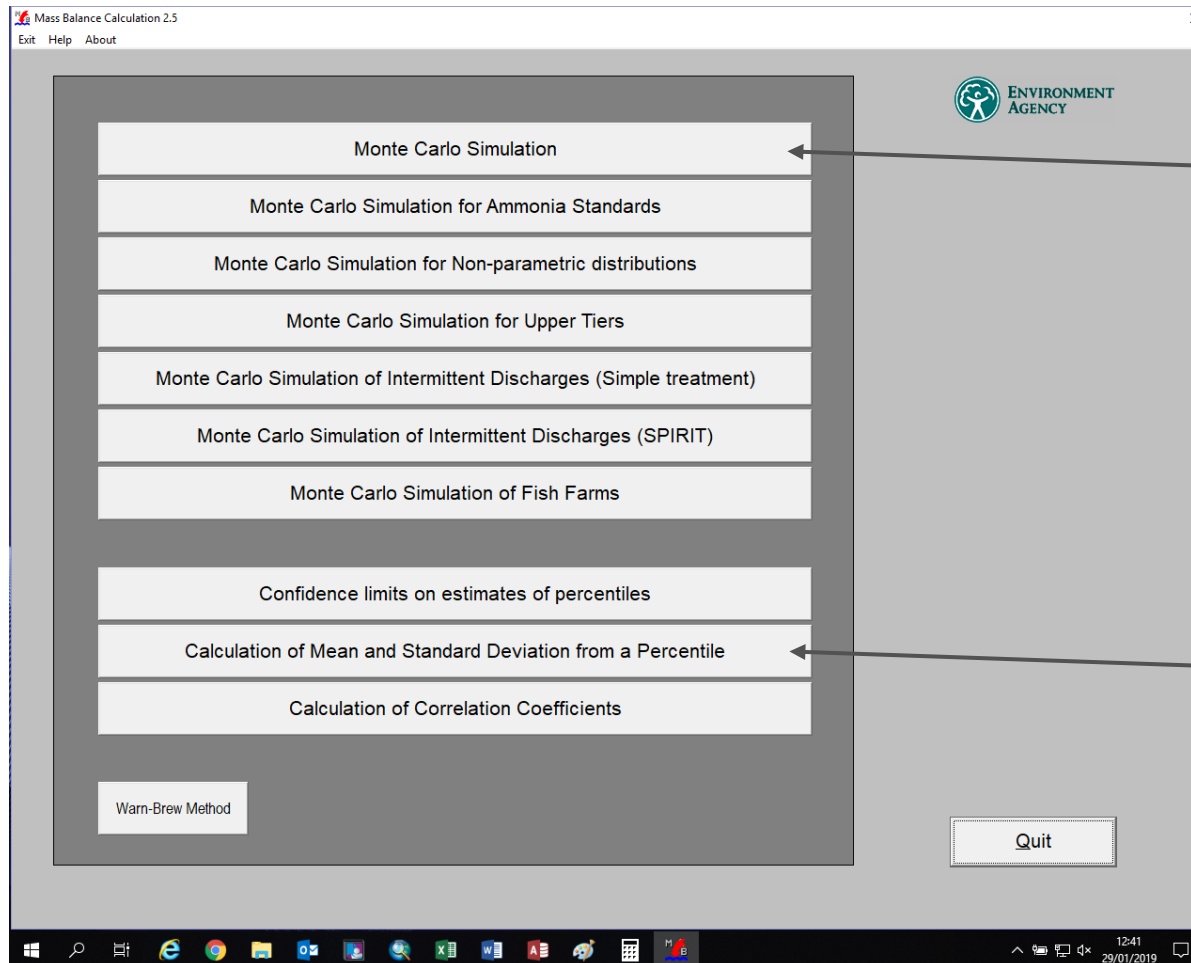


Monte Carlo Simulation Procedure



Click on Monte Carlo Simulation shortcut icon located on desktop:



To be used for Monte Carlo Simulation of Biochemical Oxygen Demand & Ammonia

To be completed first, calculated figures required for Monte Carlo Simulation

Calculation of Mean and Standard Deviation from a Percentile

Exit Print Help About

INPUT DATA

Percentile concentration

4.5

Percentile

90

Coefficient of variation

0.5

RESULTS

Mean

2.75

Standard deviation

1.37

Calculate

Mid Class value to be obtained from
ArcGIS layer *RWB_Regs_Team_Nov_17*

Always 90% for river data

Coefficient of Variation for BOD; 0.5, and
for Ammonia; 0.7

Obtaining Percentile Concentration form ArcGIS – identify BOD_Stat15, if status isn't "HIGH" use BOD_GMC value, if status is "HIGH" use BOD_HMC

Industrial Consents_APR18.mxd - ArcMap

File Edit View Bookmarks Insert Selection Geoprocessing Customize Windows Help

1:400,000

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Identify

Identify from: <Top-most layer>

T450_RWB_Reg_Team_Nov_17_with_N2Ksites
Markethill River

Location: 294,920.157 340,127.590 Meters

Field	Value
localId	UKGBNI1NB030308119
namespace	Markethill River
spZoneType	riverWaterBody
Area_km2	16.21683
UKRBD	UKGBNI1NB030308119
RWBID450	GBNI1NB030308119
LMA	Upper Bann
CSG	Upper Neagh Bann
STAT_2015	MODERATE
OBJ_2021	MODERATE
OBJ_2027	GOOD
FFD_Desig	ND
DO_Stat15	HIGH
DO_Typo	LHA
DO_HMC	85
DO_GMC	65
SRP_Stat15	MODERATE
SRP_GMC	0.04762
BOD_Stat15	GOOD
BOD_Typo	LHA
BOD_HMC	2
BOD_GMC	4.5
NH4_Stat15	HIGH
NH4_Typo	LHA
NH4_HMC	0.15
NH4_GMC	0.45
SAC_SPA	
Shape_STAI	16216832.7438
Shape_STLe	29339.529264

Identified 1 feature

245601.725 398547.707 Meters

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Monte Carlo Method
File Help About

Name of discharge: TC187/18
Name of river: Gallrock
Name of determinand: BOD

UPSTREAM RIVER DATA		DISCHARGE DATA	
Mean flow	3033	Mean flow	
95% exceedence flow	217	Standard deviation of flow	
Mean quality	2.75	Mean quality	
Standard deviation of river quality	1.37	Standard deviation of quality	
90-percentile	4.50	... or 95-percentile	

☒ Calculate required discharge quality
 ☐ Calculate effect of input discharge quality

River quality target downstream of discharge:
 Percentile: 90
 (Enter M for Mean Standard)

Fields coloured must contain data before calculations are carried out.

File Reference to be used

Input river name if known

BOD, Ammonia or metals

Flows obtained from Hydrology Flow Report

Quality figures are previous results from calculation of mean and standard deviation from a percentile

Auto populates once figures entered above to confirm percentile concentration previously entered

Monte Carlo Method
File Help About

Name of discharge: TC187/18
Name of river: Gallrock
Name of determinand: BOD

UPSTREAM RIVER DATA	
Mean flow	3033
95% exceedence flow	217
Mean quality	2.75
Standard deviation of river quality	1.37
90-percentile	4.50

DISCHARGE DATA	
Mean flow	9.6
Standard deviation of flow	3.2
Mean quality	20.56
Standard deviation of quality	10.28
... or 95-percentile	40.00

☒ Calculate required discharge quality
 ☐ Calculate effect of input discharge quality

River quality target downstream of discharge:
 Percentile: 90
 (Enter M for Mean Standard)

Fields coloured must contain data before calculations are carried out.

Figure obtained from application form; 'Maximum quantity it is proposed to discharge in any one day'.

Standard deviation of flow – Generally assumed to be 1/3 of mean flow figure.

Figures obtained from BOD/Ammonia standards tables, dependent on estimated limit of discharge to be used i.e. 40 BOD/60 SS.

Auto populates once figures entered above to confirm BOD value entered

Monte Carlo Method
File Help About

Name of discharge: TC187/18
Name of river: Gallrock
Name of determinand: BOD

UPSTREAM RIVER DATA	
Mean flow	3033
95% exceedence flow	217
Mean quality	2.75
Standard deviation of river quality	1.37
90-percentile	4.50

DISCHARGE DATA	
Mean flow	9.6
Standard deviation of flow	3.2
Mean quality	20.56
Standard deviation of quality	10.28
... or 95-percentile	40.00

☒ Calculate required discharge quality
 ☐ Calculate effect of input discharge quality

River quality target downstream of discharge: 5.085
 Percentile: 90
 (Enter M for Mean Standard)

Fields coloured must contain data before calculations are carried out.

Windows taskbar: 11:34 13/02/2019

Figure is calculated as upstream river quality 90%ile + a % deterioration. 13% deterioration for BOD and 28% for ammonia, 10% for all other parameters.

Cant model if this quality target downgrades a river classification.

Example calculation:

$$4.5/100 = 0.045,$$

$$*13 = 0.585,$$

$$+4.5 = 5.085$$

Method 1 calculation

Monte Carlo Method

File Base Data Further Data Results Help About

Name of discharge	TC187/18
Name of river	Gallrock
Name of determinand	BOD

UPSTREAM RIVER DATA

Mean flow	3033
95% exceedence flow	217
Mean quality	2.75
Standard deviation of river quality	1.37
90-percentile	4.50

DISCHARGE DATA

Mean flow	9.6
Standard deviation of flow	3.2
Mean quality	20.56
Standard deviation of quality	10.28
... or 95-percentile	40.00

RIVER DOWNSTREAM OF DISCHARGE

Mean quality	3.15
Standard deviation of quality	1.46
90-percentile quality	5.09
95-percentile quality	5.93
99-percentile quality	7.52
Quality target (90-percentile)	5.09

DISCHARGE QUALITY NEEDED

Mean quality	41.52
Standard deviation of quality	20.11
95-percentile quality	79.93
99-percentile quality	107.37
99.5-percentile quality	116.30

Permissible limit of discharge quality

Method 2 calculation

Monte Carlo Method

File Base Data Further Data Results Help About

Name of discharge	TC187/18
Name of river	Gallrock
Name of determinand	BOD

UPSTREAM RIVER DATA

Mean flow	3033
95% exceedence flow	217
Mean quality	2.75
Standard deviation of river quality	1.37
90-percentile	4.50

DISCHARGE DATA

Mean flow	9.6
Standard deviation of flow	3.2
Mean quality	20.56
Standard deviation of quality	10.28
... or 95-percentile	40.00

RIVER DOWNSTREAM OF DISCHARGE

Mean quality	2.95
Standard deviation of quality	1.39
90-percentile quality	4.66
95-percentile quality	5.48
99-percentile quality	7.36

DISCHARGE QUALITY

Mean quality	20.98
Standard deviation of quality	10.16
95-percentile quality	40.39
99-percentile quality	54.25
99.5-percentile quality	58.77

Differences between the above values and the corresponding input data are due to the effect of the Monte Carlo sample.

BOD discharge value of 40 mg/l applied

Upstream river quality

Downstream river quality with BOD value of 40 mg/l applied

Flow Response 2019_003.DOCX [Read-Only] - Word

FILE HOME HP Records Manager INSERT DESIGN PAGE LAYOUT REFERENCES MAILINGS REVIEW VIEW DESIGN LAYOUT

Open Save Save As Paste Font Paragraph Styles Editing

Find Replace Select

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19

Hydrology
Water Management Unit
Environmental Protection

NIEA Northern Ireland Environment Agency
www.ni-environment.gov.uk

To: [REDACTED] Our ref : 2019_003

Flow Estimate
Please find below our estimate in reply to request for the following location:

Location address: [REDACTED]

IGR: [REDACTED]

Watercourse name: [REDACTED]

Enquiry reference TC187/18 **Enquiry date:** [REDACTED]

Estimated Flow	Q95(1) :	217 m ³ /day
	Mean Flow :	3033 m ³ /day
	Estimated Catchment Area:	3.600 km ²

Calculation basis

1. Point at or near gauging station on watercourse with flow records over 20 years.
2. Point at or near gauging station on watercourse with records less than 20 years.
3. Point on a gauged watercourse with records over 20 years.
4. Point on a gauged watercourse with records less than 20 years.
5. Point on an ungauged watercourse using catchment characteristics and parameters from a similar type gauged

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BOD std mg/l (95%ile)	CoV	Mean	SD
5	0.5	2.57	1.29
6	0.5	3.08	1.54
7	0.5	3.60	1.80
8	0.5	4.11	2.06
9	0.5	4.63	2.31
10	0.5	5.14	2.57
11	0.5	5.65	2.83
12	0.5	6.17	3.08
13	0.5	6.68	3.34
14	0.5	7.20	3.60
15	0.5	7.71	3.86
16	0.5	8.22	4.11
17	0.5	8.74	4.37
18	0.5	9.25	4.63
19	0.5	9.77	4.88
20	0.5	10.28	5.14
21	0.5	10.80	5.40
22	0.5	11.31	5.65
23	0.5	11.82	5.91
24	0.5	12.34	6.17
25	0.5	12.85	6.43
26	0.5	13.37	6.68
27	0.5	13.88	6.94
28	0.5	14.39	7.20
29	0.5	14.91	7.45
30	0.5	15.42	7.71
31	0.5	15.94	7.97
32	0.5	16.45	8.22
33	0.5	16.96	8.48
34	0.5	17.48	8.74
35	0.5	17.99	9.00
36	0.5	18.51	9.25
37	0.5	19.02	9.51
38	0.5	19.53	9.77
39	0.5	20.05	10.02
40	0.5	20.56	10.28

Ammonia std mg/l (95%ile)	CoV	Mean	SD
0.5	0.7	0.22	0.15
1	0.7	0.43	0.30
1.5	0.7	0.65	0.45
2	0.7	0.86	0.60
2.5	0.7	1.08	0.76
3	0.7	1.30	0.91
3.5	0.7	1.51	1.06
4	0.7	1.73	1.21
5	0.7	2.16	1.51
6	0.7	2.59	1.81
7	0.7	3.02	2.12
8	0.7	3.46	2.42
9	0.7	3.89	2.72
10	0.7	4.32	3.02
11	0.7	4.75	3.33
12	0.7	5.18	3.63
13	0.7	5.62	3.93
14	0.7	6.05	4.23
15	0.7	6.48	4.54
35	0.7	15.12	10.58