

## **A14.3 Water Quality Calculations**

### **1 Introduction**

- 1.1.1 This appendix provides additional information on the calculations used to inform the water quality assessment of the route options, as reported in DMRB Stage 2 Scheme Assessment Report, Part 3: Environmental Assessment, Chapter 14 (Road Drainage and the Water Environment).
- 1.1.2 As part of the water quality assessment, routine runoff and accidental spillage risk to the surface water features proposed to receive road drainage were assessed using the Highways Agency's (now Highways England) Water Risk Assessment Tool (HAWRAT), in line with \* DMRB Volume 11, Section 3, Part 10 (HD45/09): Road Drainage and the Water Environment (The Highways Agency, Transport Scotland, Welsh Assembly Government and The Department for Regional Development Northern Ireland 2009).
- 1.1.3 The results of the HAWRAT assessments are provided in Section 2. Routine runoff parameters and results can be found in Section 3 (Routine Runoff Assessment – HAWRAT Output Sheets (Location Details, User Parameters and Results)) and the results of the spillage risk assessment can be found in Section 4 (Accidental Spillage Inverness Risk Assessment – Calculation Tables).

## **2 Results of HAWRAT Assessments**

### **Assessment of Pollution Impacts from Spillages**

- 2.1.1 The risk of an accidental spillage or vehicle fire, which could lead to a pollution incident, is considered to be proportional to the risk of a collision of heavy goods vehicles. Not all spillages lead to pollution incidents, as action can be taken to control spillages and prevent them from affecting the water environment.
- 2.1.2 The assessment has been completed for both individual outfalls and for outfalls discharging into the same reach (assessment of cumulative risk), for each route option. The results show that the risk of a serious pollution incident for each outfall (including the cumulative risk where more than one outfall discharges into the same reach) has an annual probability far below the 1% quoted in the DMRB guidance for outfalls that are not within 1km of a protected area (none of the outfalls would be located within 1km of a protected area). Therefore, the assessment has identified that no measures are required to mitigate spillage risk. In addition, the preferred option would be designed to modern highway codes and standards, which would also reduce the likelihood of such an accident.

### **Assessment of Pollution Impacts from Routine Runoff to Surface Waters**

- 2.1.3 HAWRAT routine runoff assessments have been completed for all of the drainage catchments that are proposed to discharge to surface water, by route option. An assessment could not be completed for the proposed lane gain/drop along the A9 because no information was available about the discharge of routine runoff from this section of road.
- 2.1.4 The results of the HAWRAT routine runoff assessments have been used to help determine the magnitude and significance of the operational effects of each route option on water quality.
- 2.1.5 Individual (single outfall) routine runoff assessments have been completed for all drainage catchments that would discharge to surface water. In addition, cumulative routine runoff assessments have been undertaken where two or more outfalls discharge into the same reach of a surface water feature. There are two types of cumulative routine runoff assessment, as follows:
- a cumulative assessment for soluble and sediment-bound pollutants is required when two or more outfalls are located within 100m of each other in the same reach of a surface water feature; and
  - a cumulative assessment for soluble pollutants is required when two or more outfalls are located over 100m from each other, but within 1km, in the same reach of a surface water feature.
- 2.1.6 All of the proposed outfalls (for all route options) failed Step 1 of the individual and cumulative assessments, as would normally be expected. Therefore, Step 2 assessments were completed for all of the drainage catchments. The results of these assessments are shown (including their impact magnitude), by route option, in Tables 1 to 9. Resulting impact significance is reported in Chapter 14 (Road Drainage and the Water Environment). Detailed assessment input and output sheets are provided in Section 4 (Routine Runoff Assessment – HAWRAT Input and Output Sheets).

#### *Option 1A*

- 2.1.7 Table 1 summarises the results of the Step 2 individual HAWRAT routine runoff assessment for soluble and sediment-bound pollutants. Impact magnitude is determined based on the magnitude criteria provided in Table 14.2 of Chapter 14 (Road Drainage and the Water Environment).

**Table 1: Summary of Step 2 HAWRAT Individual Routine Runoff Assessment**

Drainage Catchments	Receiving Watercourse	HAWRAT Results			Compliance with EQS		Required Treatment of Solubles <sup>1</sup>		Required Settlement of Sediments	Impact Magnitude
		Soluble Acute Impacts		Sediment Chronic Impacts	Cu	Zn	Cu	Zn		
		Cu	Zn							
1	SWF 02	Pass	Fail	Fail	Pass	Pass	0%	11%	59%	<b>moderate</b>
2	SWF 04	Pass	Pass	Pass	Pass	Pass	0%	0%	0%	<b>negligible</b>
3	SWF 07	Fail	Fail	Fail	Fail	Fail	52%	64%	93%	<b>major</b>
4	SWF 08	Pass	Pass	Alert 2	Pass	Pass	0%	0%	Not quantified	<b>negligible</b>
5	SWF 03	Pass	Pass	Fail	Pass	Pass	0%	0%	22%	<b>minor</b>

2.1.8 None of the drainage catchments included in the preliminary drainage design for Option 1A discharge into the same surface water feature. Therefore, a cumulative assessment was not needed for this option.

*Option 1B*

2.1.9 Table 2 summarises the results of the Step 2 individual HAWRAT routine runoff assessment for soluble and sediment-bound pollutants.

2.1.10 Table 3 summarises the results of the Step 2 cumulative HAWRAT routine runoff assessments for soluble pollutants.

**Table 2: Summary of Step 2 HAWRAT Individual Routine Runoff Assessment**

Drainage Catchments	Receiving Watercourse	HAWRAT Results			Compliance with EQS		Required Treatment of Solubles <sup>2</sup>		Required Settlement of Sediments	Impact Magnitude
		Soluble Acute Impacts		Sediment Chronic Impacts	Cu	Zn	Cu	Zn		
		Cu	Zn							
1	SWF 02	Pass	Fail	Fail	Pass	Pass	0%	11%	59%	<b>moderate</b>
2	SWF 04	Pass	Pass	Pass	Pass	Pass	0%	0%	0%	<b>negligible</b>
3	SWF 08	Pass	Pass	Fail	Pass	Pass	0%	0%	19%	<b>minor</b>
4	SWF 08	Pass	Pass	Alert 2	Pass	Pass	0%	0%	Not quantified	<b>negligible</b>
5	SWF 03	Pass	Pass	Fail	Pass	Pass	0%	0%	45%	<b>minor</b>

<sup>1</sup> Not specified in detailed results but passes when figure entered for proposed 'treatment for solubles' (HAWRAT Step 3). Figure is not based on a proposed discharge rate as this is not yet known (may change when discharge rate applied).

<sup>2</sup> Not specified in detailed results but passes when figure entered for proposed 'treatment for solubles' (HAWRAT Step 3). Figure is not based on a proposed discharge rate as this is not yet known (may change when discharge rate applied).

**Table 3: Summary of Step 2 HAWRAT Cumulative Routine Runoff Assessment for Soluble Impacts**

Drainage Catchments	Receiving Watercourse	HAWRAT Results Soluble Acute Impacts		Compliance with Environmental Quality Standards		Required Treatment of Solubles		Impact Magnitude
		Cu	Zn	Cu	Zn	Cu	Zn	
3 & 4	SWF 08	Pass	Fail	Pass	Pass	0%	13%	minor

*Option 2A*

2.1.11 Table 4 summarises the results of the Step 2 individual HAWRAT routine runoff assessment for soluble and sediment-bound pollutants.

**Table 4: Summary of Step 2 HAWRAT Individual Routine Runoff Assessment**

Drainage Catchments	Receiving Watercourse	HAWRAT Results			Compliance with EQS	Required Treatment of Solubles <sup>3</sup>	Required Settlement of Sediments	Impact Magnitude		
		Soluble Acute Impacts		Sediment Chronic Impacts						
		Cu	Zn		Cu	Zn	Cu	Zn		
1	SWF 02	Pass	Fail	Fail	Pass	Pass	0%	10%	59%	moderate
3	SWF 04	Pass	Pass	Pass	Pass	Pass	0%	0%	0%	negligible
4	SWF 07	Fail	Fail	Fail	Fail	Fail	52%	64%	93%	major
5	SWF 08	Pass	Pass	Alert 2	Pass	Pass	0%	0%	Not quantified	negligible
6	SWF 03	Pass	Pass	Fail	Pass	Pass	0%	0%	22%	minor

2.1.12 None of the drainage catchments included in the preliminary drainage design for Option 2A discharge into the same surface water feature. Therefore, a cumulative assessment was not needed for this option.

*Option 2B*

2.1.13 Table 5 summarises the results of the Step 2 individual HAWRAT routine runoff assessment for soluble and sediment-bound pollutants.

2.1.14 Table 6 summarises the results of the Step 2 cumulative HAWRAT routine runoff assessments for soluble pollutants.

<sup>3</sup> Not specified in detailed results but passes when figure entered for proposed 'treatment for solubles' (HAWRAT Step 3). Figure is not based on a proposed discharge rate as this is not yet known (may change when discharge rate applied).

**Table 5: Summary of Step 2 HAWRAT Individual Routine Runoff Assessment**

Drainage Catchments	Receiving Watercourse	HAWRAT Results			Compliance with EQS		Required Treatment of Solubles <sup>4</sup>		Required Settlement of Sediments	Impact Magnitude
		Soluble Acute Impacts		Sediment Chronic Impacts						
		Cu	Zn		Cu	Zn	Cu	Zn		
1	SWF 02	Pass	Fail	Fail	Pass	Pass	0%	10%	59%	<b>moderate</b>
3	SWF 04	Pass	Pass	Pass	Pass	Pass	0%	0%	0%	<b>negligible</b>
4	SWF 08	Pass	Pass	Fail	Pass	Pass	0%	0%	19%	<b>minor</b>
5	SWF 08	Pass	Pass	Alert 2	Pass	Pass	0%	0%	Not quantified	<b>negligible</b>
6	SWF 03	Pass	Pass	Fail	Pass	Pass	0%	0%	45%	<b>minor</b>

**Table 6: Summary of Step 2 HAWRAT Cumulative Routine Runoff Assessment for Soluble Impacts**

Drainage Catchments	Receiving Watercourse	HAWRAT Results Soluble Acute Impacts		Compliance with Environmental Quality Standards		Required Treatment of Solubles <sup>1</sup>		Impact Magnitude
		Cu	Zn	Cu	Zn	Cu	Zn	
4 & 5	SWF 08	Pass	Fail	Pass	Pass	0%	13%	<b>minor</b>

*Option 3A*

2.1.15 Table 7 summarises the results of the Step 2 individual HAWRAT routine runoff assessment for soluble and sediment-bound pollutants.

**Table 7: Summary of Step 2 HAWRAT Individual Routine Runoff Assessment**

Drainage Catchments	Receiving Watercourse	HAWRAT Results			Compliance with EQS		Required Treatment of Solubles <sup>5</sup>		Required Settlement of Sediments	Impact Magnitude
		Soluble Acute Impacts		Sediment Chronic Impacts						
		Cu	Zn		Cu	Zn	Cu	Zn		
1	SWF 02	Pass	Pass	Alert 2	Pass	Pass	0%	0%	Not quantified	<b>negligible</b>
2	SWF 04	Pass	Pass	Pass	Pass	Pass	0%	0%	0%	<b>negligible</b>
3	SWF 07	Fail	Fail	Fail	Fail	Fail	52%	64%	93%	<b>major</b>
4	SWF 08	Pass	Pass	Alert 2	Pass	Pass	0%	0%	Not quantified	<b>negligible</b>
5	SWF 03	Pass	Pass	Fail	Pass	Pass	0%	0%	22%	<b>minor</b>

<sup>4</sup> Not specified in detailed results but passes when figure entered for proposed 'treatment for solubles' (HAWRAT Step 3). Figure is not based on a proposed discharge rate as this is not yet known (may change when discharge rate applied).

<sup>5</sup> Not specified in detailed results but passes when figure entered for proposed 'treatment for solubles' (HAWRAT Step 3). Figure is not based on a proposed discharge rate as this is not yet known (may change when discharge rate applied).

2.1.16 None of the drainage catchments included in the preliminary drainage design for Option 3A discharge into the same surface water feature. Therefore, a cumulative assessment was not needed for this option.

*Option 3B*

2.1.17 Table 8 summarises the results of the Step 2 individual HAWRAT routine runoff assessment for soluble and sediment-bound pollutants.

2.1.18 Table 9 summarises the results of the Step 2 cumulative HAWRAT routine runoff assessments for soluble pollutants.

**Table 8: Summary of Step 2 HAWRAT Individual Routine Runoff Assessment**

Drainage Catchments	Receiving Watercourse	HAWRAT Results			Compliance with EQS		Required Treatment of Solubles <sup>6</sup>		Required Settlement of Sediments	Impact Magnitude
		Soluble Acute Impacts		Sediment Chronic Impacts	Cu	Zn	Cu	Zn		
		Cu	Zn							
1	SWF 02	Pass	Pass	Alert 2	Pass	Pass	0%	0%	Not quantified	negligible
2	SWF 04	Pass	Pass	Pass	Pass	Pass	0%	0%	0%	negligible
3	SWF 08	Pass	Pass	Fail	Pass	Pass	0%	0%	19%	minor
4	SWF 08	Pass	Pass	Alert 2	Pass	Pass	0%	0%	Not quantified	negligible
5	SWF 03	Pass	Pass	Fail	Pass	Pass	0%	0%	45%	minor

**Table 9: Summary of Step 2 HAWRAT Cumulative Routine Runoff Assessment for Soluble Impacts**

Drainage Catchments	Receiving Watercourse	HAWRAT Results Soluble Acute Impacts		Compliance with Environmental Quality Standards		Required Treatment of Solubles <sup>1</sup>		Impact Magnitude
		Cu	Zn	Cu	Zn	Cu	Zn	
3 & 4	SWF 08	Pass	Fail	Pass	Pass	0%	13%	minor

<sup>6</sup> Not specified in detailed results but passes when figure entered for proposed 'treatment for solubles' (HAWRAT Step 3). Figure is not based on a proposed discharge rate as this is not yet known (may change when discharge rate applied).

### **3 Routine Runoff Assessment – HAWRAT Input and Output Sheets (Location Details, User Parameters and Results)**

3.1.1 The following table shows the details of the rainfall site chosen and used in relation to the HAWARAT assessment for all route options (1A, 1B, 2A, 2B, 3A and 3B).

Details of the chosen rainfall site	
SAAR (mm)	1343.9
Altitude (m)	130
Easting	2704
Northing	7389
Coastal distance (km)	58

3.1.2 HAWRAT output results each individual drainage catchment for all Route Options are presented below. Routine Runoff results for cumulative assessments, Route 1B drainage catchments 3 & 4, Route 2B drainage catchments 4 & 5 and Route 3B drainage catchments 3 & 4, are also presented.

**Routine Runoff Parameters: Individual Assessments**

**Route Option 1A: Drainage Catchment 1**

<b>Road Number</b>	A9/A96 Inshes to Smithton		<b>Assessment type</b>	Non-cumulative assessment (single outfall)
<b>HA Area/DBFO number</b>			<b>Receiving watercourse</b>	SWF02
<b>OS grid reference of assessment point (m)</b>	<b>Eastings</b>		<b>EA receiving water Detailed River Network ID</b>	
	<b>Northings</b>			
<b>OS grid reference of outfall structure (m)</b>	<b>Eastings</b>		<b>Assessor and affiliation</b>	Jane Gooding, Jacobs
	<b>Northings</b>			<b>Date of assessment</b>
<b>Outfall number</b>	1		<b>Version of assessment</b>	
<b>List of outfalls in cumulative assessment</b>				
<b>Notes</b>	DS 2036: Routine Runoff Assessment for Option 1A, Catchment 1			

Parameter	Units	Default Value	Value used	Notes (Enter notes in the left-hand cells only)
<b>Runoff Risk Assessments</b>				
AADT	vpd	>10,000 and <50,000	>10,000 and <50,000	
Climatic Region	-	Warm Dry	Colder Wet	
Rainfall Site	-	Ashford (SAAR 710mm)	Ardalnalg (SAAR 1343.9mm)	
95%ile River flow	m <sup>3</sup> /s	0	0.001	
Baseflow Index	-	0.5	0.763	
Impermeable road area drained	ha	1	0.75	
Permeable area draining to outfall	ha	1	0.18	
Is the discharge in or within 1 km upstream of a protected site for conservation?	-	No	No	
Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge?	-	No	No	
Hardness	-	Low = <50mg CaCO <sub>3</sub> /l	Low = <50mg CaCO <sub>3</sub> /l	
Use Tier 1	-	TRUE	TRUE	
Use Tier 2	-	FALSE	FALSE	
Tier 1 Estimated river width at Q95	0	5	0.5	
Tier 2 Bed width	m	3	3	
Tier 2 Side slope	m/m	0.5	0.5	
Tier 2 Long slope	m/m	0.0001	0.0001	
Tier 2 Manning's n	-	0.07	0.07	
Existing treatment for solubles	%	0	0	description for existing measures
Existing attenuation -restricted discharge rate	1/5	Unlimited	Unlimited	
Existing settlement of sediments	%	0	0	description for proposed measures
Proposed treatment for solubles	%	0	0	
Proposed attenuation -restricted discharge rate	1/5	Unlimited	Unlimited	
Proposed settlement of sediments	%	0	0	

**Route Option 1A: Drainage Catchment 2**

<b>Road Number</b>	A9/A96 Inshes to Smithton		<b>Assessment type</b>	Non-cumulative assessment (single outfall)
<b>HA Area/DBFO number</b>			<b>Receiving watercourse</b>	SWF 04
<b>OS grid reference of assessment point (m)</b>	<b>Eastings</b>		<b>EA receiving water Detailed River Network ID</b>	
	<b>Northings</b>			
<b>OS grid reference of outfall structure (m)</b>	<b>Eastings</b>		<b>Assessor and affiliation</b>	Jane Gooding, Jacobs
	<b>Northings</b>			<b>Date of assessment</b>
<b>Outfall number</b>	2		<b>Version of assessment</b>	
<b>List of outfalls in cumulative assessment</b>				
<b>Notes</b>	DS 2036: Routine Runoff Assessment for Option 1A, Catchment 2			

Parameter	Units	Default Value	Value used	Notes (Enter notes in the left-hand cells only)
<b>Runoff Risk Assessments</b>				
AADT	vpd	>10,000 and <50,000	>10,000 and <50,000	
Climatic Region	-	Warm Dry	Colder Wet	
Rainfall Site	-	Ashford (SAAR 710mm)	Ardalnalg (SAAR 1343.9mm)	
95%ile River flow	m <sup>3</sup> /s	0	0.005	
Baseflow Index	-	0.5	0.764	
Impermeable road area drained	ha	1	1.93	
Permeable area draining to outfall	ha	1	0.51	
Is the discharge in or within 1 km upstream of a protected site for conservation?	-	No	No	
Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge?	-	No	No	
Hardness	-	Low = <50mg CaCO <sub>3</sub> /l	Low = <50mg CaCO <sub>3</sub> /l	
Use Tier 1	-	TRUE	TRUE	
Use Tier 2	-	FALSE	FALSE	
Tier 1 Estimated river width at Q95	0	5	0.6	
Tier 2 Bed width	m	3	3	
Tier 2 Side slope	m/m	0.5	0.5	
Tier 2 Long slope	m/m	0.0001	0.0001	
Tier 2 Manning's n	-	0.07	0.07	
Existing treatment for solubles	%	0	0	description for existing measures
Existing attenuation -restricted discharge rate	1/5	Unlimited	Unlimited	
Existing settlement of sediments	%	0	0	description for proposed measures
Proposed treatment for solubles	%	0	0	
Proposed attenuation -restricted discharge rate	1/5	Unlimited	Unlimited	
Proposed settlement of sediments	%	0	0	

**Route Option 1A: Drainage Catchment 3**

Road Number	A9/A96 Inshes to Smithton		Assessment type	Non-cumulative assessment (single outfall)
HA Area/DBFO number			Receiving watercourse	SWF07
OS grid reference of assessment point (m)	Easting		EA receiving water Detailed River Network ID	
	Northing		Assessor and affiliation	Jane Gooding, Jacobs
OS grid reference of outfall structure (m)	Easting		Date of assessment	24/01/2017
	Northing		Version of assessment	1
Outfall number	3			
List of outfalls in cumulative assessment				
Notes	DS 2036: Routine Runoff Assessment for Option 1A, Catchment 3			

Parameter	Units	Default Value	Value used	Notes (Enter notes in the left-hand cells only)
<b>Runoff Risk Assessments</b>				
AADT	vpd	>10,000 and <50,000	>10,000 and <50,000	
Climatic Region	-	Warm Dry	Colder Wet	
Rainfall Site	-	Ashford (SAAR 710mm)	Ardalnaig (SAAR 1343.9mm)	
95%ile River flow	m <sup>3</sup> /s	0	0.0001	
Baseflow Index	-	0.5	0.576	
Impermeable road area drained	ha	1	1.23	
Permeable area draining to outfall	ha	1	0.33	
Is the discharge in or within 1 km upstream of a protected site for conservation?	-	No	No	
Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge?	-	No	No	
Hardness	-	Low = <50mg CaCO <sub>3</sub> /l	Low = <50mg CaCO <sub>3</sub> /l	
Use Tier 1	-	TRUE	TRUE	
Use Tier 2	-	FALSE	FALSE	
Tier 1 Estimated river width at O95	0	5	0.3	
Tier2 Bed width	m	3	3	
Tier2 Side slope	m/m	0.5	0.5	
Tier2 Long slope	m/m	0.0001	0.0001	
Tier2 Mannings' n	-	0.07	0.07	
Existing treatment for solubles	%	0	0	description for existing measures
Existing attenuation -restricted discharge rate	l/s	Unlimited	Unlimited	
Existing settlement of sediments	%	0	0	
Proposed treatment for solubles	%	0	0	description for proposed measures
Proposed attenuation -restricted discharge rate	l/s	Unlimited	Unlimited	
Proposed settlement of sediments	%	0	0	

**Route Option 1A: Drainage Catchment 4**

Road Number	A9/A96 Inshes to Smithton		Assessment type	Non-cumulative assessment (single outfall)
HA Area/DBFO number			Receiving watercourse	SWF08
OS grid reference of assessment point (m)	Easting		EA receiving water Detailed River Network ID	
	Northing		Assessor and affiliation	Jane Gooding, Jacobs
OS grid reference of outfall structure (m)	Easting		Date of assessment	24/01/2017
	Northing		Version of assessment	1
Outfall number	4			
List of outfalls in cumulative assessment				
Notes	DS 2036: Routine Runoff Assessment for Option 1A, Catchment 14			

Parameter	Units	Default Value	Value used	Notes (Enter notes in the left-hand cells only)
<b>Runoff Risk Assessments</b>				
AADT	vpd	>10,000 and <50,000	>10,000 and <50,000	
Climatic Region	-	Warm Dry	Colder Wet	
Rainfall Site	-	Ashford (SAAR 710mm)	Ardalnaig (SAAR 1343.9mm)	
95%ile River flow	m <sup>3</sup> /s	0	0.002	
Baseflow Index	-	0.5	0.584	
Impermeable road area drained	ha	1	0.73	
Permeable area draining to outfall	ha	1	0.06	
Is the discharge in or within 1 km upstream of a protected site for conservation?	-	No	No	
Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge?	-	No	Yes	
Hardness	-	Low = <50mg CaCO <sub>3</sub> /l	Low = <50mg CaCO <sub>3</sub> /l	
Use Tier 1	-	TRUE	TRUE	
Use Tier 2	-	FALSE	FALSE	
Tier 1 Estimated river width at O95	0	5	0.5	
Tier2 Bed width	m	3	3	
Tier2 Side slope	m/m	0.5	0.5	
Tier2 Long slope	m/m	0.0001	0.0001	
Tier2 Mannings' n	-	0.07	0.07	
Existing treatment for solubles	%	0	0	description for existing measures
Existing attenuation -restricted discharge rate	l/s	Unlimited	Unlimited	
Existing settlement of sediments	%	0	0	
Proposed treatment for solubles	%	0	0	description for proposed measures
Proposed attenuation -restricted discharge rate	l/s	Unlimited	Unlimited	
Proposed settlement of sediments	%	0	0	

**Route Option 1A: Drainage Catchment 5**

<b>Road Number</b>	A9/A96 Inshes to Smithton		<b>Assessment type</b>	Non-cumulative assessment (single outfall)
<b>HA Area/DBFO number</b>			<b>Receiving watercourse</b>	SWF03
<b>OS grid reference of assessment point (m)</b>	<b>Easting</b>		<b>EA receiving water Detailed River Network ID</b>	
	<b>Northing</b>			
<b>OS grid reference of outfall structure (m)</b>	<b>Easting</b>		<b>Assessor and affiliation</b>	Jane Gooding, Jacobs
	<b>Northing</b>			<b>Date of assessment</b>
<b>Outfall number</b>	5		<b>Version of assessment</b>	
<b>List of outfalls in cumulative assessment</b>				
<b>Notes</b>	DS 2036: Routine Runoff Assessment for Option 1A, Catchment 5			

Parameter	Units	Default Value	Value used	Notes (Enter notes in the left-hand cells only)
<b>Runoff Risk Assessments</b>				
AADT	vpd	>10,000 and <50,000	>10,000 and <50,000	
Climatic Region	-	Warm Dry	Colder Wet	
Rainfall Site	-	Ashford (SAAR 710mm)	Ardaraiga (SAAR 1343.9mm)	
95%ile River flow	m3/s	0	0.002	
Baseflow Index	-	0.5	0.712	
Impermeable road area drained	ha	1	0.61	
Permeable area draining to outfall	ha	1	0.16	
Is the discharge in or within 1 km upstream of a protected site for conservation?	-	No	No	
Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge?	-	No	No	
Hardness	-	Low = <50mg CaCO3/l	Low = <50mg CaCO3/l	
Use Tier 1	-	TRUE	TRUE	
Use Tier 2	-	FALSE	FALSE	
Tier 1 Estimated river width at Q95	0	5	0.8	
Tier2 Bed width	m	3	3	
Tier2 Side slope	m/m	0.5	0.5	
Tier2 Long slope	m/m	0.0001	0.0001	
Tier2 Mannings' n	-	0.07	0.07	
Existing treatment for solubles	%	0	0	description for existing measures
Existing attenuation -restricted discharge rate	l/s	Unlimited	Unlimited	
Existing settlement of sediments	%	0	0	
Proposed treatment for solubles	%	0	0	description for proposed measures
Proposed attenuation -restricted discharge rate	l/s	Unlimited	Unlimited	
Proposed settlement of sediments	%	0	0	

**Route Option 1B: Drainage Catchment 1**

<b>Road Number</b>	A9/A96 Inshes to Smithton		<b>Assessment type</b>	Non-cumulative assessment (single outfall)
<b>HA Area/DBFO number</b>			<b>Receiving watercourse</b>	SWF02
<b>OS grid reference of assessment point (m)</b>	<b>Easting</b>		<b>EA receiving water Detailed River Network ID</b>	
	<b>Northing</b>			
<b>OS grid reference of outfall structure (m)</b>	<b>Easting</b>		<b>Assessor and affiliation</b>	Jane Gooding, Jacobs
	<b>Northing</b>			<b>Date of assessment</b>
<b>Outfall number</b>	1		<b>Version of assessment</b>	
<b>List of outfalls in cumulative assessment</b>				
<b>Notes</b>	DS 2036: Routine Runoff Assessment for Option 1B, Catchment 1			

Parameter	Units	Default Value	Value used	Notes (Enter notes in the left-hand cells only)
<b>Runoff Risk Assessments</b>				
AADT	vpd	>10,000 and <50,000	>10,000 and <50,000	
Climatic Region	-	Warm Dry	Colder Wet	
Rainfall Site	-	Ashford (SAAR 710mm)	Ardaraiga (SAAR 1343.9mm)	
95%ile River flow	m3/s	0	0.001	
Baseflow Index	-	0.5	0.763	
Impermeable road area drained	ha	1	0.75	
Permeable area draining to outfall	ha	1	0.18	
Is the discharge in or within 1 km upstream of a protected site for conservation?	-	No	No	
Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge?	-	No	No	
Hardness	-	Low = <50mg CaCO3/l	Low = <50mg CaCO3/l	
Use Tier 1	-	TRUE	TRUE	
Use Tier 2	-	FALSE	FALSE	
Tier 1 Estimated river width at Q95	0	5	0.5	
Tier2 Bed width	m	3	3	
Tier2 Side slope	m/m	0.5	0.5	
Tier2 Long slope	m/m	0.0001	0.0001	
Tier2 Mannings' n	-	0.07	0.07	
Existing treatment for solubles	%	0	0	description for existing measures
Existing attenuation -restricted discharge rate	l/s	Unlimited	Unlimited	
Existing settlement of sediments	%	0	0	
Proposed treatment for solubles	%	0	0	description for proposed measures
Proposed attenuation -restricted discharge rate	l/s	Unlimited	Unlimited	
Proposed settlement of sediments	%	0	0	

**Route Option 1B: Drainage Catchment 2**

<b>Road Number</b>	A9/A96 Inshes to Smithton		<b>Assessment type</b>	Non-cumulative assessment (single outfall)
<b>HA Area/DBFO number</b>			<b>Receiving watercourse</b>	SWF 04
<b>OS grid reference of assessment point (m)</b>	<b>Eastings</b>		<b>EA receiving water Detailed River Network ID</b>	
	<b>Northing</b>			
<b>OS grid reference of outfall structure (m)</b>	<b>Eastings</b>		<b>Assessor and affiliation</b>	Jane Gooding, Jacobs
	<b>Northing</b>			<b>Date of assessment</b>
<b>Outfall number</b>	2		<b>Version of assessment</b>	1
<b>List of outfalls in cumulative assessment</b>				
<b>Notes</b>	DS 1036: Routine Runoff Assessment for Option 1B, Catchment 2			

Parameter	Units	Default Value	Value used	Notes (Enter notes in the left-hand cells only)
<b>Runoff Risk Assessments</b>				
AA DT	vpd	>10,000 and <50,000	>10,000 and <50,000	
Climatic Region	-	Warm Dry	Colder Wet	
Rainfall Site	-	Ashford (SAAR 710mm)	Ardaraig (SAAR 1343.9mm)	
95%ile River flow	m <sup>3</sup> /s	0	0.005	
Baseflow Index	-	0.5	0.764	
Impermeable road area drained	ha	1	1.99	
Permeable area draining to outfall	ha	1	0.53	
Is the discharge in or within 1 km upstream of a protected site for conservation?	-	No	No	
Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge?	-	No	No	
Hardness	-	Low = <50mg CaCO <sub>3</sub> /l	Low = <50mg CaCO <sub>3</sub> /l	
Use Tier 1	-	TRUE	TRUE	
Use Tier 2	-	FALSE	FALSE	
Tier 1 Estimated river width at Q95	0	5	0.6	
Tier2 Bed width	m	3	3	
Tier2 Side slope	m/m	0.5	0.5	
Tier2 Long slope	m/m	0.0001	0.0001	
Tier2 Mannings' n	-	0.07	0.07	
Existing treatment for solubles	%	0	0	description for existing measures
Existing attenuation -restricted discharge rate	l/s	Unlimited	Unlimited	
Existing settlement of sediments	%	0	0	description for proposed measures
Proposed treatment for solubles	%	0	0	
Proposed attenuation -restricted discharge rate	l/s	Unlimited	Unlimited	
Proposed settlement of sediments	%	0	0	

**Route Option 1B: Drainage Catchment 3**

<b>Road Number</b>	A9/A96 Inshes to Smithton		<b>Assessment type</b>	Non-cumulative assessment (single outfall)
<b>HA Area/DBFO number</b>			<b>Receiving watercourse</b>	SWF08
<b>OS grid reference of assessment point (m)</b>	<b>Eastings</b>		<b>EA receiving water Detailed River Network ID</b>	
	<b>Northing</b>			
<b>OS grid reference of outfall structure (m)</b>	<b>Eastings</b>		<b>Assessor and affiliation</b>	Jane Gooding, Jacobs
	<b>Northing</b>			<b>Date of assessment</b>
<b>Outfall number</b>	3		<b>Version of assessment</b>	1
<b>List of outfalls in cumulative assessment</b>				
<b>Notes</b>	DS 1036: Routine Runoff Assessment for Option 1B, Catchment 3			

Parameter	Units	Default Value	Value used	Notes (Enter notes in the left-hand cells only)
<b>Runoff Risk Assessments</b>				
AA DT	vpd	>10,000 and <50,000	>10,000 and <50,000	
Climatic Region	-	Warm Dry	Colder Wet	
Rainfall Site	-	Ashford (SAAR 710mm)	Ardaraig (SAAR 1343.9mm)	
95%ile River flow	m <sup>3</sup> /s	0	0.002	
Baseflow Index	-	0.5	0.584	
Impermeable road area drained	ha	1	1.17	
Permeable area draining to outfall	ha	1	0.45	
Is the discharge in or within 1 km upstream of a protected site for conservation?	-	No	No	
Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge?	-	No	No	
Hardness	-	Low = <50mg CaCO <sub>3</sub> /l	Low = <50mg CaCO <sub>3</sub> /l	
Use Tier 1	-	TRUE	TRUE	
Use Tier 2	-	FALSE	FALSE	
Tier 1 Estimated river width at Q95	0	5	0.5	
Tier2 Bed width	m	3	3	
Tier2 Side slope	m/m	0.5	0.5	
Tier2 Long slope	m/m	0.0001	0.0001	
Tier2 Mannings' n	-	0.07	0.07	
Existing treatment for solubles	%	0	0	description for existing measures
Existing attenuation -restricted discharge rate	l/s	Unlimited	Unlimited	
Existing settlement of sediments	%	0	0	description for proposed measures
Proposed treatment for solubles	%	0	0	
Proposed attenuation -restricted discharge rate	l/s	Unlimited	Unlimited	
Proposed settlement of sediments	%	0	0	

**Route Option 1B: Drainage Catchment 4**

<b>Road Number</b>	A9/A96 Inshes to Smithton		<b>Assessment type</b>	Non-cumulative assessment (single outfall)
<b>HA Area/DBFO number</b>			<b>Receiving watercourse</b>	SWFD8
<b>OS grid reference of assessment point (m)</b>	<b>Eastings</b>		<b>EA receiving water Detailed River Network ID</b>	
	<b>Northing</b>			
<b>OS grid reference of outfall structure (m)</b>	<b>Eastings</b>		<b>Assessor and affiliation</b>	Jane Gooding, Jacobs
	<b>Northing</b>		<b>Date of assessment</b>	24/01/2017
<b>Outfall number</b>	4		<b>Version of assessment</b>	1
<b>List of outfalls in cumulative assessment</b>				
<b>Notes</b>	DS 2036: Routine Runoff Assessment for Option 1B, Catchment 4			

Parameter	Units	Default Value	Value used	Notes (Enter notes in the left-hand cells only)
<b>Runoff Risk Assessments</b>				
AADT	vpd	>10,000 and <50,000	>10,000 and <50,000	
Climatic Region	-	Warm Dry	Colder Wet	
Rainfall Site	-	Ashford (SAAR 710mm)	Ardatnalig (SAAR 1343.9mm)	
95%ile River flow	m3/s	0	0.002	
Baseflow Index	-	0.5	0.584	
Impermeable road area drained	ha	1	0.77	
Permeable area draining to outfall	ha	1	0.06	
Is the discharge in or within 1 km upstream of a protected site for conservation?	-	No	No	
Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge?	-	No	Yes	
Hardness	-	Low = <50mg CaCO3/l	Low = <50mg CaCO3/l	
Use Tier 1	-	TRUE	TRUE	
Use Tier 2	-	FALSE	FALSE	
Tier 1 Estimated river width at Q95	0	5	0.5	
Tier2 Bed width	m	3	3	
Tier2 Side slope	m/m	0.5	0.5	
Tier2 Long slope	m/m	0.0001	0.0001	
Tier2 Mannings' n	-	0.07	0.07	
Existing treatment for solubles	%	0	0	description for existing measures
Existing attenuation-restricted discharge rate	l/s	Unlimited	Unlimited	
Existing settlement of sediments	%	0	0	description for proposed measures
Proposed treatment for solubles	%	0	0	
Proposed attenuation-restricted discharge rate	l/s	Unlimited	Unlimited	
Proposed settlement of sediments	%	0	0	

**Route Option 1B: Drainage Catchment 5**

<b>Road Number</b>	A9/A96 Inshes to Smithton		<b>Assessment type</b>	Non-cumulative assessment (single outfall)
<b>HA Area/DBFO number</b>			<b>Receiving watercourse</b>	SWFD3
<b>OS grid reference of assessment point (m)</b>	<b>Eastings</b>		<b>EA receiving water Detailed River Network ID</b>	
	<b>Northing</b>			
<b>OS grid reference of outfall structure (m)</b>	<b>Eastings</b>		<b>Assessor and affiliation</b>	Jane Gooding, Jacobs
	<b>Northing</b>		<b>Date of assessment</b>	24/01/2017
<b>Outfall number</b>	5		<b>Version of assessment</b>	1
<b>List of outfalls in cumulative assessment</b>				
<b>Notes</b>	DS 2036: Routine Runoff Assessment for Option 1B, Catchment 5			

Parameter	Units	Default Value	Value used	Notes (Enter notes in the left-hand cells only)
<b>Runoff Risk Assessments</b>				
AADT	vpd	>10,000 and <50,000	>10,000 and <50,000	
Climatic Region	-	Warm Dry	Colder Wet	
Rainfall Site	-	Ashford (SAAR 710mm)	Ardatnalig (SAAR 1343.9mm)	
95%ile River flow	m3/s	0	0.002	
Baseflow Index	-	0.5	0.712	
Impermeable road area drained	ha	1	0.86	
Permeable area draining to outfall	ha	1	0.2	
Is the discharge in or within 1 km upstream of a protected site for conservation?	-	No	No	
Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge?	-	No	No	
Hardness	-	Low = <50mg CaCO3/l	Low = <50mg CaCO3/l	
Use Tier 1	-	TRUE	TRUE	
Use Tier 2	-	FALSE	FALSE	
Tier 1 Estimated river width at Q95	0	5	0.8	
Tier2 Bed width	m	3	3	
Tier2 Side slope	m/m	0.5	0.5	
Tier2 Long slope	m/m	0.0001	0.0001	
Tier2 Mannings' n	-	0.07	0.07	
Existing treatment for solubles	%	0	0	description for existing measures
Existing attenuation-restricted discharge rate	l/s	Unlimited	Unlimited	
Existing settlement of sediments	%	0	0	description for proposed measures
Proposed treatment for solubles	%	0	0	
Proposed attenuation-restricted discharge rate	l/s	Unlimited	Unlimited	
Proposed settlement of sediments	%	0	0	

**Route Option 2A: Drainage Catchment 1**

Road Number	A9/A96 Inshes to Smithton		Assessment type	Non-cumulative assessment (single outfall)
HA Area/DBFO number			Receiving watercourse	SWF02
OS grid reference of assessment point (m)	Easting		EA receiving water Detailed River Network ID	
	Northing		Assessor and affiliation	Jane Gooding, Jacobs
OS grid reference of outfall structure (m)	Easting		Date of assessment	24/01/2017
	Northing		Version of assessment	1
Outfall number	1			
List of outfalls in cumulative assessment				
Notes	DS 2036: Routine Runoff Assessment for Option 2A, Catchment 1			

Parameter	Units	Default Value	Value used	Notes (Enter notes in the left-hand cells only)
<b>Runoff Risk Assessments</b>				
AADT	vpd	>10,000 and <50,000	>10,000 and <50,000	
Climatic Region	-	Warm Dry	Colder Wet	
Rainfall Site	-	Ashford (SAAR 710mm)	Ardalnaig (SAAR 1343.9mm)	
95%ile River flow	m <sup>3</sup> /s	0	0.001	
Baseflow Index	-	0.5	0.763	
Impermeable road area drained	ha	1	0.74	
Permeable area draining to outfall	ha	1	0.18	
Is the discharge in or within 1 km upstream of a protected site for conservation?	-	No	No	
Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge?	-	No	Yes	
Hardness	-	Low = <50mg CaCO <sub>3</sub> /l	Low = <50mg CaCO <sub>3</sub> /l	
Use Tier 1	-	TRUE	TRUE	
Use Tier 2	-	FALSE	FALSE	
Tier 1 Estimated river width at Q95	0	5	0.5	
Tier2 Bed width	m	3	3	
Tier2 Side slope	m/m	0.5	0.5	
Tier2 Long slope	m/m	0.0001	0.0001	
Tier2 Mannings' n	-	0.07	0.07	
Existing treatment for solubles	%	0	0	description for existing measures
Existing attenuation-restricted discharge rate	l/s	Unlimited	Unlimited	
Existing settlement of sediments	%	0	0	description for proposed measures
Proposed treatment for solubles	%	0	0	
Proposed attenuation-restricted discharge rate	l/s	Unlimited	Unlimited	
Proposed settlement of sediments	%	0	0	

**Route Option 2A: Drainage Catchment 3**

Road Number	A9/A96 Inshes to Smithton		Assessment type	Non-cumulative assessment (single outfall)
HA Area/DBFO number			Receiving watercourse	SWF 04
OS grid reference of assessment point (m)	Easting		EA receiving water Detailed River Network ID	
	Northing		Assessor and affiliation	Jane Gooding, Jacobs
OS grid reference of outfall structure (m)	Easting		Date of assessment	26/01/2017
	Northing		Version of assessment	1
Outfall number	3			
List of outfalls in cumulative assessment				
Notes	DS 2036: Routine Runoff Assessment for Option 2A, Catchment 3			

Parameter	Units	Default Value	Value used	Notes (Enter notes in the left-hand cells only)
<b>Runoff Risk Assessments</b>				
AADT	vpd	>10,000 and <50,000	>10,000 and <50,000	
Climatic Region	-	Warm Dry	Colder Wet	
Rainfall Site	-	Ashford (SAAR 710mm)	Ardalnaig (SAAR 1343.9mm)	
95%ile River flow	m <sup>3</sup> /s	0	0.005	
Baseflow Index	-	0.5	0.764	
Impermeable road area drained	ha	1	1.93	
Permeable area draining to outfall	ha	1	0.51	
Is the discharge in or within 1 km upstream of a protected site for conservation?	-	No	No	
Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge?	-	No	No	
Hardness	-	Low = <50mg CaCO <sub>3</sub> /l	Low = <50mg CaCO <sub>3</sub> /l	
Use Tier 1	-	TRUE	TRUE	
Use Tier 2	-	FALSE	FALSE	
Tier 1 Estimated river width at Q95	0	5	0.6	
Tier2 Bed width	m	3	3	
Tier2 Side slope	m/m	0.5	0.5	
Tier2 Long slope	m/m	0.0001	0.0001	
Tier2 Mannings' n	-	0.07	0.07	
Existing treatment for solubles	%	0	0	description for existing measures
Existing attenuation-restricted discharge rate	l/s	Unlimited	Unlimited	
Existing settlement of sediments	%	0	0	description for proposed measures
Proposed treatment for solubles	%	0	0	
Proposed attenuation-restricted discharge rate	l/s	Unlimited	Unlimited	
Proposed settlement of sediments	%	0	0	

**Route Option 2A: Drainage Catchment 4**

Road Number	A9/A96 Inshes to Smithton		Assessment type	Non-cumulative assessment (single outfall)
HA Area/DBFO number			Receiving watercourse	SWF07
OS grid reference of assessment point (m)	Eastings		EA receiving water Detailed River Network ID	
	Northing		Assessor and affiliation	Jane Gooding, Jacobs
OS grid reference of outfall structure (m)	Eastings		Date of assessment	24/01/2017
	Northing		Version of assessment	1
Outfall number	4			
List of outfalls in cumulative assessment				
Notes	DS 2036: Routine Runoff Assessment for Option 2A, Catchment 4			

Parameter	Units	Default Value	Value used	Notes (Enter notes in the left-hand cells only)
<b>Runoff Risk Assessments</b>				
AADT	vpd	>10,000 and <50,000	>10,000 and <50,000	
Climatic Region	-	Warm Dry	Colder Wet	
Rainfall Site	-	Ashford (SAAR 710mm)	Ardtnaig (SAAR 1343.9mm)	
95thile River flow	m3/s	0	0.0001	
Baseflow Index	-	0.5	0.576	
Impermeable road area drained	ha	1	1.23	
Permeable area draining to outfall	ha	1	0.33	
Is the discharge in or within 1 km upstream of a protected site for conservation?	-	No	No	
Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge?	-	No	No	
Hardness	-	Low = <50mg CaCO3/l	Low = <50mg CaCO3/l	
Use Tier 1	-	TRUE	TRUE	
Use Tier 2	-	FALSE	FALSE	
Tier 1 Estimated river width at Q95	0	5	0.3	
Tier2 Bed width	m	3	3	
Tier2 Side slope	m/m	0.5	0.5	
Tier2 Long slope	m/m	0.0001	0.0001	
Tier2 Mannings' n	-	0.07	0.07	
Existing treatment for solubles	%	0	0	description for existing measures
Existing attenuation -restricted discharge rate	l/s	Unlimited	Unlimited	
Existing settlement of sediments	%	0	0	description for proposed measures
Proposed treatment for solubles	%	0	0	
Proposed attenuation -restricted discharge rate	l/s	Unlimited	Unlimited	
Proposed settlement of sediments	%	0	0	

**Route Option 2A: Drainage Catchment 5**

Road Number	A9/A96 Inshes to Smithton		Assessment type	Non-cumulative assessment (single outfall)
HA Area/DBFO number			Receiving watercourse	SWF08
OS grid reference of assessment point (m)	Eastings		EA receiving water Detailed River Network ID	
	Northing		Assessor and affiliation	Jane Gooding, Jacobs
OS grid reference of outfall structure (m)	Eastings		Date of assessment	24/01/2017
	Northing		Version of assessment	1
Outfall number	5			
List of outfalls in cumulative assessment				
Notes	DS 2036: Routine Runoff Assessment for Option 2A, Catchment 5			

Parameter	Units	Default Value	Value used	Notes (Enter notes in the left-hand cells only)
<b>Runoff Risk Assessments</b>				
AADT	vpd	>10,000 and <50,000	>10,000 and <50,000	
Climatic Region	-	Warm Dry	Colder Wet	
Rainfall Site	-	Ashford (SAAR 710mm)	Ardtnaig (SAAR 1343.9mm)	
95thile River flow	m3/s	0	0.002	
Baseflow Index	-	0.5	0.584	
Impermeable road area drained	ha	1	0.73	
Permeable area draining to outfall	ha	1	0.06	
Is the discharge in or within 1 km upstream of a protected site for conservation?	-	No	No	
Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge?	-	No	Yes	
Hardness	-	Low = <50mg CaCO3/l	Low = <50mg CaCO3/l	
Use Tier 1	-	TRUE	TRUE	
Use Tier 2	-	FALSE	FALSE	
Tier 1 Estimated river width at Q95	0	5	0.5	
Tier2 Bed width	m	3	3	
Tier2 Side slope	m/m	0.5	0.5	
Tier2 Long slope	m/m	0.0001	0.0001	
Tier2 Mannings' n	-	0.07	0.07	
Existing treatment for solubles	%	0	0	description for existing measures
Existing attenuation -restricted discharge rate	l/s	Unlimited	Unlimited	
Existing settlement of sediments	%	0	0	description for proposed measures
Proposed treatment for solubles	%	0	0	
Proposed attenuation -restricted discharge rate	l/s	Unlimited	Unlimited	
Proposed settlement of sediments	%	0	0	

**Route Option 2A: Drainage Catchment 6**

Road Number	A9/A96 Inshes to Smithton		Assessment type	Non-cumulative assessment (single outfall)
HA Area/DBFO number			Receiving watercourse	SWF03
OS grid reference of assessment point (m)	Easting		EA receiving water Detailed River Network ID	
	Northing		Assessor and affiliation	Jane Gooding, Jacobs
OS grid reference of outfall structure (m)	Easting		Date of assessment	24/01/2017
	Northing		Version of assessment	1
Outfall number	6			
List of outfalls in cumulative assessment				
Notes	OS 2036: Routine Runoff Assessment for Option 2A, Catchment 6			

Parameter	Units	Default Value	Value used	Notes (Enter notes in the left-hand cells only)
<b>Runoff Risk Assessments</b>				
AADT	vpd	>10,000 and <50,000	>10,000 and <50,000	
Climatic Region	-	Warm Dry	Colder Wet	
Rainfall Site	-	Ashford (SAAR 710mm)	Ardalnaig (SAAR 1343.9mm)	
95%ile River flow	m <sup>3</sup> /s	0	0.002	
Baseflow Index	-	0.5	0.712	
Impermeable road area drained	ha	1	0.61	
Permeable area draining to outfall	ha	1	0.16	
Is the discharge in or within 1 km upstream of a protected site for conservation?	-	No	No	
Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge?	-	No	No	
Hardness	-	Low = <50mg CaCO <sub>3</sub> /l	Low = <50mg CaCO <sub>3</sub> /l	
Use Tier 1	-	TRUE	TRUE	
Use Tier 2	-	FALSE	FALSE	
Tier 1 Estimated river width at Q95	0	5	0.8	
Tier2 Bed width	m	3	3	
Tier2 Side slope	m/m	0.5	0.5	
Tier2 Long slope	m/m	0.0001	0.0001	
Tier2 Mannings' n	-	0.07	0.07	
Existing treatment for solubles	%	0	0	description for existing measures
Existing attenuation -restricted discharge rate	l/s	Unlimited	Unlimited	
Existing settlement of sediments	%	0	0	description for proposed measures
Proposed treatment for solubles	%	0	0	
Proposed attenuation -restricted discharge rate	l/s	Unlimited	Unlimited	
Proposed settlement of sediments	%	0	0	

**Route Option 2B: Drainage Catchment 1**

Road Number	A9/A96 Inshes to Smithton		Assessment type	Non-cumulative assessment (single outfall)
HA Area/DBFO number			Receiving watercourse	SWF02
OS grid reference of assessment point (m)	Easting		EA receiving water Detailed River Network ID	
	Northing		Assessor and affiliation	Jane Gooding, Jacobs
OS grid reference of outfall structure (m)	Easting		Date of assessment	24/01/2017
	Northing		Version of assessment	1
Outfall number	1			
List of outfalls in cumulative assessment				
Notes	OS 2036: Routine Runoff Assessment for Option 2B, Catchment 1			

Parameter	Units	Default Value	Value used	Notes (Enter notes in the left-hand cells only)
<b>Runoff Risk Assessments</b>				
AADT	vpd	>10,000 and <50,000	>10,000 and <50,000	
Climatic Region	-	Warm Dry	Colder Wet	
Rainfall Site	-	Ashford (SAAR 710mm)	Ardalnaig (SAAR 1343.9mm)	
95%ile River flow	m <sup>3</sup> /s	0	0.001	
Baseflow Index	-	0.5	0.763	
Impermeable road area drained	ha	1	0.74	
Permeable area draining to outfall	ha	1	0.18	
Is the discharge in or within 1 km upstream of a protected site for conservation?	-	No	No	
Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge?	-	No	Yes	
Hardness	-	Low = <50mg CaCO <sub>3</sub> /l	Low = <50mg CaCO <sub>3</sub> /l	
Use Tier 1	-	TRUE	TRUE	
Use Tier 2	-	FALSE	FALSE	
Tier 1 Estimated river width at Q95	0	5	0.5	
Tier2 Bed width	m	3	3	
Tier2 Side slope	m/m	0.5	0.5	
Tier2 Long slope	m/m	0.0001	0.0001	
Tier2 Mannings' n	-	0.07	0.07	
Existing treatment for solubles	%	0	0	description for existing measures
Existing attenuation -restricted discharge rate	l/s	Unlimited	Unlimited	
Existing settlement of sediments	%	0	0	description for proposed measures
Proposed treatment for solubles	%	0	0	
Proposed attenuation -restricted discharge rate	l/s	Unlimited	Unlimited	
Proposed settlement of sediments	%	0	0	

**Route Option 2B: Drainage Catchment 3**

Road Number	A9/A96 Inshes to Smithton		Assessment type	Non-cumulative assessment (single outfall)
HA Area/DBFO number			Receiving watercourse	SWF 04
OS grid reference of assessment point (m)	Eastings		EA receiving water Detailed River Network ID	
	Northing		Assessor and affiliation	Jane Gooding, Jacobs
OS grid reference of outfall structure (m)	Eastings		Date of assessment	26/01/2017
	Northing		Version of assessment	1
Outfall number	3			
List of outfalls in cumulative assessment				
Notes	DS 2036: Routine Runoff Assessment for Option 2B, Catchment 3			

Parameter	Units	Default Value	Value used	Notes (Enter notes in the left-hand cells only)
<b>Runoff Risk Assessments</b>				
AA DT	vpd	>10,000 and <50,000	>10,000 and <50,000	
Climatic Region	-	Warm Dry	Colder Wet	
Rainfall Site	-	Ashford (SAAR 710mm)	Ardaltnaig (SAAR 1343.9mm)	
95%ile River flow	m <sup>3</sup> /s	0	0.005	
Baseflow Index	-	0.5	0.764	
Impermeable road area drained	ha	1	1.99	
Permeable area draining to outfall	ha	1	0.53	
Is the discharge in or within 1 km upstream of a protected site for conservation?	-	No	No	
Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge?	-	No	No	
Hardness	-	Low = <50mg CaCO <sub>3</sub> /l	Low = <50mg CaCO <sub>3</sub> /l	
Use Tier 1	-	TRUE	TRUE	
Use Tier 2	-	FALSE	FALSE	
Tier 1 Estimated river width at Q95	0	5	0.6	
Tier2 Bed width	m	3	3	
Tier2 Side slope	m/m	0.5	0.5	
Tier2 Long slope	m/m	0.0001	0.0001	
Tier2 Manning's n	-	0.07	0.07	
Existing treatment for solubles	%	0	0	description for existing measures
Existing attenuation -restricted discharge rate	1/s	Unlimited	Unlimited	
Existing settlement of sediments	%	0	0	
Proposed treatment for solubles	%	0	0	description for proposed measures
Proposed attenuation -restricted discharge rate	1/s	Unlimited	Unlimited	
Proposed settlement of sediments	%	0	0	

**Route Option 2B: Drainage Catchment 4**

Road Number	A9/A96 Inshes to Smithton		Assessment type	Non-cumulative assessment (single outfall)
HA Area/DBFO number			Receiving watercourse	SWF06
OS grid reference of assessment point (m)	Eastings		EA receiving water Detailed River Network ID	
	Northing		Assessor and affiliation	Jane Gooding, Jacobs
OS grid reference of outfall structure (m)	Eastings		Date of assessment	24/01/2017
	Northing		Version of assessment	1
Outfall number	4			
List of outfalls in cumulative assessment				
Notes	DS 2036: Routine Runoff Assessment for Option 2B, Catchment 4			

Parameter	Units	Default Value	Value used	Notes (Enter notes in the left-hand cells only)
<b>Runoff Risk Assessments</b>				
AA DT	vpd	>10,000 and <50,000	>10,000 and <50,000	
Climatic Region	-	Warm Dry	Colder Wet	
Rainfall Site	-	Ashford (SAAR 710mm)	Ardaltnaig (SAAR 1343.9mm)	
95%ile River flow	m <sup>3</sup> /s	0	0.002	
Baseflow Index	-	0.5	0.584	
Impermeable road area drained	ha	1	1.17	
Permeable area draining to outfall	ha	1	0.45	
Is the discharge in or within 1 km upstream of a protected site for conservation?	-	No	No	
Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge?	-	No	No	
Hardness	-	Low = <50mg CaCO <sub>3</sub> /l	Low = <50mg CaCO <sub>3</sub> /l	
Use Tier 1	-	TRUE	TRUE	
Use Tier 2	-	FALSE	FALSE	
Tier 1 Estimated river width at Q95	0	5	0.5	
Tier2 Bed width	m	3	3	
Tier2 Side slope	m/m	0.5	0.5	
Tier2 Long slope	m/m	0.0001	0.0001	
Tier2 Manning's n	-	0.07	0.07	
Existing treatment for solubles	%	0	0	description for existing measures
Existing attenuation -restricted discharge rate	1/s	Unlimited	Unlimited	
Existing settlement of sediments	%	0	0	
Proposed treatment for solubles	%	0	0	description for proposed measures
Proposed attenuation -restricted discharge rate	1/s	Unlimited	Unlimited	
Proposed settlement of sediments	%	0	0	

**Route Option 2B: Drainage Catchment 5**

Road Number	A9/A96 Inshes to Smithton		Assessment type	Non-cumulative assessment (single outfall)
HA Area/DBFO number			Receiving watercourse	SWF03
OS grid reference of assessment point (m)	Easting		EA receiving water Detailed River Network ID	
	Northing		Assessor and affiliation	Jane Gooding, Jacobs
OS grid reference of outfall structure (m)	Easting		Date of assessment	24/01/2017
	Northing		Version of assessment	1
Outfall number	5			
List of outfalls in cumulative assessment				
Notes	DS 2036: Routine Runoff Assessment for Option 2B, Catchment 5			

Parameter	Units	Default Value	Value used	Notes (Enter notes in the left-hand cells only)
<b>Runoff Risk Assessments</b>				
AADT	vpd	>10,000 and <50,000	>10,000 and <50,000	
Climatic Region	-	Warm Dry	Colder Wet	
Rainfall Site	-	Ashford (SAAR 710mm)	Ardalnalga (SAAR 1343.9mm)	
95%ile River flow	m <sup>3</sup> /s	0	0.002	
Baseflow Index	-	0.5	0.584	
Impermeable road area drained	ha	1	0.77	
Permeable area draining to outfall	ha	1	0.06	
Is the discharge in or within 1 km upstream of a protected site for conservation?	-	No	No	
Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge?	-	No	Yes	
Hardness	-	Low = <50mg CaCO <sub>3</sub> /l	Low = <50mg CaCO <sub>3</sub> /l	
Use Tier 1	-	TRUE	TRUE	
Use Tier 2	-	FALSE	FALSE	
Tier 1 Estimated river width at Q95	0	5	0.5	
Tier 2 Bed width	m	3	3	
Tier 2 Side slope	m/m	0.5	0.5	
Tier 2 Long slope	m/m	0.0001	0.0001	
Tier 2 Mannings' n	-	0.07	0.07	
Existing treatment for solubles	%	0	0	description for existing measures
Existing attenuation -restricted discharge rate	l/s	Unlimited	Unlimited	
Existing settlement of sediments	%	0	0	description for proposed measures
Proposed treatment for solubles	%	0	0	
Proposed attenuation -restricted discharge rate	l/s	Unlimited	Unlimited	
Proposed settlement of sediments	%	0	0	

**Route Option 2B: Drainage Catchment 6**

Road Number	A9/A96 Inshes to Smithton		Assessment type	Non-cumulative assessment (single outfall)
HA Area/DBFO number			Receiving watercourse	SWF03
OS grid reference of assessment point (m)	Easting		EA receiving water Detailed River Network ID	
	Northing		Assessor and affiliation	Jane Gooding, Jacobs
OS grid reference of outfall structure (m)	Easting		Date of assessment	24/01/2017
	Northing		Version of assessment	1
Outfall number	6			
List of outfalls in cumulative assessment				
Notes	DS 2036: Routine Runoff Assessment for Option 2B, Catchment 6			

Parameter	Units	Default Value	Value used	Notes (Enter notes in the left-hand cells only)
<b>Runoff Risk Assessments</b>				
AADT	vpd	>10,000 and <50,000	>10,000 and <50,000	
Climatic Region	-	Warm Dry	Colder Wet	
Rainfall Site	-	Ashford (SAAR 710mm)	Ardalnalga (SAAR 1343.9mm)	
95%ile River flow	m <sup>3</sup> /s	0	0.002	
Baseflow Index	-	0.5	0.712	
Impermeable road area drained	ha	1	0.86	
Permeable area draining to outfall	ha	1	0.2	
Is the discharge in or within 1 km upstream of a protected site for conservation?	-	No	No	
Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge?	-	No	No	
Hardness	-	Low = <50mg CaCO <sub>3</sub> /l	Low = <50mg CaCO <sub>3</sub> /l	
Use Tier 1	-	TRUE	TRUE	
Use Tier 2	-	FALSE	FALSE	
Tier 1 Estimated river width at Q95	0	5	0.8	
Tier 2 Bed width	m	3	3	
Tier 2 Side slope	m/m	0.5	0.5	
Tier 2 Long slope	m/m	0.0001	0.0001	
Tier 2 Mannings' n	-	0.07	0.07	
Existing treatment for solubles	%	0	0	description for existing measures
Existing attenuation -restricted discharge rate	l/s	Unlimited	Unlimited	
Existing settlement of sediments	%	0	0	description for proposed measures
Proposed treatment for solubles	%	0	0	
Proposed attenuation -restricted discharge rate	l/s	Unlimited	Unlimited	
Proposed settlement of sediments	%	0	0	

**Route Option 3A: Drainage Catchment 1**

Road Number	A9/A96 Inshes to Smithton		Assessment type	Non-cumulative assessment (single outfall)
HA Area/DBFO number			Receiving watercourse	SWF02
OS grid reference of assessment point (m)	Easting		EA receiving water Detailed River Network ID	
	Northing		Assessor and affiliation	Jane Gooding, Jacobs
OS grid reference of outfall structure (m)	Easting		Date of assessment	24/01/2017
	Northing		Version of assessment	1
Outfall number	1			
List of outfalls in cumulative assessment				
Notes	DS 2036: Routine Runoff Assessment for Option 3A, Catchment 1			

Parameter	Units	Default Value	Value used	Notes (Enter notes in the left-hand cells only)
<b>Runoff Risk Assessments</b>				
AADT	vpd	>10,000 and <50,000	>10,000 and <50,000	
Climatic Region	-	Warm Dry	Colder Wet	
Rainfall Site	-	Ashford (SAAR 710mm)	Ardtnaiga (SAAR 1343.9mm)	
95thile River flow	m3/s	0	0.001	
Baseflow Index	-	0.5	0.763	
Impermeable road area drained	ha	1	0.29	
Permeable area draining to outfall	ha	1	0.02	
Is the discharge in or within 1 km upstream of a protected site for conservation?	-	No	No	
Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge?	-	No	Yes	
Hardness	-	Low = <50mg CaCO3/l	Low = <50mg CaCO3/l	
Use Tier 1	-	TRUE	TRUE	
Use Tier 2	-	FALSE	FALSE	
Tier 1 Estimated river width at Q95	0	5	0.5	
Tier2 Bed width	m	3	3	
Tier2 Side slope	m/m	0.5	0.5	
Tier2 Long slope	m/m	0.0001	0.0001	
Tier2 Mannings' n	-	0.07	0.07	
Existing treatment for solubles	%	0	0	description for existing measures
Existing attenuation-restricted discharge rate	l/s	Unlimited	Unlimited	
Existing settlement of sediments	%	0	0	
Proposed treatment for solubles	%	0	0	description for proposed measures
Proposed attenuation-restricted discharge rate	l/s	Unlimited	Unlimited	
Proposed settlement of sediments	%	0	0	

**Route Option 3A: Drainage Catchment 2**

Road Number	A9/A96 Inshes to Smithton		Assessment type	Non-cumulative assessment (single outfall)
HA Area/DBFO number			Receiving watercourse	SWF 04
OS grid reference of assessment point (m)	Easting		EA receiving water Detailed River Network ID	
	Northing		Assessor and affiliation	Jane Gooding, Jacobs
OS grid reference of outfall structure (m)	Easting		Date of assessment	26/01/2017
	Northing		Version of assessment	1
Outfall number	2			
List of outfalls in cumulative assessment				
Notes	DS 2036: Routine Runoff Assessment for Option 3A, Catchment 2			

Parameter	Units	Default Value	Value used	Notes (Enter notes in the left-hand cells only)
<b>Runoff Risk Assessments</b>				
AADT	vpd	>10,000 and <50,000	>10,000 and <50,000	
Climatic Region	-	Warm Dry	Colder Wet	
Rainfall Site	-	Ashford (SAAR 710mm)	Ardtnaiga (SAAR 1343.9mm)	
95thile River flow	m3/s	0	0.005	
Baseflow Index	-	0.5	0.764	
Impermeable road area drained	ha	1	1.43	
Permeable area draining to outfall	ha	1	0.37	
Is the discharge in or within 1 km upstream of a protected site for conservation?	-	No	No	
Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge?	-	No	No	
Hardness	-	Low = <50mg CaCO3/l	Low = <50mg CaCO3/l	
Use Tier 1	-	TRUE	TRUE	
Use Tier 2	-	FALSE	FALSE	
Tier 1 Estimated river width at Q95	0	5	0.6	
Tier2 Bed width	m	3	3	
Tier2 Side slope	m/m	0.5	0.5	
Tier2 Long slope	m/m	0.0001	0.0001	
Tier2 Mannings' n	-	0.07	0.07	
Existing treatment for solubles	%	0	0	description for existing measures
Existing attenuation-restricted discharge rate	l/s	Unlimited	Unlimited	
Existing settlement of sediments	%	0	0	
Proposed treatment for solubles	%	0	0	description for proposed measures
Proposed attenuation-restricted discharge rate	l/s	Unlimited	Unlimited	
Proposed settlement of sediments	%	0	0	

**Route Option 3A: Drainage Catchment 3**

Road Number	A9/A96 Inshes to Smithton		Assessment type	Non-cumulative assessment (single outfall)
HA Area/DBFO number			Receiving watercourse	SWF07
OS grid reference of assessment point (m)	Eastings		EA receiving water Detailed River Network ID	
	Northings		Assessor and affiliation	Jane Gooding, Jacobs
OS grid reference of outfall structure (m)	Eastings		Date of assessment	24/01/2017
	Northings		Version of assessment	1
Outfall number	3			
List of outfalls in cumulative assessment				
Notes	DS 2036: Routine Runoff Assessment for Option 3A, Catchment 3			

Parameter	Units	Default Value	Value used	Notes (Enter notes in the left-hand cells only)
<b>Runoff Risk Assessments</b>				
AADT	vpd	>10,000 and <50,000	>10,000 and <50,000	
Climatic Region	-	Warm Dry	Colder Wet	
Rainfall Site	-	Ashford (SAAR 710mm)	Ardaraing (SAAR 1343.9mm)	
95%ile River flow	m <sup>3</sup> /s	0	0.0001	
Baseflow Index	-	0.5	0.578	
Impermeable road area drained	ha	1	1.23	
Permeable area draining to outfall	ha	1	0.33	
Is the discharge in or within 1 km upstream of a protected site for conservation?	-	No	No	
Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge?	-	No	No	
Hardness	-	Low = <50mg CaCO <sub>3</sub> /l	Low = <50mg CaCO <sub>3</sub> /l	
Use Tier 1	-	TRUE	TRUE	
Use Tier 2	-	FALSE	FALSE	
Tier 1 Estimated river width at Q95	0	5	0.3	
Tier 2 Bed width	m	3	3	
Tier 2 Side slope	m/m	0.5	0.5	
Tier 2 Long slope	m/m	0.0001	0.0001	
Tier 2 Mannings' n	-	0.07	0.07	
Existing treatment for solubles	%	0	0	description for existing measures
Existing attenuation-restricted discharge rate	l/s	Unlimited	Unlimited	
Existing settlement of sediments	%	0	0	description for proposed measures
Proposed treatment for solubles	%	0	0	
Proposed attenuation-restricted discharge rate	l/s	Unlimited	Unlimited	
Proposed settlement of sediments	%	0	0	

**Route Option 3A: Drainage Catchment 4**

Road Number	A9/A96 Inshes to Smithton		Assessment type	Non-cumulative assessment (single outfall)
HA Area/DBFO number			Receiving watercourse	SWF08
OS grid reference of assessment point (m)	Eastings		EA receiving water Detailed River Network ID	
	Northings		Assessor and affiliation	Jane Gooding, Jacobs
OS grid reference of outfall structure (m)	Eastings		Date of assessment	24/01/2017
	Northings		Version of assessment	1
Outfall number	4			
List of outfalls in cumulative assessment				
Notes	DS 2036: Routine Runoff Assessment for Option 3A, Catchment 4			

Parameter	Units	Default Value	Value used	Notes (Enter notes in the left-hand cells only)
<b>Runoff Risk Assessments</b>				
AADT	vpd	>10,000 and <50,000	>10,000 and <50,000	
Climatic Region	-	Warm Dry	Colder Wet	
Rainfall Site	-	Ashford (SAAR 710mm)	Ardaraing (SAAR 1343.9mm)	
95%ile River flow	m <sup>3</sup> /s	0	0.002	
Baseflow Index	-	0.5	0.584	
Impermeable road area drained	ha	1	0.73	
Permeable area draining to outfall	ha	1	0.06	
Is the discharge in or within 1 km upstream of a protected site for conservation?	-	No	No	
Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge?	-	No	Yes	
Hardness	-	Low = <50mg CaCO <sub>3</sub> /l	Low = <50mg CaCO <sub>3</sub> /l	
Use Tier 1	-	TRUE	TRUE	
Use Tier 2	-	FALSE	FALSE	
Tier 1 Estimated river width at Q95	0	5	0.5	
Tier 2 Bed width	m	3	3	
Tier 2 Side slope	m/m	0.5	0.5	
Tier 2 Long slope	m/m	0.0001	0.0001	
Tier 2 Mannings' n	-	0.07	0.07	
Existing treatment for solubles	%	0	0	description for existing measures
Existing attenuation-restricted discharge rate	l/s	Unlimited	Unlimited	
Existing settlement of sediments	%	0	0	description for proposed measures
Proposed treatment for solubles	%	0	0	
Proposed attenuation-restricted discharge rate	l/s	Unlimited	Unlimited	
Proposed settlement of sediments	%	0	0	

**Route Option 3A: Drainage Catchment 5**

Road Number	A9/A96 Inshes to Smithton		Assessment type	Non-cumulative assessment (single outfall)
HA Area/DBFO number			Receiving watercourse	SWF03
OS grid reference of assessment point (m)	Easting		EA receiving water Detailed River Network ID	
	Northing		Assessor and affiliation	Jane Gooding, Jacobs
OS grid reference of outfall structure (m)	Easting		Date of assessment	24/01/2017
	Northing		Version of assessment	1
Outfall number	5			
List of outfalls in cumulative assessment				
Notes	DS 2036: Routine Runoff Assessment for Option 3A, Catchment 5			

Parameter	Units	Default Value	Value used	Notes (Enter notes in the left-hand cells only)
<b>Runoff Risk Assessments</b>				
AADT	vpd	>10,000 and <50,000	>10,000 and <50,000	
Climatic Region	-	Warm Dry	Colder Wet	
Rainfall Site	-	Ashford (SAAR 710mm)	Ardalnaig (SAAR 1343.9mm)	
95%ile River flow	m3/s	0	0.002	
Baseflow Index	-	0.5	0.712	
Impermeable road area drained	ha	1	0.61	
Permeable area draining to outfall	ha	1	0.16	
Is the discharge in or within 1 km upstream of a protected site for conservation?	-	No	No	
Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge?	-	No	No	
Hardness	-	Low = <50mg CaCO3/l	Low = <50mg CaCO3/l	
Use Tier 1	-	TRUE	TRUE	
Use Tier 2	-	FALSE	FALSE	
Tier 1 Estimated river width at Q95	0	5	0.8	
Tier2 Bed width	m	3	3	
Tier2 Side slope	m/m	0.5	0.5	
Tier2 Long slope	m/m	0.0001	0.0001	
Tier2 Mannings' n	-	0.07	0.07	
Existing treatment for solubles	%	0	0	description for existing measures
Existing attenuation -restricted discharge rate	1/s	Unlimited	Unlimited	
Existing settlement of sediments	%	0	0	
Proposed treatment for solubles	%	0	0	description for proposed measures
Proposed attenuation -restricted discharge rate	1/s	Unlimited	Unlimited	
Proposed settlement of sediments	%	0	0	

**Route Option 3B: Drainage Catchment 1**

Road Number	A9/A96 Inshes to Smithton		Assessment type	Non-cumulative assessment (single outfall)
HA Area/DBFO number			Receiving watercourse	SWF02
OS grid reference of assessment point (m)	Easting		EA receiving water Detailed River Network ID	
	Northing		Assessor and affiliation	Jane Gooding, Jacobs
OS grid reference of outfall structure (m)	Easting		Date of assessment	24/01/2017
	Northing		Version of assessment	1
Outfall number	1			
List of outfalls in cumulative assessment				
Notes	DS 2036: Routine Runoff Assessment for Option 3B, Catchment 1			

Parameter	Units	Default Value	Value used	Notes (Enter notes in the left-hand cells only)
<b>Runoff Risk Assessments</b>				
AADT	vpd	>10,000 and <50,000	>10,000 and <50,000	
Climatic Region	-	Warm Dry	Colder Wet	
Rainfall Site	-	Ashford (SAAR 710mm)	Ardalnaig (SAAR 1343.9mm)	
95%ile River flow	m3/s	0	0.001	
Baseflow Index	-	0.5	0.763	
Impermeable road area drained	ha	1	0.29	
Permeable area draining to outfall	ha	1	0.02	
Is the discharge in or within 1 km upstream of a protected site for conservation?	-	No	No	
Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge?	-	No	Yes	
Hardness	-	Low = <50mg CaCO3/l	Low = <50mg CaCO3/l	
Use Tier 1	-	TRUE	TRUE	
Use Tier 2	-	FALSE	FALSE	
Tier 1 Estimated river width at Q95	0	5	0.5	
Tier2 Bed width	m	3	3	
Tier2 Side slope	m/m	0.5	0.5	
Tier2 Long slope	m/m	0.0001	0.0001	
Tier2 Mannings' n	-	0.07	0.07	
Existing treatment for solubles	%	0	0	description for existing measures
Existing attenuation -restricted discharge rate	1/s	Unlimited	Unlimited	
Existing settlement of sediments	%	0	0	
Proposed treatment for solubles	%	0	0	description for proposed measures
Proposed attenuation -restricted discharge rate	1/s	Unlimited	Unlimited	
Proposed settlement of sediments	%	0	0	

**Route Option 3B: Drainage Catchment 2**

Road Number	A9/A96 Inshes to Smithton		Assessment type	Non-cumulative assessment (single outfall)
HA Area/DBFO number			Receiving watercourse	SWF 04
OS grid reference of assessment point (m)	Eastng		EA receiving water Detailed River Network ID	
	Northing		Assessor and affiliation	Jane Gooding, Jacobs
OS grid reference of outfall structure (m)	Eastng		Date of assessment	25/01/2017
	Northing		Version of assessment	1
Outfall number	2			
List of outfalls in cumulative assessment				
Notes	DS 2036: Routine Runoff Assessment for Option 3B, Catchment 2			

Parameter	Units	Default Value	Value used	Notes (Enter notes in the left-hand cells only)
<b>Runoff Risk Assessments</b>				
AADT	vpd	>10,000 and <50,000	>10,000 and <50,000	
Climatic Region	-	Warm Dry	Colder Wet	
Rainfall Site	-	Ashford (SAAR 710mm)	Ardaraigaig (SAAR 1343.9mm)	
95%ile River flow	m <sup>3</sup> /s	0	0.005	
Baseflow Index	-	0.5	0.764	
Impermeable road area drained	ha	1	1.49	
Permeable area draining to outfall	ha	1	0.39	
Is the discharge in or within 1 km upstream of a protected site for conservation?	-	No	No	
Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge?	-	No	No	
Hardness	-	Low = <50mg CaCO <sub>3</sub> /l	Low = <50mg CaCO <sub>3</sub> /l	
Use Tier 1	-	TRUE	TRUE	
Use Tier 2	-	FALSE	FALSE	
Tier 1 Estimated river width at Q95	0	5	0.6	
Tier2 Bed width	m	3	3	
Tier2 Side slope	m/m	0.5	0.5	
Tier2 Long slope	m/m	0.0001	0.0001	
Tier2 Mannings' n	-	0.07	0.07	
Existing treatment for solubles	%	0	0	description for existing measures
Existing attenuation -restricted discharge rate	l/s	Unlimited	Unlimited	
Existing settlement of sediments	%	0	0	
Proposed treatment for solubles	%	0	0	description for proposed measures
Proposed attenuation -restricted discharge rate	l/s	Unlimited	Unlimited	
Proposed settlement of sediments	%	0	0	

**Route Option 3B: Drainage Catchment 3**

Road Number	A9/A96 Inshes to Smithton		Assessment type	Non-cumulative assessment (single outfall)
HA Area/DBFO number			Receiving watercourse	SWF08
OS grid reference of assessment point (m)	Eastng		EA receiving water Detailed River Network ID	
	Northing		Assessor and affiliation	Jane Gooding, Jacobs
OS grid reference of outfall structure (m)	Eastng		Date of assessment	24/01/2017
	Northing		Version of assessment	1
Outfall number	3			
List of outfalls in cumulative assessment				
Notes	DS 2036: Routine Runoff Assessment for Option 3B, Catchment 3			

Parameter	Units	Default Value	Value used	Notes (Enter notes in the left-hand cells only)
<b>Runoff Risk Assessments</b>				
AADT	vpd	>10,000 and <50,000	>10,000 and <50,000	
Climatic Region	-	Warm Dry	Colder Wet	
Rainfall Site	-	Ashford (SAAR 710mm)	Ardaraigaig (SAAR 1343.9mm)	
95%ile River flow	m <sup>3</sup> /s	0	0.002	
Baseflow Index	-	0.5	0.584	
Impermeable road area drained	ha	1	1.17	
Permeable area draining to outfall	ha	1	0.45	
Is the discharge in or within 1 km upstream of a protected site for conservation?	-	No	No	
Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge?	-	No	No	
Hardness	-	Low = <50mg CaCO <sub>3</sub> /l	Low = <50mg CaCO <sub>3</sub> /l	
Use Tier 1	-	TRUE	TRUE	
Use Tier 2	-	FALSE	FALSE	
Tier 1 Estimated river width at Q95	0	5	0.5	
Tier2 Bed width	m	3	3	
Tier2 Side slope	m/m	0.5	0.5	
Tier2 Long slope	m/m	0.0001	0.0001	
Tier2 Mannings' n	-	0.07	0.07	
Existing treatment for solubles	%	0	0	description for existing measures
Existing attenuation -restricted discharge rate	l/s	Unlimited	Unlimited	
Existing settlement of sediments	%	0	0	
Proposed treatment for solubles	%	0	0	description for proposed measures
Proposed attenuation -restricted discharge rate	l/s	Unlimited	Unlimited	
Proposed settlement of sediments	%	0	0	

**Route Option 3B: Drainage Catchment 4**

Road Number	A9/A96 Inshes to Smithton		Assessment type	Non-cumulative assessment (single outfall)
HA Area/DBFO number			Receiving watercourse	SWF08
OS grid reference of assessment point (m)	Easting		EA receiving water Detailed River Network ID	
	Northing		Assessor and affiliation	Jane Gooding, Jacobs
OS grid reference of outfall structure (m)	Easting		Date of assessment	24/01/2017
	Northing		Version of assessment	1
Outfall number	4			
List of outfalls in cumulative assessment				
Notes	DS 2036: Routine Runoff Assessment for Option 3B, Catchment 4			

Parameter	Units	Default Value	Value used	Notes (Enter notes in the left-hand cells only)
<b>Runoff Risk Assessments</b>				
AADT	vpd	>10,000 and <50,000	>10,000 and <50,000	
Climatic Region	-	Warm Dry	Colder Wet	
Rainfall Site	-	Ashford (SAAR 710mm)	Ardalnaig (SAAR 1343.9mm)	
95%ile River flow	m <sup>3</sup> /s	0	0.002	
Baseflow Index	-	0.5	0.584	
Impermeable road area drained	ha	1	0.77	
Permeable area draining to outfall	ha	1	0.06	
Is the discharge in or within 1 km upstream of a protected site for conservation?	-	No	No	
Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge?	-	No	Yes	
Hardness	-	Low = <50mg CaCO <sub>3</sub> /l	Low = <50mg CaCO <sub>3</sub> /l	
Use Tier 1	-	TRUE	TRUE	
Use Tier 2	-	FALSE	FALSE	
Tier 1 Estimated river width at Q95	0	5	0.5	
Tier2 Bed width	m	3	3	
Tier2 Side slope	m/m	0.5	0.5	
Tier2 Long slope	m/m	0.0001	0.0001	
Tier2 Mannings' n	-	0.07	0.07	
Existing treatment for solubles	%	0	0	description for existing measures
Existing attenuation -restricted discharge rate	l/s	Unlimited	Unlimited	
Existing settlement of sediments	%	0	0	
Proposed treatment for solubles	%	0	0	description for proposed measures
Proposed attenuation -restricted discharge rate	l/s	Unlimited	Unlimited	
Proposed settlement of sediments	%	0	0	

**Route Option 3B: Drainage Catchment 5**

Road Number	A9/A96 Inshes to Smithton		Assessment type	Non-cumulative assessment (single outfall)
HA Area/DBFO number			Receiving watercourse	SWF03
OS grid reference of assessment point (m)	Easting		EA receiving water Detailed River Network ID	
	Northing		Assessor and affiliation	Jane Gooding, Jacobs
OS grid reference of outfall structure (m)	Easting		Date of assessment	24/01/2017
	Northing		Version of assessment	1
Outfall number	5			
List of outfalls in cumulative assessment				
Notes	DS 2036: Routine Runoff Assessment for Option 3B, Catchment 5			

Parameter	Units	Default Value	Value used	Notes (Enter notes in the left-hand cells only)
<b>Runoff Risk Assessments</b>				
AADT	vpd	>10,000 and <50,000	>10,000 and <50,000	
Climatic Region	-	Warm Dry	Colder Wet	
Rainfall Site	-	Ashford (SAAR 710mm)	Ardalnaig (SAAR 1343.9mm)	
95%ile River flow	m <sup>3</sup> /s	0	0.002	
Baseflow Index	-	0.5	0.712	
Impermeable road area drained	ha	1	0.86	
Permeable area draining to outfall	ha	1	0.2	
Is the discharge in or within 1 km upstream of a protected site for conservation?	-	No	No	
Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge?	-	No	No	
Hardness	-	Low = <50mg CaCO <sub>3</sub> /l	Low = <50mg CaCO <sub>3</sub> /l	
Use Tier 1	-	TRUE	TRUE	
Use Tier 2	-	FALSE	FALSE	
Tier 1 Estimated river width at Q95	0	5	0.8	
Tier2 Bed width	m	3	3	
Tier2 Side slope	m/m	0.5	0.5	
Tier2 Long slope	m/m	0.0001	0.0001	
Tier2 Mannings' n	-	0.07	0.07	
Existing treatment for solubles	%	0	0	description for existing measures
Existing attenuation -restricted discharge rate	l/s	Unlimited	Unlimited	
Existing settlement of sediments	%	0	0	
Proposed treatment for solubles	%	0	0	description for proposed measures
Proposed attenuation -restricted discharge rate	l/s	Unlimited	Unlimited	
Proposed settlement of sediments	%	0	0	

**Routine Runoff Parameters: Cumulative Assessments**

**Route Option 1B: Drainage Catchments 3 & 4**

<b>Road Number</b>	A9/A96 Inshes to Smithton		<b>Assessment type</b>	Cumulative assessment excluding sediments (outfalls between 100m and 1km apart)
<b>HA Area/DBFO number</b>			<b>Receiving watercourse</b>	SWF08
<b>OS grid reference of assessment point (m)</b>	<b>Easting</b>		<b>EA receiving water Detailed River Network ID</b>	
	<b>Northing</b>			
<b>OS grid reference of outfall structure (m)</b>	<b>Easting</b>		<b>Assessor and affiliation</b>	Jane Gooding, Jacobs
	<b>Northing</b>			<b>Date of assessment</b>
<b>Outfall number</b>	3 & 4		<b>Version of assessment</b>	
<b>List of outfalls in cumulative assessment</b>				
<b>Notes</b>	DS 2036: Cumulative Routine Runoff Assessment for Option 1B, Catchments 3 & 4			

Parameter	Units	Default Value	Value used	Notes (Enter notes in the left-hand cells only)
<b>Runoff Risk Assessments</b>				
AADT	vpd	>10,000 and <50,000	>10,000 and <50,000	
Climatic Region	-	Warm Dry	Colder Wet	
Rainfall Site	-	Ashford (SAAR 710mm)	Ardalnaig (SAAR 1343.9mm)	
95%ile River flow	m <sup>3</sup> /s	0	0.002	
Baseflow Index	-	0.5	0.584	
Impermeable road area drained	ha	1	1.94	
Permeable area draining to outfall	ha	1	0.51	
Is the discharge in or within 1 km upstream of a protected site for conservation?	-	No	No	
Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge?	-	No	No	
Hardness	-	Low = <50mg CaCO <sub>3</sub> /l	Low = <50mg CaCO <sub>3</sub> /l	
Use Tier 1	-	TRUE	TRUE	
Use Tier 2	-	FALSE	FALSE	
Tier 1 Estimated river width at Q95	0	5	0.8	
Tier2 Bed width	m	3	3	
Tier2 Side slope	m/m	0.5	0.5	
Tier2 Long slope	m/m	0.0001	0.0001	
Tier2 Mannings' n	-	0.07	0.07	
Existing treatment for solubles	%	0	0	description for existing measures
Existing attenuation-restricted discharge rate	l/s	Unlimited	Unlimited	
Existing settlement of sediments	%	0	0	description for proposed measures
Proposed treatment for solubles	%	0	0	
Proposed attenuation-restricted discharge rate	l/s	Unlimited	Unlimited	
Proposed settlement of sediments	%	0	0	

**Route Option 2B: Drainage Catchments 4 & 5**

<b>Road Number</b>	A9/A96 Inshes to Smithton		<b>Assessment type</b>	Cumulative assessment excluding sediments (outfalls between 100m and 1km apart)
<b>HA Area/DBFO number</b>			<b>Receiving watercourse</b>	SWF 08
<b>OS grid reference of assessment point (m)</b>	<b>Easting</b>		<b>EA receiving water Detailed River Network ID</b>	
	<b>Northing</b>			
<b>OS grid reference of outfall structure (m)</b>	<b>Easting</b>		<b>Assessor and affiliation</b>	Jane Gooding, Jacobs
	<b>Northing</b>			<b>Date of assessment</b>
<b>Outfall number</b>	4 & 5		<b>Version of assessment</b>	
<b>List of outfalls in cumulative assessment</b>				
<b>Notes</b>	DS 2036: Cumulative Routine Runoff Assessment for Option 2B, Catchments 4 & 5			

Parameter	Units	Default Value	Value used	Notes (Enter notes in the left-hand cells only)
<b>Runoff Risk Assessments</b>				
AADT	vpd	>10,000 and <50,000	>10,000 and <50,000	
Climatic Region	-	Warm Dry	Colder Wet	
Rainfall Site	-	Ashford (SAAR 710mm)	Ardalnaig (SAAR 1343.9mm)	
95%ile River flow	m <sup>3</sup> /s	0	0.002	
Baseflow Index	-	0.5	0.584	
Impermeable road area drained	ha	1	1.94	
Permeable area draining to outfall	ha	1	0.51	
Is the discharge in or within 1 km upstream of a protected site for conservation?	-	No	No	
Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge?	-	No	No	
Hardness	-	Low = <50mg CaCO <sub>3</sub> /l	Low = <50mg CaCO <sub>3</sub> /l	
Use Tier 1	-	TRUE	TRUE	
Use Tier 2	-	FALSE	FALSE	
Tier 1 Estimated river width at Q95	0	5	5	
Tier2 Bed width	m	3	3	
Tier2 Side slope	m/m	0.5	0.5	
Tier2 Long slope	m/m	0.0001	0.0001	
Tier2 Mannings' n	-	0.07	0.07	
Existing treatment for solubles	%	0	0	description for existing measures
Existing attenuation-restricted discharge rate	l/s	Unlimited	Unlimited	
Existing settlement of sediments	%	0	0	description for proposed measures
Proposed treatment for solubles	%	0	0	
Proposed attenuation-restricted discharge rate	l/s	Unlimited	Unlimited	
Proposed settlement of sediments	%	0	0	

**Route Option 3B: Drainage Catchments 3 & 4**

<b>Road Number</b>	A9/A96 Inshes to Smithton		<b>Assessment type</b>	Cumulative assessment excluding sediments (outfalls between 100m and 1km apart)
<b>HA Area/DBFO number</b>			<b>Receiving watercourse</b>	SWF08
<b>OS grid reference of assessment point (m)</b>	<b>Easting</b>		<b>EA receiving water Detailed River Network ID</b>	
	<b>Northing</b>		<b>Assessor and affiliation</b>	Jane Gooding, Jacobs
<b>OS grid reference of outfall structure (m)</b>	<b>Easting</b>		<b>Date of assessment</b>	24/01/2017
	<b>Northing</b>		<b>Version of assessment</b>	1
<b>Outfall number</b>	3 & 4			
<b>List of outfalls in cumulative assessment</b>				
<b>Notes</b>	DS 2036: Cumulative Routine Runoff Assessment for Option 3B, Catchments 3 & 4			

Parameter	Units	Default Value	Value used	Notes (Enter notes in the left-hand cells only)
<b>Runoff Risk Assessments</b>				
AA DT	vpd	>10,000 and <50,000	>10,000 and <50,000	
Climatic Region	-	Warm Dry	Colder Wet	
Rainfall Site	-	Ashford (SAAR 710mm)	Ardaraiga (SAAR 1343.9mm)	
95thile River flow	m3/s	0	0.002	
Baseflow Index	-	0.5	0.584	
Impermeable road area drained	ha	1	1.94	
Permeable area draining to outfall	ha	1	0.51	
Is the discharge in or within 1 km upstream of a protected site for conservation?	-	No	No	
Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge?	-	No	No	
Hardness	-	Low = <50mg CaCO3/l	Low = <50mg CaCO3/l	
Use Tier 1	-	TRUE	TRUE	
Use Tier 2	-	FALSE	FALSE	
Tier 1 Estimated river width at Q95	0	5	0.8	
Tier2 Bed width	m	3	3	
Tier2 Side slope	m/m	0.5	0.5	
Tier2 Long slope	m/m	0.0001	0.0001	
Tier2 Mannings' n	-	0.07	0.07	
Existing treatment for solubles	%	0	0	description for existing measures
Existing attenuation -restricted discharge rate	l/s	Unlimited	Unlimited	
Existing settlement of sediments	%	0	0	
Proposed treatment for solubles	%	0	0	description for proposed measures
Proposed attenuation -restricted discharge rate	l/s	Unlimited	Unlimited	
Proposed settlement of sediments	%	0	0	

**Routine Runoff Results: Individual Assessments**

**Route Option 1A: Drainage Catchment 1**

Summary of predictions

Soluble - Acute Impact

Sediment - Chronic Impact

Prediction of Impact	Step 1
	Step 2
	Step 3

Copper	Zinc

Copper	Zinc	Cadmium	Total PAH	Pyrene	Fluoranthene	Anthracene	Phenanthrene

**DETAILED RESULTS**

**In Runoff**

Allowable Exceedances/year	
No. of exceedances/year	
No. of exceedances/worst year	
Allowable Exceedances/year	
No. of exceedances/year	
No. of exceedances/worst year	
Thresholds	
Thresholds	
Event Statistics	Mean
	90%ile
	95%ile
	99%ile

**Step 1**

Copper	Zinc	
RST24		
1	1	
63.00	56.70	
61	64	
RST6		
1	1	
18.00	20.60	
24	27	
(ug/l)	(ug/l)	
RST24	21	60
RST6	42	120
Event Statistics	Mean	
	90%ile	
	95%ile	
	99%ile	

**Step 1**

Copper	Zinc	Cadmium	Total PAH	Pyrene	Fluoranthene	Anthracene	Phenanthrene	
Toxicity Threshold								
1	1	1	1	1	1	1	1	
83.80	112.10	2.20	48.30	111.00	48.30	23.00	91.60	
97	128	7	59	127	59	82	101	
(mg/kg)	(mg/kg)	(mg/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)	
Toxicity Threshold	197	315	3.5	16770	875	2355	345	515
Event Statistics	Mean							
	90%ile							
	95%ile							
	99%ile							

**In River (no mitigation)**

Allowable Exceedances/year	
No. of exceedances/year	
No. of exceedances/worst year	
No. of exceedances/summer	
No. of exceedances/worst summer	
Allowable Exceedances/year	
No. of exceedances/year	
No. of exceedances/worst year	
No. of exceedances/summer	
No. of exceedances/worst summer	
Annual average concentration (ug/l)	
Thresholds	
Thresholds	
Event Statistics	Mean
	90%ile
	95%ile
	99%ile

**Step 2**

Copper	Zinc	
RST24		
2	2	
0.9	2	
2	5	
0.5	1.1	
2	5	
RST6		
1	1	
6	0.4	
0	2	
0	0.1	
0	1	
Annual average concentration (ug/l)		
0.58	1.79	
(ug/l)	(ug/l)	
RST24	21	60
RST6	42	120
Event Statistics	Mean	
	90%ile	
	95%ile	
	99%ile	

Velocity **0.03** m/s \*Tief 1 is used for the calculation

DI **242.58**

% settlement needed **59** %

**In River (with mitigation)**

Allowable Exceedances/year	
No. of exceedances/year	
No. of exceedances/worst year	
No. of exceedances/summer	
No. of exceedances/worst summer	
Allowable Exceedances/year	
No. of exceedances/year	
No. of exceedances/worst year	
No. of exceedances/summer	
No. of exceedances/worst summer	
Annual average concentration (ug/l)	
Thresholds	
Thresholds	
Event Statistics	Mean
	90%ile
	95%ile
	99%ile

**Step 2**

Copper	Zinc	
RST24		
2	2	
-	-	
-	-	
-	-	
-	-	
RST6		
1	1	
-	-	
-	-	
-	-	
-	-	
Annual average concentration (ug/l)		
-	-	
(ug/l)	(ug/l)	
RST24	21	60
RST6	42	120
Event Statistics	Mean	
	90%ile	
	95%ile	
	99%ile	

DI **-**

**Route Option 1A: Drainage Catchment 2**

**Summary of predictions**

Prediction of impact	Step1
	Step2
	Step3

**Soluble - Acute Impact**

Copper	Zinc
1	1
63.00	56.70
81	64

**Sediment - Chronic Impact**

Copper	Zinc	Cadmium	Total PAH	Pyrene	Fluoranthene	Anthracene	Phenanthrene
1	1	1	1	1	1	1	1
83.80	112.16	2.20	48.30	111.06	48.30	23.80	91.80
97	128	7	59	127	59	82	101

**DETAILED RESULTS**

**In Runoff**

**Step 1**

Allowable Exceedances/year	1
No. of exceedances/year	63.00
No. of exceedances/worst year	81
Allowable Exceedances/year	1
No. of exceedances/year	18.00
No. of exceedances/worst year	24
Thresholds	(ug/l)
RST24	21
RST6	42
Event Statistics	Mean
	90%ile
	95%ile
	99%ile

Copper	Zinc
RST24	
1	1
63.00	56.70
81	64
RST6	
1	1
18.00	20.60
24	27
	(ug/l)
RST24	21
RST6	42
	(ug/l)
23.36	67.70
45.65	147.58
54.99	194.62
96.36	372.28

**Step 1**

Copper	Zinc	Cadmium	Total PAH	Pyrene	Fluoranthene	Anthracene	Phenanthrene
Toxicity Threshold							
1	1	1	1	1	1	1	1
83.80	112.16	2.20	48.30	111.06	48.30	23.80	91.80
97	128	7	59	127	59	82	101
	(mg/kg)	(mg/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)
197	315	3.5	16770	875	2355	245	515
351	1165	1	16068	2780	2667	170	752
733	2672	2	35481	6138	5890	376	1661
961	3572	3	70795	12247	11752	750	3313
1383	5637	4	89125	15419	14795	945	4171

**In River (no mitigation)**

**Step 2**

Allowable Exceedances/year	2
No. of exceedances/year	0.2
No. of exceedances/worst year	1
No. of exceedances/summer	0.1
No. of exceedances/worst summer	1
Allowable Exceedances/year	1
No. of exceedances/year	0
No. of exceedances/worst year	0
No. of exceedances/summer	0
No. of exceedances/worst summer	0
Annual average concentration (ug/l)	0.34
Thresholds	(ug/l)
RST24	21
RST6	42
Event Statistics	Mean
	90%ile
	95%ile
	99%ile

Copper	Zinc
RST24	
2	2
0.2	1.2
1	4
0.1	0.8
1	4
RST6	
1	1
0	0.1
0	1
0	0
0	0
	(ug/l)
RST24	21
RST6	42
	(ug/l)
1.00	3.14
2.91	7.38
5.38	13.60
11.48	50.80

Velocity **0.10** m/s Tier 1 is used for the calculation  
 DI **59.66**  
 % settlement needed  %

**In River (with mitigation)**

**Step 3**

Allowable Exceedances/year	2
No. of exceedances/year	-
No. of exceedances/worst year	-
No. of exceedances/summer	-
No. of exceedances/worst summer	-
Allowable Exceedances/year	1
No. of exceedances/year	-
No. of exceedances/worst year	-
No. of exceedances/summer	-
No. of exceedances/worst summer	-
Annual average concentration (ug/l)	-
Thresholds	(ug/l)
RST24	21
RST6	42
Event Statistics	Mean
	90%ile
	95%ile
	99%ile

Copper	Zinc
RST24	
2	2
-	-
-	-
-	-
-	-
RST6	
1	1
-	-
-	-
-	-
-	-
	(ug/l)
RST24	21
RST6	42
	(ug/l)
-	-
-	-
-	-
-	-

DI **-**

**Route Option 1A: Drainage Catchment 3**

**Summary of predictions**

Prediction of impact	Step1
	Step2
	Step3

**Soluble - Acute Impact**

Copper	Zinc

**Sediment - Chronic Impact**

Copper	Zinc	Cadmium	Total PAH	Pyrene	Fluoranthene	Anthracene	Phenanthrene

**DETAILED RESULTS**

**In Runoff**

Allowable Exceedances/year  
No. of exceedances/year  
No. of exceedances/worst year

Step 1

Copper	Zinc
RST24	
1	1
63.60	56.70
81	64

Allowable Exceedances/year  
No. of exceedances/year  
No. of exceedances/worst year

Copper	Zinc
RST6	
1	1
18.80	26.60
24	27

Thresholds  
Thresholds

	(µg/l)	(µg/l)
RST24	21	60
RST6	42	128

Event Statistics Mean  
90%ile  
95%ile  
99%ile

23.36	67.70
45.85	147.58
54.99	194.62
96.36	372.28

**Step 1**

Copper	Zinc	Cadmium	Total PAH	Pyrene	Fluoranthene	Anthracene	Phenanthrene
Toxicity Threshold							
1	1	1	1	1	1	1	1
83.80	112.10	2.20	48.30	111.00	48.30	23.00	91.00
97	128	7	59	127	59	32	101

	(mg/kg)	(mg/kg)	(mg/kg)	(µg/kg)	(µg/kg)	(µg/kg)	(µg/kg)	(µg/kg)
Toxicity Threshold	197	315	3.5	16770	875	2355	245	515

931	1165	1	16068	2780	2667	170	752
735	2672	2	35481	6138	5890	576	1061
962	3572	3	70795	12247	11752	750	8913
1383	5637	4	89125	15419	14795	945	4171

**In River (no mitigation)**

Allowable Exceedances/year  
No. of exceedances/year  
No. of exceedances/worst year  
No. of exceedances/summer  
No. of exceedances/worst summer

Step 2

Copper	Zinc
RST24	
2	2
11.6	12.2
16	17
6.1	5.9
15	16

Allowable Exceedances/year  
No. of exceedances/year  
No. of exceedances/worst year  
No. of exceedances/summer  
No. of exceedances/worst summer

Copper	Zinc
RST6	
1	1
2.1	4
5	9
1.2	1.8
4	8

Annual average concentration (µg/l)

2.95	9.41
------	------

Thresholds  
Thresholds

	(µg/l)	(µg/l)
RST24	21	60
RST6	42	128

Event Statistics Mean  
90%ile  
95%ile  
99%ile

6.82	19.95
17.96	54.12
27.22	77.30
49.25	169.32

Velocity 0.01 m/s

Tier 1 is used for the calculation

DI 1341.33

% settlement needed 93 %

**In River (with mitigation)**

Allowable Exceedances/year  
No. of exceedances/year  
No. of exceedances/worst year  
No. of exceedances/summer  
No. of exceedances/worst summer

Step 3

Copper	Zinc
RST24	
2	2
-	-
-	-
-	-
-	-

Allowable Exceedances/year  
No. of exceedances/year  
No. of exceedances/worst year  
No. of exceedances/summer  
No. of exceedances/worst summer

Copper	Zinc
RST6	
1	1
-	-
-	-
-	-
-	-

Annual average concentration (µg/l)

-	-
---	---

Thresholds  
Thresholds

	(µg/l)	(µg/l)
RST24	21	60
RST6	42	128

Event Statistics Mean  
90%ile  
95%ile  
99%ile

-	-
-	-
-	-
-	-

DI -



# A9/A96 Inshes to Smithton DMRB Stage 2 Scheme Assessment Report Part 6: Appendices



## Route Option 1A: Drainage Catchment 5

### Summary of predictions

Prediction of impact	Step 1
	Step 2
	Step 3

### Soluble - Acute Impact

Copper	Zinc

### Sediment - Chronic Impact

Copper	Zinc	Cadmium	Total PAH	Pyrene	Fluoranthene	Anthracene	Phenanthrene

### DETAILED RESULTS

#### In Runoff

	Step 1		Step 1								
	Copper	Zinc	Copper	Zinc	Cadmium	Total PAH	Pyrene	Fluoranthene	Anthracene	Phenanthrene	
Allowable Exceedances/year	RST24		Toxicity Threshold								
No. of exceedances/year	1	1	1	1	1	1	1	1	1	1	
No. of exceedances/worst year	63.90	56.70	83.80	112.10	2.20	48.30	111.00	48.30	23.00	91.00	
	81	64	97	128	7	59	127	59	82	101	
Allowable Exceedances/year	RST6										
No. of exceedances/year	1	1									
No. of exceedances/worst year	18.00	20.60									
	24	27									
Thresholds	(ug/l)	(ug/l)	(mg/kg)	(mg/kg)	(mg/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)	
Thresholds	RST24	RST6	Toxicity Threshold								
	21	60	197	315	3.5	16770	875	2355	245	915	
Event Statistics	Mean	23.36	67.70	331	1105	1	16058	2780	2957	170	752
90%ile	45.65	147.58	783	2672	2	35481	6138	5890	376	1661	
95%ile	54.99	194.62	962	3572	3	70795	12247	11752	750	3313	
99%ile	96.36	372.38	1383	5637	4	89125	15419	14795	945	4171	

#### In River (no mitigation)

	Step 2		Step 2	
	Copper	Zinc	Velocity	DI
Allowable Exceedances/year	RST24		0.02 m/s	Tier 1 is used for the calculation
No. of exceedances/year	2	2		
No. of exceedances/worst year	0.1	0.9		
No. of exceedances/summer	1	3		
No. of exceedances/worst summer	0.1	0.6		
	1	3		
Allowable Exceedances/year	RST6		% settlement needed	22 %
No. of exceedances/year	1	1		
No. of exceedances/worst year	0	0		
No. of exceedances/summer	0	0		
No. of exceedances/worst summer	0	0		
Annual average concentration (ug/l)	0.27	0.85		
Thresholds	(ug/l)	(ug/l)		
Thresholds	RST24	RST6		
	21	60		
	42	120		
Event Statistics	Mean	0.82	2.60	
90%ile	2.34	5.83		
95%ile	4.54	11.21		
99%ile	10.05	45.32		

#### In River (with mitigation)

	Step 3		DI
	Copper	Zinc	
Allowable Exceedances/year	RST24		
No. of exceedances/year	2	2	
No. of exceedances/worst year	-	-	
No. of exceedances/summer	-	-	
No. of exceedances/worst summer	-	-	
Allowable Exceedances/year	RST6		
No. of exceedances/year	1	1	
No. of exceedances/worst year	-	-	
No. of exceedances/summer	-	-	
No. of exceedances/worst summer	-	-	
Annual average concentration (ug/l)	-	-	
Thresholds	(ug/l)	(ug/l)	
Thresholds	RST24	RST6	
	21	60	
	42	120	
Event Statistics	Mean	-	-
90%ile	-	-	
95%ile	-	-	
99%ile	-	-	

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**Route Option 1B: Drainage Catchment 1**

**Summary of predictions**

**Soluble - Acute Impact**

**Sediment - Chronic Impact**

Prediction of Impact	Step1
	Step2
	Step3

Copper	Zinc

Copper	Zinc	Cadmium	Total PAH	Pyrene	Fluoranthene	Anthracene	Phenanthrene

**DETAILED RESULTS**

**In Runoff**

**Step 1**

**Step 1**

Allowable Exceedances/year  
No. of exceedances/year  
No. of exceedances/worst year

Copper	Zinc
RST24	
1	1
63.00	56.79
81	64

Copper	Zinc	Cadmium	Total PAH	Pyrene	Fluoranthene	Anthracene	Phenanthrene
Toxicity Threshold							
1	1	1	1	1	1	1	1
83.80	112.16	2.29	48.30	111.08	48.30	23.80	91.80
97	128	7	59	127	59	32	101

Allowable Exceedances/year  
No. of exceedances/year  
No. of exceedances/worst year

Copper	Zinc
RST6	
1	1
18.00	20.64
24	27

	(mg/kg)	(mg/kg)	(mg/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)
Toxicity Threshold	197	313	3.5	16770	875	2355	245	515

Thresholds  
Thresholds

	(ug/l)	(ug/l)
RST24	21	60
RST6	42	120

Event Statistics  
Mean  
90%ile  
95%ile  
99%ile

	Mean	90%ile	95%ile	99%ile
Copper	23.36	45.65	54.99	96.36
Zinc	67.70	147.58	194.62	372.28

	(mg/kg)	(mg/kg)	(mg/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)
Toxicity Threshold	331	1105	1	16068	2780	2667	170	752
	739	2072	2	35481	6138	5890	376	1661
	962	3572	3	70795	12247	11752	750	3313
	1383	5637	4	89125	15419	14795	945	4171

**In River (no mitigation)**

**Step 2**

**Step 2**

Allowable Exceedances/year  
No. of exceedances/year  
No. of exceedances/worst year  
No. of exceedances/summer  
No. of exceedances/worst summer

Copper	Zinc
RST24	
2	2
0.9	2
2	5
0.5	1.1
2	5

Velocity **0.63** m/s Tier 1 is used for the calculation  
DI **242.58**  
% settlement needed

Allowable Exceedances/year  
No. of exceedances/year  
No. of exceedances/worst year  
No. of exceedances/summer  
No. of exceedances/worst summer

Copper	Zinc
RST6	
1	1
0	0.4
0	2
0	0.1
0	1

Annual average concentration (ug/l)

Copper	Zinc
0.58	1.79

Thresholds  
Thresholds

	(ug/l)	(ug/l)
RST24	21	60
RST6	42	120

Event Statistics  
Mean  
90%ile  
95%ile  
99%ile

	Mean	90%ile	95%ile	99%ile
Copper	1.63	5.01	8.63	16.16
Zinc	5.00	12.38	22.43	68.67

**In River (with mitigation)**

**Step 3**

Allowable Exceedances/year  
No. of exceedances/year  
No. of exceedances/worst year  
No. of exceedances/summer  
No. of exceedances/worst summer

Copper	Zinc
RST24	
2	2
-	-
-	-
-	-
-	-

DI **-**

Allowable Exceedances/year  
No. of exceedances/year  
No. of exceedances/worst year  
No. of exceedances/summer  
No. of exceedances/worst summer

Copper	Zinc
RST6	
1	1
-	-
-	-
-	-
-	-

Annual average concentration (ug/l)

Copper	Zinc
-	-

Thresholds  
Thresholds

	(ug/l)	(ug/l)
RST24	21	60
RST6	42	120

Event Statistics  
Mean  
90%ile  
95%ile  
99%ile

	Mean	90%ile	95%ile	99%ile
Copper	-	-	-	-
Zinc	-	-	-	-

**Route Option 1B: Drainage Catchment 2**

Summary of predictions

Soluble - Acute Impact

Sediment - Chronic Impact

Prediction of impact	Step 1
	Step 2
	Step 3

Copper	Zinc
1	1
63.00	56.70
81	64

Copper	Zinc	Cadmium	Total PAH	Pyrene	Fluoranthene	Anthracene	Phenanthrene
1	1	1	1	1	1	1	1
83.80	112.10	2.20	48.30	111.80	48.30	20.00	91.60
97	128	7	59	127	59	82	101

**DETAILED RESULTS**

In Runoff

Step 1

Step 1

Allowable Exceedances/year  
No. of exceedances/year  
No. of exceedances/worst year

Copper	Zinc
RST24	
1	1
63.00	56.70
81	64

Copper	Zinc	Cadmium	Total PAH	Pyrene	Fluoranthene	Anthracene	Phenanthrene
Toxicity Threshold							
1	1	1	1	1	1	1	1
83.80	112.10	2.20	48.30	111.80	48.30	20.00	91.60
97	128	7	59	127	59	82	101

Allowable Exceedances/year  
No. of exceedances/year  
No. of exceedances/worst year

Copper	Zinc
RST6	
1	1
18.00	20.90
24	27

Copper	Zinc	Cadmium	Total PAH	Pyrene	Fluoranthene	Anthracene	Phenanthrene
Toxicity Threshold							
1	1	1	1	1	1	1	1
83.80	112.10	2.20	48.30	111.80	48.30	20.00	91.60
97	128	7	59	127	59	82	101

Thresholds  
Thresholds

	(ug/l)	(ug/l)
RST24	21	60
RST6	42	120

	(mg/kg)	(mg/kg)	(mg/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)
Toxicity Threshold	197	315	3.5	16770	875	2355	245	515

Event Statistics  
Mean  
90%ile  
95%ile  
99%ile

	Mean	90%ile	95%ile	99%ile
Copper	23.36	45.05	54.99	96.36
Zinc	67.70	147.58	194.62	372.28

	Mean	90%ile	95%ile	99%ile
Copper	331	733	962	1388
Zinc	1105	2672	3572	5637
Cadmium	1	2	3	4
Total PAH	18068	35461	70795	89125
Pyrene	2780	6138	12247	15419
Fluoranthene	2667	5890	11752	14795
Anthracene	170	376	750	945
Phenanthrene	752	1661	3313	4171

In River (no mitigation)

Step 2

Step 2

Allowable Exceedances/year  
No. of exceedances/year  
No. of exceedances/worst year  
No. of exceedances/summer  
No. of exceedances/worst summer

Copper	Zinc
RST24	
2	2
0.2	1.2
1	4
0.1	0.8
1	4

Velocity **8.10** m/s

Factor 1 is used for the calculation

DI **61.51**

% settlement needed  %

Allowable Exceedances/year  
No. of exceedances/year  
No. of exceedances/worst year  
No. of exceedances/summer  
No. of exceedances/worst summer

Copper	Zinc
RST6	
1	1
6	0.2
0	2
0	0
0	0

Annual average concentration (ug/l)

Copper	Zinc
0.35	1.08

Thresholds  
Thresholds

	(ug/l)	(ug/l)
RST24	21	60
RST6	42	120

Event Statistics  
Mean  
90%ile  
95%ile  
99%ile

	Mean	90%ile	95%ile	99%ile
Copper	1.03	2.99	5.50	11.89
Zinc	3.21	7.55	13.93	51.52

In River (with mitigation)

Step 2

Step 2

Allowable Exceedances/year  
No. of exceedances/year  
No. of exceedances/worst year  
No. of exceedances/summer  
No. of exceedances/worst summer

Copper	Zinc
RST24	
2	2
-	-
-	-
-	-
-	-

DI

Allowable Exceedances/year  
No. of exceedances/year  
No. of exceedances/worst year  
No. of exceedances/summer  
No. of exceedances/worst summer

Copper	Zinc
RST6	
1	1
-	-
-	-
-	-
-	-

Annual average concentration (ug/l)

Copper	Zinc
-	-

Thresholds  
Thresholds

	(ug/l)	(ug/l)
RST24	21	60
RST6	42	120

Event Statistics  
Mean  
90%ile  
95%ile  
99%ile

	Mean	90%ile	95%ile	99%ile
Copper	-	-	-	-
Zinc	-	-	-	-

**Route Option 1B: Drainage Catchment 3**

Summary of predictions

Prediction of impact	Step1
	Step2
	Step3

**Soluble - Acute Impact**

Copper	Zinc

**Sediment - Chronic Impact**

Copper	Zinc	Cadmium	Total PAH	Pyrene	Fluoranthene	Anthracene	Phenanthrene

**DETAILED RESULTS**

**In Runoff**

**Step 1**

Copper	Zinc
RST24	
1	1
63.00	56.70
81	64

Copper	Zinc
RST6	
1	1
16.00	20.60
24	27

	(µg/l)	(µg/l)
RST24	21	60
RST6	42	120

Event Statistics	Mean	23.36	67.70
	90thile	45.65	147.58
	95thile	54.99	194.62
	99thile	96.36	372.28

**Step 1**

Copper	Zinc	Cadmium	Total PAH	Pyrene	Fluoranthene	Anthracene	Phenanthrene
Toxicity Threshold							
1	1	1	1	1	1	1	1
83.80	112.10	2.20	48.30	111.00	48.30	23.80	91.80
97	128	7	59	127	59	32	101

	(mg/kg)	(mg/kg)	(mg/kg)	(µg/g)	(µg/g)	(µg/g)	(µg/g)
Toxicity Threshold	197	315	3.5	16770	875	2355	515

	331	1165	1	16068	2780	2667	170	752
	733	2672	2	35481	6138	5890	376	1661
	962	3572	8	70795	12247	11752	750	3313
	1388	5637	4	89125	15419	14795	945	4171

**In River (no mitigation)**

**Step 2**

Copper	Zinc
RST24	
2	2
0.5	1.6
1	5
0.2	1
1	5

Copper	Zinc
RST6	
1	1
0	0.2
0	2
0	0
0	0

	(µg/l)	(µg/l)
RST24	21	60
RST6	42	120

Event Statistics	Mean	1.31	4.03
	90thile	3.76	9.15
	95thile	6.87	17.96
	99thile	14.04	62.37

Velocity **0.85** m/s Tier 1 is used for the calculation  
 DI **123.35**  
 % settlement needed  %

**In River (with mitigation)**

**Step 3**

Copper	Zinc
RST24	
2	2
-	-
-	-
-	-
-	-

Copper	Zinc
RST6	
1	1
-	-
-	-
-	-

	(µg/l)	(µg/l)
RST24	21	60
RST6	42	120

Event Statistics	Mean	-	-
	90thile	-	-
	95thile	-	-
	99thile	-	-

DI **-**

**Route Option 1B: Drainage Catchment 4**

Summary of predictions

Soluble - Acute Impact

Sediment - Chronic Impact

Prediction of impact	Step1
	Step2
	Step3

Copper	Zinc

Copper	Zinc	Cadmium	Total PAH	Pyrene	Fluoranthene	Anthracene	Phenanthrene

**DETAILED RESULTS**

**In Runoff**

**Step 1**

**Step 1**

Allowable Exceedances/year  
No. of exceedances/year  
No. of exceedances/worst year

Copper	Zinc
RST24	
1	1
63.00	56.70
81	64

Copper	Zinc	Cadmium	Total PAH	Pyrene	Fluoranthene	Anthracene	Phenanthrene
Toxicity Threshold							
1	1	1	1	1	1	1	1
63.00	112.50	2.20	48.30	111.00	48.30	23.00	91.00
97	128	7	59	127	59	32	101

Allowable Exceedances/year  
No. of exceedances/year  
No. of exceedances/worst year

Copper	Zinc
RST6	
1	1
18.00	20.60
24	27

Toxicity Threshold	(mg/kg)	(mg/kg)	(mg/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)
	197	315	3.5	16770	875	2355	245

Thresholds  
Thresholds

RST24	(ug/l)	RST6	(ug/l)
	21		60
	42		120

Event Statistics Mean  
90%ile  
95%ile  
99%ile

Mean	90%ile	95%ile	99%ile
23.36	45.65	54.99	96.36
87.70	147.58	194.62	872.28

331	1185	1	16968	2780	2667	170	752
733	2672	2	85481	6138	5890	876	1661
962	3572	3	70795	12247	11752	790	3315
1389	5687	4	89125	15419	14795	945	4171

**In River (no mitigation)**

**Step 2**

**Step 2**

Allowable Exceedances/year  
No. of exceedances/year  
No. of exceedances/worst year  
No. of exceedances/summer  
No. of exceedances/worst summer

Copper	Zinc
RST24	
2	2
0.2	0.9
1	3
0.1	0.6
1	3

Velocity **0.05** m/s Tier 1 is used for the calculation  
DI **81.18**  
% settlement needed **0** %

Allowable Exceedances/year  
No. of exceedances/year  
No. of exceedances/worst year  
No. of exceedances/summer  
No. of exceedances/worst summer

Copper	Zinc
RST6	
1	1
0	0.2
0	2
0	0
0	0

Annual average concentration (ug/l)

0.89	1.01
------	------

Thresholds  
Thresholds

RST24	(ug/l)	RST6	(ug/l)
	21		60
	42		120

Event Statistics Mean  
90%ile  
95%ile  
99%ile

Mean	90%ile	95%ile	99%ile
0.97	2.70	5.46	11.54
3.04	6.84	13.19	52.53

**In River (with mitigation)**

**Step 3**

Allowable Exceedances/year  
No. of exceedances/year  
No. of exceedances/worst year  
No. of exceedances/summer  
No. of exceedances/worst summer

Copper	Zinc
RST24	
2	2
-	-
-	-
-	-
-	-

DI **-**

Allowable Exceedances/year  
No. of exceedances/year  
No. of exceedances/worst year  
No. of exceedances/summer  
No. of exceedances/worst summer

Copper	Zinc
RST6	
1	1
-	-
-	-
-	-
-	-

Annual average concentration (ug/l)

-	-
---	---

Thresholds  
Thresholds

RST24	(ug/l)	RST6	(ug/l)
	21		60
	42		120

Event Statistics Mean  
90%ile  
95%ile  
99%ile

Mean	90%ile	95%ile	99%ile
-	-	-	-
-	-	-	-
-	-	-	-

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**Route Option 1B: Drainage Catchment 5**

Summary of predictions

Soluble - Acute Impact

Sediment - Chronic Impact

Prediction of impact	Step 1
	Step 2
	Step 3

Copper	Zinc

Copper	Zinc	Cadmium	Total PAH	Pyrene	Fluoranthene	Anthracene	Phenanthrene

**DETAILED RESULTS**

**In Runoff**

Step 1

Step 1

Allowable Exceedances/year  
No. of exceedances/year  
No. of exceedances/worst year

Copper	Zinc
RST24	
1	1
63.00	96.70
81	64

Copper	Zinc	Cadmium	Total PAH	Pyrene	Fluoranthene	Anthracene	Phenanthrene
Toxicity Threshold							
1	1	1	1	1	1	1	1
83.80	112.10	2.20	48.30	111.00	48.30	23.00	91.00
97	128	7	59	127	59	32	101

Allowable Exceedances/year  
No. of exceedances/year  
No. of exceedances/worst year

Copper	Zinc
RST6	
1	1
18.00	20.60
24	27

	(mg/kg)	(mg/kg)	(mg/kg)	(µg/kg)	(µg/kg)	(µg/kg)	(µg/kg)
Toxicity Threshold	197	315	3.5	16770	875	2355	245

Thresholds

Thresholds

Event Statistics  
Mean  
90%ile  
95%ile  
99%ile

(µg/l)	(µg/l)
RST24	RST6
21	80
42	120
23.36	67.70
45.05	147.50
54.99	194.62
96.36	372.38

331	1165	1	10008	2780	2667	170	752
733	2672	2	85481	6138	5890	376	1661
962	3572	3	70795	12347	11752	750	3313
1383	5637	4	89125	15419	14795	945	4171

**In River (no mitigation)**

Step 2

Step 2

Allowable Exceedances/year  
No. of exceedances/year  
No. of exceedances/worst year  
No. of exceedances/summer  
No. of exceedances/worst summer

Copper	Zinc
RST24	
7	2
9.2	1.3
1	4
0.1	0.8
1	4

Velocity 0.02 m/s

Tier 1 is used for the calculation

DI 180.19

% settlement needed 45 %

Allowable Exceedances/year  
No. of exceedances/year  
No. of exceedances/worst year  
No. of exceedances/summer  
No. of exceedances/worst summer

Copper	Zinc
RST6	
1	1
0	0.2
0	2
0	0
0	0

Annual average concentration (µg/l)

0.36	1.13
------	------

Thresholds

Thresholds

Event Statistics  
Mean  
90%ile  
95%ile  
99%ile

(µg/l)	(µg/l)
RST24	RST6
21	80
42	120
1.07	3.35
3.00	7.73
5.89	14.63
12.25	54.20

**In River (with mitigation)**

Step 3

Allowable Exceedances/year  
No. of exceedances/year  
No. of exceedances/worst year  
No. of exceedances/summer  
No. of exceedances/worst summer

Copper	Zinc
RST24	
2	2
-	-
-	-
-	-
-	-

DI -

Allowable Exceedances/year  
No. of exceedances/year  
No. of exceedances/worst year  
No. of exceedances/summer  
No. of exceedances/worst summer

Copper	Zinc
RST6	
1	1
-	-
-	-
-	-
-	-

Annual average concentration (µg/l)

-	-
---	---

Thresholds hresholds

Thresholds

Event Statistics  
Mean  
90%ile  
95%ile  
99%ile

(µg/l)	(µg/l)
RST24	RST6
21	80
42	120
-	-
-	-
-	-

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**Route Option 2A: Drainage Catchment 1**

Summary of predictions

Soluble - Acute Impact

Sediment - Chronic Impact

Prediction of impact	Step 1
	Step 2
	Step 3

Copper	Zinc

Copper	Zinc	Cadmium	Total PAH	Pyrene	Fluoranthene	Anthracene	Phenanthrene

**DETAILED RESULTS**

**In Runoff**

Step 1

Step 1

Allowable Exceedances/year  
No. of exceedances/year  
No. of exceedances/worst year

RST24	
Copper	Zinc
1	1
63.00	96.70
81	64

Toxicity Threshold							
Copper	Zinc	Cadmium	Total PAH	Pyrene	Fluoranthene	Anthracene	Phenanthrene
1	1	1	1	1	1	1	1
83.88	112.10	2.20	48.38	111.00	48.38	23.08	91.09
97	128	7	59	127	59	32	101

Allowable Exceedances/year  
No. of exceedances/year  
No. of exceedances/worst year

RST6	
Copper	Zinc
1	1
18.80	29.60
24	27

Toxicity Threshold	(mg/kg)	(mg/kg)	(mg/kg)	(µg/kg)	(µg/kg)	(µg/kg)	(µg/kg)
	197	315	3.5	16770	875	2355	245

Thresholds  
Thresholds

RST24	(µg/l)	(µg/l)
	21	60
RST6	42	120

Event Statistics  
Mean  
90%ile  
95%ile  
99%ile

	23.36	67.70
	45.05	147.58
	54.99	194.62
	96.36	372.28

	331	1165	1	16068	2780	2667	170	752
	733	2672	2	35481	6138	5890	376	1661
	962	3572	3	70795	12247	11752	750	3313
	1383	5637	4	89125	15419	14795	945	4171

**In River (no mitigation)**

Step 2

Step 2

Allowable Exceedances/year  
No. of exceedances/year  
No. of exceedances/worst year  
No. of exceedances/summer  
No. of exceedances/worst summer

RST24	
Copper	Zinc
2	2
0.9	2
2	5
0.5	1.1
2	5

Velocity **0.03** m/s Tier 1 is used for the calculation  
DI **236.34**  
% settlement needed **59** %

Allowable Exceedances/year  
No. of exceedances/year  
No. of exceedances/worst year  
No. of exceedances/summer  
No. of exceedances/worst summer

RST6	
Copper	Zinc
1	1
0	0.4
0	2
0	0.1
0	1

Annual average concentration (µg/l)

	0.57	1.77
--	------	------

Thresholds  
Thresholds

RST24	(µg/l)	(µg/l)
	21	60
RST6	42	120

Event Statistics  
Mean  
90%ile  
95%ile  
99%ile

	1.62	4.95
	4.57	12.29
	8.54	22.19
	16.06	68.31

**In River (with mitigation)**

Step 3

Allowable Exceedances/year  
No. of exceedances/year  
No. of exceedances/worst year  
No. of exceedances/summer  
No. of exceedances/worst summer

RST24	
Copper	Zinc
2	2
-	-
-	-
-	-
-	-

DI **-**

Allowable Exceedances/year  
No. of exceedances/year  
No. of exceedances/worst year  
No. of exceedances/summer  
No. of exceedances/worst summer

RST6	
Copper	Zinc
1	1
-	-
-	-
-	-
-	-

Annual average concentration (µg/l)

	-	-
--	---	---

Thresholds  
Thresholds

RST24	(µg/l)	(µg/l)
	21	60
RST6	42	120

Event Statistics  
Mean  
90%ile  
95%ile  
99%ile

	-	-
	-	-
	-	-
	-	-

**Route Option 2A: Drainage Catchment 3**

Summary of predictions

Soluble - Acute Impact

Sediment - Chronic Impact

Prediction of impact	Step1
	Step2
	Step3

Copper	Zinc

Copper	Zinc	Cadmium	Total PAH	Pyrene	Fluoranthene	Anthracene	Phenanthrene

**DETAILED RESULTS**

**In Runoff**

**Step 1**

**Step 1**

Allowable Exceedances/year  
No. of exceedances/year  
No. of exceedances/worst year

Copper	Zinc
RST24	
1	1
63.60	56.70
81	64

Copper	Zinc	Cadmium	Total PAH	Pyrene	Fluoranthene	Anthracene	Phenanthrene
Toxicity Threshold							
1	1	1	1	1	1	1	1
63.60	112.98	2.20	48.30	111.00	48.30	23.60	93.08
97	128	7	59	127	59	32	101

Allowable Exceedances/year  
No. of exceedances/year  
No. of exceedances/worst year

Copper	Zinc
RST6	
1	1
18.60	20.60
24	27

Copper	Zinc	Cadmium	Total PAH	Pyrene	Fluoranthene	Anthracene	Phenanthrene
Toxicity Threshold							
1	1	1	1	1	1	1	1
63.60	112.98	2.20	48.30	111.00	48.30	23.60	93.08
97	128	7	59	127	59	32	101

Thresholds  
Thresholds

(µg/l)	(µg/l)
RST24	RST6
21	60
42	128

Toxicity Threshold	(mg/kg)	(mg/kg)	(mg/kg)	(µg/kg)	(µg/kg)	(µg/kg)	(µg/kg)
	197	315	3.5	16770	875	2355	245

Event Statistics Mean  
90%ile  
95%ile  
99%ile

Mean	90%ile	95%ile	99%ile
23.36	45.65	54.99	96.36
67.70	147.58	194.62	872.38

	(mg/kg)	(mg/kg)	(mg/kg)	(µg/kg)	(µg/kg)	(µg/kg)	(µg/kg)
	331	738	962	1883	1185	2672	5637
	1	2	3	4	16068	35481	70795
	2780	6138	12247	15419	2667	5890	14795
	170	376	750	945	752	1661	3313

**In River (no mitigation)**

**Step 2**

**Step 2**

Allowable Exceedances/year  
No. of exceedances/year  
No. of exceedances/worst year  
No. of exceedances/summer  
No. of exceedances/worst summer

Copper	Zinc
RST24	
2	2
0.2	1.2
1	4
0.1	0.8
1	4

Velocity  m/s Tier 1 is used for the calculation  
 DI   
 % settlement needed  %

Allowable Exceedances/year  
No. of exceedances/year  
No. of exceedances/worst year  
No. of exceedances/summer  
No. of exceedances/worst summer

Copper	Zinc
RST6	
1	1
0	0.1
0	1
0	0
0	0

Annual average concentration (µg/l)

Copper	Zinc
0.84	1.05

Thresholds  
Thresholds

(µg/l)	(µg/l)
RST24	RST6
21	60
42	128

Event Statistics Mean  
90%ile  
95%ile  
99%ile

Mean	90%ile	95%ile	99%ile
1.00	2.91	5.88	11.48
3.14	7.38	13.60	50.80

**In River (with mitigation)**

**Step 3**

**Step 3**

Allowable Exceedances/year  
No. of exceedances/year  
No. of exceedances/worst year  
No. of exceedances/summer  
No. of exceedances/worst summer

Copper	Zinc
RST24	
2	2
-	-
-	-
-	-
-	-

DI

Allowable Exceedances/year  
No. of exceedances/year  
No. of exceedances/worst year  
No. of exceedances/summer  
No. of exceedances/worst summer

Copper	Zinc
RST6	
1	1
-	-
-	-
-	-
-	-

Annual average concentration (µg/l)

Copper	Zinc
-	-

Thresholds thresholds  
Thresholds

(µg/l)	(µg/l)
RST24	RST6
21	60
42	128

Event Statistics Mean  
90%ile  
95%ile  
99%ile

Mean	90%ile	95%ile	99%ile
-	-	-	-
-	-	-	-
-	-	-	-
-	-	-	-

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**Route Option 2A: Drainage Catchment 4**

Summary of predictions

Soluble - Acute Impact

Sediment - Chronic Impact

Prediction of impact	Step 1
	Step 2
	Step 3

Copper	Zinc

Copper	Zinc	Cadmium	Total PAH	Pyrene	Fluoranthene	Anthracene	Phenanthrene

**DETAILED RESULTS**

**In Runoff**

Step 1

Step 1

Allowable Exceedances/year  
No. of exceedances/year  
No. of exceedances/worst year

Copper	Zinc
RST24	
1	1
63.00	56.70
81	64

Copper	Zinc	Cadmium	Total PAH	Pyrene	Fluoranthene	Anthracene	Phenanthrene
Toxicity Threshold							
1	1	1	1	1	1	1	1
83.86	112.10	2.20	48.36	111.00	48.36	23.06	91.00
97	128	7	59	127	59	32	101

Allowable Exceedances/year  
No. of exceedances/year  
No. of exceedances/worst year

Copper	Zinc
RST6	
1	1
18.00	20.60
24	27

Toxicity Threshold	(mg/kg)	(mg/kg)	(mg/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)
RST24	21	60		19770	875	2355	245
RST6	42	120					

Thresholds  
Thresholds

(ug/l)	(ug/l)
RST24	21
RST6	42

331	1165	1	16068	2780	2667	170	752
733	2672	2	35481	6138	5890	376	1661
962	3572	3	70795	12247	11752	750	3313
1383	5637	4	89125	15419	14795	945	4171

Event Statistics Mean  
90%ile  
95%ile  
99%ile

23.36	67.70
45.65	147.58
54.99	194.62
96.36	372.28

**In River (no mitigation)**

Step 2

Step 2

Allowable Exceedances/year  
No. of exceedances/year  
No. of exceedances/worst year  
No. of exceedances/summer  
No. of exceedances/worst summer

Copper	Zinc
RST24	
2	2
11.6	12.2
16	17
6.1	5.9
15	16

Velocity 0.01 m/s Tier 1 is used for the calculation  
DI 1341.33  
% settlement needed 63 %

Allowable Exceedances/year  
No. of exceedances/year  
No. of exceedances/worst year  
No. of exceedances/summer  
No. of exceedances/worst summer

Copper	Zinc
RST6	
1	1
2.1	4
5	9
1.2	1.8
4	8

Annual average concentration (ug/l)

2.95	9.41
------	------

Thresholds  
Thresholds

(ug/l)	(ug/l)
RST24	21
RST6	42

Event Statistics Mean  
90%ile  
95%ile  
99%ile

6.82	19.95
17.96	54.12
27.22	77.30
49.23	169.32

**In River (with mitigation)**

Step 2

Allowable Exceedances/year  
No. of exceedances/year  
No. of exceedances/worst year  
No. of exceedances/summer  
No. of exceedances/worst summer

Copper	Zinc
RST24	
2	2
-	-
-	-
-	-
-	-

DI -

Allowable Exceedances/year  
No. of exceedances/year  
No. of exceedances/worst year  
No. of exceedances/summer  
No. of exceedances/worst summer

Copper	Zinc
RST6	
1	1
-	-
-	-
-	-
-	-

Annual average concentration (ug/l)

-	-
---	---

Thresholds  
Thresholds

(ug/l)	(ug/l)
RST24	21
RST6	42

Event Statistics Mean  
90%ile  
95%ile  
99%ile

-	-
-	-
-	-
-	-

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**Route Option 2A: Drainage Catchment 5**

**Summary of predictions**

Prediction of impact	Step 1
	Step 2
	Step 3

**Soluble - Acute Impact**

Copper	Zinc

**Sediment - Chronic Impact**

Copper	Zinc	Cadmium	Total PAH	Pyrene	Fluoranthene	Anthracene	Phenanthrene

**DETAILED RESULTS**

**In Runoff**

Allowable Exceedances/year  
No. of exceedances/year  
No. of exceedances/worst year

**Step 1**

Copper	Zinc
RST24	
1	1
43.40	56.70
61	64

**Step 1**

Copper	Zinc	Cadmium	Total PAH	Pyrene	Fluoranthene	Anthracene	Phenanthrene
Toxicity Threshold							
1	1	1	1	1	1	1	1
83.80	112.10	2.20	48.30	111.00	48.00	23.00	91.00
97	128	7	59	127	59	32	101

Allowable Exceedances/year  
No. of exceedances/year  
No. of exceedances/worst year

RST6

Copper	Zinc
1	1
18.80	20.60
24	27

Toxicity Threshold

(mg/kg)	(mg/kg)	(mg/kg)	(µg/kg)	(µg/kg)	(µg/kg)	(µg/kg)	(µg/kg)
197	315	3.5	16770	875	2355	245	515

Thresholds  
Thresholds

RST24

(µg/l)	(µg/l)
21	60
42	120

331	1165	1	16068	2780	2667	170	752
735	2672	2	35481	6138	5890	376	1661
962	3572	3	70795	12247	11752	750	3313
1383	5837	4	89125	15419	14795	945	4171

Event Statistics Mean  
90%ile  
95%ile  
99%ile

23.36	67.70
45.85	147.58
54.99	194.62
96.36	372.28

**In River (no mitigation)**

Allowable Exceedances/year  
No. of exceedances/year  
No. of exceedances/worst year  
No. of exceedances/summer  
No. of exceedances/worst summer

**Step 2**

Copper	Zinc
RST24	
2	2
0.2	0.9
1	3
0.1	0.6
1	3

Velocity 0.05 m/s

Tier 1 is used for the calculation

DI 76.96

% settlement needed 0 %

Allowable Exceedances/year  
No. of exceedances/year  
No. of exceedances/worst year  
No. of exceedances/summer  
No. of exceedances/worst summer

RST6

Copper	Zinc
1	1
0	0.1
0	1
0	0
0	0

Annual average concentration (µg/l)

0.51	0.97
------	------

Thresholds  
Thresholds

RST24

(µg/l)	(µg/l)
21	60
42	120

Event Statistics Mean  
90%ile  
95%ile  
99%ile

0.93	2.92
2.58	6.54
5.21	12.65
11.18	50.94

**In River (with mitigation)**

Allowable Exceedances/year  
No. of exceedances/year  
No. of exceedances/worst year  
No. of exceedances/summer  
No. of exceedances/worst summer

**Step 3**

Copper	Zinc
RST24	
2	2
-	-
-	-
-	-

DI -

Allowable Exceedances/year  
No. of exceedances/year  
No. of exceedances/worst year  
No. of exceedances/summer  
No. of exceedances/worst summer

RST6

Copper	Zinc
1	1
-	-
-	-
-	-

Annual average concentration (µg/l)

-	-
---	---

Thresholds  
Thresholds

RST24

(µg/l)	(µg/l)
21	60
42	120

Event Statistics Mean  
90%ile  
95%ile  
99%ile

-	-
-	-
-	-
-	-

# A9/A96 Inshes to Smithton DMRB Stage 2 Scheme Assessment Report Part 6: Appendices



## Route Option 2A: Drainage Catchment 6

### Summary of predictions

Prediction of impact	Step1
	Step2
	Step3

### Soluble - Acute Impact

Copper	Zinc

### Sediment - Chronic Impact

Copper	Zinc	Cadmium	Total PAH	Pyrene	Fluoranthene	Anthracene	Phenanthrene

### DETAILED RESULTS

#### In Runoff

Allowable Exceedances/year  
No. of exceedances/year  
No. of exceedances/worst year

Step 1	
Copper	Zinc
RST24	
1	1
63.00	56.70
81	64

Allowable Exceedances/year  
No. of exceedances/year  
No. of exceedances/worst year

Step 1	
Copper	Zinc
RST6	
1	1
18.00	20.60
24	27

Thresholds

Thresholds

Event Statistics

Mean

90%ile

95%ile

99%ile

(µg/l)	(µg/l)
21	60
42	120

Copper	Zinc
RST24	
23.36	67.70
45.65	147.58
54.99	194.62
96.36	372.28

#### Step 1

Copper	Zinc	Cadmium	Total PAH	Pyrene	Fluoranthene	Anthracene	Phenanthrene
Toxicity Threshold							
1	1	1	1	1	1	1	1
83.80	112.98	2.29	48.30	111.00	48.30	23.60	91.60
97	128	7	59	127	59	32	101

Toxicity Threshold

(mg/kg)	(mg/kg)	(mg/kg)	(µg/kg)	(µg/kg)	(µg/kg)	(µg/kg)	(µg/kg)
197	315	3.5	16770	875	2305	245	515
331	1165	1	10068	2780	2667	170	752
733	2672	2	35481	6138	5890	376	1661
962	3572	3	70795	12247	11752	750	3313
1383	5637	4	89125	15419	14795	945	4171

#### In River (no mitigation)

Allowable Exceedances/year  
No. of exceedances/year  
No. of exceedances/worst year  
No. of exceedances/summer  
No. of exceedances/worst summer

Step 2	
Copper	Zinc
RST24	
2	2
0.1	0.9
1	3
0.1	0.6
1	3

Allowable Exceedances/year  
No. of exceedances/year  
No. of exceedances/worst year  
No. of exceedances/summer  
No. of exceedances/worst summer

Step 2	
Copper	Zinc
RST6	
1	1
0	0
0	0
0	0
0	0

Annual average concentration (µg/l)

Thresholds

Thresholds

Event Statistics

Mean

90%ile

95%ile

99%ile

(µg/l)	(µg/l)
21	60
42	120

Copper	Zinc
RST24	
0.82	2.60
2.24	5.83
4.54	11.21
10.05	45.32

Velocity 0.62 m/s

Tier 1 is used for the calculation

DI 127.81

% settlement needed 22 %

#### In River (with mitigation)

Allowable Exceedances/year  
No. of exceedances/year  
No. of exceedances/worst year  
No. of exceedances/summer  
No. of exceedances/worst summer

Step 3	
Copper	Zinc
RST24	
2	2
-	-
-	-
-	-
-	-

Allowable Exceedances/year  
No. of exceedances/year  
No. of exceedances/worst year  
No. of exceedances/summer  
No. of exceedances/worst summer

Step 3	
Copper	Zinc
RST6	
1	1
-	-
-	-
-	-
-	-

Annual average concentration (µg/l)

Thresholds

Thresholds

Event Statistics

Mean

90%ile

95%ile

99%ile

(µg/l)	(µg/l)
21	60
42	120

Copper	Zinc
RST24	
-	-
-	-
-	-
-	-

DI -

**Route Option 2B: Drainage Catchment 1**

Summary of predictions

Soluble - Acute Impact

Sediment - Chronic Impact

Prediction of impact	Step1
	Step2
	Step3

Copper	Zinc

Copper	Zinc	Cadmium	Total PAH	Pyrene	Fluoranthene	Anthracene	Phenanthrene

**DETAILED RESULTS**

**In Runoff**

**Step 1**

**Step 1**

Allowable Exceedances/year  
No. of exceedances/year  
No. of exceedances/worst year

Copper	Zinc
RST24	
1	1
63.00	56.70
81	64

Copper	Zinc	Cadmium	Total PAH	Pyrene	Fluoranthene	Anthracene	Phenanthrene
Toxicity Threshold							
1	1	1	1	1	1	1	1
63.88	112.10	2.20	48.36	111.00	48.36	23.08	91.00
97	128	7	59	127	59	92	101

Allowable Exceedances/year  
No. of exceedances/year  
No. of exceedances/worst year

Copper	Zinc
RST6	
1	1
18.00	20.60
24	27

	(µg/l)	(µg/l)	(mg/kg)	(mg/kg)	(mg/kg)	(µg/kg)	(µg/kg)	(µg/kg)	(µg/kg)
Toxicity Threshold	21	66	197	315	3.5	16770	875	2355	245
RST24	42	120							
RST6									

Event Statistics Mean  
90%ile  
95%ile  
99%ile

	23.36	67.70
	45.65	147.58
	54.99	194.62
	96.36	372.28

	331	1165	1	16068	2780	2667	170	752
	733	2672	2	35481	6138	5890	376	1661
	962	3572	3	70795	12247	11752	750	3313
	1383	5637	4	89125	15419	14795	945	4171

**In River (no mitigation)**

**Step 2**

**Step 2**

Allowable Exceedances/year  
No. of exceedances/year  
No. of exceedances/worst year  
No. of exceedances/summer  
No. of exceedances/worst summer

Copper	Zinc
RST24	
2	2
0.9	2
2	5
0.5	1.1
2	5

Velocity **0.03** m/s Tier 1 is used for the calculation  
D<sub>50</sub> **236.34**  
% settlement needed **59** %

Allowable Exceedances/year  
No. of exceedances/year  
No. of exceedances/worst year  
No. of exceedances/summer  
No. of exceedances/worst summer

Copper	Zinc
RST6	
1	1
0	0.4
0	2
0	0.1
0	1

Annual average concentration (µg/l)

	0.57	1.77
--	------	------

Thresholds  
Thresholds

	(µg/l)	(µg/l)
RST24	21	66
RST6	42	120

Event Statistics Mean  
90%ile  
95%ile  
99%ile

	1.62	4.95
	4.97	12.29
	8.54	22.19
	16.06	68.31

**In River (with mitigation)**

**Step 2**

Allowable Exceedances/year  
No. of exceedances/year  
No. of exceedances/worst year  
No. of exceedances/summer  
No. of exceedances/worst summer

Copper	Zinc
RST24	
2	2
-	-
-	-
-	-
-	-

D<sub>50</sub> **-**

Allowable Exceedances/year  
No. of exceedances/year  
No. of exceedances/worst year  
No. of exceedances/summer  
No. of exceedances/worst summer

Copper	Zinc
RST6	
1	1
-	-
-	-
-	-
-	-

Annual average concentration (µg/l)

	-	-
--	---	---

Thresholds  
Thresholds

	(µg/l)	(µg/l)
RST24	21	66
RST6	42	120

Event Statistics Mean  
90%ile  
95%ile  
99%ile

	-	-
	-	-
	-	-
	-	-

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**Route Option 2B: Drainage Catchment 3**

**Summary of predictions**

**Soluble - Acute Impact**

**Sediment - Chronic Impact**

Prediction of Impact	Step 1
	Step 2
	Step 3

Copper	Zinc

Copper	Zinc	Cadmium	Total PAH	Pyrene	Fluoranthene	Aanthracene	Phenanthrene

**DETAILED RESULTS**

**In Runoff**

**Step 1**

**Step 1**

Allowable Exceedances/year  
No. of exceedances/year  
No. of exceedances/worst year

Copper	Zinc
RST24	
1	1
83.00	56.70
81	64

Copper	Zinc	Cadmium	Total PAH	Pyrene	Fluoranthene	Aanthracene	Phenanthrene
Toxicity Threshold							
1	1	1	1	1	1	1	1
83.80	112.10	2.20	48.30	111.00	48.30	23.60	91.80
97	128	7	59	127	59	32	101

Allowable Exceedances/year  
No. of exceedances/year  
No. of exceedances/worst year

Copper	Zinc
RST6	
1	1
18.00	20.90
24	27

Copper	Zinc	Cadmium	Total PAH	Pyrene	Fluoranthene	Aanthracene	Phenanthrene
Toxicity Threshold							
1	1	1	1	1	1	1	1
83.80	112.10	2.20	48.30	111.00	48.30	23.60	91.80
97	128	7	59	127	59	32	101

Thresholds

	(µg/l)	(µg/l)
RST24	21	60
RST6	42	120

	(mg/kg)	(mg/kg)	(mg/kg)	(µg/g)	(µg/g)	(µg/g)	(µg/g)	(µg/g)
Toxicity Threshold	197	315	3.5	16770	875	2355	245	515

Event Statistics Mean  
90%ile  
95%ile  
99%ile

	23.36	67.70
	45.65	147.58
	54.99	194.02
	96.96	372.28

	331	1165	1	16068	2780	2667	170	752
	733	2672	2	35481	6138	5890	376	1661
	962	3572	3	70795	12247	11752	750	3313
	1383	5937	4	89125	15419	14795	945	4171

**In River (no mitigation)**

**Step 2**

**Step 2**

Allowable Exceedances/year  
No. of exceedances/year  
No. of exceedances/worst year  
No. of exceedances/summer  
No. of exceedances/worst summer

Copper	Zinc
RST24	
2	2
0.2	1.2
1	4
0.1	0.8
1	4

Velocity 6.10 m/s Tier 1 is used for the calculation  
 DI 61.51  
 % settlement needed 0 %

Allowable Exceedances/year  
No. of exceedances/year  
No. of exceedances/worst year  
No. of exceedances/summer  
No. of exceedances/worst summer

Copper	Zinc
RST6	
1	1
9	0.2
0	2
0	0
0	0

Annual average concentration (µg/l)

Copper	Zinc
0.35	1.08

Thresholds

	(µg/l)	(µg/l)
RST24	21	60
RST6	42	120

Event Statistics Mean  
90%ile  
95%ile  
99%ile

	1.03	3.21
	2.99	7.55
	5.50	13.93
	11.69	51.52

**In River (with mitigation)**

**Step 3**

Allowable Exceedances/year  
No. of exceedances/year  
No. of exceedances/worst year  
No. of exceedances/summer  
No. of exceedances/worst summer

Copper	Zinc
RST24	
2	2
-	-
-	-
-	-

DI -

Allowable Exceedances/year  
No. of exceedances/year  
No. of exceedances/worst year  
No. of exceedances/summer  
No. of exceedances/worst summer

Copper	Zinc
RST6	
1	1
-	-
-	-
-	-

Annual average concentration (µg/l)

Copper	Zinc
-	-

Thresholds

	(µg/l)	(µg/l)
RST24	21	60
RST6	42	120

Event Statistics Mean  
90%ile  
95%ile  
99%ile

	-	-
	-	-
	-	-
	-	-

**Route Option 2B: Drainage Catchment 4**

**Summary of predictions**

Prediction of impact	Step 1
	Step 2
	Step 3

**Soluble - Acute Impact**

Copper	Zinc

**Sediment - Chronic Impact**

Copper	Zinc	Cadmium	Total PAH	Pyrene	Fluoranthene	Anthracene	Phenanthrene

**DETAILED RESULTS**

**In Runoff**

Allowable Exceedances/year  
No. of exceedances/year  
No. of exceedances/worst year

Step 1

Copper	Zinc
RST24	
1	1
63.00	16.79
81	64

Allowable Exceedances/year  
No. of exceedances/year  
No. of exceedances/worst year

RST6	
1	1
18.00	20.00
24	27

Thresholds  
Thresholds

	(µg/l)	(µg/l)
RST24	21	60
RST6	42	120

Event Statistics Mean  
90%ile  
95%ile  
99%ile

	23.36	67.70
	45.65	147.58
	54.99	194.62
	96.36	372.28

**Step 1**

Copper	Zinc	Cadmium	Total PAH	Pyrene	Fluoranthene	Anthracene	Phenanthrene
1	1	1	1	1	1	1	1
83.80	112.16	2.29	46.30	111.08	48.30	23.80	91.80
97	128	7	59	127	59	32	101

Toxicity Threshold

(mg/kg)	(mg/kg)	(mg/kg)	(µg/kg)	(µg/kg)	(µg/kg)	(µg/kg)	(µg/kg)
197	315	3.5	16770	875	2355	245	515

	331	1165	1	10068	2780	2667	170	752
	733	2972	2	35481	6138	5890	376	1661
	962	3572	3	70795	12247	11752	750	3313
	1383	5637	4	89125	15419	14795	945	4171

**In River (no mitigation)**

Allowable Exceedances/year  
No. of exceedances/year  
No. of exceedances/worst year  
No. of exceedances/summer  
No. of exceedances/worst summer

Step 2

Copper	Zinc
RST24	
2	2
0.5	1.8
1	5
0.2	1
1	5

Allowable Exceedances/year  
No. of exceedances/year  
No. of exceedances/worst year  
No. of exceedances/summer  
No. of exceedances/worst summer

RST6	
1	1
0	0.2
0	2
0	0
0	0

Annual average concentration (µg/l)

	0.46	1.41
--	------	------

Thresholds  
Thresholds

	(µg/l)	(µg/l)
RST24	21	60
RST6	42	120

Event Statistics Mean  
90%ile  
95%ile  
99%ile

	1.31	4.08
	3.76	9.15
	6.87	17.96
	14.04	62.37

Velocity **0.05** m/s **Tier 1 is used for the calculation**  
 DI **123.35**  
 % settlement needed **19** %

**In River (with mitigation)**

Allowable Exceedances/year  
No. of exceedances/year  
No. of exceedances/worst year  
No. of exceedances/summer  
No. of exceedances/worst summer

Step 3

Copper	Zinc
RST24	
2	2
-	-
-	-
-	-
-	-

Allowable Exceedances/year  
No. of exceedances/year  
No. of exceedances/worst year  
No. of exceedances/summer  
No. of exceedances/worst summer

RST6	
1	1
-	-
-	-
-	-
-	-

Annual average concentration (µg/l)

	-	-
--	---	---

Thresholds thresholds  
Thresholds

	(µg/l)	(µg/l)
RST24	21	60
RST6	42	120

Event Statistics Mean  
90%ile  
95%ile  
99%ile

	-	-
	-	-
	-	-
	-	-

DI **-**

# A9/A96 Inshes to Smithton DMRB Stage 2 Scheme Assessment Report Part 6: Appendices



## Route Option 2B: Drainage Catchment 5

### Summary of predictions

Prediction of impact	Step1
	Step2
	Step3

### Soluble - Acute Impact

Copper	Zinc

### Sediment - Chronic Impact

Copper	Zinc	Cadmium	Total PAH	Pyrene	Fluoranthene	Anthracene	Phenanthrene

### DETAILED RESULTS

#### In Runoff

Allowable Exceedances/year	
No. of exceedances/year	
No. of exceedances/worst year	
Allowable Exceedances/year	
No. of exceedances/year	
No. of exceedances/worst year	
Thresholds	
Thresholds	
Event Statistics	Mean
	90%ile
	95%ile
	99%ile

Step 1	
Copper	Zinc
RST24	
1	1
63.00	56.79
81	64
RST6	
1	1
18.00	20.09
24	27
(µg/l)	(µg/l)
RST24	21
RST6	60
	42
	120
Event Statistics	Mean
	90%ile
	95%ile
	99%ile

Step 1							
Copper	Zinc	Cadmium	Total PAH	Pyrene	Fluoranthene	Anthracene	Phenanthrene
Toxicity Threshold							
1	1	1	1	1	1	1	1
83.80	112.18	2.28	48.30	111.08	48.30	23.80	91.80
97	128	7	59	127	59	32	101
(mg/kg)	(mg/kg)	(mg/kg)	(µg/kg)	(µg/kg)	(µg/kg)	(µg/kg)	(µg/kg)
197	315	3.5	16770	875	2355	245	515
331	1165	1	16068	2780	2667	170	752
733	2072	2	35481	6138	5890	376	1661
962	3572	3	70795	12247	11752	750	3313
1383	5637	4	89125	15419	14795	945	4171

#### In River (no mitigation)

Allowable Exceedances/year	
No. of exceedances/year	
No. of exceedances/worst year	
No. of exceedances/summer	
No. of exceedances/worst summer	
Allowable Exceedances/year	
No. of exceedances/year	
No. of exceedances/worst year	
No. of exceedances/summer	
No. of exceedances/worst summer	
Annual average concentration (µg/l)	
Thresholds	
Thresholds	
Event Statistics	Mean
	90%ile
	95%ile
	99%ile

Step 2	
Copper	Zinc
RST24	
2	2
0.2	0.9
1	3
0.1	0.6
1	3
RST6	
1	1
9	0.2
0	2
0	0
0	0
(µg/l)	(µg/l)
RST24	21
RST6	60
	42
	120
Event Statistics	Mean
	90%ile
	95%ile
	99%ile

Velocity  m/s Tier 1 is used for the calculation

DI

% settlement needed  %

#### In River (with mitigation)

Allowable Exceedances/year	
No. of exceedances/year	
No. of exceedances/worst year	
No. of exceedances/summer	
No. of exceedances/worst summer	
Allowable Exceedances/year	
No. of exceedances/year	
No. of exceedances/worst year	
No. of exceedances/summer	
No. of exceedances/worst summer	
Annual average concentration (µg/l)	
Thresholds	
Thresholds	
Event Statistics	Mean
	90%ile
	95%ile
	99%ile

Step 3	
Copper	Zinc
RST24	
2	2
-	-
-	-
-	-
-	-
RST6	
1	1
-	-
-	-
-	-
-	-
(µg/l)	(µg/l)
RST24	21
RST6	60
	42
	120
Event Statistics	Mean
	90%ile
	95%ile
	99%ile

DI

# A9/A96 Inshes to Smithton DMRB Stage 2 Scheme Assessment Report Part 6: Appendices



## Route Option 2B: Drainage Catchment 6

### Summary of predictions

Prediction of impact	Step1
	Step2
	Step3

### Soluble - Acute Impact

Copper	Zinc

### Sediment - Chronic Impact

Copper	Zinc	Cadmium	Total PAH	Pyrene	Fluoranthene	Anthracene	Phenanthrene

### DETAILED RESULTS

#### In Runoff

Allowable Exceedances/year  
No. of exceedances/year  
No. of exceedances/worst year

Step 1	
Copper	Zinc
RST24	
1	1
83.00	56.79
81	64

Allowable Exceedances/year  
No. of exceedances/year  
No. of exceedances/worst year

RST6	
1	1
18.00	20.99
24	27

Thresholds

Thresholds

Event Statistics  
Mean  
90%ile  
95%ile  
99%ile

RST24	
(µg/l)	(µg/l)
21	60
42	120
23.36	67.70
45.65	147.58
54.99	194.62
96.36	372.28

#### Step 1

Copper	Zinc	Cadmium	Total PAH	Pyrene	Fluoranthene	Anthracene	Phenanthrene
1	1	1	1	1	1	1	1
83.60	112.19	2.29	48.30	111.99	48.30	23.60	91.60
97	128	7	59	127	59	32	101

Toxicity Threshold

(mg/kg)	(mg/kg)	(mg/kg)	(µg/kg)	(µg/kg)	(µg/kg)	(µg/kg)	(µg/kg)
197	315	3.5	16770	875	2355	245	515
331	1105	1	16068	2780	2667	170	752
733	2072	2	35481	6138	5890	376	1661
962	3572	3	70795	12247	11752	750	3313
1383	5637	4	89125	15419	14795	945	4171

#### In River (no mitigation)

Allowable Exceedances/year  
No. of exceedances/year  
No. of exceedances/worst year  
No. of exceedances/summer  
No. of exceedances/worst summer

Step 2	
Copper	Zinc
RST24	
2	2
0.2	1.3
1	4
0.1	0.8
1	4

Allowable Exceedances/year  
No. of exceedances/year  
No. of exceedances/worst year  
No. of exceedances/summer  
No. of exceedances/worst summer

RST6	
1	1
0	0.2
0	2
0	0
0	0

Annual average concentration (µg/l)

0.36	1.13
------	------

Thresholds

Thresholds

Event Statistics  
Mean  
90%ile  
95%ile  
99%ile

RST24	
(µg/l)	(µg/l)
21	60
42	120
1.07	3.35
3.00	7.73
5.89	14.63
12.25	54.20

Velocity 0.62 m/s

Tier 1 is used for the calculation

DI 180.19

% settlement needed 45 %

#### In River (with mitigation)

Allowable Exceedances/year  
No. of exceedances/year  
No. of exceedances/worst year  
No. of exceedances/summer  
No. of exceedances/worst summer

Step 3	
Copper	Zinc
RST24	
2	2
-	-
-	-
-	-
-	-

Allowable Exceedances/year  
No. of exceedances/year  
No. of exceedances/worst year  
No. of exceedances/summer  
No. of exceedances/worst summer

RST6	
1	1
-	-
-	-
-	-
-	-

Annual average concentration (µg/l)

-	-
---	---

Thresholds

Thresholds

Event Statistics  
Mean  
90%ile  
95%ile  
99%ile

RST24	
(µg/l)	(µg/l)
21	60
42	120
-	-
-	-
-	-
-	-

DI -

# A9/A96 Inshes to Smithton DMRB Stage 2 Scheme Assessment Report Part 6: Appendices



## Route Option 3A: Drainage Catchment 1

### Summary of predictions

Prediction of impact	Step 1
	Step 2
	Step 3

### Soluble - Acute Impact

Copper	Zinc

### Sediment - Chronic Impact

Copper	Zinc	Cadmium	Total PAH	Pyrene	Fluoranthene	Anthracene	Phenanthrene

### DETAILED RESULTS

#### In Runoff

	Step 1		Step 1							
	Copper	Zinc	Copper	Zinc	Cadmium	Total PAH	Pyrene	Fluoranthene	Anthracene	Phenanthrene
Allowable Exceedances/year	1	1	1	1	1	1	1	1	1	1
No. of exceedances/year	63.00	56.70	83.80	112.98	2.20	48.30	111.06	48.30	23.80	91.80
No. of exceedances/worst year	81	64	97	128	7	59	127	59	32	101
Allowable Exceedances/year	1	1								
No. of exceedances/year	18.00	20.60								
No. of exceedances/worst year	24	27								
Thresholds	(µg/l)	(µg/l)	(mg/kg)	(mg/kg)	(mg/kg)	(µg/kg)	(µg/kg)	(µg/kg)	(µg/kg)	(µg/kg)
Thresholds	RST24 21	RST6 60	197	315	3.5	16770	875	2355	245	515
Event Statistics	Mean	Mean	331	1165	1	16068	2780	2667	170	752
	90%ile	90%ile	733	2672	2	35481	6138	5890	376	1661
	95%ile	95%ile	962	3572	3	70795	12247	11752	750	3313
	99%ile	99%ile	1383	5637	4	89125	15419	14795	945	4171

#### In River (no mitigation)

	Step 2		Step 2	
	Copper	Zinc	Velocity	DI
Allowable Exceedances/year	2	2	0.03	93.80
No. of exceedances/year	0.1	0.9		
No. of exceedances/worst year	1	3		
No. of exceedances/summer	0.1	0.6		
No. of exceedances/worst summer	1	3		
Allowable Exceedances/year	1	1		
No. of exceedances/year	0	0		
No. of exceedances/worst year	0	0		
No. of exceedances/summer	0	0		
No. of exceedances/worst summer	0	0		
Annual average concentration (µg/l)	0.26	0.83		
Thresholds	(µg/l)	(µg/l)		
Thresholds	RST24 21	RST6 60		
Event Statistics	Mean	Mean		
	90%ile	90%ile		
	95%ile	95%ile		
	99%ile	99%ile		
	0.81	2.56		
	2.25	5.76		
	4.32	10.91		
	9.84	43.82		

Velocity **0.03** m/s Tier 1 is used for the calculation  
 DI **93.80**  
 % settlement needed **0** %

#### In River (with mitigation)

	Step 3		DI
	Copper	Zinc	
Allowable Exceedances/year	2	2	-
No. of exceedances/year	-	-	
No. of exceedances/worst year	-	-	
No. of exceedances/summer	-	-	
No. of exceedances/worst summer	-	-	
Allowable Exceedances/year	1	1	
No. of exceedances/year	-	-	
No. of exceedances/worst year	-	-	
No. of exceedances/summer	-	-	
No. of exceedances/worst summer	-	-	
Annual average concentration (µg/l)	-	-	
Thresholds	(µg/l)	(µg/l)	
Thresholds	RST24 21	RST6 60	
Event Statistics	Mean	Mean	
	90%ile	90%ile	
	95%ile	95%ile	
	99%ile	99%ile	
	-	-	
	-	-	
	-	-	
	-	-	

**Route Option 3A: Drainage Catchment 2**

Summary of predictions

Soluble - Acute Impact

Sediment - Chronic Impact

Prediction of impact	Step 1
	Step 2
	Step 3

Copper	Zinc

Copper	Zinc	Cadmium	Total PAH	Pyrene	Fluoranthene	Anthracene	Phenanthrene

**DETAILED RESULTS**

In Runoff

Step 1

Step 1

Allowable Exceedances/year  
No. of exceedances/year  
No. of exceedances/worst year

RST24	
Copper	Zinc
1	1
63.00	56.70
81	64

RST24		RST6		RST24		RST6	
Copper	Zinc	Cadmium	Total PAH	Pyrene	Fluoranthene	Anthracene	Phenanthrene
1	1	1	1	1	1	1	1
83.80	112.10	2.20	48.30	111.00	48.30	23.00	91.00
97	128	7	59	127	59	32	101

Allowable Exceedances/year  
No. of exceedances/year  
No. of exceedances/worst year

RST6	
Copper	Zinc
1	1
18.00	20.60
24	27

Toxicity Threshold		Toxicity Threshold		Toxicity Threshold		Toxicity Threshold	
(mg/kg)	(mg/kg)	(mg/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)
197	315	3.5	16770	875	2355	245	515

Thresholds  
Thresholds

	(ug/l)	(ug/l)
RST24	21	60
RST6	42	120

	(mg/kg)	(mg/kg)	(mg/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)
Toxicity Threshold	197	315	3.5	16770	875	2355	245

Event Statistics  
Mean  
90%ile  
95%ile  
99%ile

	Mean	90%ile	95%ile	99%ile
Copper	23.86	45.65	54.99	66.36
Zinc	67.70	147.58	194.62	372.28

	Mean	90%ile	95%ile	99%ile
Cadmium	1	2	3	4
Total PAH	16068	35481	70795	89125
Pyrene	2780	6138	12247	15419
Fluoranthene	2667	5890	11752	14795
Anthracene	170	376	750	945
Phenanthrene	752	1661	3313	4171

In River (no mitigation)

Step 2

Step 2

Allowable Exceedances/year  
No. of exceedances/year  
No. of exceedances/worst year  
No. of exceedances/summer  
No. of exceedances/worst summer

RST24	
Copper	Zinc
2	2
0.1	0.9
1	3
0.1	0.6
1	3

Velocity **6.10** m/s Tier 1 is used for the calculation  
 DI **44.20**  
 % settlement needed  %

Allowable Exceedances/year  
No. of exceedances/year  
No. of exceedances/worst year  
No. of exceedances/summer  
No. of exceedances/worst summer

RST6	
Copper	Zinc
1	1
0	0
0	0
0	0
0	0

Annual average concentration (ug/l)

Copper	0.26	0.82
--------	------	------

Thresholds  
Thresholds

	(ug/l)	(ug/l)
RST24	21	60
RST6	42	120

Event Statistics  
Mean  
90%ile  
95%ile  
99%ile

	Mean	90%ile	95%ile	99%ile
Copper	0.79	2.21	4.23	9.65
Zinc	2.91	5.67	10.70	42.84

In River (with mitigation)

Step 2

Allowable Exceedances/year  
No. of exceedances/year  
No. of exceedances/worst year  
No. of exceedances/summer  
No. of exceedances/worst summer

RST24	
Copper	Zinc
2	2
-	-
-	-
-	-
-	-

DI

Allowable Exceedances/year  
No. of exceedances/year  
No. of exceedances/worst year  
No. of exceedances/summer  
No. of exceedances/worst summer

RST6	
Copper	Zinc
1	1
-	-
-	-
-	-
-	-

Annual average concentration (ug/l)

Copper	-	-
--------	---	---

Thresholds  
Thresholds

	(ug/l)	(ug/l)
RST24	21	60
RST6	42	120

Event Statistics  
Mean  
90%ile  
95%ile  
99%ile

	Mean	90%ile	95%ile	99%ile
Copper	-	-	-	-
Zinc	-	-	-	-



**Route Option 3A: Drainage Catchment 4**

Summary of predictions

Prediction of impact	Step 1
	Step 2
	Step 3

**Soluble - Acute Impact**

Copper	Zinc

**Sediment - Chronic Impact**

Copper	Zinc	Cadmium	Total PAH	Pyrene	Fluoranthene	Astracene	Phenanthrene

**DETAILED RESULTS**

**In Runoff**

Allowable Exceedances/year  
No. of exceedances/year  
No. of exceedances/worst year

Allowable Exceedances/year  
No. of exceedances/year  
No. of exceedances/worst year

Thresholds  
Thresholds

Event Statistics Mean  
90%ile  
95%ile  
99%ile

Step 1	
Copper	Zinc
RST24	
1	1
83.00	56.70
81	64
RST6	
1	1
18.00	20.90
24	27
	(µg/l)
RST24	21
RST6	42
	(µg/l)
	23.36
	45.65
	54.99
	96.36
	67.70
	147.58
	194.62
	372.28

Step 1							
Copper	Zinc	Cadmium	Total PAH	Pyrene	Fluoranthene	Astracene	Phenanthrene
Toxicity Threshold							
1	1	1	1	1	1	1	1
83.80	112.50	2.20	48.30	111.00	48.30	23.60	91.60
97	128	7	59	127	59	32	101
	(mg/kg)	(mg/kg)	(µg/kg)	(µg/kg)	(µg/kg)	(µg/kg)	(µg/kg)
Toxicity Threshold	197	315	3.5	16770	875	2355	245
	331	1165	1	16068	2780	2667	170
	733	2672	2	35481	6138	5890	376
	962	3572	3	70795	12247	11752	750
	1383	5637	4	89125	15419	14795	945

**In River (no mitigation)**

Allowable Exceedances/year  
No. of exceedances/year  
No. of exceedances/worst year  
No. of exceedances/summer  
No. of exceedances/worst summer

Allowable Exceedances/year  
No. of exceedances/year  
No. of exceedances/worst year  
No. of exceedances/summer  
No. of exceedances/worst summer

Annual average concentration (µg/l)

Thresholds  
Thresholds

Event Statistics Mean  
90%ile  
95%ile  
99%ile

Step 2	
Copper	Zinc
RST24	
2	2
0.2	0.9
1	3
0.1	0.6
1	3
RST6	
1	1
9	0.1
0	1
0	0
0	0
	(µg/l)
RST24	21
RST6	42
	(µg/l)
	0.93
	2.58
	5.21
	11.18
	2.92
	6.54
	12.63
	50.94

Velocity **0.05** m/s Tier 1 is used for the calculation

DI **78.96**

% settlement needed **0** %

**In River (with mitigation)**

Allowable Exceedances/year  
No. of exceedances/year  
No. of exceedances/worst year  
No. of exceedances/summer  
No. of exceedances/worst summer

Allowable Exceedances/year  
No. of exceedances/year  
No. of exceedances/worst year  
No. of exceedances/summer  
No. of exceedances/worst summer

Annual average concentration (µg/l)

Thresholds  
Thresholds

Event Statistics Mean  
90%ile  
95%ile  
99%ile

Step 3	
Copper	Zinc
RST24	
2	2
-	-
-	-
-	-
RST6	
1	1
-	-
-	-
-	-
-	-
	(µg/l)
RST24	21
RST6	42
	(µg/l)
	-
	-
	-
	-

DI **-**

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**Route Option 3A: Drainage Catchment 5**

**Summary of predictions**

Prediction of impact	Step 1
	Step 2
	Step 3

**Soluble - Acute Impact**

Copper	Zinc

**Sediment - Chronic Impact**

Copper	Zinc	Cadmium	Total PAH	Pyrene	Fluoranthene	Anthracene	Phenanthrene

**DETAILED RESULTS**

**In Runoff**

Allowable Exceedances/year	1
No. of exceedances/year	63.00
No. of exceedances/worst year	81
Allowable Exceedances/year	1
No. of exceedances/year	18.00
No. of exceedances/worst year	24
Thresholds	(ug/l)
Thresholds	RST24 21, RST6 42
Event Statistics	Mean 23.36, 90%ile 45.65, 95%ile 54.99, 99%ile 96.36

Step 1	Copper	Zinc
	RST24	
	1	1
	63.00	96.70
	81	64
	RST6	
	1	1
	18.00	29.60
	24	27
	(ug/l)	(ug/l)
	RST24 21	RST6 42
	69	120
	23.36	67.70
	45.65	147.58
	54.99	194.62
	96.36	372.28

Step 1	Copper	Zinc	Cadmium	Total PAH	Pyrene	Fluoranthene	Anthracene	Phenanthrene
	Toxicity Threshold							
	1	1	1	1	1	1	1	1
	83.00	112.10	2.20	48.30	111.00	40.30	23.00	91.00
	97	128	7	59	127	59	32	101
	(mg/kg)	(mg/kg)	(mg/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)
	197	315	3.5	16778	875	2355	245	515
	331	1165	1	16068	2780	2667	170	752
	733	2672	2	35481	6138	5890	376	1661
	962	3572	3	70795	12247	11752	750	3313
	1583	5687	4	89125	15419	14795	945	4171

**In River (no mitigation)**

Allowable Exceedances/year	2
No. of exceedances/year	0.1
No. of exceedances/worst year	1
No. of exceedances/summer	0.1
No. of exceedances/worst summer	1
Allowable Exceedances/year	1
No. of exceedances/year	0
No. of exceedances/worst year	0
No. of exceedances/summer	0
No. of exceedances/worst summer	0
Annual average concentration (ug/l)	0.27
Thresholds	(ug/l)
Thresholds	RST24 21, RST6 42
Event Statistics	Mean 0.82, 90%ile 2.24, 95%ile 4.54, 99%ile 10.05

Step 2	Copper	Zinc
	RST24	
	2	2
	0.1	0.9
	1	3
	0.1	0.6
	1	3
	RST6	
	1	1
	0	0
	0	0
	0	0
	0	0
	(ug/l)	(ug/l)
	RST24 21	RST6 42
	69	120
	0.82	2.60
	2.24	5.83
	4.54	11.21
	10.05	45.32

Velocity 0.02 m/s  
 DI 127.81  
 % settlement needed 22 %  
 Trier 1 is used for the calculation

**In River (with mitigation)**

Allowable Exceedances/year	2
No. of exceedances/year	-
No. of exceedances/worst year	-
No. of exceedances/summer	-
No. of exceedances/worst summer	-
Allowable Exceedances/year	1
No. of exceedances/year	-
No. of exceedances/worst year	-
No. of exceedances/summer	-
No. of exceedances/worst summer	-
Annual average concentration (ug/l)	-
Thresholds	(ug/l)
Thresholds	RST24 21, RST6 42
Event Statistics	Mean -, 90%ile -, 95%ile -, 99%ile -

Step 3	Copper	Zinc
	RST24	
	2	2
	-	-
	-	-
	-	-
	-	-
	RST6	
	1	1
	-	-
	-	-
	-	-
	-	-
	(ug/l)	(ug/l)
	RST24 21	RST6 42
	69	120
	-	-
	-	-
	-	-
	-	-

DI -

**Route Option 3B: Drainage Catchment 1**

Summary of predictions

Soluble - Acute Impact

Sediment - Chronic Impact

Prediction of impact	Step1
	Step2
	Step3

Copper	Zinc

Copper	Zinc	Cadmium	Total PAH	Pyrene	Fluoranthene	Anthracene	Phenanthrene

**DETAILED RESULTS**

**In Runoff**

Step 1

Step 1

Allowable Exceedances/year  
No. of exceedances/year  
No. of exceedances/worst year

Copper	Zinc
RST24	
1	1
63.80	56.70
81	64

Copper	Zinc	Cadmium	Total PAH	Pyrene	Fluoranthene	Anthracene	Phenanthrene
Toxicity Threshold							
1	1	1	1	1	1	1	1
83.80	112.50	2.20	48.30	111.00	48.30	23.00	91.00
97	128	7	50	127	50	32	101

Allowable Exceedances/year  
No. of exceedances/year  
No. of exceedances/worst year

Copper	Zinc
RST6	
1	1
18.00	20.60
24	27

Copper	Zinc	Cadmium	Total PAH	Pyrene	Fluoranthene	Anthracene	Phenanthrene
Toxicity Threshold							
1	1	1	1	1	1	1	1
83.80	112.50	2.20	48.30	111.00	48.30	23.00	91.00
97	128	7	50	127	50	32	101

Thresholds  
Thresholds

	(µg/l)	(µg/l)
RST24	21	60
RST6	42	120

Toxicity Threshold	(mg/kg)	(mg/kg)	(mg/kg)	(µg/kg)	(µg/kg)	(µg/kg)	(µg/kg)
	197	315	3.5	10770	875	2355	245

Event Statistics  
Mean  
90%ile  
95%ile  
99%ile

	23.36	67.70
	45.65	147.58
	54.99	194.62
	96.36	372.28

	331	1165	1	16068	2780	2667	170
	738	2672	2	35481	6138	5890	376
	962	3572	3	70795	12247	11752	750
	1883	5687	4	89125	15419	14795	945

**In River (no mitigation)**

Step 2

Step 2

Allowable Exceedances/year  
No. of exceedances/year  
No. of exceedances/worst year  
No. of exceedances/summer  
No. of exceedances/worst summer

Copper	Zinc
RST24	
2	2
0.1	0.9
1	3
0.3	0.6
1	3

Velocity 0.03 m/s Tier 1 is used for the calculation  
 DI 93.80  
 % settlement needed 0 %

Allowable Exceedances/year  
No. of exceedances/year  
No. of exceedances/worst year  
No. of exceedances/summer  
No. of exceedances/worst summer

Copper	Zinc
RST6	
1	1
0	0
0	0
0	0
0	0

Annual average concentration (µg/l)

Copper	Zinc
0.26	0.83

Thresholds  
Thresholds

	(µg/l)	(µg/l)
RST24	21	60
RST6	42	120

Event Statistics  
Mean  
90%ile  
95%ile  
99%ile

	0.81	2.56
	2.25	5.70
	4.32	10.91
	9.84	43.82

**In River (with mitigation)**

Step 3

Allowable Exceedances/year  
No. of exceedances/year  
No. of exceedances/worst year  
No. of exceedances/summer  
No. of exceedances/worst summer

Copper	Zinc
RST24	
2	2
-	-
-	-
-	-
-	-

DI -

Allowable Exceedances/year  
No. of exceedances/year  
No. of exceedances/worst year  
No. of exceedances/summer  
No. of exceedances/worst summer

Copper	Zinc
RST6	
1	1
-	-
-	-
-	-
-	-

Annual average concentration (µg/l)

Copper	Zinc
-	-

Thresholds  
Thresholds

	(µg/l)	(µg/l)
RST24	21	60
RST6	42	120

Event Statistics  
Mean  
90%ile  
95%ile  
99%ile

	-	-
	-	-
	-	-
	-	-

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**Route Option 3B: Drainage Catchment 2**

Summary of predictions

Soluble - Acute Impact

Sediment - Chronic Impact

Prediction of impact	Step 1
	Step 2
	Step 3

Copper	Zinc

Copper	Zinc	Cadmium	Total PAH	Pyrene	Fluoranthene	Anthracene	Phenanthrene

**DETAILED RESULTS**

In Runoff

Step 1

Step 1

Allowable Exceedances/year  
No. of exceedances/year  
No. of exceedances/worst year

Copper	Zinc
RST24	
1	1
63.00	56.70
81	64

Copper	Zinc	Cadmium	Total PAH	Pyrene	Fluoranthene	Anthracene	Phenanthrene
Toxicity Threshold							
1	1	1	1	1	1	1	1
63.00	112.10	2.20	48.30	111.00	48.30	23.00	91.00
97	128	7	59	127	59	32	101

Allowable Exceedances/year  
No. of exceedances/year  
No. of exceedances/worst year

Copper	Zinc
RST6	
1	1
18.00	29.40
24	27

	(mg/kg)	(mg/kg)	(mg/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)
Toxicity Threshold	197	315	3.5	10770	875	2355	245

Event Statistics  
Mean  
90%ile  
95%ile  
99%ile

(ug/l)	(ug/l)
23.36	67.70
45.65	147.56
54.99	194.62
96.36	372.28

	(mg/kg)	(mg/kg)	(mg/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)
	331	3105	1	10098	2780	2067	170
	733	2672	2	35481	6138	5890	376
	962	3572	3	70795	12347	11752	750
	1385	5637	4	89125	15419	14795	945

In River (no mitigation)

Step 2

Step 2

Allowable Exceedances/year  
No. of exceedances/year  
No. of exceedances/worst year  
No. of exceedances/summer  
No. of exceedances/worst summer

Copper	Zinc
RST24	
2	2
0.1	0.3
1	3
0.1	0.6
1	3

Velocity **0.10** m/s Tier 1 is used for the calculation  
 DE **46.06**  
 % settlement needed **0** %

Allowable Exceedances/year  
No. of exceedances/year  
No. of exceedances/worst year  
No. of exceedances/summer  
No. of exceedances/worst summer

Copper	Zinc
RST6	
1	1
0	0
0	0
0	0
0	0

Annual average concentration (ug/l)

Copper	Zinc
0.27	0.85

Thresholds  
Thresholds

	(ug/l)	(ug/l)
RST24	21	66
RST6	42	120

Event Statistics  
Mean  
90%ile  
95%ile  
99%ile

	(ug/l)	(ug/l)
	0.82	2.59
	2.30	5.89
	4.40	11.05
	9.94	43.93

In River (with mitigation)

Step 2

Allowable Exceedances/year  
No. of exceedances/year  
No. of exceedances/worst year  
No. of exceedances/summer  
No. of exceedances/worst summer

Copper	Zinc
RST24	
2	2
-	-
-	-
-	-
-	-

DE **-**

Allowable Exceedances/year  
No. of exceedances/year  
No. of exceedances/worst year  
No. of exceedances/summer  
No. of exceedances/worst summer

Copper	Zinc
RST6	
1	1
-	-
-	-
-	-
-	-

Annual average concentration (ug/l)

Copper	Zinc
-	-

Thresholds  
Thresholds

	(ug/l)	(ug/l)
RST24	21	66
RST6	42	120

Event Statistics  
Mean  
90%ile  
95%ile  
99%ile

	(ug/l)	(ug/l)
	-	-
	-	-
	-	-
	-	-

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**Route Option 3B: Drainage Catchment 3**

Summary of predictions

Prediction of impact	Step1
	Step2
	Step3

Soluble - Acute Impact

Copper	Zinc

Sediment - Chronic Impact

Copper	Zinc	Cadmium	Total PAH	Pyrene	Fluoranthene	Anthracene	Phenanthrene

**DETAILED RESULTS**

**In Runoff**

**Step 1**

Copper		Zinc	
RST24			
1	1		
83.00	56.70		
81	64		
RST6			
1	1		
18.00	20.90		
24	27		
(µg/l)		(µg/l)	
RST24	21	60	
RST6	42	120	
Event Statistics		Mean	
90%ile	23.36	67.70	
95%ile	45.65	147.58	
99%ile	54.99	194.62	
99%ile	96.36	372.28	

**Step 1**

Copper		Zinc		Cadmium		Total PAH		Pyrene		Fluoranthene		Anthracene		Phenanthrene	
Toxicity Threshold															
1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
83.80	112.10	2.20	48.30	111.00	48.30	23.80	91.80								
97	128	7	59	127	59	32	101								
(mg/kg)		(mg/kg)		(mg/kg)		(µg/g)		(µg/g)		(µg/g)		(µg/g)		(µg/g)	
Toxicity Threshold	197	315	3.5	16770	875	2355	245	515							
Event Statistics		Mean		90%ile		95%ile		99%ile		Mean		90%ile		95%ile	
	331	1165	1	16068	2780	2667	170	752							
	733	2672	2	35481	6138	5890	376	1661							
	902	3972	3	70795	12247	11752	750	3313							
	1383	5637	4	89125	15419	14795	945	4171							

**In River (no mitigation)**

**Step 2**

Copper		Zinc	
RST24			
2	2		
0.5	1.6		
1	5		
0.2	1		
1	5		
RST6			
1	1		
0	0.2		
0	0		
0	0		
Annual average concentration (µg/l)		0.46	
		1.41	
(µg/l)		(µg/l)	
RST24	21	60	
RST6	42	120	
Event Statistics		Mean	
90%ile	1.31	4.08	
95%ile	3.76	9.15	
99%ile	6.87	17.96	
99%ile	14.04	62.37	

**Step 2**

Velocity  m/s Tier 1 is used for the calculation  
 DI   
 % settlement needed  %

**In River (with mitigation)**

**Step 3**

Copper		Zinc	
RST24			
2	2		
-	-		
-	-		
-	-		
-	-		
RST6			
1	1		
-	-		
-	-		
-	-		
-	-		
Annual average concentration (µg/l)		-	
		-	
(µg/l)		(µg/l)	
RST24	21	60	
RST6	42	120	
Event Statistics		Mean	
90%ile	-	-	
95%ile	-	-	
99%ile	-	-	
99%ile	-	-	

DI

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**Route Option 3B: Drainage Catchment 4**

Summary of predictions

Soluble - Acute Impact

Sediment - Chronic Impact

Prediction of Impact	Step 1
	Step 2
	Step 3

Copper	Zinc

Copper	Zinc	Cadmium	Total PAH	Pyrene	Fluoranthene	Anthracene	Phenanthrene

**DETAILED RESULTS**

In Runoff

Step 1

Step 1

Allowable Exceedances/year  
No. of exceedances/year  
No. of exceedances/worst year

RST24	
Copper	Zinc
1	1
63.60	56.70
81	64

Copper	Zinc	Cadmium	Total PAH	Pyrene	Fluoranthene	Anthracene	Phenanthrene
Toxicity Threshold							
1	1	1	1	1	1	1	1
63.60	112.19	2.20	48.30	111.00	48.30	23.00	91.00
97	128	7	59	127	59	32	101

Allowable Exceedances/year  
No. of exceedances/year  
No. of exceedances/worst year

RST6	
Copper	Zinc
1	1
18.00	20.00
24	27

	(mg/kg)	(mg/kg)	(mg/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)
Toxicity Threshold	197	315	3.5	16770	875	2355	245

Thresholds  
Thresholds

	(ug/l)	(ug/l)
RST24	21	60
RST6	42	128

331	1265	1	16968	2780	2667	170	752
738	2672	2	35481	6138	5990	376	1661
962	3372	3	70795	12247	11752	750	3313
1383	5687	4	89125	15419	14795	945	4171

Event Statistics Mean  
90%ile  
95%ile  
99%ile

23.36	67.70
45.65	147.58
54.99	194.62
96.36	872.28

In River (no mitigation)

Step 2

Step 2

Allowable Exceedances/year  
No. of exceedances/year  
No. of exceedances/worst year  
No. of exceedances/summer  
No. of exceedances/worst summer

RST24	
Copper	Zinc
2	2
6.2	6.9
1	3
0.1	0.6
1	3

Velocity **0.05** m/s Tier 1 is used for the calculation  
DI **81.18**  
% settlement needed **0** %

Allowable Exceedances/year  
No. of exceedances/year  
No. of exceedances/worst year  
No. of exceedances/summer  
No. of exceedances/worst summer

RST6	
Copper	Zinc
1	1
0	6.2
0	2
0	0
0	0

Annual average concentration (ug/l)

0.33	1.01
------	------

Thresholds  
Thresholds

	(ug/l)	(ug/l)
RST24	21	60
RST6	42	128

Event Statistics Mean  
90%ile  
95%ile  
99%ile

0.97	3.04
2.70	6.84
5.46	13.19
11.54	32.53

In River (with mitigation)

Step 3

Allowable Exceedances/year  
No. of exceedances/year  
No. of exceedances/worst year  
No. of exceedances/summer  
No. of exceedances/worst summer

RST24	
Copper	Zinc
2	2
-	-
-	-
-	-
-	-

DI **-**

Allowable Exceedances/year  
No. of exceedances/year  
No. of exceedances/worst year  
No. of exceedances/summer  
No. of exceedances/worst summer

RST6	
Copper	Zinc
1	1
-	-
-	-
-	-
-	-

Annual average concentration (ug/l)

-	-
---	---

Thresholds thresholds  
Thresholds

	(ug/l)	(ug/l)
RST24	21	60
RST6	42	128

Event Statistics Mean  
90%ile  
95%ile  
99%ile

-	-
-	-
-	-
-	-

**Route Option 3B: Drainage Catchment 5**

Summary of predictions

Soluble - Acute Impact

Sediment - Chronic Impact

Prediction of Impact	Step1
	Step2
	Step3

Copper	Zinc

Copper	Zinc	Cadmium	Total PAH	Pyrene	Fluoranthene	Anthracene	Phenanthrene

**DETAILED RESULTS**

**In Runoff**

Step 1

Step 1

Allowable Exceedances/year  
 No. of exceedances/year  
 No. of exceedances/worst year

Copper	Zinc
RST24	
1	1
63.60	56.70
81	64

Copper	Zinc	Cadmium	Total PAH	Pyrene	Fluoranthene	Anthracene	Phenanthrene
Toxicity Threshold							
1	1	1	1	1	1	1	1
83.89	112.99	2.20	48.30	111.00	48.30	23.00	91.06
97	128	7	59	127	59	32	101

Allowable Exceedances/year  
 No. of exceedances/year  
 No. of exceedances/worst year

Copper	Zinc
RST6	
1	1
18.80	20.60
24	27

	(mg/kg)	(mg/kg)	(mg/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)
Toxicity Threshold	197	315	3.5	16770	875	2355	245

Thresholds  
 Thresholds

	(ug/l)	(ug/l)
RST24	21	60
RST6	42	129

Event Statistics Mean  
 90%ile  
 95%ile  
 99%ile

	23.36	67.70
	45.65	147.58
	54.99	194.62
	96.36	872.28

	331	1165	1	16068	2780	2667	170	752
	738	2672	2	35481	6138	5890	876	1661
	962	3572	3	70795	12247	11752	750	3313
	1383	5687	4	89125	15419	14795	945	4171

**In River (no mitigation)**

Step 2

Step 2

Allowable Exceedances/year  
 No. of exceedances/year  
 No. of exceedances/worst year  
 No. of exceedances/summer  
 No. of exceedances/worst summer

Copper	Zinc
RST24	
2	2
0.2	1.3
1	4
0.1	0.8
1	4

Velocity  m/s Tier 1 is used for the calculation  
 DI   
 % settlement needed  %

Allowable Exceedances/year  
 No. of exceedances/year  
 No. of exceedances/worst year  
 No. of exceedances/summer  
 No. of exceedances/worst summer

Copper	Zinc
RST6	
1	1
0	0.2
0	2
0	0
0	0

Annual average concentration (ug/l)

	0.86	1.13
--	------	------

Thresholds  
 Thresholds

	(ug/l)	(ug/l)
RST24	21	60
RST6	42	129

Event Statistics Mean  
 90%ile  
 95%ile  
 99%ile

	1.07	3.35
	3.00	7.73
	5.89	14.63
	12.25	54.20

**In River (with mitigation)**

Step 3

Allowable Exceedances/year  
 No. of exceedances/year  
 No. of exceedances/worst year  
 No. of exceedances/summer  
 No. of exceedances/worst summer

Copper	Zinc
RST24	
2	2
-	-
-	-
-	-

DI

Allowable Exceedances/year  
 No. of exceedances/year  
 No. of exceedances/worst year  
 No. of exceedances/summer  
 No. of exceedances/worst summer

Copper	Zinc
RST6	
1	1
-	-
-	-
-	-

Annual average concentration (ug/l)

	-	-
--	---	---

Thresholds thresholds  
 Thresholds

	(ug/l)	(ug/l)
RST24	21	60
RST6	42	129

Event Statistics Mean  
 90%ile  
 95%ile  
 99%ile

	-	-
	-	-
	-	-
	-	-

**Routine Runoff Assessment: Cumulative Assessments  
Route Option 1B: Drainage Catchments 3 & 4**

Summary of predictions

Prediction of Impact	Step 1
	Step 2
	Step 3

Soluble - Acute Impact

Copper	Zinc

Sediment - Chronic Impact

Copper	Zinc	Cadmium	Total PAH	Pyrene	Fluoranthene	Anthracene	Phenanthrene

**DETAILED RESULTS**

**In Runoff**

Allowable Exceedances/year	
No. of exceedances/year	
No. of exceedances/worst year	
Allowable Exceedances/year	
No. of exceedances/year	
No. of exceedances/worst year	
Thresholds	
Thresholds	
Event Statistics	Mean
	90%ile
	95%ile
	99%ile

Step 1	
Copper	Zinc
RST24	
1	1
63.09	96.79
81	64
RST6	
1	1
18.09	20.69
24	27
(ug/l)	
RST24	RST6
21	60
42	120
(ug/l)	
23.36	67.70
45.65	147.58
54.99	104.62
96.36	372.28

Step 1							
Copper	Zinc	Cadmium	Total PAH	Pyrene	Fluoranthene	Anthracene	Phenanthrene
Toxicity Threshold							
1	1	1	1	1	1	1	1
(mg/kg)							
197	315	3.5	16779	875	2355	245	515
(ug/kg)							

**In River (no mitigation)**

Allowable Exceedances/year	
No. of exceedances/year	
No. of exceedances/worst year	
No. of exceedances/summer	
No. of exceedances/worst summer	
Allowable Exceedances/year	
No. of exceedances/year	
No. of exceedances/worst year	
No. of exceedances/summer	
No. of exceedances/worst summer	
Annual average concentration (ug/l)	
Thresholds	
Thresholds	
Event Statistics	Mean
	90%ile
	95%ile
	99%ile

Step 2	
Copper	Zinc
RST24	
2	2
1.1	2.2
3	5
0.6	1.2
3	5
RST6	
1	1
0	0.6
0	2
0	0.3
0	2
(ug/l)	
RST24	RST6
21	60
42	120
(ug/l)	
1.88	5.67
5.50	13.95
9.61	26.22
19.20	79.42

Velocity  m/s Tier 1 is used for the calculation  
 DI   
 % settlement needed  %

**In River (with mitigation)**

Allowable Exceedances/year	
No. of exceedances/year	
No. of exceedances/worst year	
No. of exceedances/summer	
No. of exceedances/worst summer	
Allowable Exceedances/year	
No. of exceedances/year	
No. of exceedances/worst year	
No. of exceedances/summer	
No. of exceedances/worst summer	
Annual average concentration (ug/l)	
Thresholds	
Thresholds	
Event Statistics	Mean
	90%ile
	95%ile
	99%ile

Step 2	
Copper	Zinc
RST24	
2	2
-	-
-	-
-	-
-	-
RST6	
1	1
-	-
-	-
-	-
-	-
(ug/l)	
RST24	RST6
21	60
42	120
(ug/l)	
-	-
-	-
-	-
-	-

DI

**Route Option 2B: Drainage Catchments 4 & 5**

**Summary of predictions**

**Soluble - Acute Impact**

**Sediment - Chronic Impact**

Prediction of impact	Step1
	Step2
	Step3

Copper	Zinc

Copper	Zinc	Cadmium	Total PAH	Pyrene	Fluoranthene	Anthracene	Phenanthrene

**DETAILED RESULTS**

**In Runoff**

**Step 1**

**Step 1**

Allowable Exceedances/year  
No. of exceedances/year  
No. of exceedances/worst year

Copper	Zinc
RST24	
1	1
63.00	56.70
81	64

Copper	Zinc	Cadmium	Total PAH	Pyrene	Fluoranthene	Anthracene	Phenanthrene
Toxicity Threshold							
1	1	1	1	1	1	1	1

Allowable Exceedances/year  
No. of exceedances/year  
No. of exceedances/worst year

Copper	Zinc
RST6	
1	1
18.00	20.00
24	27

	(mg/kg)	(mg/kg)	(mg/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)
Toxicity Threshold	197	315	3.5	16778	875	2355	245	515

Thresholds  
Thresholds

	(ug/l)	(ug/l)
RST24	21	69
RST6	42	120

Event Statistics  
Mean  
90%ile  
95%ile  
99%ile

	23.36	67.70
	45.65	147.58
	54.99	194.62
	96.36	372.28

**In River (no mitigation)**

**Step 2**

**Step 2**

Allowable Exceedances/year  
No. of exceedances/year  
No. of exceedances/worst year  
No. of exceedances/summer  
No. of exceedances/worst summer

Copper	Zinc
RST24	
2	2
1.1	2.2
3	5
0.6	1.2
3	5

Velocity  m/s Tier 1 is used for the calculation  
 DI   
 % settlement needed  %

Allowable Exceedances/year  
No. of exceedances/year  
No. of exceedances/worst year  
No. of exceedances/summer  
No. of exceedances/worst summer

Copper	Zinc
RST6	
1	1
0	0.6
0	2
0	0.3
0	2

Annual average concentration (ug/l)

Copper	Zinc
0.68	2.08

Thresholds  
Thresholds

	(ug/l)	(ug/l)
RST24	21	69
RST6	42	120

Event Statistics  
Mean  
90%ile  
95%ile  
99%ile

	1.88	5.67
	5.50	13.95
	9.61	26.22
	19.20	79.42

**In River (with mitigation)**

**Step 3**

Allowable Exceedances/year  
No. of exceedances/year  
No. of exceedances/worst year  
No. of exceedances/summer  
No. of exceedances/worst summer

Copper	Zinc
RST24	
2	2
-	-
-	-
-	-
-	-

DI

Allowable Exceedances/year  
No. of exceedances/year  
No. of exceedances/worst year  
No. of exceedances/summer  
No. of exceedances/worst summer

Copper	Zinc
RST6	
1	1
-	-
-	-
-	-
-	-

Annual average concentration (ug/l)

Copper	Zinc
-	-

Thresholds  
Thresholds

	(ug/l)	(ug/l)
RST24	21	69
RST6	42	120

Event Statistics  
Mean  
90%ile  
95%ile  
99%ile

	-	-
	-	-
	-	-
	-	-

**Route Option 3B: Drainage Catchments 3 & 4**

Summary of predictions

Soluble - Acute Impact

Sediment - Chronic Impact

Prediction of impact	Step 1
	Step 2
	Step 3

Copper	Zinc

Copper	Zinc	Cadmium	Total PAH	Pyrene	Fluoranthene	Anthracene	Phenanthrene

**DETAILED RESULTS**

**In Runoff**

Allowable Exceedances/year	
No. of exceedances/year	
No. of exceedances/worst year	
Allowable Exceedances/year	
No. of exceedances/year	
No. of exceedances/worst year	
Thresholds	
Thresholds	
Event Statistics	Mean
	90%ile
	95%ile
	99%ile

**Step 1**

Copper	Zinc
RST24	
1	1
63.00	96.70
81	64
RST6	
1	1
18.00	29.60
24	27
(ug/l)	(ug/l)
RST24	21
RST6	42
	90
	120
	23.36
	67.70
	45.65
	147.58
	54.99
	194.62
	96.36
	372.28

**Step 1**

Copper	Zinc	Cadmium	Total PAH	Pyrene	Fluoranthene	Anthracene	Phenanthrene
Toxicity Threshold							
1	1	1	1	1	1	1	1
(mg/kg)	(mg/kg)	(mg/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)
Toxicity Threshold	197	315	3.5	16770	875	2335	245

**In River (no mitigation)**

Allowable Exceedances/year	
No. of exceedances/year	
No. of exceedances/worst year	
No. of exceedances/summer	
No. of exceedances/worst summer	
Allowable Exceedances/year	
No. of exceedances/year	
No. of exceedances/worst year	
No. of exceedances/summer	
No. of exceedances/worst summer	
Annual average concentration (ug/l)	
Thresholds	
Thresholds	
Event Statistics	Mean
	90%ile
	95%ile
	99%ile

**Step 2**

Copper	Zinc
RST24	
7	2
1.1	2.2
3	5
0.6	1.2
3	5
RST6	
1	1
0	0.6
0	2
0	0.3
0	2
	0.68
	2.08
(ug/l)	(ug/l)
RST24	21
RST6	42
	90
	120
	1.88
	5.67
	5.50
	13.55
	9.61
	26.22
	19.20
	79.42

Velocity  m/s Tier 1 is used for the calculation

DI

% settlement needed  %

**In River (with mitigation)**

Allowable Exceedances/year	
No. of exceedances/year	
No. of exceedances/worst year	
No. of exceedances/summer	
No. of exceedances/worst summer	
Allowable Exceedances/year	
No. of exceedances/year	
No. of exceedances/worst year	
No. of exceedances/summer	
No. of exceedances/worst summer	
Annual average concentration (ug/l)	
Thresholds	
Thresholds	
Event Statistics	Mean
	90%ile
	95%ile
	99%ile

**Step 3**

Copper	Zinc
RST24	
2	2
-	-
-	-
-	-
-	-
RST6	
1	1
-	-
-	-
-	-
-	-
	-
	-
(ug/l)	(ug/l)
RST24	21
RST6	42
	90
	120
	-
	-
	-
	-

DI

## **4 Accidental Spillage Risk Assessment – Calculation Tables**

- 4.1.1 The following tables show details results site of Spillage Risk Assessment for all route options (1A, 1B, 2A, 2B, 3A and 3B) in relation to Method D – Assessment of Pollution Impacts from Spillages, outlined in DMRB Volume 11, Section 3, Part 10, HD45/09.

**Spillage Risk Results**

**Route Option 1A**

**Drainage Catchment 1**

2036 Do Something Catchment 1	Total Annual Accident Probability (Pacc)					Annual Pollution Incident Probability (Pinc)			
	Road Length (km)	Serious Spillage Risk Factor	Two-way AADT	%HGV	Annual Probability (Pacc)	Probability Factor (Ppol)	Probability	Return Period (years)	Percentage Probability (%)
Road within 100m of roundabout	0.1	5.35	21,936	1.44	0.00006168315	0.45	2.77574E-05	36026	0.003
Road within 100m of side road	0.02	1.81	21,936	1.44	0.00000417370	0.45	1.87817E-06	532434	0.000
Road within 100m of side road	0.02	1.81	21,883	1.44	0.00000416362	0.45	1.87363E-06	533723	0.000
Road within 100m of side road	0.1	1.81	21,883	1.44	0.00002081809	0.45	9.36814E-06	106744	0.001
Road no junction	0.28	0.31	21,883	1.44	0.00000998348	0.45	4.49257E-06	222589	0.000
Total for Catchment 1					0.00010082204	0.45	4.53699E-05	22041	0.005

**Drainage Catchment 2**

2036 Do Something Catchment 2	Total Annual Accident Probability (Pacc)					Annual Pollution Incident Probability (Pinc)			
	Road Length (km)	Serious Spillage Risk Factor	Two-way AADT	%HGV	Annual Probability (Pacc)	Probability Factor (Ppol)	Probability	Return Period (years)	Percentage Probability (%)
Road no junction	0.47	0.31	21,883	1.44	0.00001675798	0.45	7.54109E-06	132607	0.001
Road within 100m of roundabout	0.1	5.35	21,883	1.44	0.00006153412	0.45	2.76904E-05	36114	0.003
Road within 100m of roundabout	0.1	5.35	5,199	3.10	0.00003147228	0.45	1.41625E-05	70609	0.001
Road within 100m of side road	0.04	1.81	5,199	3.10	0.00000425905	0.45	1.91657E-06	521765	0.000
Road within 100m of roundabout	0.08	5.35	7,187	1.39	0.00001560627	0.45	7.02282E-06	142393	0.001
Road within 100m of roundabout	0.1	5.35	2,514	1.46	0.00000716745	0.45	3.22535E-06	310044	0.000
Road no junction	0.12	0.31	2,514	1.46	0.00000049837	0.45	2.24268E-07	4458960	0.000
Road within 100m of roundabout	0.1	5.35	28,760	1.12	0.00006290042	0.45	2.83052E-05	35329	0.003
Road no junction	0.29	0.31	28,760	1.12	0.00001056962	0.45	4.75633E-06	210246	0.000
Total for Catchment 2					0.00021076557	0.45	9.48445E-05	10544	0.009

**Drainage Catchment 3**

2036 Do Something Catchment 3	Total Annual Accident Probability (Pacc)					Annual Pollution Incident Probability (Pinc)			
	Road Length (km)	Serious Spillage Risk Factor	Two-way AADT	%HGV	Annual Probability (Pacc)	Probability Factor (Ppol)	Probability	Return Period (years)	Percentage Probability (%)
Road no junction	0.18	0.31	28,760	1.12	0.00000656046	0.45	2.9522E-06	338730	0.000
Road within 100m of roundabout	0.1	5.35	28,760	1.12	0.00006290042	0.45	2.83052E-05	35329	0.003
Road within 100m of roundabout	0.1	5.35	22,162	1.43	0.00006188589	0.45	2.78487E-05	35908	0.003
Road no junction	0.42	0.31	22,162	1.43	0.00001255069	0.45	5.64781E-06	177060	0.001
Total for Catchment 3					0.00014389745	0.45	6.47539E-05	15443	0.006

**Drainage Catchment 4**

2036 Do Something Catchment 4	Total Annual Accident Probability (Pacc)					Annual Pollution Incident Probability (Pinc)			
	Road Length (km)	Serious Spillage Risk Factor	Two-way AADT	%HGV	Annual Probability (Pacc)	Probability Factor (Ppol)	Probability	Return Period (years)	Percentage Probability (%)
Road no junction	0.39	0.31	22,162	1.43	0.00001398505	0.45	6.29327E-06	158900	0.001
Road within 100m of roundabout	0.1	5.35	22,162	1.43	0.00006188589	0.45	2.78487E-05	35908	0.003
Total for Catchment 4					0.00007587094	0.45	3.41419E-05	29290	0.003

**Drainage Catchment 5**

2036 Do Something Catchment 5	Total Annual Accident Probability (Pacc)					Annual Pollution Incident Probability (Pinc)			
	Road Length (km)	Serious Spillage Risk Factor	Two-way AADT	%HGV	Annual Probability (Pacc)	Probability Factor (Ppol)	Probability	Return Period (years)	Percentage Probability (%)
Road within 100m of roundabout	0.1	5.35	6,404	0.55	0.00000687798	0.45	3.09509E-06	323092	0.000
Road no junction	0.35	0.31	6,404	0.55	0.00000139488	0.45	6.27696E-07	1593129	0.000
Total for Catchment 5					0.00000827286	0.45	3.72278E-06	268616	0.000

**Route Option 1B**

**Drainage Catchment 1**

2036 Do Something Catchment 1	Total Annual Accident Probability (Pacc)					Annual Pollution Incident Probability (Pinc)			
	Road Length (km)	Serious Spillage Risk Factor	Two-way AADT	%HGV	Annual Probability (Pacc)	Probability Factor (Ppol)	Probability	Return Period (years)	Percentage Probability (%)
Road within 100m of roundabout	0.1	5.35	21,936	1.44	0.00006168315	0.45	2.77574E-05	36026	0.003
Road within 100m of side road	0.02	1.81	21,936	1.44	0.00000417370	0.45	1.87817E-06	532434	0.000
Road within 100m of side road	0.02	1.81	21,883	1.44	0.00000416362	0.45	1.87363E-06	533724	0.000
Road within 100m of side road	0.1	1.81	21,883	1.44	0.00002081809	0.45	9.36814E-06	106745	0.001
Road no junction	0.28	0.31	21,883	1.44	0.00000998348	0.45	4.49257E-06	222590	0.000
Total for Catchment 1					0.00010082204	0.45	4.53699E-05	22041	0.005

**Drainage Catchment 2**

2036 Do Something Catchment 2	Total Annual Accident Probability (Pacc)					Annual Pollution Incident Probability (Pinc)			
	Road Length (km)	Serious Spillage Risk Factor	Two-way AADT	%HGV	Annual Probability (Pacc)	Probability Factor (Ppol)	Probability	Return Period (years)	Percentage Probability (%)
Road no junction	0.47	0.31	21,883	1.44	0.00001675798	0.45	7.54109E-06	132607	0.001
Road within 100m of roundabout	0.1	5.35	21,883	1.44	0.00006153412	0.45	2.76904E-05	36114	0.003
Road within 100m of roundabout	0.1	5.35	5,199	3.10	0.00003147228	0.45	1.41625E-05	70609	0.001
Road within 100m of side road	0.04	1.81	5,199	3.10	0.00000425905	0.45	1.91657E-06	521765	0.000
Road within 100m of roundabout	0.08	5.35	7,187	1.39	0.00001560627	0.45	7.02282E-06	142393	0.001
Road within 100m of roundabout	0.1	5.35	2,514	1.46	0.00000716745	0.45	3.22535E-06	310044	0.000
Road no junction	0.12	0.31	2,514	1.46	0.00000049837	0.45	2.24268E-07	4458960	0.000
Road within 100m of roundabout	0.1	5.35	28,760	1.12	0.00006290042	0.45	2.83052E-05	35329	0.003
Road no junction	0.3	0.31	28,760	1.12	0.00001093409	0.45	4.92034E-06	203238	0.000
Total for Catchment 2					0.00021113004	0.45	9.50085E-05	10525	0.010

**Drainage Catchment 3**

2036 Do Something Catchment 3	Total Annual Accident Probability (Pacc)					Annual Pollution Incident Probability (Pinc)			
	Road Length (km)	Serious Spillage Risk Factor	Two-way AADT	%HGV	Annual Probability (Pacc)	Probability Factor (Ppol)	Probability	Return Period (years)	Percentage Probability (%)
Road no junction	0.06	0.31	28,760	1.12	0.00000218682	0.45	9.84068E-07	1016190	0.000
Road within 100m of roundabout	0.1	5.35	28,760	1.12	0.00006290042	0.45	2.83052E-05	35329	0.003
Road within 100m of roundabout	0.1	5.35	22,162	1.43	0.00006188589	0.45	2.78487E-05	35908	0.003
Road no junction	0.11	0.31	22,162	1.43	0.00000394450	0.45	1.77503E-06	563372	0.000
Road within 100m of side road	0.1	1.81	22,162	1.43	0.00002093710	0.45	9.42169E-06	106138	0.001
Road within 100m of side road	0.1	1.81	22,162	1.43	0.00002093710	0.45	9.42169E-06	106138	0.001
Road no junction	0.21	0.31	22,162	1.43	0.00000753041	0.45	3.38869E-06	295100	0.000
Total for Catchment 3					0.00018032223	0.45	8.1145E-05	12324	0.008

**Drainage Catchment 4**

2036 Do Something Catchment 4	Total Annual Accident Probability (Pacc)					Annual Pollution Incident Probability (Pinc)			
	Road Length (km)	Serious Spillage Risk Factor	Two-way AADT	%HGV	Annual Probability (Pacc)	Probability Factor (Ppol)	Probability	Return Period (years)	Percentage Probability (%)
Road no junction	0.41	0.31	22,162	1.43	0.00001470224	0.45	6.61601E-06	151149	0.001
Road within 100m of roundabout	0.1	5.35	22,162	1.43	0.00006188589	0.45	2.78487E-05	35908	0.003
Total for Catchment 4					0.00007658813	0.45	3.44647E-05	29015	0.003

**Drainage Catchment 5**

2036 Do Something Catchment 5	Total Annual Accident Probability (Pacc)					Annual Pollution Incident Probability (Pinc)			
	Road Length (km)	Serious Spillage Risk Factor	Two-way AADT	%HGV	Annual Probability (Pacc)	Probability Factor (Ppol)	Probability	Return Period (years)	Percentage Probability (%)
Road within 100m of roundabout	0.1	5.35	6,404	0.55	0.00000687798	0.45	3.09509E-06	323092	0.000
Road no junction	0.54	0.31	6,404	0.55	0.00000215210	0.45	9.68445E-07	1032583	0.000
Total for Catchment 5					0.00000903008	0.45	4.06353E-06	246091	0.000

Cumulative annual probability from catchments 3 and 4 = 0.012%

**Route Option 2A**

**Drainage Catchment 1**

2036 Do Something Catchment 1	Total Annual Accident Probability (Pacc)					Annual Pollution Incident Probability (Pinc)			
	Road Length (km)	Serious Spillage Risk Factor	Two-way AADT	%HGV	Annual Probability (Pacc)	Probability Factor (Ppol)	Probability	Return Period (years)	Percentage Probability (%)
Road within 100m of roundabout	0.1	5.35	27,711	2.48	0.00013419939	0.45	6.03897E-05	16559	0.006
Road within 100m of side road	0.02	1.81	27,711	2.48	0.00000908041	0.45	4.08618E-06	244727	0.000
Road within 100m of side road	0.02	1.81	27,826	2.45	0.00000900779	0.45	4.05351E-06	246700	0.000
Road within 100m of side road	0.1	1.81	27,826	2.45	0.00004503895	0.45	2.02675E-05	49340	0.002
Road no junction	0.18	0.31	27,826	2.45	0.00001388494	0.45	6.24822E-06	160046	0.001
Road within 100m of crossroad	0.1	1.46	27,826	2.45	0.00003632976	0.45	1.63484E-05	61168	0.002
Total for Catchment 1					0.00024754124	0.45	0.000111394	8977	0.011

**Drainage Catchment 2**

2036 Do Something Catchment 2	Total Annual Accident Probability (Pacc)					Annual Pollution Incident Probability (Pinc)			
	Road Length (km)	Serious Spillage Risk Factor	Two-way AADT	%HGV	Annual Probability (Pacc)	Probability Factor (Ppol)	Probability	Return Period (years)	Percentage Probability (%)
Road within 100m of crossroad	0.1	1.46	9,351	2.44	0.00001215888	0.45	5.4715E-06	182765	0.001
Road no junction	0.37	0.31	9,351	2.44	0.00000955222	0.45	4.2985E-06	232639	0.000
Road within 100m of slip road	0.1	0.36	9,351	2.44	0.00000299808	0.45	1.34914E-06	741215	0.000
Road within 100m of crossroad	0.1	1.46	5,039	3.41	0.00000915682	0.45	4.12057E-06	242685	0.000
Road no junction	0.17	0.31	5,039	3.41	0.00000330523	0.45	1.48736E-06	672334	0.000
Road within 100m of slip road	0.1	0.36	5,039	3.41	0.00000225784	0.45	1.01603E-06	984223	0.000
Total for Catchment 2					0.00003942907	0.45	1.77431E-05	56360	0.002

**Drainage Catchment 3**

2036 Do Something Catchment 3	Total Annual Accident Probability (Pacc)					Annual Pollution Incident Probability (Pinc)			
	Road Length (km)	Serious Spillage Risk Factor	Two-way AADT	%HGV	Annual Probability (Pacc)	Probability Factor (Ppol)	Probability	Return Period (years)	Percentage Probability (%)
Road within 100m of crossroad	0.1	1.46	23,835	1.96	0.00002489528	0.45	1.12029E-05	89263	0.001
Road no junction	0.36	0.31	23,835	1.96	0.00001902954	0.45	8.56329E-06	116778	0.001
Road within 100m of roundabout	0.1	5.35	23,835	1.96	0.00009122584	0.45	4.10516E-05	24360	0.004
Road within 100m of roundabout	0.1	5.35	7,426	1.55	0.00002247674	0.45	1.01145E-05	98868	0.001
Road within 100m of side road	0.04	1.81	7,426	1.55	0.00000304171	0.45	1.36877E-06	730583	0.000
Road within 100m of roundabout	0.08	5.35	6,414	3.90	0.00003907781	0.45	1.7585E-05	56867	0.002
Road within 100m of roundabout	0.1	5.35	3,518	1.55	0.00001064815	0.45	4.79167E-06	208696	0.000
Road no junction	0.12	0.31	3,518	1.55	0.00000074039	0.45	3.33178E-07	3001402	0.000
Road within 100m of roundabout	0.1	5.35	29,087	1.13	0.00006418359	0.45	2.88826E-05	34623	0.003
Road no junction	0.29	0.31	29,087	1.13	0.00001078524	0.45	4.85336E-06	206043	0.000
Total for Catchment 3					0.00028610430	0.45	0.000128747	7767	0.013

**Drainage Catchment 4**

2036 Do Something Catchment 4	Total Annual Accident Probability (Pacc)					Annual Pollution Incident Probability (Pinc)			
	Road Length (km)	Serious Spillage Risk Factor	Two-way AADT	%HGV	Annual Probability (Pacc)	Probability Factor (Ppol)	Probability	Return Period (years)	Percentage Probability (%)
Road no junction	0.18	0.31	29,087	1.13	0.00000669429	0.45	3.01243E-06	331958	0.000
Road within 100m of roundabout	0.1	5.35	29,087	1.13	0.00006418359	0.45	2.88826E-05	34623	0.003
Road within 100m of roundabout	0.1	5.35	22,726	1.46	0.00006479217	0.45	2.91565E-05	34298	0.003
Road no junction	0.42	0.31	22,726	1.46	0.00001576811	0.45	7.09565E-06	140931	0.001
Total for Catchment 4					0.00015143816	0.45	6.81472E-05	14674	0.007

**Drainage Catchment 5**

2036 Do Something Catchment 5	Total Annual Accident Probability (Pacc)					Annual Pollution Incident Probability (Pinc)			
	Road Length (km)	Serious Spillage Risk Factor	Two-way AADT	%HGV	Annual Probability (Pacc)	Probability Factor (Ppol)	Probability	Return Period (years)	Percentage Probability (%)
Road no junction	0.39	0.31	22,726	1.46	0.00001464182	0.45	6.58882E-06	151772	0.001
Road within 100m of roundabout	0.1	5.35	22,726	1.46	0.00006479217	0.45	2.91565E-05	34298	0.003
Total for Catchment 5					0.00007943399	0.45	3.57453E-05	27976	0.004

**Drainage Catchment 6**

2036 Do Something Catchment 6	Total Annual Accident Probability (Pacc)					Annual Pollution Incident Probability (Pinc)			
	Road Length (km)	Serious Spillage Risk Factor	Two-way AADT	%HGV	Annual Probability (Pacc)	Probability Factor (Ppol)	Probability	Return Period (years)	Percentage Probability (%)
Road within 100m of roundabout	0.1	5.35	5,991	0.23	0.00000136626	0.45	6.14817E-07	1626499	0.000
Road no junction	0.35	0.31	5,991	0.23	0.00000022863	0.45	1.02881E-07	9719934	0.000
	Total for Catchment 6				0.00000159489	0.45	7.17699E-07	1393342	0.000

**Route Option 2B**

**Drainage Catchment 1**

2036 Do Something Catchment 1	Total Annual Accident Probability (Pacc)					Annual Pollution Incident Probability (Pinc)			
	Road Length (km)	Serious Spillage Risk Factor	Two-way AADT	%HGV	Annual Probability (Pacc)	Probability Factor (Ppol)	Probability	Return Period (years)	Percentage Probability (%)
Road within 100m of roundabout	0.1	5.35	27,711	2.48	0.00013419939	0.45	6.03897E-05	16559	0.006
Road within 100m of side road	0.02	1.81	27,711	2.48	0.00000908041	0.45	4.08618E-06	244727	0.000
Road within 100m of side road	0.02	1.81	27,826	2.45	0.00000900779	0.45	4.05351E-06	246700	0.000
Road within 100m of side road	0.1	1.81	27,826	2.45	0.00004503895	0.45	2.02675E-05	49340	0.002
Road no junction	0.18	0.31	27,826	2.45	0.00001388494	0.45	6.24822E-06	160045	0.001
Road within 100m of crossroad	0.1	1.46	27,826	2.45	0.00003632976	0.45	1.63484E-05	61168	0.002
Total for Catchment 1					0.00024754124	0.45	0.000111394	8977	0.011

**Drainage Catchment 2**

2036 Do Something Catchment 2	Total Annual Accident Probability (Pacc)					Annual Pollution Incident Probability (Pinc)			
	Road Length (km)	Serious Spillage Risk Factor	Two-way AADT	%HGV	Annual Probability (Pacc)	Probability Factor (Ppol)	Probability	Return Period (years)	Percentage Probability (%)
Road within 100m of crossroad	0.1	1.46	9,351	2.44	0.00001215888	0.45	5.4715E-06	182765	0.001
Road no junction	0.37	0.31	9,351	2.44	0.00000955222	0.45	4.2985E-06	232639	0.000
Road within 100m of slip road	0.1	0.36	9,351	2.44	0.00000299808	0.45	1.34914E-06	741215	0.000
Road within 100m of crossroad	0.1	1.46	5,039	3.41	0.00000915682	0.45	4.12057E-06	242685	0.000
Road no junction	0.17	0.31	5,039	3.41	0.00000330523	0.45	1.48736E-06	672334	0.000
Road within 100m of slip road	0.1	0.36	5,039	3.41	0.00000225784	0.45	1.01603E-06	984223	0.000
Total for Catchment 2					0.00003942907	0.45	1.77431E-05	56360	0.002

**Drainage Catchment 3**

2036 Do Something Catchment 3	Total Annual Accident Probability (Pacc)					Annual Pollution Incident Probability (Pinc)			
	Road Length (km)	Serious Spillage Risk Factor	Two-way AADT	%HGV	Annual Probability (Pacc)	Probability Factor (Ppol)	Probability	Return Period (years)	Percentage Probability (%)
Road within 100m of crossroad	0.1	1.46	23,835	1.96	0.00002489528	0.45	1.12029E-05	89263	0.001
Road no junction	0.36	0.31	23,835	1.96	0.00001902954	0.45	8.56329E-06	116778	0.001
Road within 100m of roundabout	0.1	5.35	23,835	1.96	0.00009122584	0.45	4.10516E-05	24360	0.004
Road within 100m of roundabout	0.1	5.35	7,426	1.55	0.00002247674	0.45	1.01145E-05	98868	0.001
Road within 100m of side road	0.04	1.81	7,426	1.55	0.00000304171	0.45	1.36877E-06	730583	0.000
Road within 100m of roundabout	0.08	5.35	6,414	3.90	0.00003907781	0.45	1.7585E-05	56867	0.002
Road within 100m of roundabout	0.1	5.35	3,518	1.55	0.00001064815	0.45	4.79167E-06	208696	0.000
Road no junction	0.12	0.31	3,518	1.55	0.0000074039	0.45	3.33178E-07	3001402	0.000
Road within 100m of roundabout	0.1	5.35	29,087	1.13	0.00006418359	0.45	2.88826E-05	34623	0.003
Road no junction	0.3	0.31	29,087	1.13	0.00001115715	0.45	5.02072E-06	199175	0.001
Total for Catchment 3					0.00028647620	0.45	0.000128914	7757	0.013

**Drainage Catchment 4**

2036 Do Something Catchment 4	Total Annual Accident Probability (Pacc)					Annual Pollution Incident Probability (Pinc)			
	Road Length (km)	Serious Spillage Risk Factor	Two-way AADT	%HGV	Annual Probability (Pacc)	Probability Factor (Ppol)	Probability	Return Period (years)	Percentage Probability (%)
Road no junction	0.06	0.31	29,087	1.13	0.0000223143	0.45	1.00414E-06	995874	0.000
Road within 100m of roundabout	0.1	5.35	29,087	1.13	0.00006418359	0.45	2.88826E-05	34623	0.003
Road within 100m of roundabout	0.1	5.35	22,726	1.46	0.00006479217	0.45	2.91565E-05	34298	0.003
Road no junction	0.11	0.31	22,726	1.46	0.00000412974	0.45	1.85838E-06	538102	0.000
Road within 100m of side road	0.1	1.81	22,726	1.46	0.00002192034	0.45	9.86415E-06	101377	0.001
Road within 100m of side road	0.1	1.81	22,726	1.46	0.00002192034	0.45	9.86415E-06	101377	0.001
Road no junction	0.21	0.31	22,726	1.46	0.00000788406	0.45	3.54783E-06	281863	0.000
Total for Catchment 4					0.00018706167	0.45	8.41778E-05	11880	0.008

**Drainage Catchment 5**

2036 Do Something Catchment 5	Total Annual Accident Probability (Pacc)					Annual Pollution Incident Probability (Pinc)			
	Road Length (km)	Serious Spillage Risk Factor	Two-way AADT	%HGV	Annual Probability (Pacc)	Probability Factor (Ppol)	Probability	Return Period (years)	Percentage Probability (%)
Road no junction	0.41	0.31	22,726	1.46	0.00001539268	0.45	6.92671E-06	144369	0.001
Road within 100m of roundabout	0.1	5.35	22,726	1.46	0.00006479217	0.45	2.91565E-05	34298	0.003
Total for Catchment 5					0.00008018485	0.45	3.60832E-05	27714	0.004

**Drainage Catchment 6**

2036 Do Something Catchment 6	Total Annual Accident Probability (Pacc)					Annual Pollution Incident Probability (Pinc)			
	Road Length (km)	Serious Spillage Risk Factor	Two-way AADT	%HGV	Annual Probability (Pacc)	Probability Factor (Ppol)	Probability	Return Period (years)	Percentage Probability (%)
Road within 100m of roundabout	0.1	5.35	5,991	0.23	0.00000136626	0.45	6.14817E-07	1626499	0.000
Road no junction	0.54	0.31	5,991	0.23	0.00000035274	0.45	1.58731E-07	6299957	0.000
Total for Catchment 6					0.00000171900	0.45	7.73549E-07	129743	0.000

**Cumulative annual probability from catchments 4 and 5 = 0.012%**

**Route Option 3A**

**Drainage Catchment 1**

2036 Do Something Catchment 1	Total Annual Accident Probability (Pacc)					Annual Pollution Incident Probability (Pinc)			
	Road Length (km)	Serious Spillage Risk Factor	Two-way AADT	%HGV	Annual Probability (Pacc)	Probability Factor (Ppol)	Probability	Return Period (years)	Percentage Probability (%)
Road no junction	0.28	0.31	33,307	2.74	0.00002891337	0.45	1.3011E-05	76858	0.001
Road within 100m of side road	0.08	1.81	33,307	2.74	0.00004823336	0.45	2.1705E-05	46072	0.002
Total for Catchment 1					0.00007714673	0.45	3.4716E-05	28805	0.003

**Drainage Catchment 2**

2036 Do Something Catchment 2	Total Annual Accident Probability (Pacc)					Annual Pollution Incident Probability (Pinc)			
	Road Length (km)	Serious Spillage Risk Factor	Two-way AADT	%HGV	Annual Probability (Pacc)	Probability Factor (Ppol)	Probability	Return Period (years)	Percentage Probability (%)
Road within 100m of roundabout	0.1	5.35	15,555	2.32	0.00007047006	0.45	3.17115E-05	31534	0.003
Road within 100m of side road	0.04	1.81	15,555	2.32	0.00000953651	0.45	4.29143E-06	233023	0.000
Road within 100m of roundabout	0.08	5.35	6,742	1.64	0.00001727306	0.45	7.77288E-06	128653	0.001
Road within 100m of roundabout	0.1	5.35	1,939	1.90	0.00000719413	0.45	3.23736E-06	308894	0.000
Road no junction	0.12	0.31	1,939	1.90	0.0000050023	0.45	2.25102E-07	4442427	0.000
Road within 100m of roundabout	0.1	5.35	20,892	1.54	0.00006282715	0.45	2.82722E-05	35370	0.003
Road no junction	0.29	0.31	20,892	1.54	0.00001055731	0.45	4.75079E-06	210491	0.000
Total for Catchment 2					0.00017835845	0.45	8.02613E-05	12459	0.008

**Drainage Catchment 3**

2036 Do Something Catchment 3	Total Annual Accident Probability (Pacc)					Annual Pollution Incident Probability (Pinc)			
	Road Length (km)	Serious Spillage Risk Factor	Two-way AADT	%HGV	Annual Probability (Pacc)	Probability Factor (Ppol)	Probability	Return Period (years)	Percentage Probability (%)
Road no junction	0.18	0.31	20,892	1.54	0.00000655281	0.45	2.94877E-06	339125	0.000
Road within 100m of roundabout	0.1	5.35	16,159	1.83	0.00005774471	0.45	2.59851E-05	38484	0.003
Road within 100m of roundabout	0.1	5.35	16,159	1.83	0.00005774471	0.45	2.59851E-05	38484	0.003
Road no junction	0.42	0.31	16,159	1.83	0.00001171084	0.45	5.26988E-06	189758	0.001
Total for Catchment 3					0.00013375308	0.45	6.01889E-05	16614	0.006

**Drainage Catchment 4**

2036 Do Something Catchment 4	Total Annual Accident Probability (Pacc)					Annual Pollution Incident Probability (Pinc)			
	Road Length (km)	Serious Spillage Risk Factor	Two-way AADT	%HGV	Annual Probability (Pacc)	Probability Factor (Ppol)	Probability	Return Period (years)	Percentage Probability (%)
Road no junction	0.39	0.31	16,159	1.83	0.00001304923	0.45	5.87215E-06	170295	0.001
Road within 100m of roundabout	0.1	5.35	16,159	1.83	0.00005774471	0.45	2.59851E-05	384834	0.003
	Total for Catchment 4				0.00007079394	0.45	3.18573E-05	31390	0.003

**Drainage Catchment 5**

2036 Do Something Catchment 5	Total Annual Accident Probability (Pacc)					Annual Pollution Incident Probability (Pinc)			
	Road Length (km)	Serious Spillage Risk Factor	Two-way AADT	%HGV	Annual Probability (Pacc)	Probability Factor (Ppol)	Probability	Return Period (years)	Percentage Probability (%)
Road within 100m of roundabout	0.1	5.35	4,793	0.85	0.00000795560	0.45	3.58002E-06	279328	0.000
Road no junction	0.35	0.31	4,793	0.85	0.00000161343	0.45	7.26042E-07	1377332	0.000
	Total for Catchment 5				0.00000956903	0.45	4.30606E-06	232231	0.000

**Route Option 3B**

**Drainage Catchment 1**

2036 Do Something Catchment 1	Total Annual Accident Probability (Pacc)					Annual Pollution Incident Probability (Pinc)			
	Road Length (km)	Serious Spillage Risk Factor	Two-way AADT	%HGV	Annual Probability (Pacc)	Probability Factor (Ppol)	Probability	Return Period (years)	Percentage Probability (%)
Road no junction	0.28	0.31	33,307	2.74	0.00002891337	0.45	1.3011E-05	76858	0.001
Road within 100m of side road	0.08	1.81	33,307	2.74	0.00004823336	0.45	2.1705E-05	46072	0.002
Total for Catchment 1					0.00007714673	0.45	3.4716E-05	28805	0.003

**Drainage Catchment 2**

2036 Do Something Catchment 2	Total Annual Accident Probability (Pacc)					Annual Pollution Incident Probability (Pinc)			
	Road Length (km)	Serious Spillage Risk Factor	Two-way AADT	%HGV	Annual Probability (Pacc)	Probability Factor (Ppol)	Probability	Return Period (years)	Percentage Probability (%)
Road within 100m of roundabout	0.1	5.35	15,555	2.32	0.00007047006	0.45	3.17115E-05	31534	0.003
Road within 100m of side road	0.04	1.81	15,555	2.32	0.00000953651	0.45	4.29143E-06	233023	0.000
Road within 100m of roundabout	0.08	5.35	6,742	1.64	0.00001727306	0.45	7.77288E-06	128653	0.001
Road within 100m of roundabout	0.1	5.35	1,939	1.90	0.00000719413	0.45	3.23736E-06	308894	0.000
Road no junction	0.12	0.31	1,939	1.90	0.00000050023	0.45	2.25102E-07	4442427	0.000
Road within 100m of roundabout	0.1	5.35	20,892	1.54	0.00006282715	0.45	2.82722E-05	35370	0.003
Road no junction	0.29	0.31	20,892	1.54	0.00001055731	0.45	4.75079E-06	210491	0.000
Total for Catchment 2					0.00017835845	0.45	8.02613E-05	12459	0.008

**Drainage Catchment 3**

2036 Do Something Catchment 3	Total Annual Accident Probability (Pacc)					Annual Pollution Incident Probability (Pinc)			
	Road Length (km)	Serious Spillage Risk Factor	Two-way AADT	%HGV	Annual Probability (Pacc)	Probability Factor (Ppol)	Probability	Return Period (years)	Percentage Probability (%)
Road no junction	0.06	0.31	20,892	1.54	0.00000218427	0.45	9.82922E-07	1017375	0.000
Road within 100m of roundabout	0.1	5.35	20,892	1.54	0.00006282715	0.45	2.82722E-05	35370	0.003
Road within 100m of roundabout	0.1	5.35	16,159	1.83	0.00005774471	0.45	2.59851E-05	38484	0.003
Road no junction	0.11	0.31	16,159	1.83	0.00000368055	0.45	1.65625E-06	603774	0.000
Road within 100m of side road	0.1	1.81	16,159	1.83	0.00001953606	0.45	8.79123E-06	113750	0.001
Road within 100m of side road	0.1	1.81	16,159	1.83	0.00001953606	0.45	8.79123E-06	113750	0.001
Road no junction	0.21	0.31	16,159	1.83	0.00000702651	0.45	3.16193E-06	316263	0.000
Total for Catchment 3					0.00017253532	0.45	7.76409E-05	12880	0.008

**Drainage Catchment 4**

2036 Do Something Catchment 4	Total Annual Accident Probability (Pacc)					Annual Pollution Incident Probability (Pinc)			
	Road Length (km)	Serious Spillage Risk Factor	Two-way AADT	%HGV	Annual Probability (Pacc)	Probability Factor (Ppol)	Probability	Return Period (years)	Percentage Probability (%)
Road no junction	0.41	0.31	16,159	1.83	0.00001371842	0.45	6.17329E-06	161988	0.001
Road within 100m of roundabout	0.1	5.35	16,159	1.83	0.00005774471	0.45	2.59851E-05	38484	0.003
Total for Catchment 4					0.00007146313	0.45	3.21584E-05	31096	0.003

**Drainage Catchment 5**

2036 Do Something Catchment 5	Total Annual Accident Probability (Pacc)					Annual Pollution Incident Probability (Pinc)			
	Road Length (km)	Serious Spillage Risk Factor	Two-way AADT	%HGV	Annual Probability (Pacc)	Probability Factor (Ppol)	Probability	Return Period (years)	Percentage Probability (%)
Road within 100m of roundabout	0.1	5.35	4,793	0.85	0.00000795560	0.45	3.58002E-06	279328	0.000
Road no junction	0.54	0.31	4,793	0.85	0.00000248929	0.45	1.12018E-06	892715	0.000
Total for Catchment 5					0.00001044489	0.45	4.7002E-06	212757	0.000

Cumulative annual probability from catchments 3 and 4 = 0.011%