Appendix 11.4

Hydromorphology Assessment Part 3



Annex 11.4.3 - Hydromorphological Catchment Assessment - 12

Cataly and Name	12	_			
Catchment Name	•	1			
	Nature of water course	Nat	tural		
Channel Nature	Size of water course	Mi	nor		
L					
	Catchment Area (km²)	0.04			
Quantitative Spatial Elements	Average slope in catchment (°)	1	10		
Spatial Elements	% Catchment over 750m (for snow melt risk)	0			
F	Manage Status and Investo				
WFD classification	Physical condition	н	igh		
un b classification	Overall ecological status	Pi	bor		
6					
	Majority Redrock (see Drawing 11.4.2.1.a.and h Catchment 12)	Gaick Reammite formation-Reammite	Registrant to weathoring impormable		
Geology	majority bedrock (see brawing 11.4.5.1 a and b catchinent 12)	Galek F Sammile Tormation - F Sammile	resistant to weathering, impermeable		
	Is an allowial fan procent at er near the crossing?	No			
	is an anovarian present at or near the crossing?	No			
r	T.	Γ	I.		
	Ramsar	No			
			Acidic scree, alpine and subalpine beaths blanket bog dry beaths		
			monntane acid grasslands , mountain		
	sac	Drumochter Hills	willow scrub, plants in crevices on acid		
Environmental	JAC .	Significant in the	rocks, species-rich grassland with mat-		
designations (see			grass in upland areas, tall herb		
Catchment 12)			communities, wet neathland with cross- leaved		
,	SPA	Drumochter Hills	Dotterel breeding, merlin breeding		
			Breeding hird assemblage fluvial		
	SSSI	Drumochter Hills	geomorphology of Scotland, montane		
			assemblage, vascular plant assemblage		
L	1	I	1		
	Changes in slope and channel confinement	See Drawing 11.4	3.2, Catchment 12		
	Is peat present in the catchment?	No			
	Is there a bog burst risk?	No			
	Potential valley side or terrace erosion	No			
	Hill slope failures (including peat slides and debris flows and slides)	No			
Sediment source	Hill slope failures coupled to channel	No			
and supply -	Vertical incision present in catchment	No			
Catchment Scale	Bank erosion/lateral migration	No			
	Unvegetated bars				
	Wooded/forested areas in catchment	No	Felling has occurred - may have change drainage and sediment supply patterns		
		Tool, and holder in which which	aromage and scament supply patterns		
	Comment on sediment source potential in catchment	Little sediment	supply to channel		
	Comment on sediment supply potential to crossing	Limited channels to sup	ply sediment to crossing		
comment on scannent supprit proteinant to crossing annexe channels to supprit scannent to crossing					
			· · · · ·		
	Channel morphology	Plane bed			
	Channel morphology Predominant sediment size Unvezetated bars	Plane bed Boulder to Gravel None			
	Channel morphology Predominant sediment size Unvegetated bars Vertical Incision	Plane bed Boulder to Gravel None Low			
Morphology and	Channel morphology Predominant sediment size Unvegetated bars Vertical incision Deposition	Plane bed Boulder to Gravel None Low Low			
Morphology and Process- Reach	Channel morphology Predominant sediment size Unvegetated bars Vertical incision Deposition Lateral migration/bank erosion	Plane bed Bouider to Gravel None Low Low High			
Morphology and Process- Reach upstream of	Channel morphology Predominant sediment size Unvegetated bars Vertical incision Deposition Lateral migration/bank erosion Infrastructure type (see Drawing 11.4.3.1 d, Catchment 12) Immart of Infrastructure	Plane bed Boulder to Gravel None Low tow High None None			
Morphology and Process- Reach upstream of crossing	Channel morphology Predominant sediment size Unvegetated bars Vertical incision Deposition Lateral migration/bank erosion Infrastructure type (see Drawing 11.4.3.1 d, Catchment 12) Impact of infrastructure	Plane bed Boulder to Gravel Low Low High None None Unclear from manning but channel			
Morphology and Process- Reach upstream of crossing	Channel morphology Predominant sediment size Unvegetated bars Vertical incision Deposition Lateral migration/bank erosion Infrastructure type (see Drawing 11.4.3.1 d, Catchment 12) Impact of infrastructure	Plane bed Boulder to Gravel Low Low High None Unclear from mapping but channel appears to have been straightened,			
Morphology and Process- Reach upstream of crossing	Channel morphology Predominant sediment size Unvegetated bars Vertical incision Deposition Lateral migration/bank erosion Infrastructure prog (see Drawing 11.4.3.1 d, Catchment 12) Impact of infrastructure Channel realignment	Plane bed Boulder to Gravel None Low High None Unclear from mapping but channel appears to have been straightened, creating a steeper gradient and also			
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Morphology and Process- Reach upstream of crossing Morphology and Process- At crossing Morphology and Process- Reach downstream of crossing	Channel morphology Predominant sediment size Unvegrated bars Vertical incision Deposition Lateral migration/Dank erosion Infrastructure type (see Drawing 11.4.3.1 d, Catchment 12) Impact of infrastructure Channel morphology Predominant sediment size Estimated discharge at 1:200 event (m ³ /s) Unvegrated bars Vertical incision Deposition Lateral migration/Dank erosion Damaged/unstable drains or armouring Channel morphology Predominant sediment size Unvegrated bars Vertical incision Deposition Lateral migration/Dank erosion Damaged/unstable drains or armouring Channel morphology Predominant sediment size Unvegrated bars Vertical incision Deposition Lateral migration/Dank erosion Damaged/unstable drains or armouring Channel morphology Predominant sediment size Channel realignment Channel is vertically unstable and incising (producing sediment and da downstream. Upstream of the cutting on the upslope side of the road the wide in plan, c.5m high) with its toe at the NMU route. The channel is verticed in the cutting on the upslope side of the road the wide in plan, c.5m high) with its toe at the NMU route. The channel is verticed in the cutting on the upslope side of the road the wide in plan, c.5m high) with its toe at the NMU route. The channel is verticed in the cutting on the upslope side of the road the wide in plan, c.5m high) with its toe at the NMU route. The channel is verticed in the cutting on the upslope side of the road the wide in plan, c.5m high) with its toe at the NMU route. The channel is verticed in the cutting on the upslope side of the road the wide in plan, c.5m high) with its toe at the NMU route. The channel is verticed in the cutting on the upslope side of the road the wide in plan, c.5m high) with its toe at the NMU route. The channel is verticed in the cutting on the upslope side of the road the wide in plan, c.5m high) with its toe at the NMU route. The channel is verticed in the cutting on the upslope side of the road the wide in plan.	Plane bed Boulder to Gravel None Low Low High None Unclear from mapping but channel appears to have been straightened, creating a steeper gradient and also takes drainage (increased discharge) Engineered Boulder to Gravel 0.23 No High Medium High None Plane bed Boulder to Gravel No Plane bed Boulder to Gravel No High Medium Amedium Medi	At crossing, but appears more stable upstream of cascade Due to incision Channel appears altered to take drains Bedrock through embankment Due to incision Due to incision		
Morphology and Process-Reach upstream of crossing Morphology and Process- At crossing Morphology and Process- Reach downstream downstream sing Summary behaviour	Channel morphology Predominant sediment size Unvegetated bars Vertical incision Deposition Lateral migration/bank erosion Infrastructure type (see Drawing 11.4.3.1 d, Catchment 12) Impact of infrastructure Channel morphology Predominant sediment size Estimated discharge at 1:200 event (m ³ /s) Unvegetated bars Vertical incision Deposition Lateral migration/bank erosion Damaged/unstable drains or armouring Channel morphology Predominant sediment size Unvegetated bars Vertical incision Deposition Lateral migration/bank erosion Infrastructure type (see Drawing 11.4.3.1 d, Catchment 12) Impact of infrastructure Channel realignment Channel is vertically unstable and incising (producing sediment and da downstream. Upstream of the cutting on the upslope side of the noad the is Downslope of the NMU route, the channel passes through more erodible b	Plane bed Boulder to Gravel Low Low High None Unclear from mapping but channel appears to have been straightened, creating a steeper gradient and also takes drainage (increased discharge) Engineered Boulder to Gravel 0.23 No High Medium High None Plane bed Boulder to Gravel No High Medium High Medium	At crossing, but appears more stable upstream of cascade Due to incision Channel appears altered to take drains Bedrock through embankment Due to incision Due to incision Due to incision		
Morphology and Process-Reach upstream of crossing Morphology and Process-At crossing Morphology and Process-Reach downstream of crossing Summary behaviour	Channel morphology Predominant sediment size Unvegetated bars Vertical incision Deposition Lateral migration/Dank erosion Infrastructure type (see Drawing 11.4.3.1 d, Catchment 12) Impact of infrastructure Channel morphology Predominant sediment size Estimated discharge at 1.200 event (m ³ /s) Unvegetated bars Vertical incision Deposition Lateral migration/Dank erosion Damaged/unstable drains or armouring Channel morphology Predominant sediment size Unvegetated bars Vertical incision Damaged/unstable drains or armouring Channel morphology Predominant sediment size Channel incision Deposition Lateral migration/Dank erosion Lateral migration/Dank erosion Channel incision Deposition Channel realignment Channel realignment Channel realignment Channel is vertically unstable and incising (producing sediment and da downstream. Upstream of the cutting on the upslope side of the road the wide in plan, c.15m high) with its to eat the NMU route, The channel discharge reader site Unvegetated bars Channel is vertically unstable and incising (producing sediment and da downstream. Upstream of the cutting on the upslope side of the road the wide in plan, c.15m high) with its to eat the NMU route, the channel discharge reader to a) and sediment supply patterns to the crossing b) gratert discharges for	Plane bed Boulder to Gravel None Low Low High None Unclear from mapping but channel appears to have been straightened, creating a steeper gradient and also takes drainage (increased discharge) Engineered Boulder to Gravel 0.23 No High Medium High None Plane bed Boulder to Gravel Boulder to Gravel Bould from Medium Medium Medium Medium NMU crossing Both will fix channel bed and bank positions and impound flood flows Unclear from mapping but channel appears to have been straightened and must descend .15m high embankment, creating a steeper gradient maging the crossing) to adjust to a more channel appears stable. The downslope s set below the level of this embankment, mumocky glacial deposits and into which elling has occurred since road constructi- elling has occurred since road constructi-	At crossing, but appears more stable Unit of the stable stable at the crossing and Channel appears altered to take drains Bedrock through embankment Due to incision Due to incision Due to incision Stable bed slope at the crossing and dide of the road is an embankment (70m and appears to be incised to bedrock. the channel has incised. This incision is on that that may have changed frainage from		
Morphology and Process- Reach upstream of crossing Morphology and Process- At crossing Morphology and Process- Reach downstream of crossing Summary behaviour	Channel morphology Predominant sediment size Unvegrated bars Vertical incision Deposition Lateral migration/Dank erosion Infrastructure type (see Drawing 11.4.3.1 d, Catchment 12) Impact of infrastructure Channel morphology Predominant sediment size Estimated discharge at 1.200 event (m ³ /s) Unvegetated bars Vertical incision Deposition Lateral migration/Dank erosion Damaged/unstable drains or armouring Channel morphology Predominant sediment size Estimated discharge at 1.200 event (m ³ /s) Unvegetated bars Vertical incision Deposition Lateral migration/Dank erosion Damaged/unstable drains or armouring Channel morphology Predominant sediment size Unvegetated bars Vertical incision Deposition Lateral migration/Dank erosion Liftrastructure type (see Drawing 11.4.3.1 d, Catchment 12) Impact of infrastructure Channel realignment Channel is vertically unstable and incising (producing sediment and da downstream. Upstream of the cutting on the upslope side of the road the wide in plan, c.15m high) with its toe at the NMU route. The channel is likely to have occurred due to increases in channel disharge related too 1) and sediment supply patterns to the crossing b) greater discharges froi neighbouring channels during very high flow ev neighbouring channels during very high flow eve	Plane bed Boulder to Gravel None Low Low High None Unclear from mapping but channel appears to have been straightened, creating a steeper gradient and also takes drainage (increased discharge) Engineered Boulder to Gravel 0.23 No High Medium High None Plane bed Boulder to Gravel No Plane bed Boulder to Gravel No High Medium Medium Medium Medium Medium NMU crossing Both will fix channel bed and bank positions and impound flood flows Unclear from mapping but channel appears to have been straightened and must descend c.15m high embankment, creating a steeper gradient tannel appears table. The downslope s set below the level of this embankment tannel appears table. The downslope s set below the level of this embankment the natural cathment and c) <i>possible</i>	At crossing, but appears more stable upstream of cascade Due to incision Channel appears altered to take drains Bedrock through embankment Due to incision Channel appears attered to take drains stable bed slope at the crossing and ide of the road is an embankment (70m and appears to be incised to bedrock. the channel has incised. This incision is on that that may have changed drainage capture of additional discharge from rege very low.		



Lateral channel change leading to change in flow path

Photograph 11.4.3.38-Upstream of crossing



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Legend			
General			
Cross	ing locati	ion	
Solid Geo	ology		
Gaick	Psammi	te Forma	ation - Psam
 Drift Geol	oav		
Peat	- 57		
Glacic	fluvial lo	e Conta	rt Donosite
Glacic	Plataau	Moraino	Eormation
Galck	Plateau		Formation
		aciai Dep	Diamiata
Arave			
Glacic	muviai Si	neet Dep	osits
Alluvit	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,		
River	Terrace I	Jeposits	
Alluvia	ai Fan De	eposits	
Неао			
	- Rock F	ragments	5
l'alus	Cone		
Environm	ental De	signatio	ons
Specia	al Site of	Scientifi	c Interest
Specia	al Area o	f Conser	vation
Specia	al Protec	tion Area	1
Morpholo	gical Pre	essures	
A Railwa	ay Bridge	;	
A Track	'Footbrid	ge	
Culve	rt		
Casca	ide		
Step i	n Bed		
• Catch	pit		
🔶 Dam o	or Weir		
- Powe	r Lines		
REV SUIT DA			DN BY A
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	×/	(3)	
TRAP	NSPORT LLAND	PE	UALLING RTH TO INVERNESS lein Garry to Dalwhianie
PROJE	CT 7 GLEN C	GARRY TO D	ALWHINNIE EI
Drawing 1	1.4.3.1 Catc	hment 12 Ca	atchment Overvi
DESIGN:			
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Annex 11.4.3 - Hydromorphological Catchment Assessment - 13-14

Catchment Name	13-14				
Catchinient Name	-]			
	Nature of water course	Nat	tural		
Channel Nature	Size of water course	Major			
L					
Quantitativa	Catchment Area (km ²) 0.7				
Quantitative Snatial Elements	Average slope in catchment (°)	9.5			
opution Electricities	% Catchment over 750m (for snow melt risk)	7			
WFD classification	Physical condition	G000			
	Overall ecological status	Po	bor		
	Majority Bedrock (see Drawing 11.4.3.1 a and b Catchment 13-14)	Gaick Psammite formation-Psammite	Resistant to weathering, impermeable		
Geology					
	Is an alluvial fan present at or near the crossing?	No			
	Ramsar	No			
			Acidic scree, alpine and subalpine		
			heaths, blanket bog, dry heaths,		
			monntane acid grasslands , mountain		
Environmontal	SAC	Drumochter Hills	willow scrub, plants in crevices on acid		
designations (see			grass in unland areas tall herb		
Drawing 11.4.3.1 c,			communities, wet heathland with cross-		
Catchment 13-14)			leaved		
1	SPA	Drumochter Hills	Dotterel breeding, merlin breeding		
1			Breeding bird assemblage, fluvial		
	5551	Drumochter Hills	geomorphology of Scotland, montane		
			assemblage, vascular plant assemblage		
	Channes in stars and shares of a second	Soo Drawing 11.4.2	2 Catchmont 12 14		
	Lhanges in slope and channel confinement	Yes	.2, Catchinent 15-14		
	Is there a bog burst risk?	Yes			
	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) Hill slope failures coupled to chappel	Yes			
Sediment source	Vertical incision present in catchment	Yes			
and supply -	Bank erosion/lateral migration	Yes			
Catchment Scale	Unvegetated bars	No			
	Wooded/forested areas in catchment	Yes	But not around channel		
	initiatioctale type (see blowing 11.4.5.1.0, catemicit 15.1.4)	Some sediment produced within the w	vider catchment, thought most is due to		
	Comment on sediment source potential in catchment	incision and erosion	local to the crossing		
	Comment on sediment supply potential to crossing	Steep slopes have potential to supply sediment, local erosion provides sedime			
		to cr	ossing		
	Channel morphology	Cascade			
	Predominant sediment size	Boulders and cobbles			
	Unvegetated bars	None			
Morphology and	Vertical incision	High			
unstream of	Lateral migration/bank erosion	High			
crossing	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 13-14)	Weir/Step			
_	Impact of infrastructure	Fixing bed level, reducing energy,			
1	Phone al configuration	reducing downstream sediment supply			
L	unannei realignment	None	1		
	Channel morphology	Engineered			
1	Predominant sediment size	None			
	Estimated discharge at 1:200 event (m ³ /s)	4.16 (Crossing 13)			
Process- At	Unvegetated bars	U.29 (Crossing 14)			
crossing	Vertical incision	High			
	Deposition	None			
	Lateral migration/bank erosion	None			
L	Damaged/Unstable drains or armouring	None	l		
	Channel morphology	Cascade			
	Predominant sediment size	Cobble and gravel			
Morphology and	Unvegetated bars	None			
Process- Reach	Vertical Incision	Medium			
downstream of	Lateral migration/bank erosion	Medium			
crossing	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 13-14)	NMU and Railway crossing culvert			
1	Impact of infrastructure	Fixing bed and banks			
	channel realignment	None	1		
Summary	Crossing has increased instability in the channel, initiating incision and la	iteral erosion. Sediment is transported th	rough the A9 and NMU crossings and		
behaviour	deposited at and downstream o	f the railway crossing as an alluvial fan.			
L					



Photograph 11.4.3.39-Upstream, bedrock cascade



Photograph 11.4.3.41-Downstream, channel incising



Photograph 11.4.3.40-Downstream



Photograph 11.4.3.42-Upstream to stone weir, fixing bed level, to reduce upstream channel incision



Photograph 11.4.3.43-Entrance to culvert

Photograph 11.4.3.44-erosion of valley side



Recent bank protection

Photograph 11.4.3.45-Downstream of small road crossing

Photograph 11.4.3.46-Downstream of NMU crossing



Photograph 11.4.3. 47-Upstream to small road crossing



Incision of the bed



Photograph 11.4.3.48-Additional outfall- crossing 14 downstream of NMU



Photograph 11.4.3.49- Upstream

Outfall of NMU crossing



Photograph 11.4.3.50- Some erosion to concrete/boulder cascade on exit of crossing



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REVISION: C01

SUITABILITY:

S3

PROJ: 495298

SHEET: 1 of 1

<u>Legend</u>			
General			
 Cross 	ing location	า	
Solid Geo	logy		
Caick	Psammite	Formatio	on - Psammite
North	Britain Silu	iro-Devoi	nian Calc-
Alkalir 🔜	ne Dyke Si	uite - Fels	site
Drift Geol	ogy		
Peat			
Glacic	ofluvial Ice	Contact I	Deposits
Gaick	Plateau M	oraine Fo	ormation
Humm	nocky Glac	ial Depos	sits
Ardve	rikie Till Fo	rmation -	Diamicton
Glacic	ofluvial She	et Depos	sits
	um T D	.,	
River	Terrace De	eposits	
	al Fan Dep	OSITS	
Head	Dook Fra	amonto	
	- RUCK Fra	yments	
Environm	Cone	anation	-
Speci	al Site of S		s nterest
Special Special	al Sile OI S al Area of (Conserva	tion
	al Protectic	on Area	
Morpholo	gical Pres	sures	
A Railwa	av Bridge		
	/Footbridge	;	
Culve	rt		
Casca	ade		
 Step i 	n Bed		
Catch	pit		
🔶 Dam d	or Weir		
- Powe	r Lines		
			BY APP
CH2MHI	LL Fairhurst JV		
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	\leq	7	
TRA	NSPORT	DU	
сомн	DHAL ALBA	PERTI Glen (arry to Dalwhinnie
PROJECT 7 GLEN GARRY TO DALWHINNIE EIA			
Drawing 11	.4.3.1 Catchm	ent 13-14 Ca	tchment Overview
DESIGN:	DRAWN:	CHK:	APP:
	15		EL



Annex 11.4.3 - Hydromorphological Catchment Assessment - 20-22

Catchment No.	20-22	-		
Catchment Name	-			
	Nature of water course	Di	rain	
Channel Nature	Size of water course	01	her	
	Size of water course	Other		
r		1		
Quantitative	Catchment Area (km ²)	0).2	
Spatial Elements	Average slope in catchment (°)		11	
opution Elemento	% Catchment over 750m (for snow melt risk)		0	
	Water, flows and levels	Gi	bod	
WFD classification	Physical condition	н	igh	
	Overall ecological status	P	oor	
	Majority Bedrock (see Drawing 11.4.3.1 a and b Catchment 20-22)	Gaick Psammite formation-Psammite	Resistant to weathering, impermeable	
Geology				
	Is an alluvial fan present at or near the crossing?	Yes	Possible vegetated fan near crossing 20	
			1	
	Ramsar	No		
			Acidic scree, alpine and subalpine	
			heaths, blanket bog, dry heaths,	
			monntane acid grasslands , mountain	
			willow scrub, plants in crevices on acid	
Environmontal	SAC	Drumochter Hills	reaks species risk grassland with mat	
docimental			areas in unland t-".	
uesignations (see			grass in upland areas, tall herb	
Drawing 11.4.3.1 c,			communities, wet heathland with cross-	
Catchment 20-22)			leaved	
	SPA	Drumochter Hills	Dotterel breeding, merlin breeding	
			Breeding bird assemblage, fluvial	
	SSSI	Drumochter Hills	geomorphology of Scotland, montane	
			assemblage, vascular plant assemblage	
	Changes in slope and channel confinement	See Drawing 11.4.3	2 Catchment 20-22	
	changes in slope and channel commence	See Brawing 11:15	Estantia descrite en flatter annual in	
	Is peat present in the catchment?	Yes	Extensive deposits on flatter ground in	
			upper catchment.	
	Is there a bog burst risk?	Yes	Low risk but possible. Unlikely to be	
	· · · · · · · · · · · · · · · · · · ·		high magnitude	
	Current valley side or terrace erosion	Yes		
Sodimont courco	Potential valley side or terrace erosion	Yes		
Seament Source	Hill slope failures (including peat slides and debris flows and slides)	Yes		
and supply -	Hill slope failures coupled to channel	No		
Catchment Scale	Vertical incision present in catchment	Vec		
	Pank grasion /atoral migration	Voc		
	bank erosion/lateral migration	ies No.		
	Unvegetated bars	NO		
	Wooded/forested areas in catchment	No		
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 20-22)	Track crossing		
	Comment on sediment source potential in catchment	Sediment is available	within the catchment	
	Comment on sediment supply potential to crossing	Very steep, channelized slope	s supply sediment to the drains	
	Channel morphology	Engineered		
	Predominant sediment size	None		
	Unvegetated bars	None		
Morphology and	Vertical incision	Low	1	
Process- Reach	Deposition	None		
upstream of	Lateral migration/bank erosion	Low		
crossing	Infrastructure type (see Drawing 11 / 2.1.d. Catchmont 20.33)	Nono		
	Impact of infrastructure	None	1	
	Channel scalingment	ivone	All farmer line of sharin	
L	lenamerredignment	162	An formalised drains	
[Channel morphology	Engineered		
	Brodominant codimont cizo	Nono		
		None		
Morphology and	Estimated discharge at 1:200 event (m ³ /s)	0.965	Crossing 20	
Process At	Unvegetated bars	None		
croceing	Vertical incision	Medium	Crossing 20	
crossing	Deposition	None		
	Lateral migration/bank erosion	None	1	
	Damaged/unstable drains or armouring	Yes		
L			ł	
	Channel morphology	Engineered		
	Predominant sediment size	Nono		
	Freuominant seument size	ivone		
Morphology and	Unvegetated bars	None		
Process- Reach	Vertical incision	None		
downstream of	Deposition	None		
uownscream of	Lateral migration/bank erosion	None		
crossing	Infrastructure type (see Drawing 11.4.3.1 d. Catchment 20-22)	Railway crossing		
	Impact of infrastructure	Fixing channel position		
	Channel realignment	None		
			I	
Summary	Small hillslong drainage channels have been formalized as nort of the AO	Channels relatively stable but see	ion and vortical instability (measing 20)	
behaviour	sman misiope uramage charmers have been formalised as part of the A9.	channels relatively stable but some eros	ion and vertical instability (crossing 20).	
1				





Annex 11.4.3 - Hydromorphological Catchment Assessment - 23

Catchment No.	23				
Catchment Name	-				
		-			
	Nature of water course	Natural			
Channel Nature					
	Size of water course	Major			
	Catchmont Area (km ²)	2	44		
Quantitative		13	12		
Spatial Elements	Average slope in catchment (*)	13			
	% Catchment over 750m (for snow melt risk)	5	J%		
		1			
	Water, flows and levels	G	bod		
WFD classification	Physical condition	н	igh		
	Overall ecological status	Pi	oor		
			1		
	Majority Redrock (see Drawing 11.4.3.1 a and b Catchment 23)	Gaick Psammite formation-Psammite	Resistant to weathering impermeable		
Geology	indjority bearbeit (see braining 11.1.5.1.4 and b eaterment 25)	Guick i summe formation i summe	nesistant to weathering, impermeasie		
	Is an alluvial fan present at or near the crossing?	No			
(1			
	Ramsar	No			
			Acidic scree, alpine and subalpine		
			heaths, blanket bog, dry heaths,		
			monntane acid grasslands , mountain		
			willow scrub plants in crevices on acid		
Environmental	SAC	Drumochter Hills	rocks, spacios, rich grassland with mat		
			TOCKS, Species-ficil grassianu with mat-		
Drewing 11, 12			grass in upland areas, tall herb		
urawing 11.4.3.1 c,			communities, wet heathland with cross-		
Catchment 23)			leaved		
	SPA	Drumochter Hills	Dotterel breeding, merlin breeding		
			Decoding hird assorbly as fluxed		
			Breeding bird assemblage, fluvial		
	SSSI	Drumochter Hills	geomorphology of Scotland, montane		
			assemblage, vascular plant assemblage		
			<u></u>		
1					
	Changes in slope and channel confinement	See Drawing 11.4	.3.2, Catchment 23		
	Is next present in the catchment?	Vec	Extensive peat deposits in lower		
	is pear present in the caterinient:	163	gradient mid-catchment slopes		
	Is there a bog burst risk?	Yes	Low but possible		
	Current valley side or terrace erosion	Some			
	Potential valley side or terrace erosion	Yes			
	Hill slope failures (including post slides and debris flows and slides)	Vec			
	Hill slope failures (including peat slides and debris nows and slides)	res			
Sediment source	Hill slope failures coupled to channel	Yes			
and supply -	Vertical incision present in catchment	Possible			
Catchment Scale	Bank erosion/lateral migration	Possible			
	Unvegetated bars	Yes			
	Wooded/forested areas in catchment	No			
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 23)	Upstream track crossing			
	Comment on codiment course notantial in catchment	Sodimont inputs will come from the	stoop clopes in the upper catchment		
	comment on scament source potentiar in cateriment	Scument inputs will come from the	steep slopes in the upper catelinent		
		Steep confined channels will transpor	a sediment to the crossing, however the		
	Comment on sediment supply potential to crossing	reduction in slope in the middle of the	catchment will reduce the volume and		
		speed of sediment s	upply to the crossing		
	Channel morphology	Cascade			
	Predominant sediment size	Boulders and cobbles			
	Unvegetated bars	Some			
Morphology and	Vertical incision	Low			
Process- Reach	Denosition	Medium			
upstream of	Lateral migration/bank erosion	Medium			
crossing	Infrastructure type (see Drawing 11.4.2.1.d. Catchment 22)	Track crossing			
	Initiastructure type (see Drawing 11.4.3.1 d, Catchinent 23)	Track crossing			
		Fixing channel banks			
L	Channel realignment	NONE	l		
			η		
			For c. 20m u/s of crossing and c.40m		
	Channel morphology	Engineered	d/s of crossing (as far as NMU crossing)		
			-, - si crossing las lar as laivio crossilig)		
	Predominant sediment size	None			
Morphology and	Estimated discharge at 1:200 event (m ³ /s)	12			
Process- At	Unvegetated bars	None			
crossing	Vertical incision	None	1		
	Deposition	None	1		
	Lateral migration/bank erosion	Medium	1		
1		weatum	Maill be adding and the second		
1	Damaged/unstable drains or armouring	Yes	will be adding some sediment to the		
L			channel		
					
	Channel morphology	Plane bed	Downstream of NMU crossing		
	Predominant sediment size	Cobble boulder			
	Unvegetated bars	Yes			
Morphology and	Vertical incision	Medium	1		
Process Boach	Deposition	Medium	1		
riocess- Reach	Lateral migration/bank erosion	Medium	1		
downstream of	Infrastructure time (see Drawing 11.4.2.4.4. Cotto mont 22)	NIAU annual annual	+		
crossing	minastructure type (see Drawing 11.4.3.1 d, Catchment 23)		+		
	Impact of infrastructure	NIVIV- Fixing bed level, creating step,			
		some downstream incision			
	Channel realignment	None			
Endiment provided from the upper enterment to the gradient sector is a first include the directly sector of the					
Summarv	Securitient provided from the upper catchment to the crossing over time.	. Localised erosion directly upstream of the	le crossing providing a local sediment		
behaviour	source. NIVIU crossing is then fixing channel bed and bank positions, creati	ing a large step in the channel bed and ca	using some incision. Differential erosion		
	taking place upstream and downstream of engineered se	ection, creating risk of undermining or ou	ıtflanking engineering.		
1	1				



Photograph 11.4.3.51-Some gravel deposition at old road crossing



Photograph 11.4.3.52-Upstream to culvert exit



Pitched bed and banks

Photograph 11.4.3.53-Crossing inflow

Photograph 11.4.3.54-Upstream of crossing



Photograph 11.4.3.55-Downstream to culvert entrance

Small pockets of gravel deposition at channel margins



Photograph 11.4.3.56-Upstream



Photograph 11.4.3.57- Cascade morphology in confined channel

Exposed unvegetated material left after pylon installation



Photograph 11.4.3.58- Cascade morphology in confined channel



Photograph 11.4.3.59-Upstream to bedrock falls



Photograph 11.4.3.61-Downtream to railway crossing

Small floodplain _ segment so little flood storage

Local erosion



Photograph 11.4.3.60-From valley top towards channel



Photograph 11.4.3.62-Upstream to small road crossing





Catchment No.	25-29				
Catchment Name	-	1			
r					
Channel Nature	Nature of water course	Na	tural		
enamernature	Size of water course	M	inor		
Quantitative	Catchment Area (km ²)	0	.41		
Snatial Flements	Average slope in catchment (°)		11		
Spatial Liements	% Catchment over 750m (for snow melt risk)		0		
		-			
	Water, flows and levels	Gi	bod		
WFD classification	Physical condition	Н	ign		
			501		
[
	Majority Bedrock (see Drawing 11.4.3.1 a and b Catchment 25-29)	Gaick Psammite formation-Psammite	Resistant to weathering, impermeable		
Geology					
	is an alluvial fan present at or near the crossing?	No			
	L	n.			
	Ramsar	No			
			Acidic scree, alpine and subalpine		
			means, blanket bog, dry heatns,		
			willow scrub, plants in crevices on acid		
Environmental	SAC	Drumochter Hills	rocks, species-rich grassland with mat-		
designations (see			grass in upland areas, tall herb		
Drawing 11.4.3.1 c,			communities, wet heathland with cross		
Catchment 25-29)			leaved		
	SPA	Drumochter Hills	Dotterel breeding, merlin breeding		
			Breeding bird assemblage, fluvial		
	SSSI	Drumochter Hills	geomorphology of Scotland, montane		
			assemblage, vascular plant assemblage		
	Changes in slope and channel confinement	See Drawing 11.4.3	.2, Catchment 25-29		
	Is peat present in the catchment?	Yes	Limited deposits in upper catchment		
	Is there a bog burst risk?	Yes	Negligible		
	Current valley side or terrace erosion	No			
	Potential valley side or terrace erosion	No			
	Hill slope failures (including peat sides and debris nows and sides)	res No			
Sediment source	Vertical incision present in catchment	Yes			
and supply -	Bank erosion/lateral migration	Yes			
Catchment Scale	Unvegetated bars	No			
	Wooded/forested areas in catchment	No			
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 25-29)	Track crossing	with potential for those to couple with		
	Comment on sediment source potential in catchment	channel Most sediment annears to be	supplied from locally incising channels		
	comment on seament source potential in cateninent	and	drains		
		Steep slopes will deliver sediment to the	e channels, however deposition is likely		
	comment on sediment supply potential to crossing	as the slope reduce	s before the crossing		
-					
	Channel morphology	Plane bed			
	Predominant sediment size	Gravel			
Morphology and	Unvegetated bars	None			
Process- Reach	Denosition	Low			
upstream of	Lateral migration/bank erosion	Low			
crossing	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 25-29)	None			
	Impact of infrastructure	None			
	Channel realignment	Yes	Drains and straightened channels		
r		- · · ·			
	Predominant sediment size	Gravel			
	Estimated discharge at 1:300 event (m^3/s)	Glavel	Design flow 0.82 m ³ /s		
Morphology and	Linvegetated bars	None	Design now 0.82 m /s		
Process- At	Vertical incision	None			
crossing	Deposition	Medium			
	Lateral migration/bank erosion	None			
	Damaged/unstable drains or armouring	Yes	Incision in drains		
[Channel merchelers	Diana had			
	Predominant sediment size	Gravel			
	Unvegetated bars	None			
Worphology and	Vertical incision	Low			
Process- Reach	Deposition	Medium			
crossing	Lateral migration/bank erosion	None			
crossing	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 25-29)	Railway crossing			
	Impact of infrastructure	Fixing channel position			
	Channel realignment	None			
Summary	Change in drainage network through the creation of drains and chann	nel straightening. Channels appear to be	incising and adding sediment to the		
behaviour	channel upstream of the crossing	, causing deposition within the crossing			
1					
1					





Annex 11.4.3 - Hydromorphological Catchment Assessment - 31

Catchment No.	31	-			
Catchment Name	-				
	Nature of water source	Na	tural		
Channel Nature	Nature of water course	Na	turai		
	Size of water course	M	ajor		
0	Catchment Area (km ²)	0	.83		
Quantitative	Average slope in catchment (°)	1	0.5		
Spatial Elements	% Catchment over 750m (for snow melt risk)		48		
	Water, flows and levels	G	bod		
WFD classification	Physical condition	G	bod		
	Overall ecological status	G	bod		
					
	Majority Bedrock (see Drawing 11.4.3.1 a and b Catchment 31)	Gaick Psammite formation-Psammite	Resistant to weathering, impermeable		
Geology			Large alluvial fan with anex at gorge		
Geology			evit Little evidence of recent instability		
	Is an alluvial fan present at or near the crossing?	Yes	except at apex but risk of avulsion		
			nonetheless		
	ł				
	Ramsar	No			
			Acidic scree, alpine and subalpine		
			heaths, blanket bog, dry heaths,		
			monntane acid grasslands , mountain		
	SAC	Drumochter Hills	willow scrub, plants in crevices on acid		
Environmental		Dranoenter milis	rocks, species-rich grassland with mat-		
designations (see			grass in upland areas, tall herb		
Drawing 11.4.3.1 c,			communities, wet heathland with cross		
Catchment 31)	CDA	Daving all 1. 1991	leaved		
	SPA	Drumochter Hills	Dotterel breeding, merlin breeding		
			Breeding bird assemblage, fluvial		
	SSSI	Drumochter Hills	geomorphology of Scotland, montane		
			assemblage, vascular plant assemblage		
L	1	1	-		
	Changes in slope and channel confinement	See Drawing 11.4	.3.2. Catchment 31		
	Is peat present in the catchment?	Yes			
	Is there a bog burst risk?	Yes			
	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			
Sediment source	Vertical incision present in catchment	Yes			
and supply -	Bank erosion/lateral migration	Yes			
Catchment Scale	Unvegetated bars	No			
	Wooded/forested areas in catchment	Yes	Small chance of floating debris		
	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 31)	No	Except ETL track and bridge (see below)		
		High notential sediment input from co	unled and channelized debris flows on		
	Comment on sediment source potential in catchment	steep	slopes		
		Catchment susceptible to flashy floods due to snowmelt that have potential to			
	Comment on sediment supply potential to crossing	transport sediment downstream. Chann	nel is also incised, increasing potential for		
		sediment supp	ly to the crossing		
	Channel morphology	Step-pool			
	Predominant sediment size	Boulder-Cobble			
Morphology and	Unvegetated bars	None			
Process- Reach	Vertical incision	Low			
upstream of	Deposition	Medium			
crossing	Lateral migration/bank erosion	LOW Track and bridge unstream of crossing			
	Impact of infrastructure	Fixing bank position			
	Channel realignment	None			
	0				
	Channel morphology	Engineered			
	Predominant sediment size	Cobbles and gravels			
Morphology av 1	Estimated discharge at 1:200 event (m ³ /s)	5.3			
Process At	Unvegetated bars	None			
crossing	Vertical incision	Medium			
crossing	Deposition	Medium			
	Lateral migration/bank erosion	Low			
	Damaged/unstable drains or armouring	Yes	I		
	Channel and the later		1		
	Channel morphology	Plane bed			
Morphology and	Preuominant sediment size	Uravels None			
	Vertical incision	None			
Process- Reach	Denosition	Low			
downstream of	Lateral migration/bank erosion	None			
crossing	Infrastructure type (see Drawing 11.4.3.1 d, Catchment 31)	Railway crossing			
	Impact of infrastructure	Fixing channel position			
	Channel realignment	None			
	-	*	*		
Summary	High sediment supply from steep slope, Catchment susceptible to flashy	r noods due to snowmelt. Crossing on an	alluvial tan so area of past large scale		
benaviour	deposition, and risk of avulsion (flow aban	uoning current channel and cutting new	cnannel).		
1	I				



Photograph 11.4.3.63-Upstream to catchment



Photograph 11.4.3.64-Downstream of crossing



Photograph 11.4.3.65-Culvert exit

Some scour

Gravel and cobble plane bed channel



Photograph 11.4.3.66- Culvert entrance



Photograph 11.4.3.67-Damaged concrete bed on entrance to the culvert



Photograph 11.4.3.69-Cascade morphology



Photograph 11.4.3.68-Upstream to catchment



Photograph 11.4.3.70-Downstream- Low gradient channel



Photograph 11.4.3.71-Debris flow tracks



Photograph 11.4.3.73-Upstrem to steep upper catchment



Photograph 11.4.3.72-Reduced channel slope downstream



Photograph 11.4.3.74-Some scour to concrete bed



Photograph 11.4.3.75-Upsteam

Incision damaging concreate bed and starting to destabilise banks

Incision undercutting engineered banks



Photograph 11.4.3.76-Downstrem to culvert



Photograph 11.4.3.77- Crossing 43 exit



Photograph 11.4.3.78-Downstream of crossing 43short section of plane bed river





DESIGN: EL	DRAWN: EL	CHK: AB	APP:	EL		
DATE: 10/07/201	DATE: 10/07/2017					
PROJ: 495298						
DWG: A9P07-CFJ-EWE-Z_ZZZZZ_ZZ-DR-EN-0002						
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