Stormwater Quality Report

Lindfield Learning Village Stage 2 & 3

Schools Infrastructure NSW

100 Eton Road, Lindfield NSW 2070

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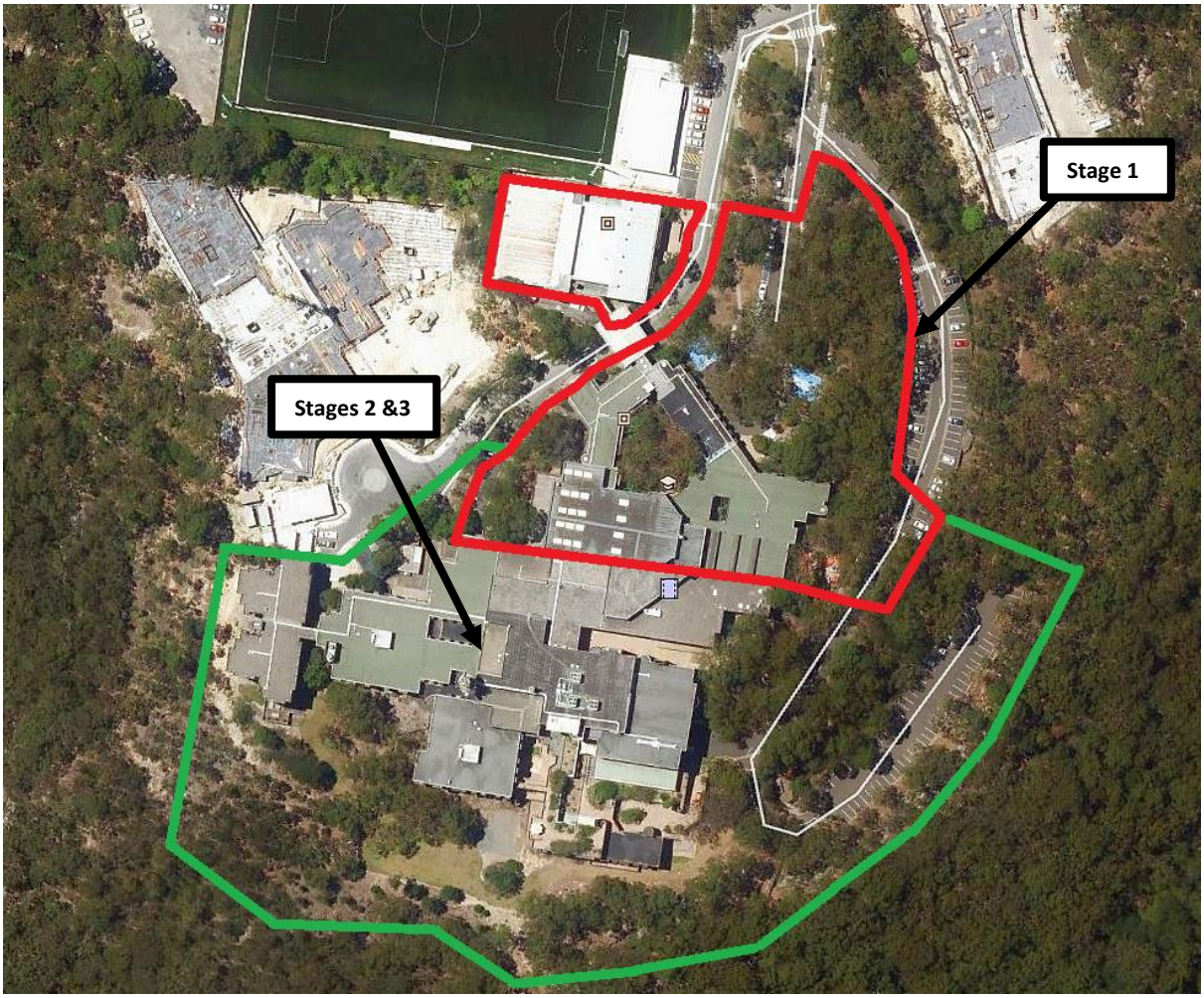

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1 INTRODUCTION

1.1 PURPOSE

EWFW Consulting Engineers Pty Ltd (EWFW) has been engaged to prepare a stormwater quality report for the proposed Lindfield Learning Village development (the site) at 100 Eton Road, Lindfield. The preparation of this stormwater quality report is based on our understanding of the existing infrastructure within the site and any new infrastructure proposed with the new development works.

In undertaking the preparation of this manual, EWFW hereby advises that it has no control over any approvals, additional third-party requirements, competitive development costs, nor does it have any control over any increase in statutory or service fees, nor can guarantee the capacity of the drainage system for future developments. All existing infrastructure that is to be retained should be inspected prior to commencement of works and post completion of works to ensure its integrity for ongoing use.

This report produced by EWFW is provided on an as is basis of its best judgement and accepted engineering practices at the time of writing.

1.2 SITE LOCATION

The site is located within Ku-ring-gai Council's (Council) local governing area. The site is currently developed with multiple buildings, roads and carparks, landscaped areas and heavily vegetated areas.

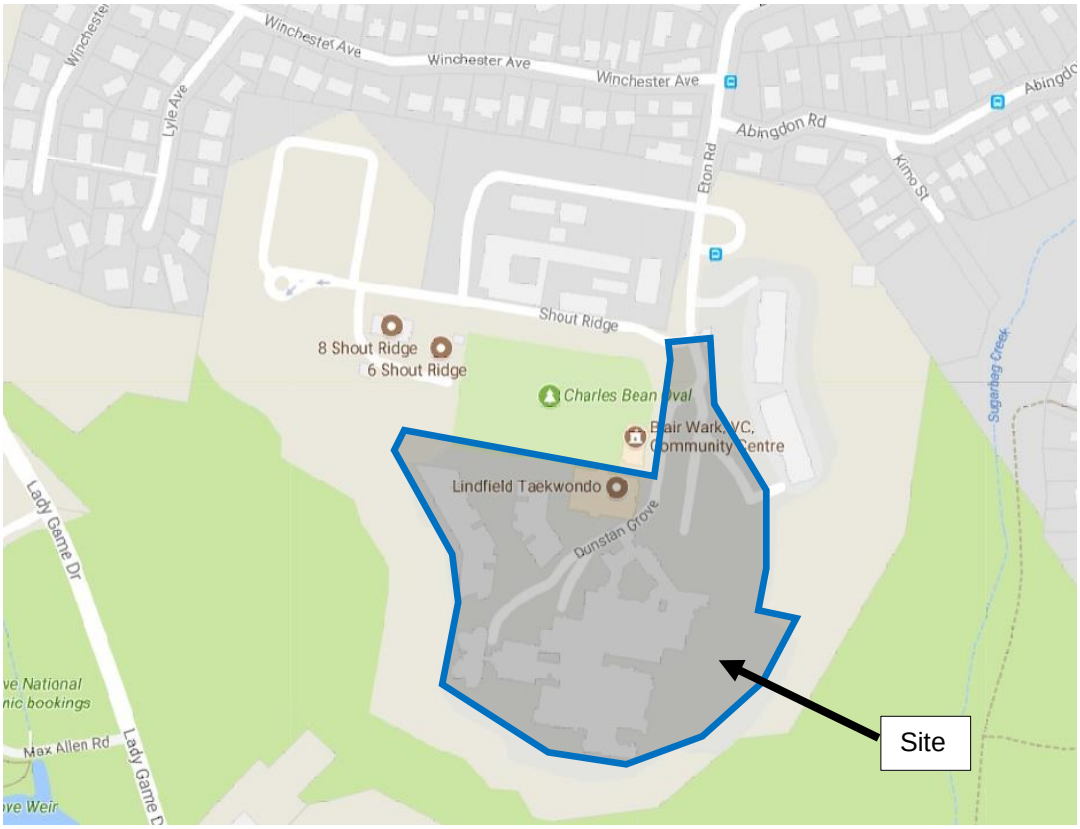


FIGURE 1-1 - SITE LOCATION PLAN - *GOOGLE MAPS*

1.3 REFERENCE DOCUMENTS

The following documents have been reviewed in order to develop this report and should be read in conjunction to this report:

TABLE 1-1 REFERENCE DOCUMENTS

Document	Reference
Ku-ring-gai Council Development Control Plan 2016 Part 24	DCP 24
EWFW Overland Flow Assessment and Stormwater Report 2020	R001

2 STORMWATER QUALITY STRATEGY

The existing site is currently developed and is occupied by multiple buildings, internal road network and carparking system, and landscape areas to which it has a mix of impervious and pervious areas. The site stormwater runoff flows into the Blue Gum Creek drainage system through the existing internal site infrastructure that discharges into Council's stormwater system for drainage conveyance onto Blue Gum Creek.

Council's DCP 24 requires stormwater quality control on all developments to reduce the amount of suspended solids, total phosphorous and total nitrogen leaving the developed site. Table 24C.6-1: Captured Stormwater Treatment Standards in DCP 24 Section C.6 illustrates the targets that developments need to achieve.

2.1 STORMWATER NETWORK

The existing stormwater network within the site comprises of below ground pit and pipe network as well as overland flow routes. The new development works are mainly within the existing building envelopes however an extension to the existing road network is proposed connecting to the new COLA area, in addition to other improvements to assist traffic movements. The new works will connect into existing stormwater infrastructure within the site, thus will be incorporated herein as part of the Stormwater Quality strategy for the site.

The following information was ascertained to form part of this strategy.

- An initial survey provided to EWFW prepared by William L. Backhouse (ref: 16521.003 issue: C)
- An additional survey provided to EWFW prepared by Usher and Company (ref: 6076-DET issue: 4)

EWFW also requested further information from Ku-ring-gai Council however no information was available.

2.2 STORMWATER QUALITY MODELLING

To demonstrate the development meets the set targets, a MUSIC (Version 6.3 – Jun 2018 Model was completed to model water quality cycles for the new development works.

The proposed measures were modelled:

- Five (5) On-Site Stormwater / settlement ponds with an overall total capacity of Total capacity of 1257m^3;
    - Pond 1 – for Catchment R4 has an area of 131 sq^2 meters & 85 m^3 storage
    - Pond 2 – for Catchment B1 zone D has an area of 172 sq^2 meters & 110 m^3 storage
    - Pond 3 – for Catchment B1 zone C has an area of 627 sq^2 meters & 402 m^3 storage
    - Pond 4 – for Catchment R1 has an area of 197 sq^2 meters & 129 m^3 storage
    - Pond 5 – for Catchment R3 & B5 an area of 738 sq^2 meters & 531 m^3 storage
- All grated inlet pits (existing and proposed) will be retrofitted with a 1500um trash filter screen fitted internally prior to stormwater entering the in-ground drainage system.
- A SPEL Floating Wetlands system in Pond 1
- A 50kL Rainwater tank for irrigation for the roof of Catchment B1 Zone C

The new development works have been incorporated in the B1 zone D and Zone C catchments of the model. Figure 2-1 shows the concept of the new COLA and road extension.

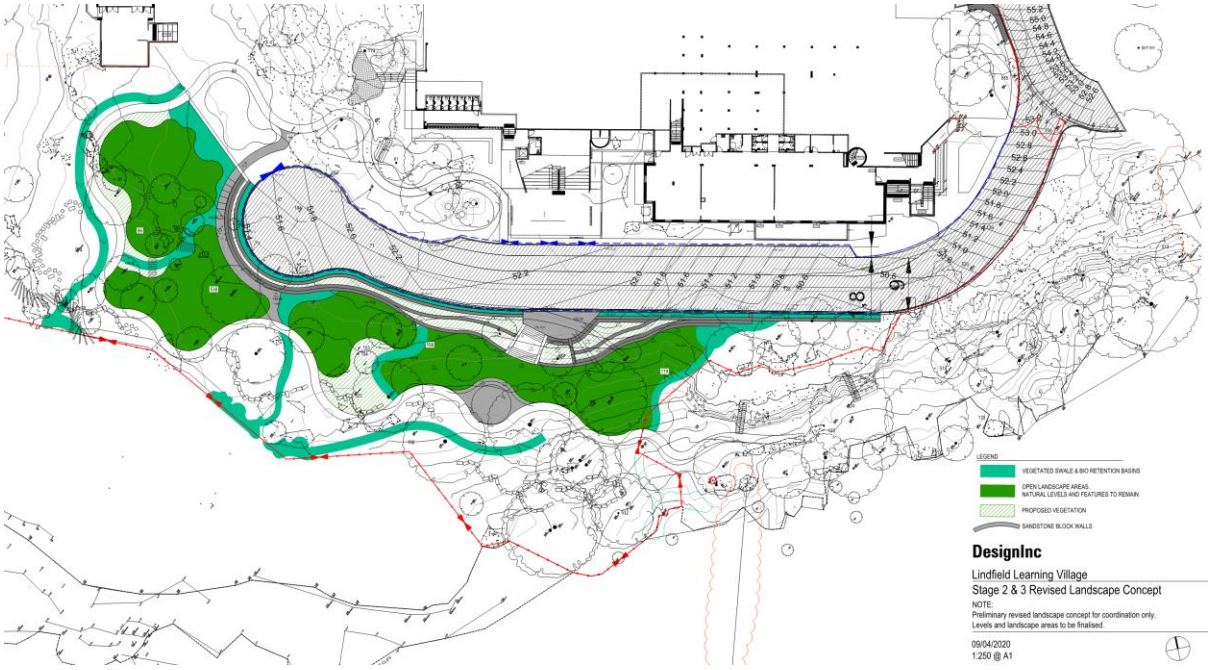


FIGURE 2-1 - PROPOSED WORKS - *DESIGNINC*

The MUSIC model was set up utilising the MUSIC Link for all data pertaining to rainfall and the like to be in accordance with Council's modelling procedures. A schematic layout of the set up model is shown in Figure 2-2.

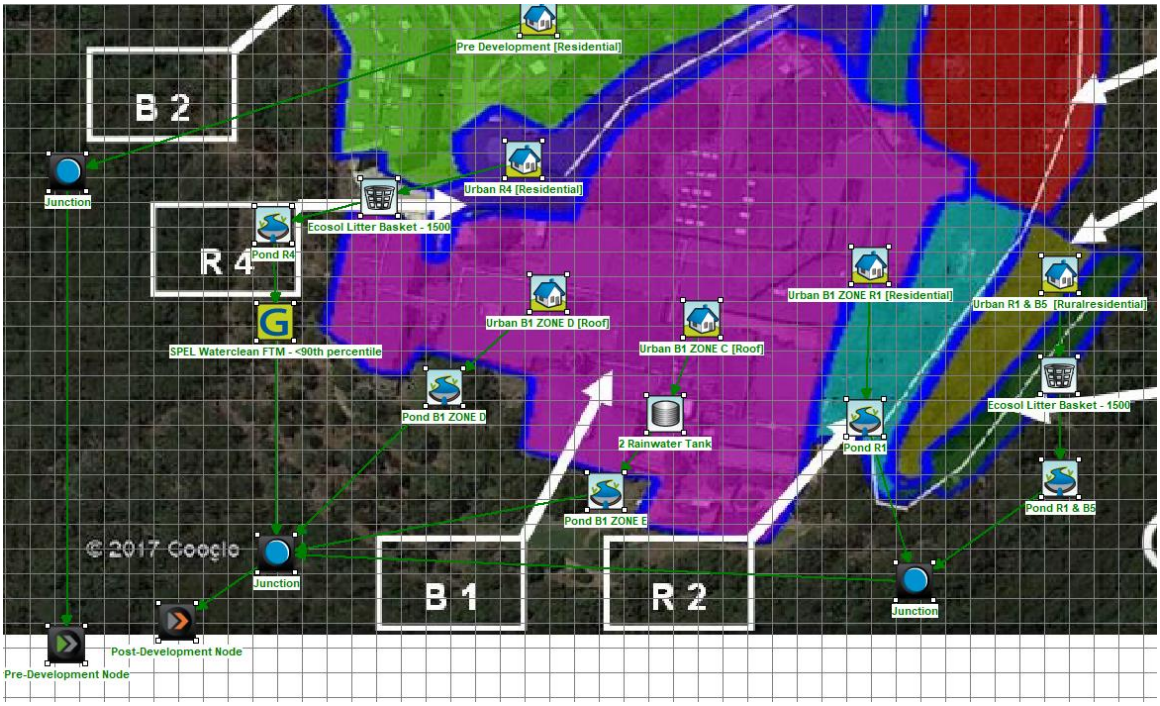
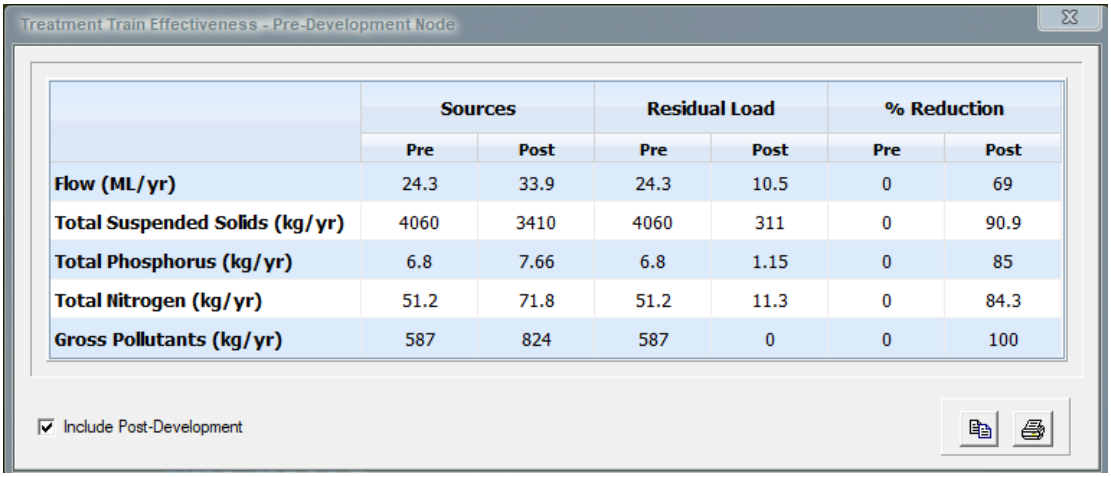


FIGURE 2-2 - SCHEMATIC MUSIC MODEL LAYOUT

The above treatment train has been modelled to demonstrate effectiveness in Figure 2-3. A copy of the MUSIC Link report is also affixed to this report in Appendix A.



	Sources		Residual Load		% Reduction	
	Pre	Post	Pre	Post	Pre	Post
Flow (ML/yr)	24.3	33.9	24.3	10.5	0	69
Total Suspended Solids (kg/yr)	4060	3410	4060	311	0	90.9
Total Phosphorus (kg/yr)	6.8	7.66	6.8	1.15	0	85
Total Nitrogen (kg/yr)	51.2	71.8	51.2	11.3	0	84.3
Gross Pollutants (kg/yr)	587	824	587	0	0	100

FIGURE 2-3 - TREATMENT TRAIN EFFECTIVENESS

The trailing figures indicated in the cumulative frequency graphs represent each item above respectively.

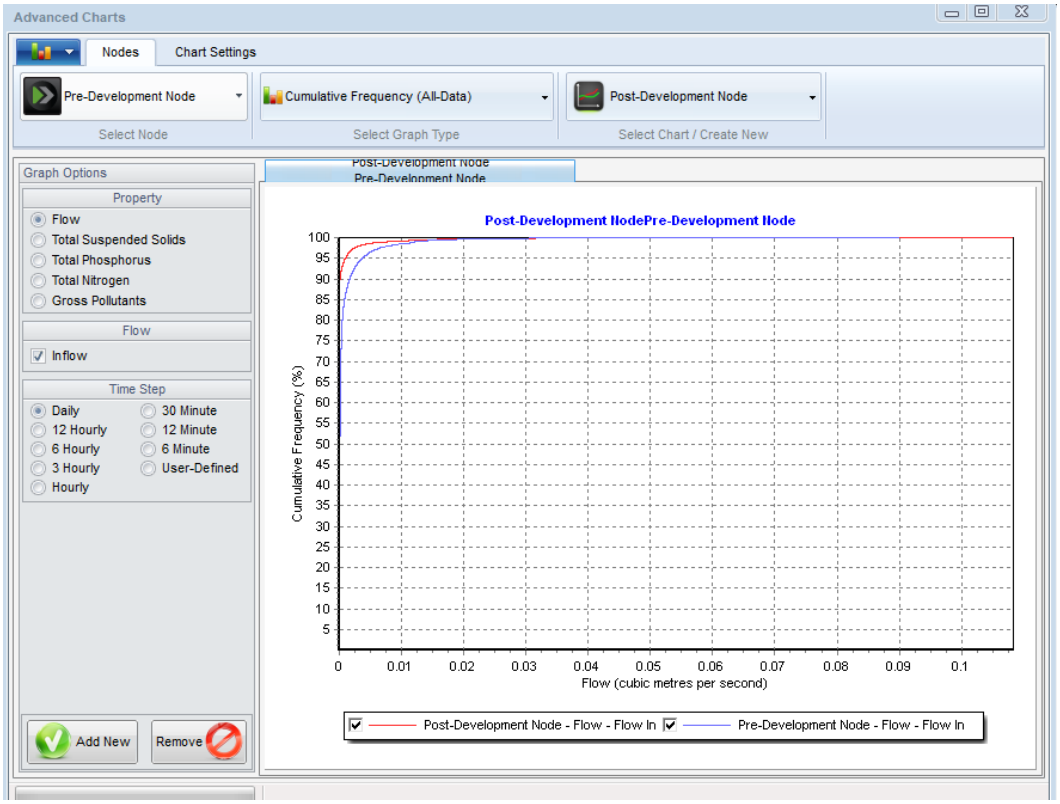


FIGURE 2-4 - TOTAL FLOWS CUMULATIVE FREQUENCY GRAPH

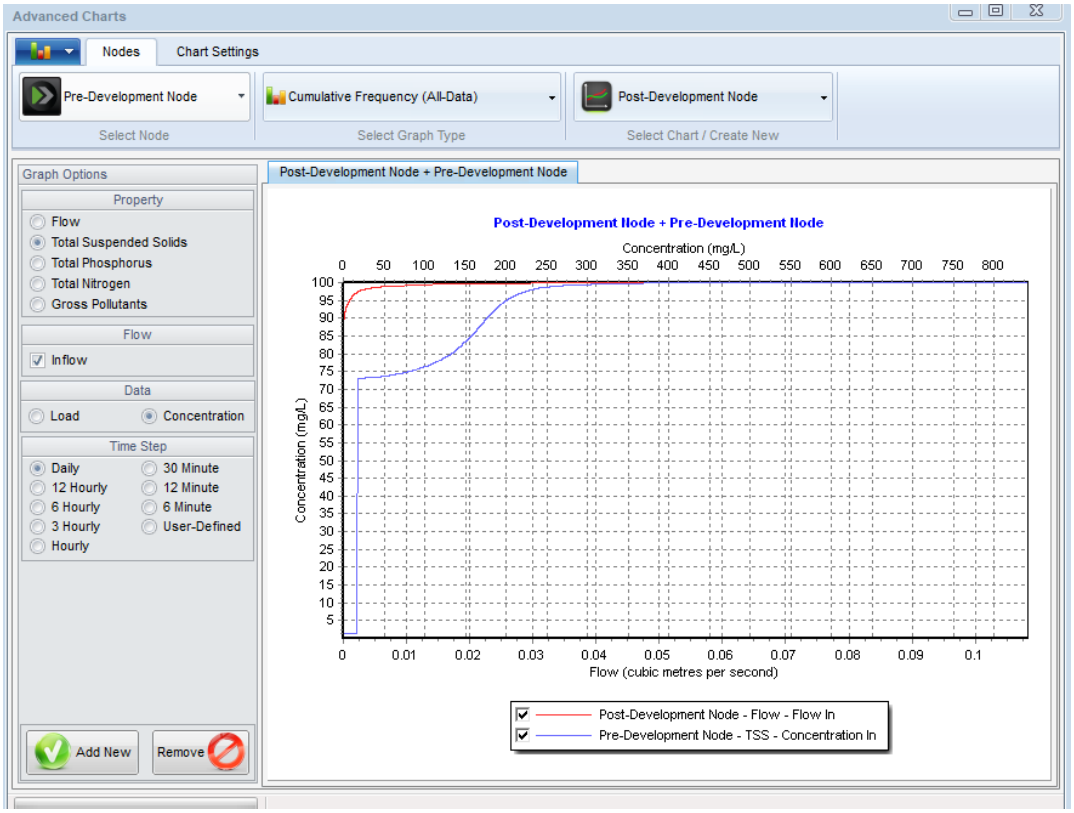


FIGURE 2-5 - TOTAL SUSPENDED SOLIDS CUMULATIVE FREQUENCY GRAPH

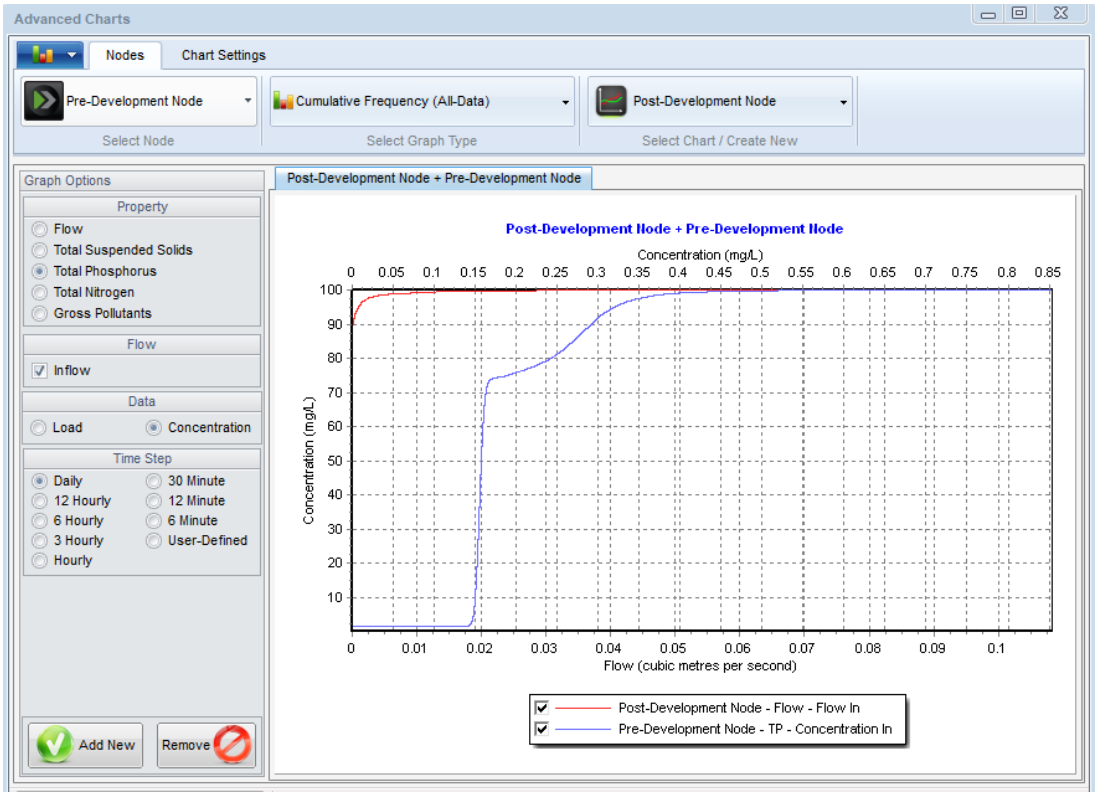


FIGURE 2-6 - TOTAL PHOSPHOROUS CUMULATIVE FREQUENCY GRAPH

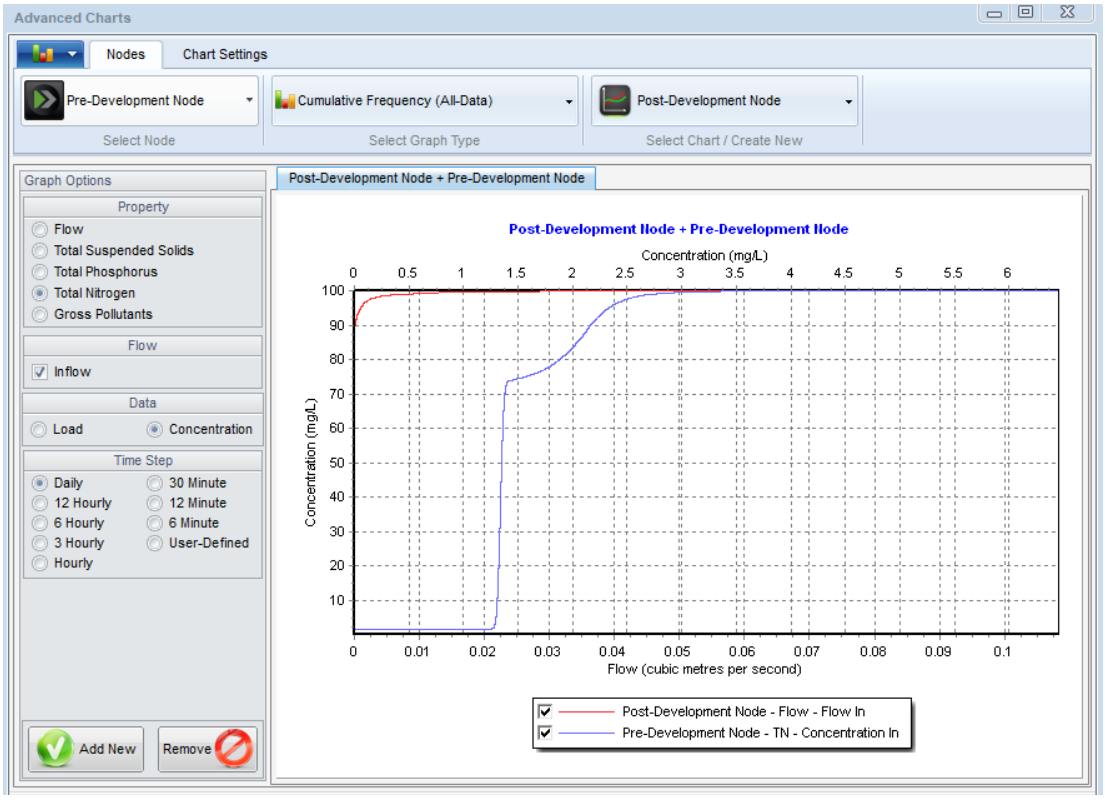


FIGURE 2-7 - TOTAL NITROGEN CUMULATIVE FREQUENCY GRAPH

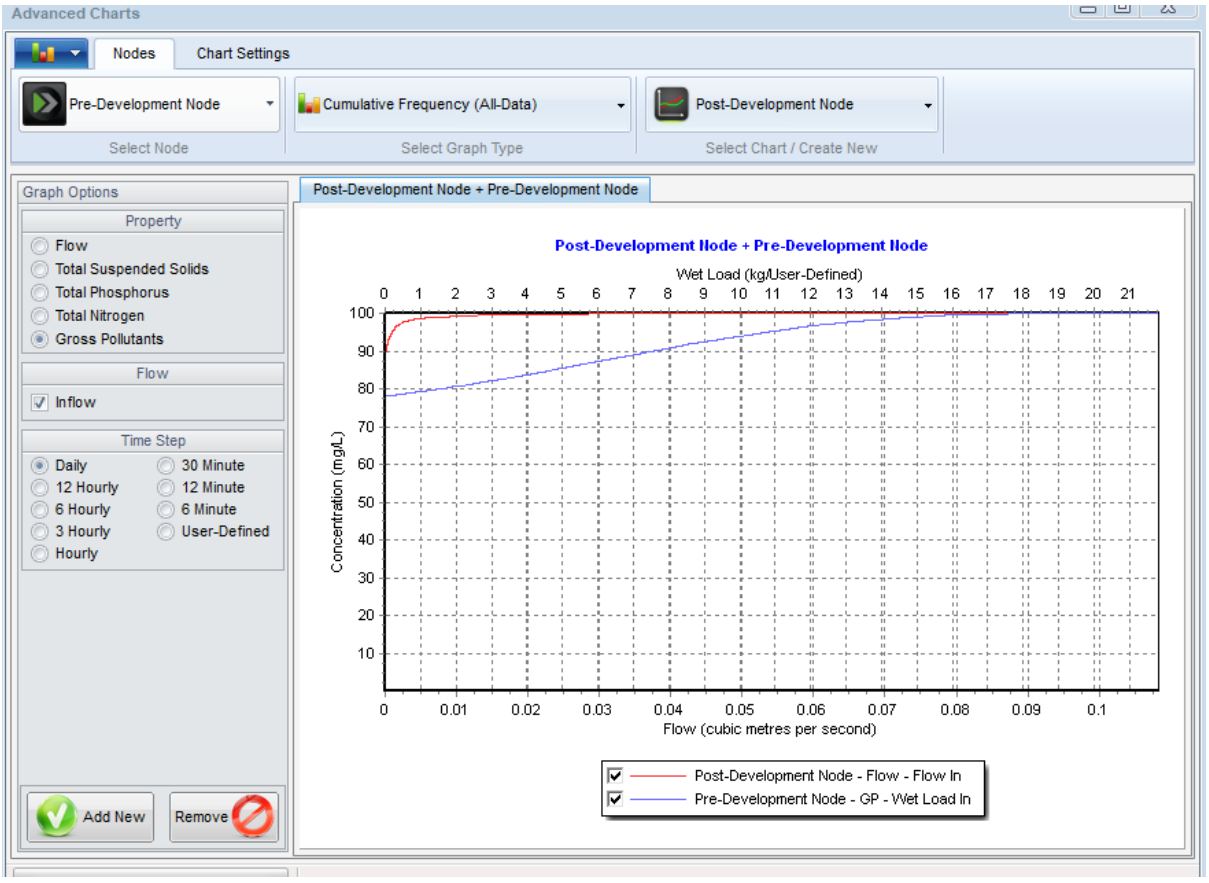


FIGURE 2-8 - GROSS POLLUTANTS CUMULATIVE FREQUENCY GRAPH

2.3 STORMWATER QUALITY DURING CONSTRUCTION

A soil and water management plan will be impleted by the contractor to ensure that downstream waterways are not affected due to site construction works. Proposed measures such as sedimentation basins, siltation fences, haybales and sandbag sediment traps will be installed and maintained throughout the construction phase to ensure sedimentation and soil erosion is mitigate. Detailed measures would be designed and document in accordance with the Contractor's construction methodologies and staging of works.

The abovementioned proposed ponds are to be installed at the commence of construction works to act as sediment basins to trap all sedimentation. A preliminary assessment and calculation has been undertaken for these and results have been affixed in Appendix B.

3 ASSUMPTIONS, LIMITATIONS AND LIABILITY

3.1 ASSUMPTIONS AND LIMITATIONS

The information contained in this document is provided for the sole use of the recipient and no reliance should be placed on the information by any other person. In the event that the information is disclosed or furnished to any other person, EWFW accepts no liability for any loss or damage incurred by that person whatsoever as a result of using the information.

This report is prepared in good faith and with due care for information purposes only and should not be relied upon as providing any warranty or guarantee as to the nature and condition of the site, building and/or its services or equipment. In particular, attention is drawn to the nature of the inspection and investigations undertaken and the limitations these impose in determining with accuracy the state of the building, its services or equipment.

Due to the limitations of our access to services in the preparation of this report, users of this report should not rely on any statements or representations contained within, but should undertake further and more detailed investigations to satisfy themselves as to the correctness of any statement or representation contained in this report.

3.2 LIABILITY

EWFW shall not be held liable for any loss or damage resulting from any defects associating in the installation of the proposed measures nor damage to any services or equipment during this stage. Any non compliance of the installation or its service, or equipment with any legislative or operational requirements, shall not be the responsibility of EWFW whether or not such defect or non compliance is referred to or reported upon in this report, unless such defect or non compliance has been made apparent to a competent Engineer for the purpose of preparation of this report.

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APPENDIX A – MUSIC LINK REPORT

KU-RING-GAI COUNCIL

MUSIC-*link* Report

Project Details		Company Details	
Project:	Lindfield	**Company:**	EWFW
Report Export Date:	3/07/2019	**Contact:**	
Catchment Name:	Lindfield	**Address:**	Lindfield
Catchment Area:	3.473ha	**Phone:**	
Impervious Area*:	59.24%	**Email:**	
Rainfall Station:	66062 SYDNEY		
Modelling Time-step:	6 Minutes		
Modelling Period:	1/01/1963 - 31/12/1993 11:54:00 PM		
Mean Annual Rainfall:	1275mm		
Evapotranspiration:	1261mm		
MUSIC Version:	6.3.0		
MUSIC-link data Version:	6.31		
Study Area:	Ku-ring-gai Council		
Scenario:	Ku-ring-gai		

* takes into account area from all source nodes that link to the chosen reporting node, excluding Import Data Nodes

Treatment Train Effectiveness		Treatment Nodes		Source Nodes	
Node: Junction	**Reduction**	**Node Type**	**Number**	**Node Type**	**Number**
Flow	66.3%	Pond Node	5	Urban Source Node	6
TSS	89.7%	Rain Water Tank Node	1		
TP	83.1%	Generic Node	1		
TN	82.9%	GPT Node	2		
GP	100%				

Comments

UTS Linfield Redevelopment Stage 2

KU-RING-GAI COUNCIL

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Passing Parameters

Node Type	Node Name	Parameter	Min	Max	Actual
GPT	Ecosol Litter Basket - 1500	Hi-flow bypass rate (cum/sec)	None	None	100
GPT	Ecosol Litter Basket - 1500	Hi-flow bypass rate (cum/sec)	None	None	100
Pond	Pond B1 ZONE D	% Reuse Demand Met	None	None	0
Pond	Pond B1 ZONE E	% Reuse Demand Met	None	None	0
Pond	Pond R1	% Reuse Demand Met	None	None	0
Pond	Pond R1 & B5	% Reuse Demand Met	None	None	0
Pond	Pond R4	% Reuse Demand Met	None	None	0
Post	Post-Development Node	% Load Reduction	None	None	66.3
Post	Post-Development Node	GP % Load Reduction	70	None	100
Post	Post-Development Node	TN % Load Reduction	45	None	82.9
Post	Post-Development Node	TP % Load Reduction	45	None	83.1
Post	Post-Development Node	TSS % Load Reduction	80	None	89.7
Pre	Pre-Development Node	% Load Reduction	None	None	0
Pre	Pre-Development Node	GP % Load Reduction	None	None	0
Pre	Pre-Development Node	TN % Load Reduction	None	None	0
Pre	Pre-Development Node	TP % Load Reduction	None	None	0
Pre	Pre-Development Node	TSS % Load Reduction	None	None	0
Urban	Pre Development	Area Impervious (ha)	None	None	1.662
Urban	Pre Development	Area Pervious (ha)	None	None	0.989
Urban	Pre Development	Total Area (ha)	None	None	2.652
Urban	Urban B1 ZONE C	Area Impervious (ha)	None	None	0.606
Urban	Urban B1 ZONE C	Area Pervious (ha)	None	None	0.241
Urban	Urban B1 ZONE C	Total Area (ha)	None	None	0.848
Urban	Urban B1 ZONE D	Area Impervious (ha)	None	None	0.165
Urban	Urban B1 ZONE D	Area Pervious (ha)	None	None	0.066
Urban	Urban B1 ZONE D	Total Area (ha)	None	None	0.232
Urban	Urban B1 ZONE R1	Area Impervious (ha)	None	None	0.164
Urban	Urban B1 ZONE R1	Area Pervious (ha)	None	None	0.102
Urban	Urban B1 ZONE R1	Total Area (ha)	None	None	0.267
Urban	Urban R1 & B5	Area Impervious (ha)	None	None	0.467
Urban	Urban R1 & B5	Area Pervious (ha)	None	None	0.718
Urban	Urban R1 & B5	Total Area (ha)	None	None	1.186
Urban	Urban R4	Area Impervious (ha)	None	None	0.653
Urban	Urban R4	Area Pervious (ha)	None	None	0.286
Urban	Urban R4	Total Area (ha)	None	None	0.94

Only certain parameters are reported when they pass validation

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Failing Parameters

Node Type	Node Name	Parameter	Min	Max	Actual
Pond	Pond B1 ZONE D	Evaporative Loss as % of PET	75	75	100
Pond	Pond B1 ZONE D	Extended detention depth (m)	0.25	1	2
Pond	Pond B1 ZONE E	Evaporative Loss as % of PET	75	75	100
Pond	Pond B1 ZONE E	Extended detention depth (m)	0.25	1	2.75
Pond	Pond R1	Evaporative Loss as % of PET	75	75	100
Pond	Pond R1	Extended detention depth (m)	0.25	1	2.25
Pond	Pond R1 & B5	Evaporative Loss as % of PET	75	75	100
Pond	Pond R1 & B5	Extended detention depth (m)	0.25	1	2
Pond	Pond R4	Evaporative Loss as % of PET	75	75	100
Pond	Pond R4	Extended detention depth (m)	0.25	1	1.75
Rain	2 Rainwater Tank	% Reuse Demand Met	80	None	0

Only certain parameters are reported when they pass validation

APPENDIX B – SEDIMENT AND EROSION BASIN CALCULATIONS

1. Erosion Hazard and Sediment Basins

Site Name: UTS Linfield

Site Location: Eaton Road, Linfield. NSW 2070

Precinct/Stage: Stage 2

Other Details:

Site area	Sub-catchment or Name of Structure						Notes
	Zone A	Zone B	Zone C	Zone D	Zone E		
Total catchment area (ha)	1.186	0.211	0.882	0.229	0.176		
Disturbed catchment area (ha)	0.783	0.134	0.664	0.132	0.102		
Soil analysis (enter sediment type if known, or laboratory particle size data)							
Sediment Type (C, F or D) if known:	C	C	C	C	C		From Appendix C (if known)
% sand (fraction 0.02 to 2.00 mm)							Enter the percentage of each soil fraction. E.g. enter 10 for 10%
% silt (fraction 0.002 to 0.02 mm)							
% clay (fraction finer than 0.002 mm)							
Dispersion percentage	11.0	11.0	11.0	11.0	11.0		E.g. enter 10 for dispersion of 10%
% of whole soil dispersible							See Section 6.3.3(e). Auto-calculated
Soil Texture Group	C	C	C	C	C		Automatic calculation from above
Rainfall data							
Design rainfall depth (no of days)	20	20	20	20	20		See Section 6.3.4 and, particularly, Table 6.3 on pages 6-24 and 6-25.
Design rainfall depth (percentile)	90	90	90	90	90		
x-day, y-percentile rainfall event (mm)	172	172	172	172	172		
Rainfall R-factor (if known)	3470.67	3470.67	3470.67	3470.67	3470.67		Only need to enter one or the other here
IFD: 2-year, 6-hour storm (if known)	12.68	12.68	12.68	12.68	12.68		
RUSLE Factors							
Rainfall erosivity (*R*-factor)	3470.67	3470.67	3470.67	3470.67	3470.67		Auto-filled from above
Soil erodibility (*K*-factor)	0.04	0.04	0.04	0.04	0.04		RUSLE LS factor calculated for a high rill/interrill ratio.
Slope length (m)	190.63	93.25	76.6	46.1	39.2		
Slope gradient (%)	9.65	11.2	0.4	13	17.2		
Length/gradient (*LS*-factor)	4.78	3.72	2.11	2.80	3.56		
Erosion control practice (*P*-factor)	1.3	1.3	1.3	1.3	1.3	1.3	
Ground cover (*C*-factor)	1	1	1	1	1	1	
Sediment Basin Design Criteria (for Type D/F basins only. Leave blank for Type C basins)							
Storage (soil) zone design (no of months)	9	6	3	4	2	2	Minimum is generally 2 months
Cv (Volumetric runoff coefficient)	0.63	0.63	0.63	0.63	0.63		See Table F2, page F-4 in Appendix F
Calculations and Type D/F Sediment Basin Volumes							
Soil loss (t/ha/yr)	862	671	381	505	642		
Soil Loss Class	6	5	4	5	5		See Table 4.2, page 4-13
Soil loss (m^3/ha/yr)	663	516	293	389	494		Conversion to cubic metres
Sediment basin storage (soil) volume (m^3)	389	35	49	17	8		See Sections 6.3.4(i) for calculations
Sediment basin settling (water) volume (m^3)	1285	229	956	248	191		See Sections 6.3.4(i) for calculations
Sediment basin total volume (m^3)	1674	264	1005	265	199		

NB for sizing of Type C (coarse) sediment basins, see Worksheet 3 (if required).

2. Flow Calculations

Peak flow is given by the Rational Formula: $Qy = 0.00278 \times C_{10} \times F_Y \times I_{y,\,tc} \times A$

where:
- Q_y is peak flow rate (m^3/sec) of average recurrence interval (ARI) of "Y" years
- C_{10} is the runoff coefficient (dimensionless) for ARI of 10 years.
- F_y is a frequency factor for "Y" years.
- A is the catchment area in hectares (ha)
- $I_{y,\,tc}$ is the average rainfall intensity (mm/hr) for an ARI of "Y" years and a design duration of "tc" (minutes or hours)

Time of concentration (t_c) = $0.76 \times (A/100)^{0.38}$ hrs

Note: For urban catchments the time of concentration should be determined by more precise calculations or reduced by a factor of 50 per cent. Place an x in the appropriate row below to automatically halve the time of concentration for that sub-catchment.

Structure Details									Notes
Name	Zone A	Zone B	Zone C	Zone D	Zone E				
Catchment Area (ha)	1.1863	0.211	0.882	0.229	0.176				
Place an x here to halve tc									Place an x if disturbed catchment
Time of concentration (tc)	8	4	8	5	4				minutes
Rainfall Intensities									
1-year, tc	80.3	95.3	80.3	95.3	95.3				Enter the relevant rainfall intensities (in mm/hr) for each of the nominated rainfall events. The time of concentration (tc) determines the duration of the event to be used
2-year, tc	102.6	121.9	102.6	121.9	121.9				
5-year, tc	130.2	154.1	130.2	154.1	154.1				
10-year, tc	145.9	172.4	145.9	172.4	172.4				
20-year, tc	167	196.9	167	196.9	196.9				
50-year, tc	194.2	228.7	194.2	228.7	228.7				
100-year, tc	214.9	252.65	214.9	252.65	252.65				
C10 runoff coefficient	0.85	0.85	0.85	0.85	0.85				Use AR&R or Table F3, pg F-6
Frequency Factors									
FF, 1-year	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	Can use 0.8 for a construction site
FF, 2-year	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	Can use 0.85 for a construction site
FF, 5-year	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	Can use 0.95 for a construction site
FF, 10-year	1	1	1	1	1	1	1	1	Generally always 1
FF, 20-year	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	Can use 1.05 for a construction site
FF, 50-year	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	Can use 1.15 for a construction site
FF, 100-year	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	Can use 1.2 for a construction site

Flow Calculations									Notes
1-year, tc (m^3/s)	0.18	0.038	0.134	0.041	0.032				
2-year, tc (m^3/s)	0.244	0.052	0.182	0.056	0.043				
5-year, tc (m^3/s)	0.347	0.073	0.258	0.079	0.061				
10-year, tc (m^3/s)	0.409	0.086	0.304	0.093	0.072				
20-year, tc (m^3/s)	0.492	0.103	0.365	0.112	0.086				
50-year, tc (m^3/s)	0.626	0.131	0.465	0.142	0.109				
100-year, tc (m^3/s)	0.723	0.151	0.537	0.164	0.126				

NB for flow calculations on sediment basin spillways, see Worksheet 3 (if required).

3. Sediment Basin Spillway Design

Structure Details

Structure Name	Zone A	Zone B	Zone C	Zone D	Zone E		Auto-filled from Worksheet 1
Catchment Area (ha)	1.1863	0.211	0.882	0.229	0.176		Auto-filled from Worksheet 1
Time of concentration (tc)	4	2	4	2	2		Auto-calculated assuming tc is halved

Rainfall Intensities (IFD Values)

1 year, tc	80.3	96.3	95.3	95.3	95.3		Enter the relevant rainfall intensities (in mm/hr) for each of the nominated rainfall events. The time of concentration (tc) determines the duration of the event to be used
2 year, tc	102.6	121.9	121.9	121.9	121.9		
5 year, tc	130.2	154.1	154.1	154.1	154.1		
10 year, tc	145.9	172.4	172.4	172.4	172.4		
20 year, tc	167	196.9	196.9	196.9	196.9		
50 year, tc	194.2	228.7	228.7	228.7	228.7		
100 year, tc	214.9	252.65	252.65	252.65	252.65		
C_{10} runoff coefficient	0.85	0.85	0.85	0.85	0.85		Use AR&R or Table F3, pg F-6
Design ARI event (select):	20	20	100	100	100	100	Select design ARI (years) from dropdown
Frequency Factor	1.05	1.05	1.2	1.2	1.2	1.2	Auto-filled based on selected ARI
Flow Calculation	0.492	0.103	0.632	0.164	0.126		Auto-calculated based on selected ARI

4. Volume of Type C (Coarse) Sediment Basins

Type C Basin Design Criteria

Structure Name	Zone A	Zone B	Zone C	Zone D	Zone E		Auto-filled from Worksheet 1
Catchment Area (ha)	1.1863	0.211	0.882	0.229	0.176		Auto-filled from Worksheet 1
Sediment type (C, F or D)	C	C	C	C	C		Auto-filled from Worksheet 1
Design rainfall event	1	1	1	1	1		Choose design event from dropdown
Flow volume (m^3/s)	0.18	0.038	0.159	0.041	0.032		Calculated from IFD values above
Area Factor	4100	4100	4100	4100	4100	4100	Default is 4,100. See pg 6-12
Depth of settling (water zone) (m)	0.6	0.6	0.6	0.6	0.6	0.6	Minimum is 0.6m (pg 6-12)

Type C Basin Volume Calculations

Basin Surface Area (m^2)	738	155.8	651.9	168.1	131.2	Not Type C	Auto-calculated
Settling (water) zone volume (m^3)	442.8	93.5	391.1	100.9	78.7	Not Type C	Auto-calculated
Storage (soil) zone volume (m^3)	88.3	11.8	33	8.7	8.6	Not Type C	Auto-calculated
Total basin volume (m^3)	531.1	105.3	424.1	109.6	87.3	Not Type C	Auto-calculated

Basin Shape

Enter length:width ratio	3	3	2	3	3	3	E.g. for 3:1 (L:W) enter 3.
Length (m)	47.1	21.6	36.1	22.5	19.8	N/A	These figures should be taken as a guide only. Detailed calcs might be required.
Width (m)	15.7	7.2	18.1	7.5	6.6	N/A	