EIA

Drawing 11.4.3.1 Catchment 10 Catchment Overview

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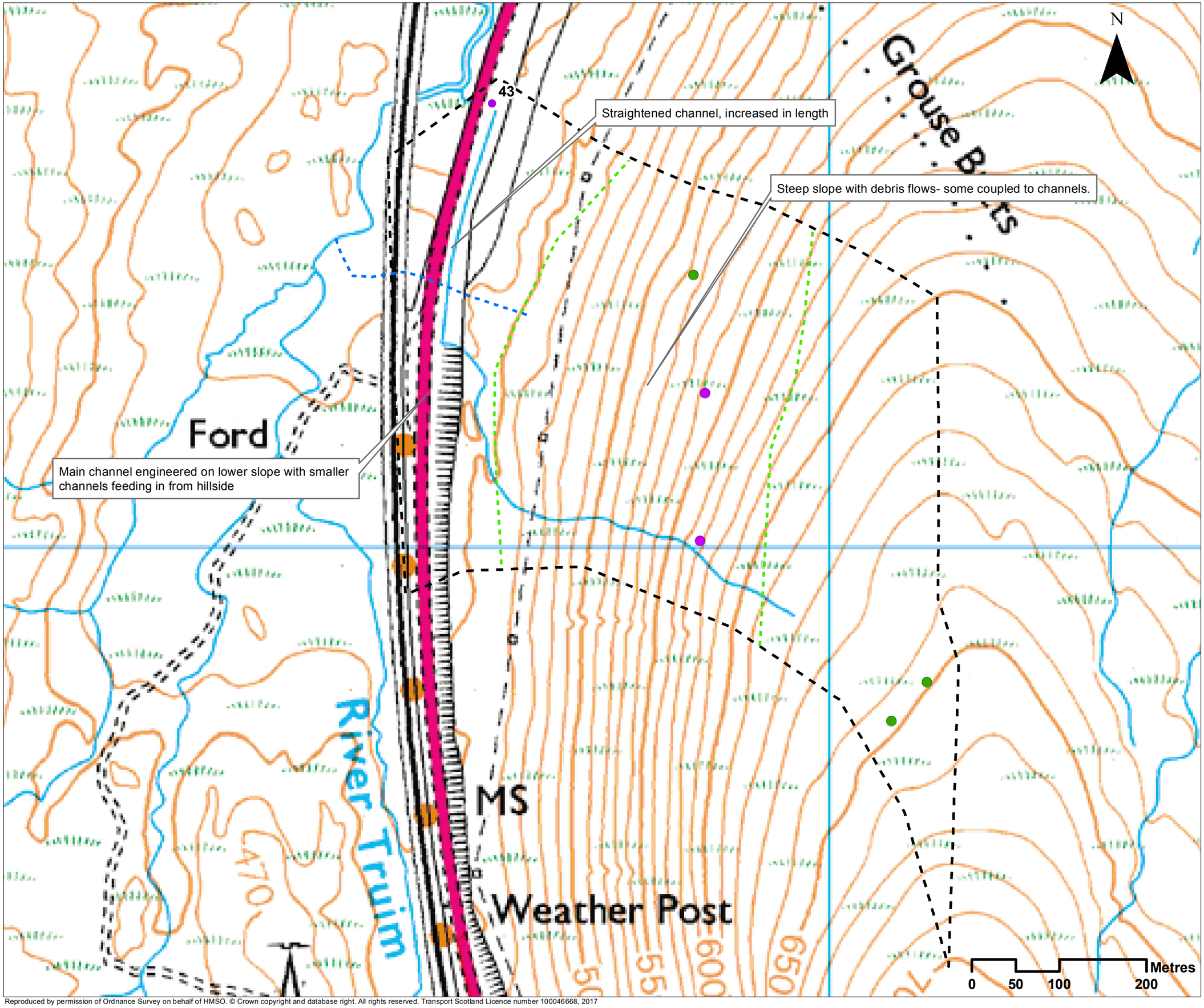

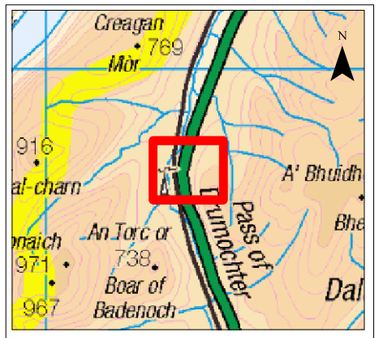

Legend

- Minor crossing
- Coupled debris flow
- Debris flow
- Break in slope
- Original channel
- Crossing catchment

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