



Llywodraeth Cymru
Welsh Government

Llywodraeth Cymru / Welsh
Government

A487 New Dyfi Bridge

Environmental Statement -
Volume 3: Appendix 15.3

HAWRAT Model

Final Issue | March 2016



15.3.1 HAWRAT Model Parameters

Dyfi Bridge
HAWRAT Model Parameters
March 2016

Single Catchment Assessment

Cumulative Catchment Assessment

	Catchment number			
	1	2 (existing baseline)	2	3
Road number	A487	A487	A487	A487
OS grid reference of assessment point	274922	274414	274414	274422
	302000	301311	301311	301909
OS grid reference of outfall structure	274922	274414	274414	274422
	302000	301311	301311	301909
Watercourse name	Dyfi	Drainage Ditch	Drainage Ditch	Dyfi
Water body id	GB110064048390	N/A	N/A	GB110064048390
Climate	cold wet	cold wet	cold wet	cold wet
Rainfall site	Colwyn Bay	Colwyn Bay	Colwyn Bay	Colwyn Bay
95% exceedance	2.339 m3/s	0.0001 m3/s *	0.0001 m3/s *	2.339 m3/s
Impermeable road area drained (ha)	0.81	0.46	0.2	1.26
Permeable road area drained (ha)	0.62	1.19	0.29	2.37
Base flow index	0.39	0.65	0.65	0.39
Protected site	No	No	No	No
Water hardness	Low	Low	Low	Low
River width (m)	41	1	1	34

Catchment number
1 and 3
A487
274422
301909
274422
301909
Dyfi
GB110064048390
cold wet
Colwyn Bay
2.339 m3/s
2.07
2.99
0.39
No
Low
34

* The Q95 for the drainage ditch has been calculated from LowFlow software of a value of 0.00083 m3/s. In accordance with HD 45/09 guidance where the value of Q95 is less than 0.0001 m3/s, a figure of 0.001 m3/s is used.

15.3.2 Proposed Routine Runoff - Outfall 1 Detailed Results

Annual Average Concentration			
	Copper	Zinc	
Step 2	0.00	0.00	ug/l
Step 3	-	-	ug/l

Soluble - Acute Impact
 Copper Pass

 Zinc Pass
Sediment - Chronic Impact
 Sediment deposition for this site is judged as:
 Accumulating? Extensive? Pass

Sediment deposition for this site is judged as:	
Yes	Low flow Vel m/s Deposition Index
No	0.04
No	1

Location Details	Road number	A487	HA Area / DBFO number	
Assessment type	Non-cumulative assessment (single outfall)			
OS grid reference of assessment point (m)	Easting	274922	Northing	302000
OS grid reference of outfall structure (m)	Easting	274922	Northing	302000
Outfall number	1	List of outfalls in cumulative assessment		
Receiving watercourse	Dyfi	Assessor and affiliation		
EA receiving water Detailed River Network ID	GB1100640408390	Version of assessment		
Date of assessment	01/03/2016			
Notes				

Step 1 Runoff Quality	AADT	>10,000 and <50,000	Climatic region	Colder/Wet	Rainfall site	Colwyn Bay (SAAR 788.1mm)
------------------------------	------	---------------------	-----------------	------------	---------------	---------------------------

Step 2 River Impacts	Annual 95%ile river flow (m ³ /s)	2.339	(Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)
	Impermeable road area drained (ha)	0.81	Permeable area draining to outfall (ha)
	Base Flow Index (BFI)	0.39	Is the discharge in or within 1 km upstream of a protected site for conservation?

For dissolved zinc only	Water hardness	Low = <50mg CaCO ₃ /l
For sediment impact only	Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge?	
	<input checked="" type="checkbox"/> Tier 1	Estimated river width (m)
	<input type="checkbox"/> Tier 2	Bed width (m)
		Manning's n
		Side slope (m/m)
		Long slope (m/m)

Step 3 Mitigation	Brief description		Estimated effectiveness	
Existing measures			Treatment for solubles (%)	Settlement of sediments (%)
Proposed measures			Attenuation for solubles - restricted discharge rate (l/s)	

Predict Impact
Show Detailed Results
Exit Tool

[Back To Top](#)

[Return To Interface](#)

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

Copper	Zinc
RST24	
1	1
60.10	49.70
70	64

Copper	Zinc
RST6	
1	1
17.20	18.10
25	29

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

Event Statistics	Mean	90%ile	95%ile	99%ile
	24.83	46.48	56.22	107.78
	69.60	143.58	190.25	396.06

Step 1

Copper	Zinc	Cadmium	Total PAH	Pyrene	Fluoranthene	Anthracene	Phenanthrene
Toxicity Threshold							
1	1	1	1	1	1	1	1
73.30	98.70	1.40	40.60	94.50	40.60	18.60	77.30
81	109	3	48	110	48	26	95

Toxicity	(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

345	1211	1	15737	2722	2612	167	736
799	2851	1	28184	4876	4679	299	1319
996	3882	2	35481	6138	5890	376	1661
1414	5918	4	89125	15419	14795	945	4171

In River (no mitigation)

Step 2

Copper	Zinc
RST24	
2	2
0	0
0	0
0	0
0	0

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

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

Event Statistics	Mean	90%ile	95%ile	99%ile
	0.00	0.00	0.00	0.01
	0.00	0.01	0.01	0.05

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
-	-
-	-
-	-
-	-

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

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

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

Step 3

DI

Details of the chosen rainfall site	
SAAR (mm)	788.1
Altitude (m)	36
Easting	2831
Northing	3796
Coastal distance (km)	0.8

15.3.4 Proposed Routine Runoff - Outfall 2 Detailed Results

Annual Average Concentration		Soluble - Acute Impact		Sediment - Chronic Impact	
	Copper	Zinc	Copper	Zinc	Sediment deposition for this site is judged as: Accumulating? Extensive?
Step 2	0.15 µg/l	0.51 µg/l	Pass	Pass	Yes 0.01 No 40 Low flow Velim's Deposition Index
Step 3	-	-	Pass	Pass	

Road number	A487		HA Area / DBFO number	
Assessment type	Non-cumulative assessment (single outfall)			
OS grid reference of assessment point (m)	Easting	274414	Northing	301311
OS grid reference of outfall structure (m)	Easting	274414	Northing	301311
Outfall number	2 - Proposed		List of outfalls in cumulative assessment	
Receiving watercourse	Drainage ditch		Assessor and affiliation	
EA receiving water Detailed River Network ID	N/A		Version of assessment	
Date of assessment	19/01/2017		RT - Arup	
Notes				

Step 1 Runoff Quality AADT Climatic region Rainfall site

Step 2 River Impacts Annual 95%ile river flow (m³/s) (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)
 Impermeable road area drained (ha) Permeable area draining to outfall (ha)
 Base Flow Index (BFI) Is the discharge in or within 1 km upstream of a protected site for conservation?

For dissolved zinc only Water hardness

For sediment impact only Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge?

Tier 1 Estimated river width (m) Manning's n Side slope (m/m) Long slope (m/m)
 Tier 2 Bed width (m)

Step 3 Mitigation

Brief description	Estimated effectiveness	
	Treatment for solubles (%)	Settlement of sediments (%)
Existing measures	<input type="text" value="0"/> <input type="text" value="D"/>	<input type="text" value="0"/> <input type="text" value="D"/>
Proposed measures	<input type="text" value="0"/> <input type="text" value="D"/>	<input type="text" value="0"/> <input type="text" value="D"/>

[Back To Top](#)

[Return To Interface](#)

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
60.10	49.70
70	64

RST24		RST6		Toxicity Threshold		Toxicity	
Copper	Zinc	Cadmium	Total PAH	Pyrene	Fluoranthene	Anthracene	Phenanthrene
1	1	1	1	1	1	1	1
73.30	98.70	1.40	40.60	94.50	40.60	18.60	77.30
81	109	3	48	110	48	26	95

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

RST6	
Copper	Zinc
1	1
17.20	18.10
25	29

	(mg/kg)	(mg/kg)	(mg/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)
Toxicity	197	315	3.5	16770	875	2355	245	515
	345	1211	1	15737	2722	2612	167	736
	799	2851	1	28184	4876	4679	299	1319
	996	3882	2	35481	6138	5890	376	1661
	1414	5918	4	89125	15419	14795	945	4171

Thresholds
Thresholds

	(ug/l)	(ug/l)
RST24	21	60
RST6	42	120
	24.83	69.60
	46.48	143.58
	56.22	190.25
	107.78	396.06

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

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	0.2
0	1
0	0.2
0	1

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

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

Annual average concentration (ug/l)

0.15	0.51
------	------

Thresholds
Thresholds

	(ug/l)	(ug/l)
RST24	21	60
RST6	42	120
	0.52	1.75
	1.55	4.00
	2.52	7.66
	5.16	23.06

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

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

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

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

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

Details of the chosen rainfall site

SAAR (mm)	788.1
Altitude (m)	36
Easting	2831
Northing	3796
Coastal distance (km)	0.8

15.3.5 Proposed Routine Runoff - Outfall 3 Detailed Results

Annual Average Concentration		
	Copper	Zinc
Step 2	0.00	0.00
Step 3	-	-

Soluble - Acute Impact
 Copper Pass

 Zinc Pass
Sediment - Chronic Impact
 Sediment deposition for this site is judged as:
 Accumulating? Extensive? Pass

Accumulating? Extensive?		Low flow Vel m/s Deposition Index	
Yes	0.06	No	2

Location Details		Road number		HA Area / DBFO number	
Road number	A487	Non-cumulative assessment (single outfall)			
Assessment type	Non-cumulative assessment (single outfall)				
OS grid reference of assessment point (m)	Easting	274422	Northing	301909	
OS grid reference of outfall structure (m)	Easting	274422	Northing	301909	
Outfall number	3	List of outfalls in cumulative assessment			
Receiving watercourse	River Dyfi	Assessor and affiliation		Stephanie Chapman	
EA receiving water Detailed River Network ID	GB110064048390	Version of assessment			
Date of assessment	01/03/2016				
Notes					

Step 1 Runoff Quality AADT Climatic region Rainfall site

Step 2 River Impacts Annual 95%ile river flow (m³/s) (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)
 Impermeable road area drained (ha) Permeable area draining to outfall (ha)
 Base Flow Index (BFI) Is the discharge in or within 1 km upstream of a protected site for conservation?

For dissolved zinc only Water hardness
For sediment impact only Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge?
 Tier 1 Estimated river width (m)
 Tier 2 Bed width (m) Manning's n Side slope (m/m) Long slope (m/m)

Step 3 Mitigation

Brief description	Estimated effectiveness		
	Treatment for solubles (%)	Attenuation for solubles - restricted discharge rate (l/s)	Settlement of sediments (%)
Existing measures	<input type="text" value="0"/> <input type="text" value="D"/>	<input type="text" value="Unlimited"/> <input type="text" value="D"/>	<input type="text" value="0"/> <input type="text" value="D"/>
Proposed measures	<input type="text" value="0"/> <input type="text" value="D"/>	<input type="text" value="Unlimited"/> <input type="text" value="D"/>	<input type="text" value="0"/> <input type="text" value="D"/>

Predict Impact
Show Detailed Results
Exit Tool

[Back To Top](#)

[Return To Interface](#)

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

RST24	
Copper	Zinc
1	1
60.10	49.70
70	64

RST24		RST6		Toxicity Threshold		Toxicity	
Copper	Zinc	Cadmium	Total PAH	Pyrene	Fluoranthene	Anthracene	Phenanthrene
1	1	1	1	1	1	1	1
73.30	98.70	1.40	40.60	94.50	40.60	18.60	77.30
81	109	3	48	110	48	26	95

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

RST6	
Copper	Zinc
1	1
17.20	18.10
25	29

	(mg/kg)	(mg/kg)	(mg/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)
Toxicity	197	315	3.5	16770	875	2355	245	515
	345	1211	1	15737	2722	2612	167	736
	799	2851	1	28184	4876	4679	299	1319
	996	3882	2	35481	6138	5890	376	1661
	1414	5918	4	89125	15419	14795	945	4171

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
RST24	24.83	69.60	46.48	143.58
RST6	56.22	190.25	107.78	396.06

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	0
0	0
0	0
0	0

Velocity 0.06 m/s Tier 1 is used for the calculation
DI 1.92
% 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
0	0
0	0
0	0

Annual average concentration (ug/l)

0.00	0.00
------	------

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
RST24	0.00	0.01	0.00	0.01
RST6	0.01	0.02	0.02	0.08

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

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

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

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

-	-
-	-
-	-
-	-

Details of the chosen rainfall site

SAAR (mm)	788.1
Altitude (m)	36
Easting	2831
Northing	3796
Coastal distance (km)	0.8

15.3.6 Proposed Routine Runoff - Outfalls 1 & 3 Cumulative Detailed Results

Annual Average Concentration		
	Copper	Zinc
Step 2	0.00	0.00
Step 3	-	-

Soluble - Acute Impact
 Copper Pass

 Zinc Pass
Sediment - Chronic Impact
 Sediment deposition for this site is judged as:
 Accumulating? Extensive? Pass

Sediment deposition for this site is judged as:	
Yes	No
0.06	3

Low flow Vel/m/s
Deposition Index

Location Details		HA Area / DBFO number	
Road number	A487		
Assessment type	Cumulative assessment including sediments (outfalls within 100m)		
OS grid reference of assessment point (m)	Easting	274422	Northing
OS grid reference of outfall structure (m)	Easting	274422	Northing
Outfall number	1 and 3		
Receiving watercourse	River Dyfi	List of outfalls in cumulative assessment	
EA receiving water Detailed River Network ID	GB110064048390	Assessor and affiliation	
Date of assessment	01/03/2016	Version of assessment	
Notes			

Step 1 Runoff Quality AADT Climatic region Rainfall site

Step 2 River Impacts

Annual 95%ile river flow (m³/s) (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)

Impermeable road area drained (ha) Permeable area draining to outfall (ha)

Base Flow Index (BFI) Is the discharge in or within 1 km upstream of a protected site for conservation?

For dissolved zinc only Water hardness

For sediment impact only Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge?

Tier 1 Estimated river width (m) Tier 2 Bed width (m) Manning's n Side slope (m/m) Long slope (m/m)

Step 3 Mitigation

Brief description	Treatment for solubles (%)	Attenuation for solubles - restricted discharge rate (l/s)	Settlement of sediments (%)
Existing measures	<input type="text" value="0"/>	<input type="text" value="Unlimited"/>	<input type="text" value="0"/>
Proposed measures	<input type="text" value="0"/>	<input type="text" value="Unlimited"/>	<input type="text" value="0"/>

Predict Impact
Show Detailed Results
Exit Tool

[Back To Top](#)

[Return To Interface](#)

Summary of predictions

[Soluble - Acute Impact](#)

[Sediment - Chronic Impact](#)

Prediction of impact
 Step1
 Step2
 Step3

Copper	Zinc
1	1
60.10	49.70
70	64

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
60.10	49.70
70	64

RST24		RST6		Toxicity Threshold		Toxicity	
Copper	Zinc	Cadmium	Total PAH	Pyrene	Fluoranthene	Anthracene	Phenanthrene
1	1	1	1	1	1	1	1

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

RST6	
Copper	Zinc
1	1
17.20	18.10
25	29

RST24		RST6		Toxicity	
Copper	Zinc	Cadmium	Total PAH	Pyrene	Fluoranthene
1	1	1	1	1	1

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	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	24.83	46.48	56.22	107.78
Zinc	69.60	143.58	190.25	396.06

	Mean	90%ile	95%ile	99%ile
Cadmium				
Total PAH				
Pyrene				
Fluoranthene				
Anthracene				
Phenanthrene				

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	0
0	0
0	0
0	0

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

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)

0.00	0.00
------	------

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	0.00	0.01	0.01	0.03
Zinc	0.01	0.02	0.03	0.13

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

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

	(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	-	-	-	-

Details of the chosen rainfall site

SAAR (mm)	788.1
Altitude (m)	36
Easting	2831
Northing	3796
Coastal distance (km)	0.8