

# Appendix A11.3

Road Drainage Network Water Quality Assessment





# **Table of contents**

Cha	pter	Pages
<b>1.</b>	Introduction	<b>1</b>
1.2.	Aims and Objectives	1
<b>2.</b>	Assessment Methods	<b>1</b>
2.1.	Method A Routine Runoff Assessment	1
2.2.	Method D Accidental Spillage Assessment	5
2.3.	Road Salt Assessment	6
<b>3.</b>	Results	<b>7</b>
3.1.	Method A Routine Runoff Assessment	7
3.2.	Method D Accidental Spillage Assessment	11
3.3.	Road Salt Assessment	11
5.	References	13
<b>Annex</b>	A. Calculation Datasheets	<b>14</b>
A.1.	Method A Routine Runoff Assessment Datasheets	14
A.2.	Method D Accidental Spillage Assessment Datasheet	29

### **Tables**

Table A2.1: Indicative Treatment Efficiencies of Drainage systems	4
Table A2.2: Example of Treatment Train Calculation	4
Table A2.3: Generic Salt Assessment Input Parameters	7
Table A3.1: Summary of Method A Routine Runoff Assessment Results	8
Table A3.2: Summary Method D Accidental Spillage Assessment Results	11
Table A3.3: Road Salt Assessment Results	11

### **Figures**

Figure 2.1: HAWRAT Assessment Process

3

┿

# 1. Introduction

- 1.1.1. This report is a technical appendix to the A9 Dualling Tomatin to Moy DMRB Stage 3 Environmental Statement, Chapter 11: Road Drainage and the Water Environment.
- 1.1.2. This document details the methods and results of the water quality assessments carried out for each mainline road drainage network, as summarised in Chapter 11.
- 1.1.3. The assessments have taken into consideration the embedded sustainable drainage systems (SuDS) incorporated within the DMRB Stage 3 drainage design.

#### 1.2. Aims and Objectives

- 1.2.1. This document provides details of the assessment methods and results of the following water quality assessments carried out for each mainline road drainage network:
  - DMRB HD 45/09 Method A assessment of pollution impacts from routine runoff on surface waters
  - DMRB HD 45/09 Method D assessment of pollution impacts from operational accidental spillage
  - Assessment of the short term, acute impacts of road salt, utilising a method developed by Jacobs for use on all projects within the A9 Dualling programme

# 2. Assessment Methods

#### 2.1. Method A Routine Runoff Assessment

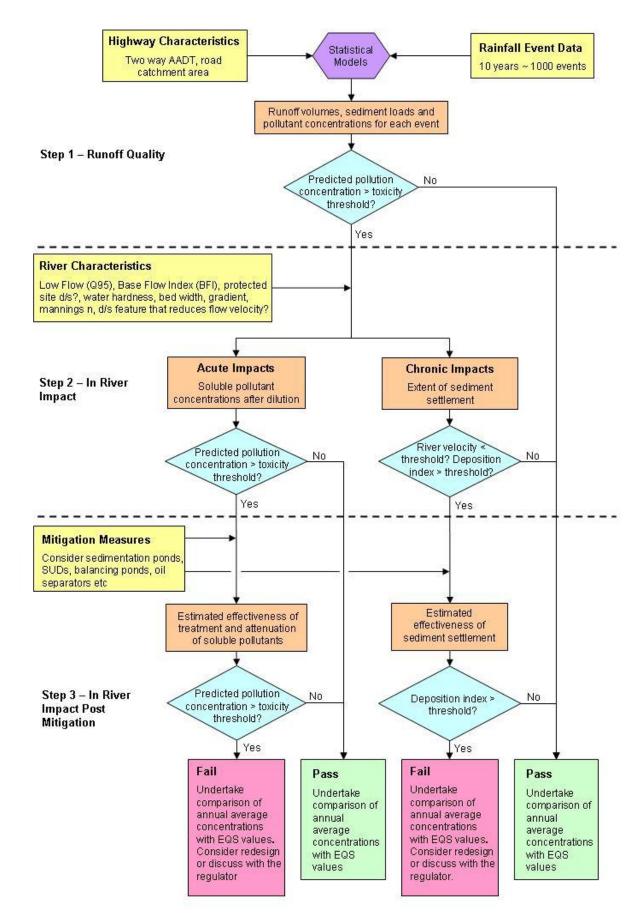
- 2.1.1. DMRB HD 45/09 Method A assessment of pollution impacts from routine runoff on surface waters, comprises two separate elements:
  - HAWRAT Assessment: the Highways Agency Water Risk Assessment Tool (HAWRAT) is a Microsoft Excel application designed to assess the short-term risks related to the intermittent nature of road runoff. It assesses the acute and chronic pollution impacts on aquatic ecology associated with soluble and sediment bound pollutants, respectively.
  - EQS Assessment: Environmental Quality Standards (EQS) are the maximum permissible annual average concentrations of potentially hazardous chemicals, as defined under the WFD. The long-term risks over the period of one year are assessed through comparison of the annual average concentration of pollutants discharged with the published EQS for those pollutants.
- 2.1.2. Both assessments require a variety of data about the proposed scheme and the receiving watercourses, this includes: the permeable and impermeable areas of each drainage network, traffic volumes associated with each drainage network, the Q<sub>95</sub> flow (flow exceeded 95% of the time) for each receiving watercourse at the point of the road discharge, watercourse baseflow index (a measure of the proportion of flow in the watercourse derived from groundwater) and watercourse dimensions such as bed width, side slopes and gradient at the point of discharge.

#### **HAWRAT Assessment**

- 2.1.3. HAWRAT is a tiered consequential system which involves up to three assessment stages:
  - Step 1 uses statistical models to determine pollutant concentrations in raw road runoff prior to any treatment or dilution in the receiving watercourse.
  - Step 2 assesses in-river pollutant concentrations after dilution and dispersion but without active mitigation.
  - Step 3 considers the in-river pollutant concentrations with active mitigation. For an individual outfall to pass the HAWRAT assessment, it must pass both soluble pollutant and sediment pollutant impacts.
- 2.1.4. Figure 2.1 below displays the HAWRAT process and stages of assessment.
- 2.1.5. For soluble pollutants HAWRAT calculates the in-river concentration of soluble copper and zinc for approximately 1000 stochastically generated rainfall events. For each rainfall event the calculated soluble copper and zinc concentrations are compared with in-built thresholds, and the number of exceedances across the 1000 rainfall events calculated. This is then compared with in-built exceedance thresholds, which vary depending on whether or not there are sensitive sites such as SSSIs located downstream of the proposed discharge location (i.e. for less sensitive locations it is considered acceptable for the 24hr copper and zinc concentration thresholds to be exceeded twice a year on average, however if a SSSI was located within 1km downstream of the discharge the number of exceedances considered acceptable in a year on average would be halved to once per year). The number of exceedances determines whether the proposed discharge passes or fails the soluble metals part of the HAWRAT assessment.
- 2.1.6. For the sediment-bound pollutants the ability of the receiving watercourse to disperse sediments is considered and, if sediment is expected to accumulate, the potential extent of sediment coverage is also considered. HAWRAT estimates the river velocity under low flow conditions and assumes that sediment arriving in the river when the velocity is less than 0.1 m/s accumulates. A basic estimation of velocity is calculated iteratively using the cross sectional area of the river channel and the flow volume at low flow conditions. The extent of deposition is evaluated by calculating the deposition index. To pass the sediment assessment within HAWRAT the discharge under assessment must pass both stages.
- 2.1.7. Where failures occur mitigation measures in the form of Sustainable Drainage Systems (SuDS) can be considered. The pollutant removal efficiency (expressed as a percentage reduction in pollutant concentrations) of the SuDS treatment train can be applied to the calculations and the assessments re-run.
- 2.1.8. The SuDS design and assessment process is iterative, and in most cases the drainage design is modified until each network passes all elements of the HAWRAT and EQS assessments.







2.1.9. The treatment efficiency values applied in the assessment are based on those documented in DMRB HD 33/16 Design of Highway Drainage Systems, and summarised in Table A2.1 below.

Treatment System Type	Suspended Solids (% removal)	Soluble Copper (% removal)	Soluble Zinc (% removal)
Swales and Grassed Channels	80	50	50
Dry / Detention Basins	50	0	0
Wet / Retention Ponds	60	40	30
Surface Flow Wetlands	60	30	50
Vortex Grit Separators	40	0	15
Sediment Tanks	40	0	0
Oil Separators	0	0	0
Reservoir Pavements / Porous Asphalt	50	0	0
Vegetated Filter Strips	25	15	15
Combined Surface and Sub- surface Drains / Filter Drains	60	0	45
Ditches	25	15	15

#### Table A2.1: Indicative Treatment Efficiencies of Drainage systems

2.1.10. Generally, where a two or three stage treatment train is proposed the treatment efficiency of the secondary and tertiary stages is half of that quoted in Table A2.1. This takes into account the reduced performance of the secondary and tertiary stages due to the already reduced pollutant concentrations. However, if the primary stage does not provide any reduction of a particular pollutant, then for the next stage of the treatment train the full treatment efficiency quoted above is used for that particular pollutant. For example, in the case of a two stage treatment train consisting of filter drains followed by a wet/retention pond, the overall treatment efficiencies for sediment, copper and zinc would be as shown in Table A2.2.

Treatment Train	Suspended Solids (% removal)	Soluble Copper (% removal)	Soluble Zinc (% removal)
Primary Treatment - Filter Drains	60	0	45
Secondary Treatment - Wet / Retention Pond	30	40	15
Overall Treatment	72	40	53

#### **EQS** Assessment

- 2.1.11. The HAWRAT program also calculates the annual average concentration of soluble copper and zinc, and these can be compared with the published EQS thresholds to determine pass or failure of the EQS assessment.
- 2.1.12. The EQS thresholds for copper and zinc are:
  - Copper an annual average of 1µg/l bioavailable copper

- Zinc an annual average of 10.9 µg/l bioavailable zinc + Ambient Background Concentration (ABC) (µg/l) dissolved zinc
- 2.1.13. HAWRAT calculates the total annual average concentration of dissolved copper and dissolved zinc, not the bioavailable fraction. Comparing these calculated values with the bioavailable EQSs results in a conservative assessment of the routine runoff impacts, which generally provides a degree of comfort in the Method A assessment. However in exceptional circumstances this approach can be overly conservative leading to very onerous mitigation requirements.

#### Limitations

- 2.1.14. With regards to the routine runoff assessment, use of HAWRAT presents several limitations.
- 2.1.15. Firstly, a rainfall site must be selected from an embedded list of 21 sites across the UK, with only three located in Scotland. The closest and most geographically similar rainfall site is Ardtalnaig (near Aberfeldy). The annual average rainfall at Ardtalnaig is reported as being 1402mm while the annual average rainfall within the study area is approximately 1053mm. There is therefore potential for overestimation of flows within the receiving watercourses and from the road drainage networks.
- 2.1.16. Additionally, HAWRAT uses two-way Annual Average Daily Traffic (AADT) volumes in the estimation of pollutant build-up on the road, where AADT data is entered in broad bands of 10,000 to 50,000, 50,000 to 100,000, and >100,000. Given that the volumes of traffic estimated for the Proposed Scheme (16,000-18,000 AADT) are at the lower end of the lowest traffic band it is likely that there is overestimation of the pollutant concentrations in the road runoff.
- 2.1.17. Finally, the required treatment percentages returned by HAWRAT are very precise, however the guidance on the treatment efficiency of SuDS provided in HD 33/16 can only be used as broad indicator of performance. With the above in mind a degree of pragmatism is required when designing and assessing the road drainage system; the treatment train should be sufficient to reasonably treat runoff.

#### 2.2. Method D Accidental Spillage Assessment

- 2.2.1. The DMRB HD 45/09 Method D Accidental Spillage Assessment takes the form of a risk assessment, where the risk is expressed as the annual probability of a serious pollution incident occurring. This risk is the product of two probabilities:
  - The probability that an accident will occur, resulting in a serious spillage of a polluting substance on the carriageway.
  - The probability that, if such a spillage did occur, the polluting substance would reach the receiving water body and cause a serious pollution incident.
- 2.2.2. The probability of a serious spillage occurring is dependent on a variety of factors; traffic volumes, percentage of heavy goods vehicles in the traffic volumes, whether the road is motorway, rural or urban trunk road, the road type categories within the road drainage catchment under assessment i.e. 'no junction', 'slip road', 'cross road' or 'roundabout' and the length of each road type within the catchment.
- 2.2.3. The probability of a serious spillage subsequently causing a serious pollution incident is dependent on the receiving surface water body and the response time of the emergency services, i.e. less than 20 minutes, less than one hour, or greater than one hour.

2.2.4. Typically an annual probability of 1% (i.e. a 1 in 100 chance of a serious pollution incident occurring in any one year) is considered by DMRB as an acceptable risk. However, where a road drainage outfall discharges within 1km of a sensitive receptor, (such as a nationally designated conservation site), a higher level of protection is required, such that the risk has no greater annual probability than 0.5% (i.e. a 1 in 200 chance of occurring in any one year).

#### 2.3. Road Salt Assessment

- 2.3.1. The DMRB does not provide a method for assessing the potential impacts of salt on the water environment, yet this is an area that has been identified as a concern by Scottish Natural Heritage (SNH). In the absence of a published method for assessing salt impacts a common methodology has been developed by Jacobs, which is to be applied to all projects within the A9 Dualling programme.
- 2.3.2. Research has not identified an applicable methodology for the assessment of salt impacts from other reference sources, or specifically the concentration of chloride ions on the water environment. It is known that chloride and the presence of salt ions (as measured by conductivity) have a negative impact on freshwater pearl mussels and fish species in the water environment. There is literature available on the application of salt for safety purposes and for the management of salt application to reduce environmental impacts (UK Roads Liaison Group, 2013<sup>i</sup>).
- 2.3.3. The application of salt on road infrastructure is a winter activity (typically October to April) intended to prevent icing and avoid excessive build-up of snow and to promote the melting of snow. It is a widespread and existing practice that is unlikely to change significantly as a direct result of the A9 dualling programme, however the dualling of the A9 will create a larger surface area to which salt is applied and new drainage systems will alter the current pathways for salt to enter the water environment.
- 2.3.4. In the absence of an existing method for assessing salt concentrations in road runoff and at the point of dilution, a simple and conservative risk-based model has been developed that follows the principles of the approach taken by the HAWRAT routine runoff method. The method uses UK Roads Liaison Group (2013) guidance on the maximum application rate of road salt, combined with information of the ratio of road salt to brine in pre-wetted salt application; enabling an estimation of the mass (kg) of salt applied per square metre of road and subsequently per section of road draining to each discharge outlet.
- 2.3.5. The mass of road salt (kg) is then adjusted to estimate the mass (kg) of specific NaCl applied, given a 23% concentration of salt within the brine and a 90% concentration of salt within the rock salt. A number of conservative assumptions have then been made; that the entire mass of NaCl is dissolved in the first 5mm of subsequent rainfall / snow melt and that the entirety of this solution will be discharged from the drainage outlet. This concentrated 'first flush' solution has been assumed to be discharged at the greenfield runoff rate, as per the design standard for the proposed road drainage networks. The result is an estimated concentration of NaCl in road runoff in kg/m<sup>3</sup>, which can be converted to milligrams per litre (mg/l).
- 2.3.6. The second stage of the assessment considers the dilution available within the receiving watercourse, due to the anticipated winter conditions at the time of application, this is calculated based on the estimated mean flow in each watercourse. No allowance for background watercourse salt concentrations is currently included in the assessment. The subsequent concentration of Cl<sup>-</sup> in the receiving watercourse is calculated from the outflow concentrations of NaCl (atomic weight of 58.44g/mol) based on the ratio of



relative atomic weights of Na (atomic weight of 22.98g/mol) and Cl<sup>-</sup> (atomic weight of 35.45g/mol) of 39:61.

- 2.3.7. There is no UK short-term EQS for CI<sup>-</sup> that can be used to assess the impact of the estimated outflow concentrations. For the purposes of this assessment, resultant CI<sup>-</sup> concentrations have been compared against the Canadian Council of Ministers of the Environment (2011)<sup>ii</sup> short-term exposure guideline value of 640mg/l. The Canadian guidance is based on chloride toxicity tests which included a mussel species with similar biology / ecology to the freshwater pearl mussel native to the UK. Freshwater mussels are noted in the Canadian guidance document as being the most sensitive taxonomic group to chloride.
- 2.3.8. Generic input parameters used within the salt assessments are provided in Table A2.3 below.

Parameter	Value Used	Source
Max application of salt per m <sup>2</sup>	40g/m <sup>2</sup>	UK Roads Liaison Group (2013)
Rainfall depth	5mm	Value adopted relates to the first flush rainfall depths used in the 'The SuDS Manual' (CIRIA, 2015).
Ratio of dry salt to brine	70:30	UK Roads Liaison Group (2013)
Runoff coefficient	1	As used in HAWRAT
Canadian Water Quality Guideline for short-term exposure to Chloride	640mgCl <sup>-</sup> /l	Canadian Council of Ministers to the Environment (2011)

#### Table A2.3: Generic Salt Assessment Input Parameters

2.3.9. It should be noted that the results of the salt assessment have not been included within the overall impact assessment for the proposed scheme, due to there being no defined UK short-term EQS for Cl<sup>-</sup>, an absence of any methodology for assessing the impacts of salt within the DMRB guidance and lack of published data on SuDS treatment efficiency of Cl<sup>-</sup>.

# 3. Results

#### 3.1. Method A Routine Runoff Assessment

- 3.1.1. The Proposed Scheme involves a total of 14 surface water discharges associated with mainline drainage. The location of these discharge outfalls and their associated hydrological catchment used in the assessment are presented on Figure A11.3.1.
- 3.1.2. One cumulative assessment has been carried out for outfalls 4A and 4B, as required for outfalls located within 1km of each other, on the same watercourse reach.
- 3.1.3. The results for each drainage network are summarised in Table A3.1. Highways Agency Water Risk Assessment Tool (HAWRAT) datasheets are provided in Annex A.1.

Mainline Drainage Network ID	Proposed SuDS Treatment Train		ment iencies val)	(%	HAWRAT Assessment					EQS Assessment			
								m/s)	Xé	Annual Average	e Dissolved Copper	Annual Average Dissolved Zinc	
		Soluble Copper	Soluble Zinc	Sediment	Soluble Copper Soluble Zinc	Soluble Zinc	Soluble Zinc Sediment	-ow Flow Vel. (m/s)	Deposition Index	Value (mg/l)	Pass / Fail	Value (mg/l)	Pass / Fail
E-A	Grassed Channel & Geocellular Storage Tank	50	50	80	Pass	Pass	Pass	0.04	7	0.02	Pass	0.05	Pass
1-A	Filter Drains, Ditches & Wet/Retention Pond	45	57	76	Pass	Pass	Pass	0.04	11	0.00	Pass	0.00	Pass
2-A	Filter Drains & Wet/Retention Pond	40	53	72	Pass	Pass	Pass	0.32	-	0.04	Pass	0.10	Pass
3-A	Filter Drains & Wet/Retention Pond	40	53	72	Pass	Pass	Pass	0.38	-	0.11	Pass	0.26	Pass
4-A	Filter Drains & Wet/Retention Pond	40	53	72	Pass	Pass	Pass	0.37	-	0.02	Pass	0.05	Pass
4-B	Filter Drains & Wet/Retention Pond	40	53	72	Pass	Pass	Pass	0.29	-	0.03	Pass	0.07	Pass
Cumulative 4A & 4B	Filter Drains & Wet/Retention Ponds	40	53	72	Pass	Pass	Pass	n/a	n/a	0.05	Pass	0.11	Pass

Table A3.1: Summary of Method A Routine Runoff Assessment Results

Mainline Drainage Network ID	Proposed SuDS Treatment Train		tment iencies oval)	(%	HAWRAT Assessment					EQS Assessment			
		~						(s/u)	хе	Annual Average	e Dissolved Copper	Annual Average Dissolved Zinc	
		Soluble Copper	Soluble Zinc	Sediment	Soluble Copper	Soluble Zinc	Sediment	Low Flow Vel. (m/s)	Deposition Index	Value (mg/l)	Pass / Fail	Value (mg/l)	Pass / Fail
5-A	Filter Drains & 2 Wet/Retention Pond	52	60	80	Pass	Pass	Pass	0.10	-	0.62	Pass	1.56	Pass
6-A	Filter Drains, & 2 Wet/Retention Ponds	52	60	80	Pass	Fail	Pass	0.12	-	1.27	Fail	3.34	Pass
7-A	Filter Drains & Wet/Retention Pond	40	53	72	Pass	Pass	Pass	0.35	-	0.25	Pass	0.60	Pass
8-A	Filter Drains & Wet/Retention Pond	40	53	72	Pass	Pass	Pass	0.40	-	0.08	Pass	0.19	Pass
9-A	Filter Drains & Wetland	30	59	72	Pass	Pass	Pass	0.15	-	0.47	Pass	0.83	Pass
X-A	Filter Drains & Wet/Retention Pond	40	53	72	Pass	Pass	Pass	0.45	-	0.10	Pass	0.25	Pass
Y-A	Filter Drains & Wet/Retention Pond	40	53	72	Pass	Pass	Pass	0.20	-	0.22	Pass	0.53	Pass
Z-A	Filter Drains & Wet/Retention Pond	40	53	72	Pass	Pass	Pass	0.10	-	0.28	Pass	0.67	Pass

- 3.1.4. As can be seen above all networks, with a single exception, pass all aspects of the routine runoff assessment.
- 3.1.5. Network 6A discharges into Funtack Burn Tributary 6, a very small stream/drain with reasonably good water quality, low flows and therefore limited dilution capacity, and low biodiversity value. Downstream of the proposed outfall this channel flows steeply downhill through conifer plantation, before being culverted under the HML and B9154. The culvert discharges on the opposite side of the B9154 into peatland, approximately 80m downstream of the outfall.
- 3.1.6. Network 6A fails discrete elements of the routine runoff assessment, namely the HAWRAT assessment for short-term acute impacts from soluble zinc and the EQS assessment for the long-term chronic impacts from soluble copper.
- 3.1.7. The preliminary results of the assessments indicated that to mitigate these impacts a 63% percent reduction of copper and a 62% reduction of zinc was required. However it should be noted that due to the relatively low traffic volumes predicted for the dualled A9, the assessment may be overestimating the pollutant loading in the runoff and therefore the treatment requirements. Three stages of treatment are proposed on this network: filter drains, followed by two retention ponds in series. In total this treatment train is expected to provide 52% and 60% reductions in copper and zinc respectively. This is a shortfall of 11% for copper and just 2% for zinc. It is unlikely that adding any further treatment stages will improve the results significantly.
- 3.1.8. Interrogation of the detailed results for the HAWRAT assessment on soluble zinc shows that with the proposed treatment train there will be on average 2.2 exceedances per year of the zinc 24 hour threshold. To put this into context the HAWRAT assessment methodology deems an average of 2 exceedances per year as acceptable.
- 3.1.9. In relation to the EQS failure for copper, the annual average soluble copper concentration downstream of the outfall (with the proposed treatment train) has been predicted to be 1.27µg/l. This is the total concentration of copper, not the bioavailable fraction. The assessment has compared this value with the published EQS of 1µg/l bioavailable copper. It is possible that the bioavailable portion of the estimated downstream concentration is less than the EQS bioavailable limit.
- 3.1.10. It is likely that the residual levels of soluble copper and zinc will have a small impact on the water quality of the Funtack Burn Tributary 6, however the proposed treatment train will minimise this impact. Furthermore it is likely that the existing A9 is currently discharging untreated runoff into the channel. In providing the proposed three levels of treatment it is possible that the water quality of the stream may actually improve.
- 3.1.11. One network (Network E-A, associated with Tomatin South Junction) involves widening of the existing A9 mainline and will subsequently convey mainline drainage for the area surrounding this junction development. The area is highly constrained with very limited space between the existing A9 carriageway and the HML railway. The mainline area to be widened as part of the junction development will therefore be drained via a geocellular storage tank and grassed channel before being conveyed via the existing road drainage ditch (Allt Cosach Trib 1). In addition to this flow, mainline drainage associated with the existing A9 dual carriageway, just south of the section to be widened, will be intercepted and diverted to the ditch also. This will then flow west to converge with the Allt Cosach. Due to the engineered nature of the existing drainage ditch and its limited natural catchment, it has not been possible, nor was it considered appropriate, to assess this outfall at the point of discharge to the drainage ditch meets the natural watercourse Allt Cosach, approximately 240m downstream.

## 3.2. Method D Accidental Spillage Assessment

- 3.2.1. The DMRB Method D Accidental Spillage Assessment results are presented in full in Annex A, Section A.2, and are summarised in Table A3.2 below.
- 3.2.2. All mainline networks pass accidental spillage assessments to the higher standard of at least a 1 in 200 year return period (where sensitive receptors are identified within 1km downstream). The minimum return period has been calculated as 1 in 2,885 years (1A). These calculations have been carried out assuming no mitigation is in place. If the SuDs proposed for the treatment of routine runoff are taken into account the accidental spillage risks will fall further.

Mainline Drainage Network ID	Return Period Probability 1 in 'X' (Years)	Pass / Fail
E-A	4,596	Pass
1-A	2,685	Pass
2-A	10,750	Pass
3-A	6,351	Pass
4-A	11,956	Pass
4-B	9,966	Pass
Cumulative 4A & 4B	5,435	Pass
5-A	3,123	Pass
6-A	10,521	Pass
7-A	8,208	Pass
8-A	5,066	Pass
9-A	3,744	Pass
X-A	7,777	Pass
Y-A	16,787	Pass
Z-A	8,100	Pass

#### Table A3.2: Summary Method D Accidental Spillage Assessment Results

#### 3.3. Road Salt Assessment

3.3.1. Using the method and generic parameters set out in Section 2.3 the concentration of Chloride ion in the theoretical raw road runoff has been estimated to be 3411mg/l. The in-river concentrations at each of the mainline road drainage outfalls is presented in Table A3.3 below.

Mainline Drainage Network ID	Imperm. Area (Ha)	Greenfield Runoff Rate (I/s)	Receiving watercourse	Mean Flow (I/s)	In-river Cl <sup>-</sup> Conc. (mg/l)	Pass / Fail
E-A	0.574	1.1	Allt Cosach	22	169	Pass
1-A	2.934	5.9	River Findhorn	10,000	2	Pass

Table A3.3: Road Salt Assessment Results
--

Mainline Drainage Network ID	Imperm. Area (Ha)	Greenfield Runoff Rate (I/s)	Greenfield Runoff Rate (I/s) Matercourse E E		In-river CI <sup>-</sup> Conc. (mg/l)	Pass / Fail
2-A	1.484	3.0	Allt na Frithe	137	72	Pass
3-A	2.342	4.7	Allt Dubhag	59	251	Pass
4A & 4B	2.709	5.4	Dalmagarry Burn	199	90	Pass
5-A	2.918	5.8	Funtack Burn Trib 3	8	1,439	Fail
6-A	1.823	3.6	Funtack Burn Trib 6	2	2,203	Fail
7-A	1.248	2.5	Caochan na h- Eaglais	18	415	Pass
8-A	1.697	3.4	Allt Loinne Moire	74	150	Pass
9-A	4.084	8.2	Allt Creag Bheithin Trib 1	22	924	Fail
X-A	1.895	3.8	Allt Creag Bheithin (lower reach)	61	200	Pass
Y-A	3.096	6.2	Allt Creag Bheithin (upper reach)	22	749	Fail
Z-A	0.514	1	Midlairgs Burn Trib 2	4	697	Fail

- 3.3.2. As can be seen above several of the outfalls located on the smallest drains and watercourses fail the road salt assessment. This is unsurprising given that, for these watercourses, a large proportion of the watercourse flow is attributed to the road drainage discharge itself. In these instances it is likely that there will be a short term impact on the watercourse due to road salt. For the theoretical calculations reported above the road salt will discharge over a period of 7 hours, however it should be noted that this is assuming a single gritter run/application of road salt. Any additional gritter runs during the winter weather event would prolong the period of salt discharge.
- 3.3.3. With regard to the watercourses where failures are anticipated, these are generally very small heavily modified drains with little or no biodiversity interest. Furthermore, each discharges into a larger watercourse a short distance downstream of the outfalls, where the salt content is diluted to levels below the acute impact threshold used in this assessment. Therefore it is unlikely there will be any significant impact on the aquatic ecology of the study area.

# 5. References

<sup>&</sup>lt;sup>i</sup> Roads Liaison Group (2013). Well-maintained Highways: Code of Practice for Highway Maintenance Management.

<sup>&</sup>lt;sup>ii</sup> Canadian Council of Ministers of the Environment (2011). Canadian Water quality Guidelines for the Protection of Aquatic Life – Chloride.



# **Annex A. Calculation Datasheets**

### A.1. Method A Routine Runoff Assessment Datasheets

#### **Soluble Copper and Sediment Result**

AGENOT		goney mate	r Risk Assessment	version 1.0 November 20	09		
	Annual Average Co Copper Step 2 0.04 Step 3 0.02	oncentration	oluble - Acute Impact Copper	Zinc Pass	Pass Accu	ent - Chronic Im nent deposition for t mulating? Yes sive? No	his site is judged as: 0.04 Low flow Vel m/ 2 Deposition Index
Location Details		T				1	
Road number		A9 T-M	2012/24 20 44	HA Area / DBFO number			
Assessment type			e assessment (single outf	all)	li	1	
DS grid reference of assessm	and a start of the second s	Easting	282370		Northing	826277	
OS grid reference of outfall str	ucture (m)	Easting	282597		Northing	826260	
Outfall number		E-A		List of outfalls in cumulative assessment			
Receiving watercourse		Allt Cosach			f.		
EA receiving water Detailed F	liver Network ID			Assessor and affiliation		AMJV	
Date of assessment		14/02/2018		Version of assessment		2	
Votes		Tier1 Assess	ment	•			
Step 2 River Impacts	Annual 95%ile river Impermeable road a			ter zero in Annual 95%ile rive meable area draining to outf		tep 1 runoff qualit	y only)
	Base Flow Index (B			ie discharge in or within 1 km	upstream of a protect	ed site for conserv	ration?
For dissolved zinc only For sediment impact only	Water hardness [	Low= <50mg Cad am structure, la ed river width (m	xe, pond or canal that red           )		n of the point of discha	rge?	ration? No -
For dissolved zinc only For sediment impact only Step 3 Mitigation	Water hardness [ Is there a downstre Tier 1 Estimate	Low= <50mg Cad am structure, la ed river width (m	ke, pond or canal that red ) 1 3 Mar	uces the velocity within 100r	n of the point of discha Side slope (m/m) [ ed effectiveness enuation for ] Set	rge?	No D
For sediment impact only Step 3 Mitigation	Water hardness [ Is there a downstre Tier 1 Estimate	Low= <50mg Cak am structure, la ed river width (m h (m)	ke, pond or canal that red ) 1 3 Mar	uces the velocity within 100r	n of the point of discha Side slope (m/m) [ ed effectiveness enuation for les - restricted arge rate (Vs)	rge?   0.5 Lon( lement of ments (%)	No 🔽 🖻 g slope (m/m) 0.0001
For sediment impact only Step 3 Mitigation Existing measures	Water hardness [ Is there a downstre Tier 1 Estimate	Low= <50mg Cak am structure, la ed river width (m h (m)	ke, pond or canal that red ) 1 3 Mar	uces the velocity within 100r	n of the point of discha Side slope (m/m) [ ed effectiveness enuation for Seti les-restricted sedi arge rate (Vs) 0	nge?	No P g slope (m/m) 0.0001 Predict Impact

HIGHWAYS	Highways A	gency Wa	ter Risk Assessment	version 1.0 N	lovember 200	19					
AGENCY	Annual Average Co Copper Step 2 0.04 Step 3 0.02		Soluble - Acute Impact Copper	Zinc Pass		Pass	Sedimer Sedime Accum Extensi	nt deposi Jating?	onic Imp ition for thi Yes No		Idged as: Low flow Vel m/s Deposition Index
Location Details											
Road number		A9 T-M	1	HA Area / DB	FO number						
Assessment type		1	itive assessment (single outfall	)							
DS grid reference of assessme		Easting	282370			Northing		326277			
DS grid reference of outfall stru	cture (m)	Easting	282597	-		Northing	6	326260			
Outfall number		E-A		List of ou cumulative a							
Receiving watercourse		Allt Cosach		cumulative a	assessment						
EA receiving water Detailed Riv	er Network ID			Assessorand	l affiliation			AMJV		~	
Date of assessment		14/02/2018		Version of as	sessment			2			
Step 2 River Impacts	AADT >10,000 and Annual 95% ile river mpermeable road a Base Flow Index (Bf Water hardness	flow (m³/s) irea drained	0.005 (Ente (ha) 0.2104 Perm 0.217 Is the	r zero in Annual eable area drain discharge in or	95%ile rive	ill (ha) [	)	p 1 runo	ff quality		No -
		d river width	lake, pond or canal that redu (m) 1	ces the velocity	within 100m	n of the point Side slope				No 💽	/m) 0.0001
Step 3 Mitigation		Brief descr	iption	Treatment for solubles (%)	r Atte solubl	ed effective ne en uation for es - restricted inge rate (Vs	Settle sedime	mentof ents(%)			ct Impact tailed Result
Existing measures				0	12 12 12 12 12 12 12 12 12 12 12 12 12 1			D		now be	caneu Resun
Proposed measures Grassed	l channel			50	Unlimite					Ex	cit Tool

#### **Soluble Copper and Sediment Result**

HIGHWAYS Highways	Agency Water Ris	sk Assessment	version 1.0 November 200	09		
Annual Average Cop Step 2 0.00 Step 3 0.00	Concentration           er         Zinc           0         0.01         ug/l	le - Acute Impact Copper Pass	Zinc Pass	Sedin	nulating? Ye	for this site is judged as:
Location Details			1		3	
Road number	A9 T-M		HA Area / DBFO number	0	1	
Assessment type		sessment (single outfall)		1		
OS grid reference of assessment point (m)	Easting	279878		Northing	830069	
OS grid reference of outfall structure (m)	Easting		10	Northing		
Outfall number	1-A		List of outfalls in cumulative assessment			
Receiving watercourse	River Findhorn			8		
EA receiving water Detailed River Network ID			Assessor and affiliation	351	AMJ∨	12
Date of assessment	14/02/2018		Version of assessment		2	
Notes						
Step 2 River Impacts Annual 95%lie riv Impermeable road Base Flow Index I	l area drained (ha)	5.54736 Perme	zero in Annual 95%ile rive able area draining to outfa discharge in or within 1 km	all (ha) 5.24164		
For dissolved zinc only Water hardness	Low= <50mg CaCO3/I	- D				
For sediment impact only is there a downstr Tier 1 Estima Tier 2 Bed wi	ted river width (m)	ond or canal that reduces 33 3 Manni				.ong slope (m/m) 0.0001
Step 3 Mitigation	Brief description		Treatment for Atte solubles (%) solubl	les - restricted sedir	lement of nents (%)	Predict Impact
Existing measures			0 D Unlimit	arge rate (Vs) red0	D	Show Detailed Results
Proposed measures Filter Drains, Wet/Retention F	ond & Ditches	2	45 Unlimit	ed 🔽 🕞 76		Exit Tool

HIGHW	Highways A						
AGENCT	Annual Average C	oncentration	oluble - Acute Impact Copper	Zinc		Sediment - Ch	ronic Impact sition for this site is judged as:
	Step 2         0.00           Step 3         0.00	0.01 ug/ 0.00 ug/	Pass	Pass	Pass	Accumulating? Extensive?	
Location Details				1			
Road number		A9 T-M		HA Area / DBFO number			
Assessment type	10 U01040 M	A CONTRACT OF A	e assessment (single outfall	)			
DS grid reference of as		Easting	279878		Northing	830069	
DS grid reference of ou	utfall structure (m)	Easting		<u>- 14</u>	Northing	~	
Dutfall number		1-A		List of outfalls in			
Receiving watercourse	3	River Findhorn		cumulative assessment			
A receiving water Def	etailed River Network ID			Assessor and affiliation		AMJV	1
Date of assessment		14/02/2018		Version of assessment		2	
Step 1 Runoff Qu	uality AADT >10,000 an	d <50,000 🚽	Climatic region Cold	er Wet 🗾 Ra	infall site	rdtalnaig (SAAR 134	13.9mm)
Step 2 River Impa	acts Annual 95%ile river Impermeable road Base Flow Index (E	r flow (m³/s) area drained (ha	1.705         (Ente           1.65.54736         Permi           0.406         Is the	r vet Ra r zero in Annual 95% ile rivi eable area draining to outf discharge in or within 1 km	er flow box to as all (ha) 5.24	ssess Step 1 run	off quality only)
Step 2 River Impa	acts Annual 95%le rivel Impermeable road Base Flow Index (E only Water hardness ct only Is there a downstre	r flow (m <sup>3</sup> /s) area drained (ha )FI) Low= <50mg CaC am structure, la ed river width (m	1.705         (Ente           1.705         Permi           0.406         Is the           03/1         D           (e, pond or canal that redu         33	r zero in Annual 95%ile rivi eable area draining to outf discharge in or within 1 km	er flow box to as all (ha) 5.24 upstream of a	protected site fo	off quality only)
Step 1 Runoff Qu Step 2 River Impo For dissolved zinc o For sediment impac Step 3 Mitigation	acts Annual 95%lle river Impermeable road Base Flow Index (E only Water hardness ct only Is there a downstre © Tier 1 Estimate © Tier 2 Bed widt	r flow (m <sup>3</sup> /s) area drained (ha )FI) Low= <50mg CaC am structure, la ed river width (m	1.705         (Enter           1.705         (Enter           0.406         Is the           0.31         D           xe, pond or canal that redu         33           3         Mann	r zero in Annual 95%ile rivi eable area draining to outf discharge in or within 1 km ces the velocity within 100r ing's n 0.07 0 Estimat Treatment for Att	er flow box to as all (ha) 5.24 I upstream of a p n of the point of	ssess Step 1 run 1164 protected site fo discharge? //m) 0.5	r conservation? No - [ No - ] Long slope (m/m) 0.0001
Step 2 River Impa For dissolved zinc o For sediment impac	acts Annual 95%lle river Impermeable road Base Flow Index (E only Water hardness ct only Is there a downstre © Tier 1 Estimate © Tier 2 Bed widt	r flow (m <sup>3</sup> /s) area drained (ha IFI) Low= <50mg CaC am structure, lai ed river width (m th (m)	1.705         (Ente           1.705         (Ente           0.406         Is the           03/1         P           xe, pond or canal that redu         33           3         Mann	r zero in Annual 95%ile riv eable area draining to outf discharge in or within 1 km ces the velocity within 100r ing's n 0.07 0 Estimat Treatment for Att solubles (%) solub	er flow box to as all (ha) 5.24 in upstream of a p in of the point of Side slope (m ed effectiveness enuation for es - restricted arge rate (Vs)	ssess Step 1 run 184 protected site fo discharge? v/m) 0.5	r conservation? No v [ No v D Long slope (m/m) 0.0001 Show Detailed Result

#### **Soluble Copper and Sediment Result**

	s Agency Water Ri	sk Assessment	version 1.0 November 2	009			
Annual Averag	Zinc         Soluk           07         0.22         ug/l           0.4         0.13         ug/l	ole - Acute Impact Copper	Zinc Pass	Sedi Pass Accu	ent - Chron ment deposi imulating? nsive?	nic Impact ition for this site No 0.32 No -	
Location Details			10				
Road number	A9 T-M		HA Area / DBFO numbe	er			
Assessment type	1).	sessment (single outfall)					-
OS grid reference of assessment point (m)	Easting	279722		Northing	830060		
OS grid reference of outfall structure (m)	Easting			Northing			
Outfall number	2-A		List of outfalls in − cumulative assessmer				
Receiving watercourse	Allt na Frithe			ь.			
EA receiving water Detailed River Network ID			Assessor and affiliation		AMJV		
Date of assessment	06/02/2018		Version of assessment		2		
Notes			Xr.				
Step 2 River Impacts Annual 95%iler	ver flow (m³/s) ad area drained (ha)	0.0228 (Enter 1.69012 Perme	r Wet  R Zero in Annual 95%ile riv eable area draining to outf discharge in or within 1 kr	er flow box to assess S all (ha)		quality only)	NO D
For dissolved zinc only Water hardness	Low = <50mg CaCC3/I						
C Tier 1 Estir	stream structure, lake, p nated river width (m) width (m)	ond or canal that reduce	es the velocity within 100r	m of the point of dischar	ge? 0.690403	No -	/m) 0.044886
Step 3 Mitigation	Brief description		Treatment for An solubles (%) solub	oles - restricted sedi	tlement of ments ( %)		lict Impact
Existing measures			0 Unlim	narge rate (I/s) ited 🔽 🕞 0	D	Show Do	etailed Results
Proposed measures Filter Drains & Wet/Retent	on Ponds		40 Unlim	ited V D 72		E	xit Tool

HIGHWAYS	Highways A	gency Water Ris	k Assessment	version 1.0 Nove	mber 200	)9				
	Annual Average Co	ncentration	e - Acute Impact Copper	Zinc			_		nic Impact	ite is judged as:
	Copper           Step 2         0.07           Step 3         0.03	0.22 ug/l 0.10 ug/l	Pass	Pass		Pass	No. 2010 Concession	ulating?		.32 Low flow Vel m/s - Deposition Index
Location Details				The second second				ř.		
Road number		A9 T-M		HA Area / DBFO r	number					
Assessment type			essment (single outfall)	(						
OS grid reference of assessment	Calebra Calebra Calebra	Easting	279722			Northing		830060		
OS grid reference of outfall structu	re (m)	Easting		and along the distribution	-94	Northing			08	
Outfall number		2-A		List of outfalls cumulative asse:						
Receiving watercourse		Allt na Frithe		Construction of the second second						
EA receiving water Detailed River	Network ID			Assessor and affil	iation			AMJV		
Date of assessment		06/02/2018		Version of assess	ment			2		
Notes	29	2		•						
Step 1 Runoff Quality AA	DT >10,000 and	<50,000 - Clir	natic region Colde	r Wet 🗾	Rai	nfall site	Ardtalnaig (	SAAR 1343.9	9mm)	
Imp	nual 95%ileriver permeable road a ise Flow Index (BF	rea drained (ha)	1.69012 Perme	zero in Annual 95% eable area draining t discharge in or withi	o outfall	l (ha)	25888		, , ,,	No 🔻 🛛
For dissolved zinc only Wa	ater hardness	Low = <50mg CaCO3/I	- D							
10		d river width (m)	nd or canal that reduc 5 8.351 Manni		n 100m	of the point of Side slope (		e? 0.690403	N₀ Long slope	(m/m) 0.044886
Step 3 Mitigation		Drading				d effectivenes			Pi	edict Impact
		Brief description		Treatment for solubles (%)	soluble discha	enuation for es - restricted rge rate (I/s)	sedim	ement of nents (%)	Show	Detailed Result
Existing measures				0	Unlimite	ed 🗾 🗖	0	D		
Proposed measures Filter Drain	is & Wet/Retention Po	onds		53	Unlimite	ed 🔽 🖸	72			Exit Tool

#### **Soluble Copper and Sediment Result**

AGENCY	Highways A	gency Water Ri	sk Assessment	version 1.0 Nove	ember 200	)9					
AGENCY	Annual Average Co Copper Step 2 0.18 Step 3 0.11	oncentration	ble - Acute Impact Copper Pass	Zinc Pass	Alert.	D/S Structure.	Sediment Sedimen Accumul Extensiv	it depos ating?	1717 - 1718 <b>- 1</b> 717 - 1717 - 1717 - 1717 - 1717 - 1717 - 1717 - 1717 - 1717 - 1717 - 1717 - 1717 - 1717 - 1717	his site is 0.38	j <b>udged as:</b> Low flow Vel m/s Deposition Index
Location Details		1					-				
Road number		A9 T-M		HA Area / DBFO	number	8					Tee
Assessment type			ssessment (single outfal	)		3					2
OS grid reference of assessm		Easting	279328			Northing	83	30451			
OS grid reference of outfall str	ucture (m)	Easting		0		Northing	12				
Outfall number		3-A		List of outfall							
Receiving watercourse		AlltDubhag		cumulative asse	essment						
EA receiving water Detailed F	River Network ID			Assessor and affi	iliation		A	MJV			
Date of assessment		06/02/2018		Version of asses	sment		2				
Notes								2			
<u>Step 2 River Impacts</u>	Annual 95%ile river Impermeable road a Base Flow Index (B	area drained (ha)	2.16994 Perm	r zero in Annual 959 eable area draining discharge in or with	to outfal	l (ha)	3806				No V D
For dissolved zinc only	Water hardness	Low = <50mg CaCO8/	- D								
For sediment impact only		ed river width (m)	5 2 Manr	tes the velocity withi	in 100m	of the point of o Side slope (m				es 🗾	1) 0.042285
Step 3 Mitigation		Brief description		Treatment for	-	d effectiveness	s Settlem	entof		Predic	t Impact
Existing measures		Ener de semption		solubles ( %)	soluble	es - restricted rge rate (l/s)	sedimer		Sh	ow Deta	ailed Results
	Drains & Wet/Retention P	onds		40	Unlimite		72			Exi	t Tool

÷

HIGHWAYS	Highways A									
AGENCY	Annual Average Co Copper Step 2 0.18 Step 3 0.08	oncentration	ele - Acute Impact Copper Pass	Zinc Pass /	Alert, D/S Structure.	Sedime	ent depos ulating?	nic Impac iition for t No No	his site is judg	<b>led as:</b> 1ow ∨el m sition Inde
Location Details Road number	•			HA Area / DBFO nur	ala a s					
		A9 T-M			nber					
Assessment type			sessment (single outfa	ll)						
OS grid reference of assessm	Concerned and the second second	Easting	279328		Northing		330451			
OS grid reference of outfall str	.,	Easting			Northing				52°	
Outfall number		3-A		List of outfalls in cumulative assessr						
Receiving watercourse		AlltDubhag		Constitution of the second s						
EA receiving water Detailed R	River Network ID			Assessor and affiliati	ion		AMJV			
Date of assessment		06/02/2018		Version of assessme	ent		2			
Notes				28		30				
	AADT >10,000 and Annual 95%ile river			der Wet			SAAR 1343.9			
Step 2 River Impacts		flow (m³/s) area drained (ha)	0.0104         (Enter           2.16994         Perm           .38         Is the		river flow box to as	ssess Ste	p 1 runoff	quality or		No 🔽
	Annual 95%ile river Impermeable road a Base Flow Index (BI Water hardness	flow (m³/s) area drained (ha) FI) 0 Low = <50mg CaC03/1	0.0104 (Ente 2.16994 Perm .38 Is the	er zero in Annual 95%ile	river flow box to as butfall (ha) 1.53	ssess Ste 3806 protected	p 1 runoff site for co	quality or		No
Step 2 River Impacts	Annual 95%ile river Impermeable road a Base Flow Index (BI Water hardness	flow (m³/s) Irea drained (ha) FI) 0 Low = <0mg CaCC03/ am structure, lake, p Id river width (m)	0.0104 (Ente 2.16994 Perm .38 Is the 	er zero in Annual 95%ile neable area draining to c e discharge in or within 1	river flow box to as butfall (ha) 1.53	ssess Ste 3806 protected discharge	p 1 runoff site for co	quality or	vn? [	No 💽
Step 2 River Impacts	Annual 95%ileriver Impermeable road a Base Flow Index (BI Water hardness [ Is there a downstrea C Tier 1 Estimate	flow (m³/s) Irea drained (ha) FI) 0 Low = <0mg CaCC03/ am structure, lake, p Id river width (m)	0.0104 (Ente 2.16994 Perm .38 Is the 	er zero in Annual 95%ile neable area draining to o e discharge in or within ? ces the velocity within 1 ning's n 0.04 Esti	river flow box to as butfall (ha) [1.53 I km upstream of a p 00m of the point of of Side slope (m mated effectiveness Attenuation for	ssess Ste 3806 protected discharge 1/m) 1 3 Settle	p 1 runoff site for co ?? .072 ment of	quality or	in? [	0.04228
Step 2 River Impacts For dissolved zinc only For sediment impact only	Annual 95%ileriver Impermeable road a Base Flow Index (BI Water hardness [ Is there a downstrea C Tier 1 Estimate	flow (m <sup>9</sup> /s) Fl) 0 Fl) 0 Low = <50mg CaCO3/I am structure, lake, p d river width (m) h (m)	0.0104 (Ente 2.16994 Perm .38 Is the 	er zero in Annual 95%ile neable area draining to c e discharge in or within ces the velocity within 1 ning's n 0.04 Treatment for solubles (%) si	river flow box to as butfall (ha) [1.53 ] km upstream of a p 00m of the point of o ] Side slope (m mated effectiveness	ssess Ste 3806 protected discharge 1/m) 1 3 Settle	p 1 runoff site for co ??	quality or onservatio	on? [ /es - ]	0.04228 pact

#### **Soluble Copper and Sediment Result**

HIGHWAYS	Highways A	gency Water Ri	sk Assessment	version 1.0 Nov	ember 201	<b>)</b> 9					
AGENCY	Annual Average Co Copper Step 2 0.03 Step 3 0.02	oncentration	ole - Acute Impact Copper Pass	Zinc Pass		Pass	Sedim	ent depos nulating?	nic Impact ition for this No	0.37 L	<b>udged as:</b> ow flow Vel m/s Deposition Index
Location Details								1			
Road number		A9 T-M		HA Area / DBFO	number						
Assessment type		Constant of the second and supplier to the state of the	sessment (single outfal	)							-
OS grid reference of assessme		Easting	279329			Northing		831977			
OS grid reference of outfall stru	icture (m)	Easting				Northing					
Outfall number		4-A	25	List of outfal cumulative asse							
Receiving watercourse		Dalmagarry Burn		currulative asse	essmeni						
EA receiving water Detailed Ri	ver Network ID			Assessor and aff	iliation			AMJV		10 A	
Date of assessment		06/02/2018		Version of asses	sment			2			
Notes											
	Annual 95%ile river Impermeable road a Base Flow Index (B	area drained (ha)	1.38985 Perm	r zero in Annual 95' eable area draining discharge in or witt	to outfal	l (ha)	.00015				No 🗸 D
For dissolved zinc only	Water hardness	Low = <50mg CaCO3/I	• D								
		ed river width (m)	ond or canal that reduced by the second seco	ces the velocity with	in 100m	of the point of the slope	_	e? 1.089077	No Long slo	<b>-</b> pe (m/m)	0.007047
Step 3 Mitigation		Brief description		Treatment for solubles ( %)	Atte	ed effectivene enuation for es - restricteo inge rate (1/s	Settl sedin	ement of hents (%)			Impact
Existing measures				0 D	Unlimit		0	D	510	w Detai	ieu kesuits
Proposed measures Filter D	rains & Wet/Retention P	onds		40	Unlimit	ed 🔽 🖸	72			Exit	Tool

÷

AGENCY										
	Annual Average Co	Solub	le - Acute Impact Copper	Zinc		Sedime	nt - Chro	nic Impa	ct	
	Copper					Sedim	ent depos	sition for	this site is	judged as:
	Step 2 0.03	0.10 ug/l	Pass	Pass	Pass	Accum	ulating?	No	0.37	Low flow Vel m
	Step 3 0.02	0.05 ug/l				Extens	sive?	No	-	Deposition Inde
ocation Details										
Road number		A9 T-M		HA Area / DBFO numbe	na	6				
Assessment type		Non-cumulative ass	sessment (single outfa	II)						
DS grid reference of as:	sessment point (m)	Easting	279329		Northing	1	831977			
DS grid reference of out	tfall structure (m)	Easting	ĺ		Northing					
Outfall number		4-A	10	List of outfalls in	a.					
Receiving watercourse		Dalmagarry Burn		cumulative assessmen	t					
A receiving water Deta	ailed River Network ID			Assessor and affiliation	1		AMJV			
Date of assessment		06/02/2018		Version of assessment			2			
		0010212010				č.	-			
Step 1 Runoff Qua				der Wet Ra	ainfall site er flow box_to	Ardtalnaig (S			nly)	
Votes Step 1 Runoff Qua Step 2 River Impa For dissolved zinc of	cts Annual 95%ile river Impermeable road a Base Flow Index (B	flow (m³/s)	0.038         (Enter           1.38985         Perm           34         Is the		er flow box to all (ha)	) assess Ste 1.00015	p 1 runoff	quality o		No
Step 1 Runoff Qua Step 2 River Impa For dissolved zinc or	cts     Annual 95%ile river       Impermeable road a     Base Flow Index (B       NUM     Water hardness       only     Is there a downstread	flow (m³/s) irea drained (ha) Fl) 0. Low = <50mg CaC03/1 am structure, lake, po id river width (m)	0.038 (Entr 1.38985 Perm 34 Is the Condition of canal that redu 5	er zero in Annual 95%ile rive	er flow box to all (ha)	o assess Ste 1.00015 f a protected of discharge	ep 1 runoff	quality o onservati	on?	D
Step 1 Runoff Qua Step 2 River Impa For dissolved zinc or For sediment impact	cts     Annual 95%ile river       Impermeable road a       Base Flow Index (B       vider hardness       only       Is there a downstrea       C Tier 1	flow (m³/s) area drained (ha) Fl) 0. Low = <50mg CaC03/I am structure, lake, po d river width (m) h (m)	0.038 (Entr 1.38985 Perm 34 Is the Condition of canal that redu 5	er zero in Annual 95%ile rive neable area draining to outfa e discharge in or within 1 km ces the velocity within 100n ning's n 0.035	er flow box to all (ha)	o assess Ste 1.00015 f a protected of discharge e (m/m) 1 ess	ep 1 runoff I site for c e?	quality o onservati	on? No -	D
Step 1 Runoff Qua Step 2 River Impa For dissolved zinc of For sediment impact Step 3 Mitigation	cts     Annual 95%ile river       Impermeable road a       Base Flow Index (B       vider hardness       only       Is there a downstrea       C Tier 1	flow (m³/s) irea drained (ha) Fl) 0. Low = <50mg CaC03/1 am structure, lake, po id river width (m)	0.038 (Entr 1.38985 Perm 34 Is the Condition of canal that redu 5	er zero in Annual 95%ile rive neable area draining to outfa e discharge in or within 1 km ces the velocity within 100n ning's n 0.035 Treatment for At solubles (%) solub	er flow box to all (ha) n upstream of Side slope tendeffectivent tenuation for les - restricter arge rate (1/s	o assess Ste 1.00015 f a protected of discharge (m/m) 1 ess Settle d sedim )	ep 1 runoff I site for c 9?	quality o onservation	on? No - Slope (m/r	1) 0.00704
Step 1 Runoff Qua Step 2 River Impa For dissolved zinc or For sediment impact	cts     Annual 95%ile river       Impermeable road a       Base Flow Index (B       vider hardness       only       Is there a downstrea       C Tier 1	flow (m³/s) area drained (ha) Fl) 0. Low = <50mg CaC03/I am structure, lake, po d river width (m) h (m)	0.038 (Entr 1.38985 Perm 34 Is the Condition of canal that redu 5	er zero in Annual 95%ile rive neable area draining to outfa e discharge in or within 1 km ces the velocity within 100n ning's n 0.035 Estimal Treatment for At solubles (%) solub	er flow box to all (ha) n upstream of Side slope tendeffectivent tenuation for les - restricter arge rate (1/s	o assess Ste 1.00015 f a protected of discharge of discharge (m/m) 1 ess Settle d sedim )	Pp 1 runoff I site for c P? .089077 :rment of	quality o onservation	on? No - Slope (m/r	D n) 0.00704

#### **Soluble Copper and Sediment Result**

A HIGHWAYS	Highways Ag	gency Wat	er Risk Assessment	version	1.0 November 20	09					
AGENCY	Annual Average Co	ncentration	Soluble - Acute Impact	Zinc				nt - Chro			
	Copper           Step 2         0.05           Step 3         0.03	Zinc 0.14 ug/l 0.09 ug/l	Pass	Pass		Pass		nulating?	No No	this site i 0.29 -	s judged as: Low flow Vel m Deposition Inde
ocation Details					120						
Road number		A9 T-M		HA Are	a / DBFO numbei	92 1					
ssessment type		Non-cumula	tive assessment (single o	utfall)							
OS grid reference of assessme	ent point (m)	Easting	279081			Northing		832070			
OS grid reference of outfall stru	ucture (m)	Easting		262		Northing					
Dutfall number		4-B			t of outfalls in						
Receiving watercourse		Dalmagarry I	Burn	cumulat	tive assessment						
A receiving water Detailed Ri	iver Network ID			Assess	or and affiliation	2	-	AMJV		23	
)ate of assessment		06/02/2018		Version	of assessment			2			
otes											
	AADT >10,000 and	<50,000 🗸	Climatic region	Colder Wet	E Ra	iinfall site	Ardtalnaig (	SAAR 1343.	9mm)		
Step 2 River Impacts	AADT >10,000 and Annual 95%ile river f Impermeable road ar Base Flow Index (BF	flow (m³/s) rea drained (	0.038 (E	Enter zero in A ermeable area	Rannual 95%ile rive a draining to outfa	r flow box t II (ha) [	0 assess Str 1.08472	əp 1 runoff	quality o		No
Step 2 River Impacts	Annual 95%ile river f Impermeable road ar Base Flow Index (BF	flow (m³/s) rea drained (	0.038 (E 0.038 (E 0.038 Is 0.34 Is	Enter zero in A ermeable area	nnual 95%ile rive a draining to outfa	r flow box t II (ha) [	0 assess Str 1.08472	əp 1 runoff	quality o		No
Step 2 River Impacts For dissolved zinc only For sediment impact only	Annual 95%ile river f Impermeable road ar Base Flow Index (BF Water hardness	flow (m³/s) rea drained ( -1) Low = <50mg ( m structure d river width i	0.038 (E 0.038 P 0.34 Is 0.34 Is 0.35 Is 0.	Enter zero in A ermeable area the discharge educes the vel	nnual 95%ile rive a draining to outfa e in or within 1 km	r flow box t II (ha) [ upstream c	o assess Str 1.08472 f a protecter of discharg	ep 1 runoff d site for c	<sup>i</sup> quality o onservati	on?	D
Step 2 River Impacts For dissolved zinc only For sediment impact only	Annual 95%ile river fr Impermeable road ar Base Flow Index (BF Water hardness Is there a downstrea C Tier 1 Estimated	flow (m³/s) rea drained ( -1) Low = <50mg ( m structure d river width i	0.038 (E 0.038 P 0.34 Is 0.34 Is 0.35 Is 0.	Enter zero in A ermeable area the discharge educes the vel	nnual 95%ile rive e draining to outfa in or within 1 km ocity within 100m	r flow box t II (ha) [ upstream c	o assess St 1.08472 f a protecter of discharg	ep 1 runoff d site for c	<sup>i</sup> quality o onservati	on? No -	D n) 0.00563
Step 2 River Impacts For dissolved zinc only For sediment impact only	Annual 95%ile river fr Impermeable road ar Base Flow Index (BF Water hardness Is there a downstrea C Tier 1 Estimated	flow (m³/s) rea drained ( -1) Low = <50mg ( m structure d river width i	0.038         (E           0.038         (E           0.34         Is           0.34         Is           0ac03/         Image: D           lake, pond or canal that rem         M           4         M	Enter zero in A ermeable area the discharge educes the vel	nnual 95%ile rive a draining to outfa b in or within 1 km ocity within 100m 0.035	r flow box t II (ha) [ upstream c of the point Side slop	o assess St 1.08472 ] f a protecter of discharg e (m/m) [ iess Setti rd sedini	ep 1 runoff d site for c	quality o onservati	on? No - Slope (m/r <b>Predi</b>	
Step 2 River Impacts For dissolved zinc only For sediment impact only	Annual 95%ile river fr Impermeable road ar Base Flow Index (BF Water hardness Is there a downstrea C Tier 1 Estimated	low (m³/s) rea drained ( -1) Low = <50mg ( m structure d river width ( n (m)	0.038         (E           0.038         (E           0.34         Is           0.34         Is           0ac03/         Image: D           lake, pond or canal that rem         M           4         M	Enter zero in A ermeable area the discharge aduces the vela lanning's n	nnual 95%ile rive a draining to outfa b in or within 1 km ocity within 100m 0.035	r flow box t II (ha) [ upstream of the point Side slop: ed effectiver enuation for enuation for ange rate ( 1/2	o assess St 1.08472 f a protected of discharg e (m/m) [ ess Setti sedin b)	ep 1 runoff d site for c e? 1	quality o onservati	on? No - Slope (m/r <b>Predi</b>	D n) 0.00563



┿

HIGHWAYS Highways	Agency Water Ris	sk Assessment	version 1.0 November 20	09	
Annual Average Step 2 0.0 Step 3 0.0	Concentration Der Zinc 5 0.14 ug/l	ole - Acute Impact Copper	Zinc Pass	Pass Accur	ent - Chronic Impact ment deposition for this site is judged as: mulating? No 0.29 Low flow Vel m/s nsive? No - Deposition Index
Location Details					1
Road number	A9 T-M		HA Area / DBFO number	2	
Assessment type		sessment (single outfall	)	1	
OS grid reference of assessment point (m)	Easting	279081		Northing	832070
OS grid reference of outfall structure (m)	Easting		(X) (X) (X)	Northing	
Outfall number	4-B		List of outfalls in cumulative assessment		
Receiving watercourse	Dalmagarry Burn		cumulative assessment		
EA receiving water Detailed River Network ID			Assessor and affiliation		AMJV
Date of assessment	06/02/2018		Version of assessment		2
Notes			·		
Step 2 River Impacts Annual 95%ile riv Impermeable roa Base Flow Index	er flow (m³/s) d area drained (ha)	1.97928 Perm	r zero in Annual 95%ile rive eable area draining to outfa discharge in or within 1 km	ll (ha) 1.08472	
For dissolved zinc only Water hardness	Low = <50mg CaCO3/	- D			
C Tier 1 Estima	ream structure, lake, p ated river width (m) idth (m)	5	es the velocity within 100m		ge? No - D 1 Long slope (m/m) 0.005637
Step 3 Mitigation	Brief description		Treatment for Att		Predict Impact
Existing measures				arge rate (I/s)	Show Detailed Result
Proposed measures Filter Drains & Wet/Retention	Ponds		53 Unlimit	ed 🗸 🖸 72	Exit Tool

#### **Soluble Copper and Sediment Result**

HIGHWAYS High	ways Agency Water Ris	k Assessment	version 1.0 November 20	09			
Annual A Step 2 Step 3	Verage Concentration Copper Zinc 0.08 0.24 ug/l 0.05 0.14 ug/l	le - Acute Impact Copper Pass	Zinc Pass	Sedin Accu	ent - Chronic Impact nent deposition for thi mulating?	s site is judged as: Low flow Vel m/s Deposition Index	
Location Details Road number	[		HA Area / DBFO number		1		
	A9 T-M					100	
Assessment type	<ul> <li>British Chronology And States And And States</li> </ul>		ediments (outfalls between 100m and 1km apart)				
	d reference of assessment point (m) Easting 279329 d reference of outfall structure (m) Easting			Northing Northing	831977		
Os grid reference or outrall structure (m) Outfall number	and the second s	87	List of outfalls in	Northing			
	Cum 4-A & 4-B		cumulative assessment		-		
Receiving watercourse	Dalmagarry Burn						
EA receiving water Detailed River Network			Assessor and affiliation		AMJV		
Date of assessment Notes	06/02/2018		Version of assessment		2		
	10,000 and <50,000 Cl 6ile river flow (m³/s)	matic region Colde	r Wet 💽 Ra zero in Annual 95%ile rive		(SAAR 1343.9mm) ep 1 runoff quality only	)	
Impermeat Base Flow For dissolved zinc only Water hard			able area draining to outfa discharge in or within 1 km		d site for conservation	? <u>No</u>	
For sediment impact only Is there a d	lownstream structure, lake, p Estimated river width (m) Bed width (m)	101 Million 102 Million			ge? No	<b>D</b> pe (m/m) 0.0001	
Step 3 Mitigation	Brief description		Treatment for Att solubles (%) solubl	es-restricted sedir	lement of ments (%)	Predict Impact	
Existing measures			0 D Unlimit	ed v D 0	Sho	w Detailed Results	
Proposed measures Filter Drains & Wet/F	etention Ponds		40 Unlimit	ed V D 0		Exit Tool	

╋

		Cal	luble - Acute Impact	and the second		Sadima	nt - Chroni	c Impact	
	Annual Average C	Concentration	Copper	Zinc		Seuline	nt - Chiloni	c impact	
	Coppe	r Zinc				Sedim	ent deposit	ion for this s	ite is judged as:
	Step 2 0.08	0.24 ug/l	Pass	Pass		1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	ulating?		Low flow Vel m/
	Step 3 0.04	0.11 ug/l				Exten	sive?		Deposition Inde
ocation Details		1.5.4.5		1					
Road number		A9 T-M		HA Area / DBFO nur					
Assessment type			essment excluding sedime	ents (outfalls between 10	and said and the second state		87. 		
OS grid reference of ass		Easting	279329		Northing		831977		
OS grid reference of out	fall structure (m)	Easting		-	Northing				
Outfall number		Cum 4-A & 4-B	(V) 1	List of outfalls in					
Receiving watercourse		Dalmagarry Bur	n	cumulative assessr			0.2		
EA receiving water Deta	iled River Network ID			Assessor and affiliat	on		AMJV		
Date of assessment		06/02/2018		Version of assessme	ent		2		
lotes		1					162		
Step 1 Runoff Qua				er Wet	Rainfall site		SAAR 1343.9n		
Step 1 Runoff Qua	Annual 95%ile river Impermeable road a Base Flow Index (B	flow (m³/s) area drained (ha) 3FI)	0.038 (Ente 3.38913 Perm 0.34 Is the	r zero in Annual 95%ile eable area draining to o discharge in or within	river flow box butfall (ha)	to assess Ste	ep 1 runoff q	uality only)	No 🗴
Step 1 Runoff Qua	Annual 95%ile river Impermeable road a Base Flow Index (B	flow (m³/s) area drained (ha)	0.038 (Ente 3.36913 Perm 0.34 is the	r zero in Annual 95%ile eable area draining to o	river flow box butfall (ha)	to assess Ste	ep 1 runoff q	uality only)	
Step 1 Runoff Qua Step 2 River Impar For dissolved zinc or	NUET         Lease           Annual 95%ile river         Impermeable road a           Base Flow Index (B         Water hardness	flow (m³/s) area drained (ha) 3Fl) Low = <50mg CaCC	0.038 (Ente 3.38913 Perm 0.34 Is the	r zero in Annual 95%ile eable area draining to o discharge in or within	river flow box outfall (ha)	to assess Ste 2.08487 of a protected	ep 1 runoff q I site for cor	uality only)	
Step 1 Runoff Qua Step 2 River Impar For dissolved zinc or	Cts       Annual 95%ile river         Impermeable road a       Base Flow Index (B         Base Flow Index (B       Water hardness         Injy       Water hardness	flow (m³/s) area drained (ha) 3Fl) Low = <50mg CaCC	0.038 (Ente 3.36913 Perm 0.34 Is the 33/ C	r zero in Annual 95%ile eable area draining to o discharge in or within	river flow box outfall (ha)	to assess Ste 2.08487 of a protected	ep 1 runoff q I site for cor	uality only)	
Step 1 Runoff Qua	Cts       Annual 95%ile river         Impermeable road a       Base Flow Index (B         Base Flow Index (B       Water hardness         Injy       Water hardness	r flow (m <sup>3</sup> /s) area drained (ha) BFI) Low = <50mg CaCC am structure, lake ed river width (m)		r zero in Annual 95%ile eable area draining to o discharge in or within ces the velocity within 1	river flow box outfall (ha)	to assess Ste 2.08487 of a protected t of discharg	ep 1 runoff q I site for cor	uality only)	
Step 1 Runoff Qua Step 2 River Impar For dissolved zinc or For sediment impact	cts       Annual 95%ile river         Impermeable road a       Base Flow Index (B         Base Flow Index (B       Index (B         Water hardness       Index (B         only       Is there a downstre         @ Tier 1       Estimate	r flow (m <sup>3</sup> /s) area drained (ha) BFI) Low = <50mg CaCC am structure, lake ed river width (m)		r zero in Annual 95%ile eable area draining to o discharge in or within ces the velocity within 1 ing's n 0.07	river flow box putfall (ha) I km upstream 00m of the poir	to assess Sta 2.08487 of a protected t of discharg	ap 1 runoff o I site for cor	uality only) Inservation? No Long slope	(m/m) 0.0001
Step 1 Runoff Qua Step 2 River Impar For dissolved zinc or For sediment impact	cts       Annual 95%ile river         Impermeable road a       Base Flow Index (B         Base Flow Index (B       Index (B         Water hardness       Index (B         only       Is there a downstre         @ Tier 1       Estimate	flow (m <sup>3</sup> /s) area drained (ha) 3FI) Low = <50mg CaCC am structure, lake ed river width (m) th (m)		r zero in Annual 95%ile eable area draining to o discharge in or within ces the velocity within 1 ing's n 0.07 Est	river flow box butfall (ha)	to assess Ste 2.08487 of a protected t of discharg re (m/m)	ep 1 runoff q I site for cor 9?	uality only) Inservation? No Long slope	D
Step 1 Runoff Qua Step 2 River Impar For dissolved zinc or For sediment impact Step 3 Mitigation	cts       Annual 95%ile river         Impermeable road a       Base Flow Index (B         Base Flow Index (B       Index (B         Water hardness       Index (B         only       Is there a downstre         @ Tier 1       Estimate	r flow (m <sup>3</sup> /s) area drained (ha) BFI) Low = <50mg CaCC am structure, lake ed river width (m)		r zero in Annual 95%ile eable area draining to o discharge in or within ces the velocity within 1 ing's n 0.07 Est Treatment for solubles (%) s	river flow box butfall (ha) I km upstream 00m of the poir Side slop Attenuation foo Jubles - restrict	to assess Ste 2.08487 of a protected t of discharg we (m/m)	ap 1 runoff o I site for cor	uality only) Inservation? No Long slope	(m/m) 0.0001
Step 1 Runoff Qua Step 2 River Impar For dissolved zinc or For sediment impact Step 3 Mitigation	cts       Annual 95%ile river         Impermeable road a       Base Flow Index (B         Base Flow Index (B       Index (B         Water hardness       Index (B         only       Is there a downstre         @ Tier 1       Estimate	flow (m <sup>3</sup> /s) area drained (ha) 3FI) Low = <50mg CaCC am structure, lake ed river width (m) th (m)		r zero in Annual 95%ile eable area draining to o discharge in or within ces the velocity within 1 ing's n 0.07 Est Treatment for solubles (%) s	river flow box butfall (ha) I km upstream 00m of the poir Side slop Attenuation foo Jobbles - restrict scharge rate ( l	to assess Ste 2.08487 of a protected t of discharg we (m/m)	ep 1 runoff o I site for cor e? 	uality only) Iservation? No Long slope	(m/m) 0.0001
Step 1 Runoff Qua Step 2 River Impar For dissolved zinc or For sediment impact	cts       Annual 95%ile river         Impermeable road a       Base Flow Index (B         Base Flow Index (B       Index (B         Water hardness       Index (B         only       Is there a downstre         @ Tier 1       Estimate	flow (m <sup>3</sup> /s) area drained (ha) 3FI) Low = <50mg CaCC am structure, lake ed river width (m) th (m)		r zero in Annual 95%ile eable area draining to o discharge in or within ces the velocity within 1 ing's n 0.07 Est Treatment for solubles (%) s	river flow box butfall (ha) I km upstream 00m of the poin Old stop Side slop Attenuation for Jubles - restrict scharge rate ( l	to assess Ste 2.08487 of a protected t of discharg we (m/m)	ep 1 runoff o I site for cor e? 	uality only) Iservation? No Long slope	(m/m) 0.0001

#### Soluble Copper and Sediment Result

HIGHWAYS	Highways A	gency Water Ri	sk Assessment	version 1.0 November 200	19		
AGENCY	Annual Average Co		le - Acute Impact	Zinc	Sedime	ent - Chronic Im	pact
	Copper           Step 2         1.29           Step 3         0.62		Pass	Pass		nulating? <mark>No</mark>	this site is judged as: 0.10 - Deposition Index
Location Details		-		4			
Road number		A9 T-M		HA Area / DBFO number			
Assessment type		A CALLER CONTRACTOR STREET	sessment (single outfall	)			-
OS grid reference of assessme			278469	Northing 832			
OS grid reference of outfall stru	cture (m)	Easting		Northing			
Outfall number		5-A		List of outfalls in cumulative assessment			
Receiving watercourse		Funtack Burn Trib 3	1	cumulative assessment			
EA receiving water Detailed Riv	ver Network ID			Assessor and affiliation		AMJV	
Date of assessment		15/02/2018		Version of assessment		2	
Notes				-Wit			
Step 1 Runoff Quality	AADT >10,000 and	I <50,000	imatic region Cold	er Wet 🗾 Ra	infall site Ardtalnaig (	SAAR 1343.9mm)	-
	Annual 95%ile river Impermeable road a Base Flow Index (Bl	area drained (ha)	3.28986 Perm	r zero in Annual 95%ile rive eable area draining to outfa discharge in or within 1 km	all (ha) 1.21914		
For dissolved zinc only	Water hardness	Low= <50mg CaCO3/I	D				
		d river width (m)	5	ces the velocity within 100m	_		No 🔽 D g slope (m/m) 0.005934
Step 3 Mitigation		Brief description		Treatment for Atte solubles (%) soluble		ement of nents (%)	Predict Impact
Existing measures Proposed measures Filter Dr	ains & 2 × Wet/Retentio	n Ponds		0 D Unlimite 52 D Unlimite	- D		Exit Tool

HIGHWAYS Highways A	gency Water Ris	sk Assessment	version 1.0 November 20	09				
AGENCT Annual Average Co	Solub	le - Acute Impact Copper	Zinc	Sedime	ent - Chronic Impac	t		
Copper Step 2 1.29		Pass	Pass	The second	ent deposition for this nulating? No	site is judged as:		
Step 3 0.51	1.56 ug/			Extens	sive? No	- Deposition Index		
Location Details	1				-			
Road number	A9 T-M		HA Area / DBFO number					
Assessment type		sessment (single outfa						
OS grid reference of assessment point (m)				Northing 832619				
OS grid reference of outfall structure (m)	Easting			Northing		-18		
Outfall number	5-A	942 	List of outfalls in					
Receiving watercourse	Funtack Burn Trib 3		cumulative assessment					
EA receiving water Detailed River Network ID			Assessor and affiliation		AMJV			
Date of assessment	15/02/2018		Version of assessment		2			
Notes			12		12			
Step 1 Runoff Quality         AADT         >10,000 and           Step 2 River Impacts         Annual 95%lle river         Impermeable road a           Base Flow Index (B         Base Flow Index (B	flow (m³/s) area drained (ha)	0.0010248 (Ente 3.28986 Perm	er wet Ra er zero in Annual 95%ile rive leable area draining to outfa e discharge in or within 1 km	er flow box to assess St all (ha) 1.21914				
For dissolved zinc only Water hardness [ For sediment impact only Is there a downstre	Low= <50mg CaCO3/I am structure, lake, p	ond or canal that redu	ices the velocity within 100r					
© Tier 1 Estimate	ed ri∨er width (m) h (m)	5 0.9 Manr	ning's n 0.05	Side slope (m/m)	0.627517 Long slo	ope (m/m) 0.005934		
Step 3 Mitigation	Brief description		Treatment for Att solubles (%) solub		ement of nents (%)	Predict Impact		
Existing measures Proposed measures Filter Drains & 2 × Wet/Retentic	n Ponds		0 D Unlimit 60 Unlimit	ed 🗕 🖸 0		Exit Tool		

#### **Soluble Copper and Sediment Result**

AGENCY	Highways A	gency Water Ris	k Assessment	version 1.0 Nove	mber 201	)9			
AGENCY	Annual Average Co Copper Step 2 2.64 Step 3 1.27	oncentration	le - Acute Impact Copper Pass	Zinc Iver Fails Toxicity Test. Try more mitigation	Alert.	D/S Structure. Accu	ent - Chron ment deposi mulating? nsive?	nic Impact ition for this site No 0.12 No -	and the second
Location Details									
Road number		A9 T-M		HA Area / DBFO	number	5			
Assessment type			essment (single outfall						-
Constant Constant and the state of the state	grid reference of assessment point (m)					Northing	833476		
	I reference of outfall structure (m) Easting					Northing			
Outfall number		6-A		List of outfalls − cumulative asse					
Receiving watercourse		Funtack Burn Trib 6							
EA receiving water Detailed Rive	er Network ID			Assessor and affil	liation		AMJV		
Date of assessment		05/02/2018		Version of assess	sment		2		
Step 2 River Impacts A In B	ADT >10,000 and Innual 95%ile river npermeable road a lase Flow Index (Bl vater hardness	flow (m³/s) rea drained (ha)	0.0001307 (Enter 1.57157 Perm	eable area draining t	6ile rivei to outfal	flow box to assess S		quality only)	No y D
o		d river width (m)	ond or canal that reduc 5 1.176 Mann	es the velocity within ng's n 0.035	n 100m	of the point of dischar Side slope (m/m)	ge? 0.547611	Yes	• 0.1
Step 3 Mitigation		Brief description		E Treatment for solubles (%)	Atte soluble		tlement of ments ( %)		dict Impact
Existing measures Proposed measures Filter Dra	ins and 2 x Wet/Reten	tion Ponds		0 D	Unlimit Unlimit	ed 🔽 🖸 0	D		etalled Results xit Tool

HIGHWAYS	Highways A	gency Water	Risk Assessment	version 1.0 Nov	ember 20	09			
AGENCY	Annual Average C Coppe Step 2 2.64 Step 3 1.06	Solution         Solution           r         Zinc         ug/l           8.36         ug/l           3.34         ug/l	uble - Acute Impact Copper Pass	Zinc tiver Fails Toxicity Test, Try more mitigation	Alert.	D/S Structure.	-	ting? No	or this site is judged as: 0.12 Low flow Vel m/s - Deposition Index
ocation Details				-					
Road number		A9 T-M		HA Area / DBFO	number				
Assessment type		-C	assessment (single outfal	1)		-			
DS grid reference of assessr		Easting	277715			Northing	833	3476	
DS grid reference of outfall st	ructure (m)	T⊏≏sting				Northing			58
Dutfall number		6-A		List of outfal					.e
Receiving watercourse		Funtack Burn Tri	5 6	cumulative asse	essmeni				
A receiving water Detailed I	River Network ID			Assessor and aff	iliation	4	AN	1JV	L.
Date of assessment		05/02/2018		Version of asses	sment		2		
itep 1 Runoff Quality	AADT >10,000 an Annual 95%ile river Impermeable road Base Flow Index (E Water hardness	flow (m³/s) area drained (ha)	0.0001307 (Ente 1.57157 Perm 0.3 Is the	r zero in Annual 95' eable area draining discharge in or with	%ile rive to outfal	r flow box to a	4043	runoff quality	
For sediment impact only	Is there a downstre	am structure, lake ed river width (m)	pond or canal that reduce	ces the velocity with	in 100m	of the point of Side slope (n		7611 Lon	Yes -
Step 3 Mitigation		Brief descriptio	n	Treatment for solubles ( %)	Att. solubl	ed effectivenes: enuation for es - restricted arge rate (I/s)	s Settleme sediment	s(%)	Predict Impact
Existing measures				0	Unlimit		0		Show Detailed Result
5			223	0			1.22	0	
Proposed measures   Filter	Drains and 2 x Wet/Reter	ntion Ponds		60	Unlimit	ed 🖵 🖸	80		Exit Tool

#### Soluble Copper and Sediment Result

HIGHWAYS Highw	ys Agency Water Risk Assessment	version 1.0 Novemb	er 2009	
Annual Ave Step 2 Step 3	Zopper     Zinc     Soluble - Acute Impact Copper       0.42     1.28     ug/l       0.25     0.77     ug/l	Zinc Pass	Alert. D/S Structure. Accu	nent - Chronic Impact iment deposition for this site is judged as: imulating? No 0.35 Low flow Vel m/s insive? No - Deposition Index
Location Details	1.0000	HA Area / DBFO nur		
Road number	A9 T-M		mber	
Assessment type	Non-cumulative assessment (single out	all)		
OS grid reference of assessment point (m)	Easting 277050		Northing	833887
OS grid reference of outfall structure (m)	Easting		Northing	
Outfall number	7-A	List of outfalls in cumulative assessr		
Receiving watercourse	Caochan na h-Eaglais			
EA receiving water Detailed River Network ID		Assessor and affiliat	ion	AMJV
Date of assessment	06/02/2018	Version of assessme	ent	2
Notes				- 4
Impermeable Base Flow In For dissolved zinc only Water hardne For sediment impact only Is there a door	road area drained (ha) 1.41462 Per ex (BFI) 0.28 Is th	meable area draining to o e discharge in or within '	1 km upstream of a protect	ed site for conservation?
© Tier 2 Bi	d width (m) 1 Mai	nning's n 0.035	Side slope (m/m)	0.307826 Long slope (m/m) 0.069533
Step 3 Mitigation           Existing measures           Proposed measures           Filter Drains & Wet/Ret	Brief description ntion Ponds	Treatment for solubles (%) s di		ttlement of iments (%)

HIGHWAYS AGENCY	Highways A	gency Water Ris	k Assessment	version 1.0 Nover	nber 200	09				
AGENCY	Annual Average Co	Solubl	e - Acute Impact Copper	Zinc		Sedin	ent - Chror	nic Impact		
	Copper Step 2 0.42		Pass	Pass	Alert	A REAL PROPERTY OF A REAP	iment depos umulating?	ition for thi		<mark>dged as:</mark> w flow ∨el m/s
	Step 3 0.20	0.60 ug/l					nsive?	No		position Index
Location Details										
Road number		A9 T-M		HA Area / DBFO r	number					14
Assessment type			essment (single outfall)	~						-
OS grid reference of assessm		Easting	277050			Northing	833887			
OS grid reference of outfall str	ucture (m)	Easting				Northing			118	
Outfall number		7-A		List of outfalls						
Receiving watercourse		Caochan na h-Eagla	is	cumulative asses	ssment					
EA receiving water Detailed R	River Network ID			Assessor and affili	iation		AMJV			
Date of assessment		06/02/2018		Version of assess	ment		2	-	-	
Notes				8						
Step 1 Runoff Quality	AADT >10,000 and	1 <50,000 💽 Clin	matic region Colde	r Wet 💌	Rai	infall site Ardtalnai	a (SAAR 1343.9	3mm)		-
Step 2 River Impacts	Annual 95%ile river	flow (m³/s)	0.00233 (Enter	zero in Annual 95%	ile river	r flow box to assess	Step 1 runoff	quality only	)	
	Impermeable road a	area drained (ha)	1.41462 Perme	able area draining t	o outfal	ll (ha) 0.68338				
	Base Flow Index (B	Fl) 0.	28 Is the	discharge in or withi	n 1 km	upstream of a protect	ed site for co	onservation'	?	No 🔻 D
For dissolved zinc only	Water hardness [	Low = <50mg CaCO3/I	<b>-</b> D							
For sediment impact only			ond or canal that reduc	es the velocity withir	100m	of the point of discha	rge?	Yes	- <u>-</u>	1
	C Tier 1 Estimate	ed river width (m)	5							
	Tier 2 Bed widt	:h (m)	1 Manni	ng's n 0.035		Side slope (m/m)	0.307826	Long slop	pe (m/m)	0.069533
Step 3 Mitigation			1	E	stimate	ed effectiveness			Predict I	mnact
		Brief description	10	Treatment for			ttlement of			
				solubles ( %)		es-restricted sed arge rate (l/s)	iments (%)	0		
Existing measures					Unlimite			- Sho	w Detaile	ed Results
				U	101031010020	• •	D			
Proposed measures Filter	Drains & Wet/Retention P	onds		53	Unlimite	ed 🗸 🖸 72			Exit T	ool

#### **Soluble Copper and Sediment Result**

HIGHWAYS	<b>Highways</b> A	gency Water Ris	k Assessment	version 1.0 Nov	ember 200	)9				
An	nual Average Co Copper tep 2 0.13 tep 3 0.08	oncentration	le - Acute Impact Copper Pass	Zinc Pass	Alert.	S D/S Structure.	ediment - Ch Sediment dej Accumulating Extensive?	osition for th	is site is ju 0.40 Lo	<b>dged as:</b> w flow ∀el m/s position Index
Location Details										
Road number		A9 T-M		HA Area / DBFO	number	8				
Assessment type		Non-cumulative ass	sessment (single outfal	)			85			
OS grid reference of assessment po		Easting	276297			Northing	83425	l,		6
OS grid reference of outfall structure	(m)	Easting				Northing				
Outfall number		8-A		List of outfal						
Receiving watercourse		Allt na Loinne Moire		− cumulative asse	essmeni					
EA receiving water Detailed River N	etwork ID			Assessor and aff	iliation		AMJV			
Date of assessment		06/02/2018		Version of asses	sment		2			
Notes		1		-						
Impe Base For dissolved zinc only Wate	Flow Index (Bl	area drained (ha) Fl) 0. Low = <50mg CaCO3/I	1.70578 Perm	r zero in Annual 95' eable area draining discharge in or with es the velocity with	i to outfal nin 1 km	l (ha) 0.979: upstream of a pr	otected site fo		1?	No 🗸 D
O Tie ● Tie	Loundeo	ed river width (m) h (m)	5 1.7 Mann	ing's n 0.04		Side slope (m/r	n) 1.705	Long sl	ope (m/m)	0.032147
Step 3 Mitigation		Brief description		Treatment for solubles ( %)	Atte	ed effectiveness enuation for es - restricted inge rate ( I/s )	Settlement of sediments ( %	6)	Predict I	mpact ed Results
Existing measures				0	Unlimite	ed V D	Г	D	on Decall	eu nesuits
Proposed measures Filter Drains &	Wet/Retention P	onds		40	Unlimite		72		Exit 1	'ool

	Annual Average Co		uble - Acute Impact	Zinc			Sedime	nt - Chro	nic Impa	ct	
	Copper           Step 2         0.13           Step 3         0.06		Copper Pass	Pass	Alert.	D/S Structure		nulating?	sition for No No	this site is 0.40 -	<b>judged as:</b> Low flow Vel m/s Deposition Index
Location Details Road number		luoza		HA Area / DBF							
		A9 T-M		ACTIVATION OF A CONTRACT OF A	Juumber	9					
Assessment type OS grid reference of assessr	an e ak a e ink (me)	Ron-cumulative Easting	assessment (single outfal	)		Northing		001051			
OS grid reference of outfall st	No construction de la construction de la construcción de la construcci	-	276297		2	Northing		834251			
	iructure (m)	Easting		List of outfo	llain	Northing					
Outfall number		8-A		List of outfa cumulative ass							
Receiving watercourse		Allt na Loinne Mo	ire	Contraction of the second strength of the sec	991 N. S.						
EA receiving water Detailed I	River Network ID			Assessor and a				AMJV			
Date of assessment Notes		06/02/2018		Version of asse	ssment			2			
	AADT <b>&gt;10,000 and</b> Annual 95%ile river			er Wet -		flow box to	Ardtalnaig ( assess Sti	-		only)	7
Step 2 River Impacts		flow (m³/s) area drained (ha)	0.0124 (Ente 1.70578 Perm 0.5 D is the		5%ile river g to outfal	flow box to	assess Ste	ep 1 runof	f quality c		No
Step 2 River Impacts	Annual 95%ile river Impermeable road a Base Flow Index (B Water hardness [ / Is there a downstrea	flow (m³/s) area drained (ha) (FI) Low = <50mg CaCC am structure, lake ed river width (m)	0.0124 (Ente 1.70578 Perm 0.5 D Is the 1.34 D , pond or canal that reduc 5	r zero in Annual 95 eable area drainin discharge in or wi	5%ile river g to outfal thin 1 km	flow box to I (ha)	assess Str 0.97922 a protecter of discharg	ep 1 runofi d site for c	f quality c		
Step 2 River Impacts For dissolved zinc only For sediment impact only	Annual 95%ile river Impermeable road a Base Flow Index (B Water hardness [ / Is there a downstrea C Tier 1 Estimate	flow (m³/s) area drained (ha) FI) Low = <50mg CaCC am structure, lake ed river width (m) th (m)	0.0124 (Ente 1.70578 Perm 0.5 D Is the 0.5 D 0.5 D 0.	r zero in Annual 96 eable area drainin discharge in or wi ces the velocity with ing's n 0.04	5%ile river 5%ile river thin 1 km hin 100m	flow box to I (ha)	assess Str 0.97922 a protected of discharg (m/m)	ep 1 runof d site for c e?	f quality c	on? Yes • slope (m/m	
Step 2 River Impacts For dissolved zinc only For sediment impact only Step 3 Mitigation	Annual 95%ile river Impermeable road a Base Flow Index (B Water hardness [ / Is there a downstrea C Tier 1 Estimate	flow (m³/s) area drained (ha) (FI) Low = <50mg CaCC am structure, lake ed river width (m)	0.0124 (Ente 1.70578 Perm 0.5 D Is the 0.5 D 0.5 D 0.	r zero in Annual 95 eable area drainin, discharge in or wi tes the velocity with ing's n 0.04 Treatment for solubles (%)	5%ile river 5%ile river thin 1 km hin 100m Estimate Solubli discha	r flow box to I (ha) of the point - Side slope subscription so - restrictions restrictions	assess Str 0.97922 a protecter of discharg (m/m) [ sss Setti b sedin )	ep 1 runof d site for c e? 1.705 ement of nents (%)	f quality c conservati	on? Yes - slope (m/m <b>Predic</b>	1) 0.032147
For sediment impact only Step 3 Mitigation Existing measures	Annual 95%ile river Impermeable road a Base Flow Index (B Water hardness [ / Is there a downstrea C Tier 1 Estimate	flow (m³/s) area drained (ha) (FI) Low = <50mg CaCC am structure, lake ed river width (m) th (m) Brief description	0.0124 (Ente 1.70578 Perm 0.5 D Is the 0.5 D 0.5 D 0.	r zero in Annual 95 eable area drainin discharge in or wi res the velocity with ing's n 0.04 Treatment for	5%ile river 5%ile river thin 1 km hin 100m Estimate Solubi	r flow box to I (ha) I	o assess Str 0.97922 a protected of discharg (m/m) ess Setti sedin ) 0	ep 1 runof d site for c e?	f quality c conservati	on? Yes - slope (m/m Predic how Det	· [

#### **Soluble Copper and Sediment Result**

HIGHWAYS Highway	Agency Water Risk	Assessment	version 1.0 November	2009	
	e Concentration per Zinc 57 2.02 ug/l	e - Acute Impact Copper Pass	Zinc Pass	Pass Accu	ent - Chronic Impact nent deposition for this site is judged as: mulating? Isive? No - Deposition Index
Location Details	100000000000				1
Road number	A9 T-M		HA Area / DBFO numb	er	
Assessment type		essment (single outfall)	110	1.200 million	
OS grid reference of assessment point (m)		275568		Northing	834710
OS grid reference of outfall structure (m)	Easting			Northing	
Outfall number	9-A		List of outfalls in cumulative assessme	nt	
Receiving watercourse	Allt Creag Bheithin Tr	ib 1			
EA receiving water Detailed River Network ID			Assessor and affiliation	1	AMJV
Date of assessment	05/02/2018		Version of assessment		2
Notes					
Step 1 Runoff Quality         AADT         >10,000           Step 2 River Impacts         Annual 95%ile ri         Impermeable roa           Base Flow Index         Base Flow Index	ver flow (m³/s) d area drained (ha)	4.03948 Perme 3 Sthe	zero in Annual 95%ile ri eable area draining to out	ver flow box to assess S	
For dissolved zinc only Water hardness	Low = <50mg CaCO3/I	- D			
O Tier 1 Estim	ream structure, lake, poi ated river width (m) ridth (m)	nd or canal that reduce 5 6.5 Manni		om of the point of dischar	ge? No J D 0.837 Long slope (m/m) 0.032064
Step 3 Mitigation	Brief description		Treatment for A solubles (%) solu		lement of ments (%)
Existing measures			Conversion of the second	nited V D 0	Show Detailed Results
Proposed measures Filter Drains and Wetlands			30 Unlin	mited T D 72	Exit Tool

AGENCY HIGHWAYS	ways Agency Water Ris	k Assessment	version 1.0 November 20	09	
	verage Concentration	le - Acute Impact Copper	Zinc		nt - Chronic Impact
Step 2 Step 3	Copper         Zinc           0.67         2.02         ug/l           0.27         0.83         ug/l	Pass	Pass	1460 C	ent deposition for this site is judged as: nulating? No 0.15 Low flow Vel m/s sive? No - Deposition Index
Location Details	1		1		
Road number	A9 T-M		HA Area / DBFO number	8	
Assessment type		sessment (single outfall)			-
OS grid reference of assessment point (m)	Easting	Easting 275568		Northing	834710
OS grid reference of outfall structure (m)	Easting	0		Northing	
Outfall number	9-A	List of outfalls in			
Receiving watercourse	Allt Creag Bheithin	Trib 1	cumulative assessment		
EA receiving water Detailed River Network	ID		Assessor and affiliation		AMJV
Date of assessment	05/02/2018		Version of assessment		2
Notes			3		
Step 1 Runoff Quality AADT	10,000 and <50,000 🗾 Cli	imatic region Colder	Wet 📕 Ra	infall site Ardtalnaig (	SAAR 1343.9mm)
	%ile river flow (m³/s) le road area drained (ha) Index (BFI)	4.03948 Perme	zero in Annual 95%ile rive able area draining to outfal discharge in or within 1 km	I (ha) 1.26752	
For dissolved zinc only Water hard	ness Low = <50mg CaCO3/I	- D			
C Tier 1	lownstream structure, lake, p Estimated river width (m) Bed width (m)	ond or canal that reduce 5 6.5 Mannir	· · · · · · · · · · · · · · · · · · ·		e? No - D 0.837 Long slope (m/m) 0.032064
Step 3 Mitigation	Brief description			ed effectiveness enuation for Settl	ement of Predict Impact
Existing measures				irge rate ( l/s )	Show Detailed Results
Proposed measures Filter Drains and Wet	lands		59 Unlimit		Exit Tool

#### **Soluble Copper and Sediment Result**

AGENCY	Highways A	gency Water Ris	k Assessment	nt version 1.0 November 2009						
AGENCY	Annual Average Co	Solub	le - Acute Impact Copper	Zinc		Sedime	nt - Chro	nic Impact		
	Copper           Step 2         0.17           Step 3         0.10	Zinc           0.53         ug/l           0.32         ug/l	Pass	Pass	Pass	2010 C C C C C C C C C C C C C C C C C C	nulating?	No No		ed as: low Vel m/s sition Index
Location Details		-		luce a server						
Road number		A9 T-M		HA Area / DBFO nun	nber					
Assessment type			sessment (single outf	all)	175 97					-
OS grid reference of assessm		Easting	274897		Northing		834784			
OS grid reference of outfall st	ructure (m)	Easting			Northing					
Outfall number		X-A		List of outfalls in cumulative assessn						
Receiving watercourse		Allt Creag Bheithin								
EA receiving water Detailed R	River Network ID			Assessor and affiliati	on		AMJV			
Date of assessment		06/02/2018		Version of assessme	ent		2			
Notes										
Step 1 Runoff Quality	AADT >10,000 and	I <50,000 - Cli	matic region Co	older Wet 🚽	Rainfall site	Ardtalnaig (	SAAR 1343.	9mm)		-
Step 2 River Impacts	Annual 95%ile river Impermeable road a Base Flow Index (Bl	area drained (ha)	2.21901 Per	ter zero in Annual 95%ile meable area draining to c ne discharge in or within 1	utfall (ha)	1.87499			-	No 🔹 D
For dissolved zinc only	Water hardness	Low = <50mg CaCO3/I	- D							
For sediment impact only		d river width (m)	5	uces the velocity within 11	00m of the point	_	e? 1.207529	No Long slo	<b>-</b> D pe (m/m)	0.019781
Step 3 Mitigation		Brief description		Treatment for solubles (%) so	mated effectiven Attenuation for plubles - restricte scharge rate ( I/s	d Setti	ement of nents ( %)		Predict Im w Detailed	
Existing measures					nlimited 🚽 🕞	- 0			n Decalleu	Results
Proposed measures Filter	Drains & Wet/Retention P	onds			nlimited <b>-</b>				Exit To	ol

HIGHWAYS	Highways A									
AGENCI	Annual Average Co Copper Step 2 0.17	oncentration	luble - Acute Impact Copper	Zinc	Pass	Sedim	nt - Chror ent depos ulating?	i i i i i i i i i i i i i i i i i i i		<b>judged as:</b> Low flow Vel m/s
	Step 3 0.08	0.55 ug/l	1.005	1,005	1 435	Extens		No	-	Deposition Index
Location Details										
Road number		A9T-M		HA Area / DBFO number						
Assessment type		The second decision of the second second decision of the	assessment (single outfa	ll)	<i>20</i>					
OS grid reference of assessr	Construction of the second structure of the second str	Easting	274897		Northing		834784			
OS grid reference of outfall s	structure (m)	Easting		(b) 1000 (b) 100 (40) 00	Northing					
Outfall number		X-A		List of outfalls in		ĺ				
Receiving watercourse		Allt Creag Bheit	nin	cumulative assessment						
EA receiving water Detailed	River Network ID			Assessor and affiliation			AMJV			
Date of assessment		06/02/2018		Version of assessment			2			
Step 1 Runoff Quality	AADT >10,000 and	1 <50,000 -	Climatic region Col	der Wet 🗾 Ra	infall site	Ardtalnaig (S	AAR 1343.	9mm)		
Step 2 River Impacts		flow (m³/s) area drained (ha)	0.011 (Ente 2.21901 Perm 0.4 Is the	ler Wet Ra er zero in Annual 95%ile rive neable area draining to outfa e discharge in or within 1 km	r flow box to a	assess Ste 87499	p 1 runoff	quality o		No
Step 2 River Impacts	Annual 95%ile river Impermeable road a Base Flow Index (BI Water hardness	flow (m <sup>9</sup> /s) area drained (ha) Fl) Low = <50mg CaC am structure, lake ed river width (m)	0.011         (Entr           2.21901         Perm           0.4         Is the           03/1 <ul> <li>D</li> <li>e, pond or canal that redu</li> <li>5</li> </ul>	er zero in Annual 95%ile rive neable area draining to outfa	r flow box to a II (ha) 1.	assess Ste 87499 a protected f discharge	p 1 runoff site for co	quality o		D
Step 1 Runoff Quality Step 2 River Impacts For dissolved zinc only For sediment impact only Step 3 Mitigation	Annual 95%ile river Impermeable road a Base Flow Index (BI Water hardness [ y Is there a downstrea C Tier 1 Estimate	flow (m <sup>9</sup> /s) area drained (ha) Fl) Low = <50mg CaC am structure, lake ed river width (m)	0.011 (Entr 2.21901 Pern 0.4 Is the 03/1 P e, pond or canal that redu 5 0.7 Man	er zero in Annual 95%ile rive neable area draining to outfa e discharge in or within 1 km ces the velocity within 100m ning's n 0.04	r flow box to a II (ha) 1. upstream of a	aprotected f discharge m/m) 1 ss	p 1 runoff site for co	quality o onservati	on? No	D 0.019781
Step 2 River Impacts For dissolved zinc only For sediment impact only	Annual 95%ile river Impermeable road a Base Flow Index (BI Water hardness [ y Is there a downstrea C Tier 1 Estimate	flow (m³/s) area drained (ha) FI) Low = <50ma CaC am structure, lak ed river width (m) th (m)	0.011 (Entr 2.21901 Pern 0.4 Is the 03/1 P e, pond or canal that redu 5 0.7 Man	er zero in Annual 95%ile rive neable area draining to outfa e discharge in or within 1 km ces the velocity within 100m ning's n 0.04	r flow box to a II (ha) of the point of Side slope (i Side slope (i enuation for es - restricted arge rate ( /s )	aprotected f discharge m/m) 1 ss	p 1 runoff site for co ?? .207529 ment of	quality o onservati	on? No	I) 0.019781

#### **Soluble Copper and Sediment Result**

.

Annual Average Concentration       Copper       Zinc         Step 2       0.37       1.13       ugft       Pass       Pass       Pass       Ac         Location Details       Road number       A.9.T-M       HA Area / DBFO number       Ac       Ex         Assessment type       Non-cumulative assessment (single outfall)       HA Area / DBFO number       Assessment (single outfall)       Northing         OS grid reference of assessment point (m)       Easting       273942       Northing         Outfall number       A.4       Casting       Northing         Outfall number       Y-A       List of outfalls in cumulative assessment       Northing         Outfall number       Y-A       Cumulative assessment       Northing         Date of assessment       DB/02/2018       Version of assessment       Northing         Date of assessment       DB/02/2018       Version of assessment       Notases         Step 1 Runoff Quality       AADT       Bio00000       Climatic region       Cader Wet       Rainfall site       Ardiain         Step 2 River Impacts       Annual 95%ile river flow (m²/s)       0.00414       (Enter zero in Annual 95%ile river flow box to assess         Impermeable road area drained (ha)       2.20284       Permeable area draining to outfall (ha) <t< th=""><th></th><th></th></t<>		
Step 2     0.37     1.13     ug/l     Pass     Pass     Pass     Acc       Location Details     Road number     A9 T-M     HA Area / DBFO number       Assessment type     Non-cumulative assessment (single outfall)     OG grid reference of assessment point (m)     Easting     273942     Northing       OS grid reference of outfall structure (m)     Easting     273942     Northing       Outfall number     Y-A     List of outfalls in cumulative assessment     Northing       Outfall number     Y-A     List of outfalls in cumulative assessment     Northing       Outfall number     Y-A     List of outfalls in cumulative assessment     Northing       Date of assessment     06/02/2018     Version of assessment     Notal assessment       Notes     Impermeable road area drained (ha)     2.00214     Permeable area draining to outfall (ha)     2.04216       Step 2 River Impacts     Annual 95% life river flow (m?/s)     0.00414     (Enter zero in Annual 95% life river flow box to assess       Impermeable road area drained (ha)     2.00264     Permeable area draining to outfall (ha)     2.04216       Base Flow Index (BFI)     0.34     Is the discharge in or within 1 km upstream of a prote       For dissolved zinc only     Vater hardness     Low = <50mg CacO3/1 Impermeable area draining to outfall (ha)     2.04216       Brief descri	diment - Chronic Im	Impact n for this site is judged as:
Road number       A8 T-M       HA Area / DBFO number         Assessment type       Non-cumulative assessment (single outfall)         OS gird reference of assessment point (m)       Easting       273942       Northing         OS gird reference of outfall structure (m)       Easting       273942       Northing         Outfall number       Y-A       List of outfalls in       Northing         Cutfall number       Y-A       List of outfalls in       Intervaluative assessment         EA receiving water Detailed River Network ID       Assessor and affiliation       Date of assessment         Date of assessment       06/02/2018       Version of assessment         Notes       Step 1 Runoff Quality       AADT       Editor region       Celder Wet       Rainfall site       Ardtain         Step 2 River Impacts       Annual 95%ile river flow (m <sup>9</sup> /s)       0.00414       (Enter zero in Annual 95%ile river flow box to assess         Impermeable road area drained (ha)       2.00284       Permeable area draining to outfall (ha)       2.04216         Base Flow Index (BFI)       0.34       Is the discharge in or within 1 km upstream of a prote         For dissolved zinc only       Water hardness       Low = <50mg CaC03/1 Implement       Implement         © Tier 1       Estimated river width (m)       5       Side slope (m/m	ccumulating? No xtensive? No	0 0.20 Low flow Vel m
Assessment type Non-cumulative assessment (single outfall) OS grid reference of assessment point (m) Easting 273942 Northing OS grid reference of outfall structure (m) Easting Northing Outfall number Y-A List of outfalls in cumulative assessment Alt Creag Bheithin Cumulative assessment Cumulative assessment In the easter of the easter o		
OS grid reference of assessment point (m)       Easting       273942       Northing         OS grid reference of outfall structure (m)       Easting       Northing         Outfall number       Y-A       List of outfalls in cumulative assessment         Receiving water Detailed River Network ID       Assessor and affiliation         Date of assessment       06/02/2018       Version of assessment         Notes       06/02/2018       Version of assessment         Step 1       Runoff Quality       AADT         Step 2       River Impacts       Annual 95%ile river flow (m³/s)       0.00414         Step 2       River Impacts       Annual 95%ile river flow (m³/s)       0.00414       (Enter zero in Annual 95%ile river flow box to assess Impermeable road area drained (ha)       2.02284       Permeable area draining to outfall (ha)       2.04216         Base Flow Index (BFI)       0.34       Is the discharge in or within 1 km upstream of a prote       For dissolved zinc only       Water hardness       Low = <50mg CaC03/1 P		
OS grid reference of outfall structure (m)       Easting       Northing         Outfall number       Y-A       List of outfalls in cumulative assessment         Receiving water Detailed River Network ID       Assessor and affiliation         Date of assessment       06/02/2018       Version of assessment         Notes       Off Quality       AADT       10,000 and <50,000	507	
Outfall number       Y-A       List of outfalls in cumulative assessment         Receiving water Detailed River Network ID       Assessor and affiliation         Date of assessment       06/02/2018         Notes       Version of assessment         Step 1 Runoff Quality       AADT         Participation       Climatic region         Colder Wat       Rainfall site         Ardtain         Step 2 River Impacts       Annual 95%ile river flow (m <sup>9</sup> /s)         Impermeable road area drained (ha)       2.20284         Permeable area draining to outfall (ha)       2.04216         Base Flow Index (BFI)       0.34         Is the discharge in or within 1 km upstream of a prote         For dissolved zinc only       Uster hardness         Low = <50mg CaC03/1	834608	
Receiving water Detailed River Network ID       Allt Creag Bheithin       Cumulative assessment         EA receiving water Detailed River Network ID       Assessor and affiliation         Date of assessment       06/02/2018       Version of assessment         Notes       Step 1 Runoff Quality       AAr)T       P10.000 and <50.000		
Receiving water Detailed River Network ID       Assessor and affiliation         Date of assessment       06/02/2018         Notes       Version of assessment         Step 1 Runoff Quality       AADT         Step 1 Runoff Quality       AADT         Step 2 River Impacts       Annual 95%ile river flow (m³/s)         Impermeable road area drained (ha)       2.20284         Permeable area draining to outfall (ha)       2.04216         Base Flow Index (BFI)       0.34         Is the discharge in or within 1 km upstream of a prote         For dissolved zinc only       Uster a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of disch C Tire 1         Estimated river width (m)       5         © Tier 2       Bed width (m)         Step 3 Mitigation       Estimated effectiveness oubles - restricted discharge rate (Vs)         Brief description       Treatment for solubles (%)         Solubles - restricted discharge rate (Vs)		
Date of assessment       06/02/2018       Version of assessment         Notes       Step 1 Runoff Quality       AADT       10,000 and 450,000       Climatic region       Colder Wet       Rainfall site       Ardtain         Step 2 River Impacts       Annual 95%ile river flow (m <sup>3</sup> /s)       0.00414       (Enter zero in Annual 95%ile river flow box to assess         Impermeable road area drained (ha)       2.20284       Permeable area draining to outfall (ha)       2.04216         Base Flow Index (BFI)       0.34       Is the discharge in or within 1 km upstream of a prote         For dissolved zinc only       Water hardness       Low = <50mg CaC037		
Step 1       Runoff Quality       AADT       210,000 and <50,000       Climatic region       Colder Wet       Rainfall site       Ardtain         Step 2       River Impacts       Annual 95% ile river flow (m³/s)       0.00414       (Enter zero in Annual 95% ile river flow box to assess impermeable road area drained (ha)       2.20284       Permeable area draining to outfall (ha)       2.04216         Base Flow Index (BFI)       0.34       Is the discharge in or within 1 km upstream of a prote         For dissolved zinc only       Water hardness       Low = <50mg CaC03/1	AMJV	
Step 1 Runoff Quality       AADT       ¥10,000 and <50,000       Climatic region       Coder Wet       Rainfall site       Ardtain         Step 2 River Impacts       Annual 95%ile river flow (m <sup>3</sup> /s)       0.00414       (Enter zero in Annual 95%ile river flow box to assess Impermeable road area drained (ha)       2.20284       Permeable area draining to outfall (ha)       2.04216         Base Flow Index (BFI)       0.34       Is the discharge in or within 1 km upstream of a prote         For dissolved zinc only       Water hardness       Low = <50mg CaCC03/1	2	
C Tier 1     Estimated river width (m)     5       Image: C Tier 2     Bed width (m)     0.6     Manning's n     0.05     Side slope (m/m)       Step 3     Mitigation     Estimated effectiveness       Brief description     Treatment for solubles (%)     Attenuation for solubles restricted discharge rate (Vs)		ality only) ervation? No 💌
Brief description Treatment for solubles (%) Attenuation for set discharge rate ( <i>Vs</i> )		No
discharge rate (Vs)	Settlement of	Predict Impact
	sediments (%)	Show Detailed Resul
Proposed measures Filter Drains & Wet/Retention Ponds 40 Unlimited D 72		Exit Tool

ACENCY	Highways A	geney materi	diale / tage additione	version 1.0 Nov	CHINGT 20	15					
AGENCY	Annual Average Co	oncentration Zinc	uble - Acute Impact Copper	Zinc			Sedim	ent depo		this site is	
	Step 2         0.37           Step 3         0.18	1.13 ug/l 0.53 ug/l	Pass	Pass		Pass	Accum Extens	ulating? sive?	No No		Low flow Vel m/s Deposition Index
ocation Details				HA Area / DBF	2			9			
Road number	7	A9 T-M			Jnumber						
ssessment type	2		assessment (single outfa	ll)							
DS grid reference of assess		Easting	273942			Northing		834608			
DS grid reference of outfall s	tructure (m)	Easting				Northing					
Dutfall number		Y-A	1997	List of outfa cumulative ass							
Receiving watercourse		Allt Creag Bheith	in								
EA receiving water Detailed	River Network ID			Assessor and a	ffiliation			AMJV			
Date of assessment	()	06/02/2018		Version of asse	ssment			2			
lotes	8			70							
	AADT >10,000 and	i <50,000 <b>↓</b>	Climatic region Co	der Wet 🚽	Ra	nfall site	Ardtalnaig (	SAAR 1343	9mm)		
	AADT ≥10,000 and Annual 95%ile river Impermeable road a Base Flow Index (B	flow (m³/s) area drained (ha)	0.00414 (Ent 2.20284 Perr	der Wet er zero in Annual 95 neable area drainin e discharge in or wi	5%ile rive g to outfal	flow box to	assess Ste 2.04216	p 1 runofi	quality o		No 💌
Step 1 Runoff Quality Step 2 River Impacts For dissolved zinc only	Annual 95%ile river	flow (m³/s) area drained (ha)	0.00414 (Ent 2.20284 Perr 0.34 Is th	er zero in Annual 95 neable area drainin	5%ile rive g to outfal	flow box to	assess Ste 2.04216	p 1 runofi	quality o		No
Step 2 River Impacts	Annual 95%ile river Impermeable road a Base Flow Index (B Water hardness	flow (m³/s) area drained (ha) FI) Low = <50mg CaCC am structure, lake ad river width (m)	0.00414 (Ent 2.20284 Perr 0.34 Is th g/ 0 pond or canal that redu	er zero in Annual 95 neable area drainin e discharge in or wi	5%ile rive g to outfal thin 1 km	flow box to (ha) 2 upstream of	assess Ste 2.04216 a protected of discharg	ep 1 runofi	quality o		D
Step 2 River Impacts For dissolved zinc only For sediment impact only	Annual 95%ile river Impermeable road a Base Flow Index (B Water hardness [ s Is there a downstrea C Tier 1 Estimate	flow (m <sup>3</sup> /s) area drained (ha) FI) Low = <50mg CaCC am structure, lake d river width (m) h (m)	0.00414 (Ent 2.20284 Perr 0.34 Is th 3/1 2 D , pond or canal that redu 5 0.6 Man	er zero in Annual 95 neable area drainin, e discharge in or wi ices the velocity with ning's n 0.05	5%ile rive g to outfal thin 1 km hin 100m Estimate	flow box to I (ha) 2 upstream of of the point of Side slope	assess Ste 2.04216 a protected of discharge (m/m)	ep 1 runoff I site for c ∋?	quality o	on? №	D
Step 2 River Impacts For dissolved zinc only For sediment impact only Step 3 Mitigation	Annual 95%ile river Impermeable road a Base Flow Index (B Water hardness [ s Is there a downstrea C Tier 1 Estimate	flow (m³/s) area drained (ha) FI) Low = <50mg CaCC am structure, lake ad river width (m)	0.00414 (Ent 2.20284 Perr 0.34 Is th 3/1 2 D , pond or canal that redu 5 0.6 Man	er zero in Annual 96 neable area drainin; e discharge in or wi cces the velocity with ning's n 0.05 Treatment for solubles (%)	5%ile rive g to outfal thin 1 km hin 100m Estimate solubl discha	flow box to I (ha) 2 upstream of of the point of Side slope multion for so - restrictor reg rate (/s	assess Ste 2.04216 of dischargo (m/m) :ss Settle i sedim )	ep 1 runoff I site for c e? 2.6135 ement of eents (%)	i quality o onservation	on? No <u> </u>	0.005985
Step 2 River Impacts For dissolved zinc only For sediment impact only Step 3 Mitigation Existing measures	Annual 95%ile river Impermeable road a Base Flow Index (B Water hardness [ s Is there a downstrea C Tier 1 Estimate	flow (m³/s) area drained (ha) FI) Low = <50mg CaCC am structure, lake d river width (m) h (m) Brief descriptio	0.00414 (Ent 2.20284 Perr 0.34 Is th 3/1 2 D , pond or canal that redu 5 0.6 Man	er zero in Annual 95 neable area drainin, e discharge in or wi ices the velocity with ning's n 0.05 Treatment for	g to outfal thin 1 km hin 100m Estimate solubi	flow box to (ha) 2 upstream of of the point of Side slope snuation for ss - restricted rige rate (Vs ad	assess Ste 2.04216 a protected of discharge (m/m)	Pp 1 runoff I site for c P? 2.6135	i quality o onservation	on? No <u> </u>	0.005985

#### **Soluble Copper and Sediment Result**

HIGHWAYS Highways	Agency Water Ris	k Assessment	version 1.0 November 20	109				
Adenci Annual Average	Solub	le - Acute Impact Copper	Zinc	Sediment - Chronic Impact				
Copp           Step 2         0.4           Step 3         0.2	er Zinc 1.42 ug/l	Pass	Pass	Pass Accu	ment deposition for this site is judged as: mulating? nsive? No - Deposition Index			
Location Details	4							
Road number	A9 T-M		HA Area / DBFO number	***	-			
Assessment type		sessment (single outfall	)	2				
OS grid reference of assessment point (m)	Easting	272627		Northing	835042			
OS grid reference of outfall structure (m)	Easting		- 12	Northing				
Outfall number	Z-A		List of outfalls in cumulative assessment					
Receiving watercourse	Midlairgs Burn Trib :	2						
EA receiving water Detailed River Network ID			Assessor and affiliation		AMJV			
Date of assessment	06/02/2018		Version of assessment		2			
Notes								
Step 2 River Impacts Annual 95%ile rive Impermeable road Base Flow Index (	l area drained (ha)	0.51375 Perm 206 Is the	r zero in Annual 95%ile rive eable area draining to outfa discharge in or within 1 km	II (ha) 0.70925				
For dissolved zinc only Water hardness	Low = <50mg CaCO3/I	- D						
	ted river width (m)	5	es the velocity within 100m	n of the point of dischard	ge? No D 0.472553 Long slope (m/m) 0.014107			
Step 3 Mitigation	Brief description		Treatment for Att solubles (%) solub		tement of ments (%)			
Existing measures Proposed measures Filter Drains & Wet/Retention	Ponds		0 Unlimi 40 Unlimi		Exit Tool			

÷

AGENCY	S Highways A	gency Wate	r Risk Assessment	version 1.0 November	2009	
AGENCY	Annual Average C Coppe Step 2 0.47 Step 3 0.22	oncentration	Coluble - Acute Impact Copper Pass	Zinc Pass	Sedir Pass Accu	ent - Chronic Impact ment deposition for this site is judged as mulating? No 0.10 Low flow Vel nsive? Deposition Ir
Location Details						1
Road number		A9 T-M		HA Area / DBFO numb	er	
Assessment type			/e assessment (single outfal	)	24-20 (S. 1997)	
OS grid reference of assess		Easting	272627		Northing	835042
OS grid reference of outfall s	structure (m)	Easting			Northing	
Outfall number		Z-A		List of outfalls in cumulative assessme		
Receiving watercourse		Midlairgs Burn	Trib 2	Cumulative assessme	n.	
EA receiving water Detailed	River Network ID			Assessor and affiliation		AMJV
Date of assessment		06/02/2018		Version of assessment		2
Notes		-				
Step 2 River Impacts	Annual 95%ile river Impermeable road a Base Flow Index (B	area drained (ha	a) 0.51375 Perm	zero in Annual 95%ile ri eable area draining to out discharge in or within 1 k	fall (ha) 0.70925	
Step 2 River Impacts	Impermeable road a	area drained (ha	a) 0.51375 Perm	eable area draining to out	fall (ha) 0.70925	
	Impermeable road a Base Flow Index (B Water hardness Vater a downstre	area drained (ha FI) Low = <50mg Ca am structure, la ed river width (m	a) 0.51375 Perm 0.206 Is the CCO3/ T D ke, pond or canal that reduc 1) 5	eable area draining to out discharge in or within 1 k	fall (ha) 0.70925	ed site for conservation? No 💌
For dissolved zinc only	Impermeable road a Base Flow Index (B Water hardness V Is there a downstre C Tier 1 Estimate	area drained (ha IFI) Low = <50mg Ca am structure, la ad river width (m th (m)	a) 0.51375 Perm 0.206 Is the cost P ke, pond or canal that reduc 1) 5 2 Mann	eable area draining to out discharge in or within 1 k es the velocity within 100 ng's n 0.035 Estim	fall (ha) 0.70925 m upstream of a protecte m of the point of dischar, Side slope (m/m) [ ated effectiveness	ed site for conservation? No -
For dissolved zinc only For sediment impact only	Impermeable road a Base Flow Index (B Water hardness V Is there a downstre C Tier 1 Estimate	area drained (ha FI) Low = <50mg Ca am structure, la ed river width (m	a) 0.51375 Perm 0.206 Is the cost P ke, pond or canal that reduc 1) 5 2 Mann	eable area draining to out discharge in or within 1 k es the velocity within 100 ng's n 0.035 Estim Treatment for 2 solubles (%) solu	fall (ha) 0.70925 m upstream of a protecter m of the point of dischar Side slope (m/m) [ ated effectiveness theruation for Set bles - restricted sed harge rate (Vs)	ed site for conservation? No ge? No 0.472553 Long slope (m/m) 0.014 Hernert of ments (%) Show Detailed Res
For dissolved zinc only For sediment impact only Step 3 Mitigation	Impermeable road a Base Flow Index (B Water hardness V Is there a downstre C Tier 1 Estimate	area drained (ha FI) Low = <50mg Ca am structure, la an structure, la ed river width (m) Brief descript	a) 0.51375 Perm 0.206 Is the cost P ke, pond or canal that reduc 1) 5 2 Mann	eable area draining to out discharge in or within 1 k es the velocity within 100 ng's n 0.035 mg's n 0.035 mg	fall (ha)     0.70925       m upstream of a protecter       m of the point of dischart       Side slope (m/m)       sted effectiveness       atted effectiveness       attenuation for bles - restricted harge rate (Vs)       inited	ed site for conservation? No • ge? No • □ 0.472553 Long slope (m/m) 0.014 terment of ments (%)

# A.2. Method D Accidental Spillage Assessment Datasheet

Formula	A9 Accide	ental Spill	age Calculatio	ns									
	× SS × (AA	DT x 365 :	x 10-") x (%HG	V /100)									
Outfall Network	Road Length (km)	Road Type	Junction Type	Spillage Accident Rates (SS)	AADT24- 2way	%HGV	P**I	P**	Pirc	Outfall Risk	Overall Prob.	Designated Area?	Annual Probability 1 in x
F-A	0.3863	Rural	Slip Road	0.83	17,907	11.4	0.00023890396075983	0.75	0.00017917797056987	0.00017917797056987	0.000179178	No	4596
L-A	0.237	Rural	No Junction	0.29	17,907	11.4	0.00005121142885710	0.75	0.00003840857164283	0.00003840857164283	0.000038409	No	4000
1-A	1.15	Rural	No Junction	0.29	17,906	11.4	0.00024848039811000	0.75	0.00018636029858250	0.00018636029858250	0.000186360	No	2685
1-4	0.4012	Rural	Slip Road	0.83	17,906	11.4	0.00024810488350536	0.75	0.00018607866262902	0.00018607866262902	0.000186079	No	2005
2-A	0.574	Rural	No Junction	0.29	17,907	11.4	0.00012403105554420	0.75	0.00009302329165815	0.00009302329165815	0.000093023	No	10750
3-A	0.9716	Rural	No Junction	0.29	17,907	11.4	0.00020994525011628	0.75	0.00015745893758721	0.00015745893758721	0.000157459	No	6351
4-A	0.5161	Rural	No Junction	0.29	17,907	11.4	0.00011151990900063	0.75	0.00008363993175047	0.00008363993175047	0.000083640	No	11956
4-B	0.6191	Rural	No Junction	0.29	17,908	11.4	0.00013378382338332	0.75	0.00010033786753749	0.00010033786753749	0.000100338	No	9966
5-A	1.036	Rural	No Junction	0.29	17,908	12.3	0.00024154764905040	0.75	0.00018116073678780	0.00018116073678780	0.000181161	No	3123
J-A	0.3024	Rural	Slip Road	0.83	17,746	11.4	0.00018533526877152	0.75	0.00013900145157864	0.00013900145157864	0.000139001	No	3123
6-A	0.5916	Rural	No Junction	0.29	17,752	11.4	0.00012672758776608	0.75	0.00009504569082456	0.00009504569082456	0.000095046	No	10521
7-A	0.7582	Rural	No Junction	0.29	17,754	11.4	0.00016243354003932	0.75	0.00012182515502949	0.00012182515502949	0.000121825	No	8208
8-A	0.3709	Rural	No Junction	0.29	17,754	11.4	0.00007946003693034	0.75	0.00005959502769776	0.00005959502769776	0.000059595	No	5066
0-A	0.2996	Rural	Slip Road	0.83	17,603	11.5	0.00018373728519790	0.75	0.00013780296389843	0.00013780296389843	0.000137803	No	5000
9-A	1.666	Rural	No Junction	0.29	17,716	11.4	0.00035615281586640	0.75	0.00026711461189980	0.00026711461189980	0.000267115	No	3744
X-A	0.8021	Rural	No Junction	0.29	17,714	11.4	0.00017145133471986	0.75	0.00012858850103990	0.00012858850103990	0.000128589	No	7777
Y-A	0.3716	Rural	No Junction	0.29	17,713	11.4	0.00007942615548852	0.75	0.00005956961661639	0.00005956961661639	0.000059570	No	16787
Z-A	0.2691	Rural	Slip Road	0.83	17,712	11.4	0.00016460857325448	0.75	0.00012345642994086	0.00012345642994086	0.000123456	No	8100