



Department of Water
Government of Western Australia

GUIDELINES FOR THE USE OF MUSIC ON THE SWAN COASTAL PLAIN

Coastal Catchment Initiative Project, 2008



#music
Model for Urban Stormwater
Improvement Conceptualisation

Department of Water

Water Resource Management Division

March 2008

1. Background Information

MUSIC (the Model for Urban Stormwater Improvement Conceptualisation) is a computer based decision support tool for the conceptual analysis of urban stormwater quality and stormwater treatment efficiencies. MUSIC allows catchment models to be easily represented where the user can implement individual or multiple stormwater treatment measures on the landscape and estimate their treatment efficiencies. MUSIC operates at a range of spatial and temporal scales ranging from an individual house lot size to catchments of 100 sqkm (providing there is uniform rainfall over this area) and with a range of modelling timesteps from 6 minutes to 24 hours.

MUSIC uses the SymHyd hydrological model (Figure 1) (Chiew and McMahon, 1997) which incorporates surface runoff, an impervious and pervious store and a single groundwater store. The SymHyd model performs well where single groundwater stores reside such as those commonly found in the eastern states.

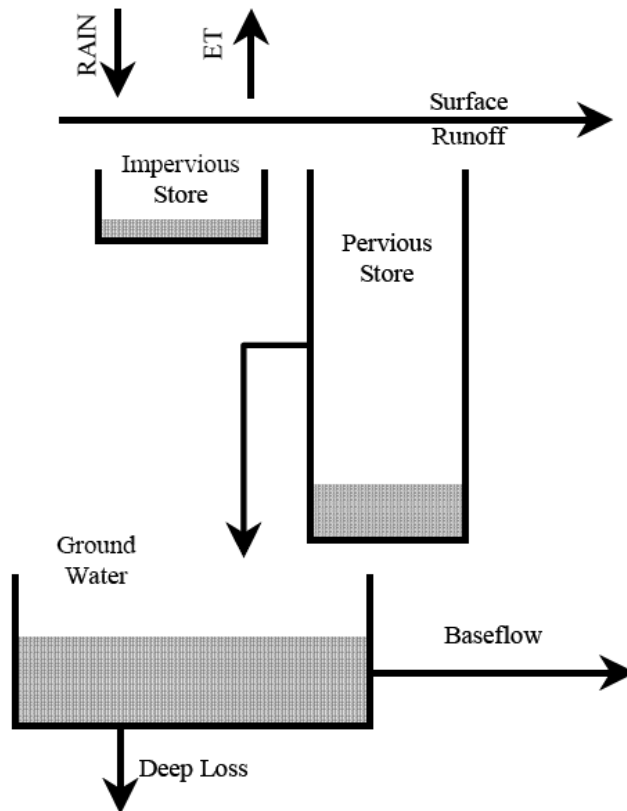


Figure 1: The SymHyd Hydrological Model

The Swan Coastal Plain (SCP) however has two distinct groundwater stores and in many areas the groundwater strongly influences streamflow. SymHyd can not model such complicated systems. When attempting to use MUSIC on the Swan Coastal Plain, careful attention must be paid to the way the catchment and its hydrology is represented in the model and the parameter values used.

This document outlines how MUSIC can be modified to enable SymHyd to model hydrological conditions on the Swan Coastal Plain.

2. Using MUSIC on the Swan Coastal Plain

For MUSIC to perform under the prevailing Swan Coastal hydrological conditions two modifications to the MUSIC model must be considered:

Firstly in areas where baseflow strongly influences streamflow, the hydrograph must be separated and each fraction must be represented in the catchment model. For the purposes of this document, we will call this ‘the hydrological fix’ and will outline how this ‘fix’ can be implemented.

Secondly the default parameters within MUSIC are based on extensive research in Brisbane and Melbourne and are tailored for the catchment conditions of those cities. In order for MUSIC to simulate SCP hydrological conditions, 9 parameters require calibration against observed or modelled flows.

2.1 Implementing the Hydrological Fix

This ‘hydrological fix’ is likely to be needed on the following soil types:

- Bassendean sands,
- Pinjarra Zone
- Quidallup Sands
- Spearwood Sands
- Vasse Zone Sands; and
- Scott Coastal Zone

Figure 2a shows a typical hydrographic response of a stream on the swan coastal plain with the 3 sources of water separated; impervious runoff, shallow groundwater and deep groundwater. For areas where the shallow groundwater presents itself and mixes with overland flow paths it is recommended that the hydrograph sources are physically separated in the MUSIC model. This is conceptually illustrated in Figure 2.

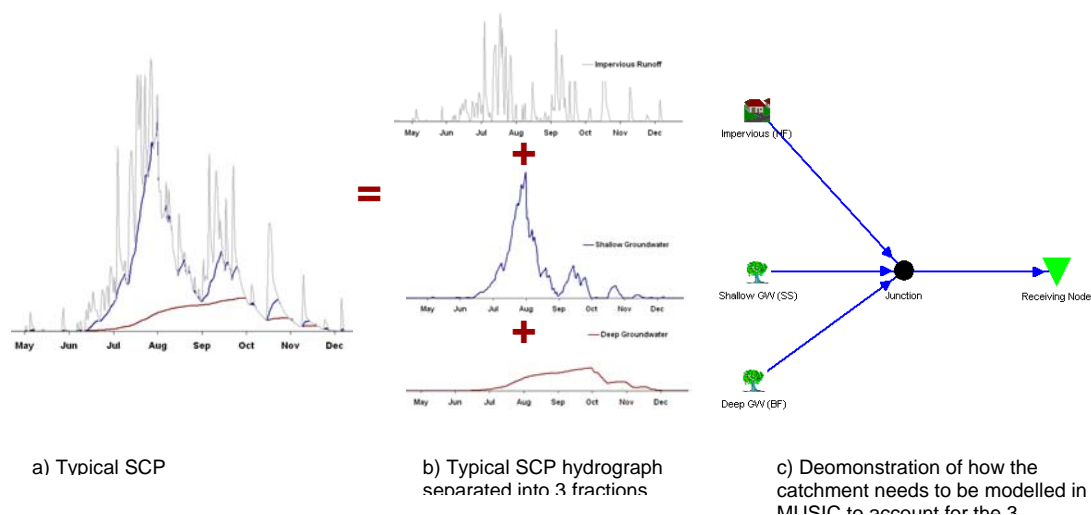


Figure 2: Physical representation of the separated hydrograph typically seen on the SCP

Figure 2 shows the impervious runoff is represented by an urban source node, with the shallow groundwater and the deep groundwater represented by two distinct pervious source nodes. These 3 separated source nodes then require 9 calibrated parameters that are catchment specific.

The following section explains how each source node is modified to represent the separated hydrograph and a list of parameters to use.

Impervious runoff fraction

An urban source node is used to represent the impervious runoff fraction of the hydrograph. This is achieved by setting the parameters to isolate the fraction of water that is surface runoff (Figure 3).

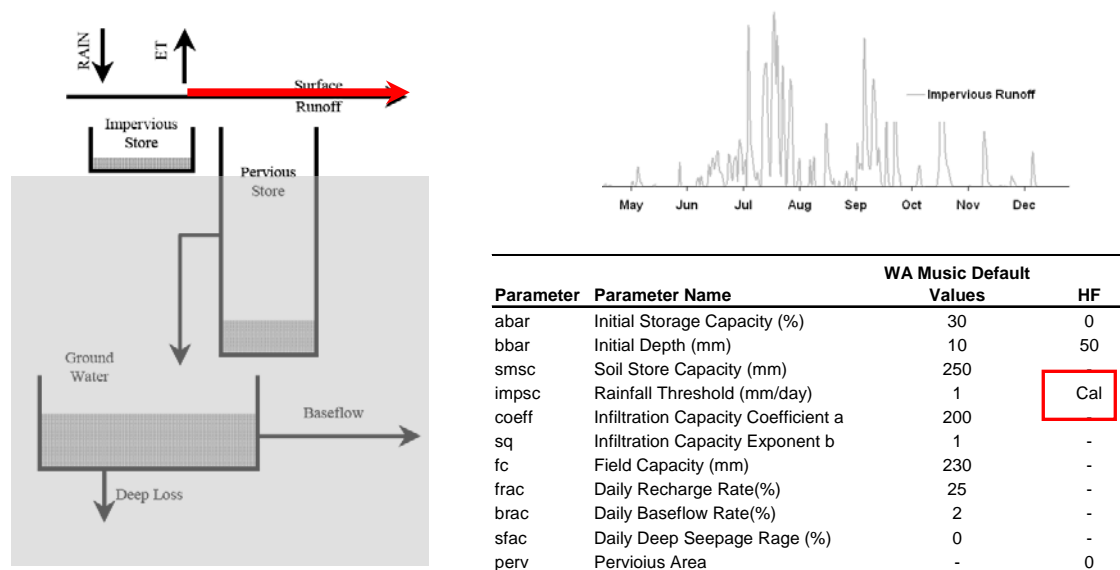


Figure 3: Isolation of the impervious store in SymHyd to represent the impervious runoff fraction of the SCP hydrograph; and music parameter table.

For the impervious runoff fraction, the *rainfall threshold* parameter must be calibrated against modelled flows. The *total area* of this source node represents the **directly connected impervious area** of the catchment. The remainder parameters to use are listed in the HF column of the parameter table.

Shallow groundwater fraction

A pervious source node is used to represent the shallow groundwater fraction of a SCP hydrograph. This is achieved by setting the parameters to isolate the fraction of water that is shallow groundwater (Figure 4).

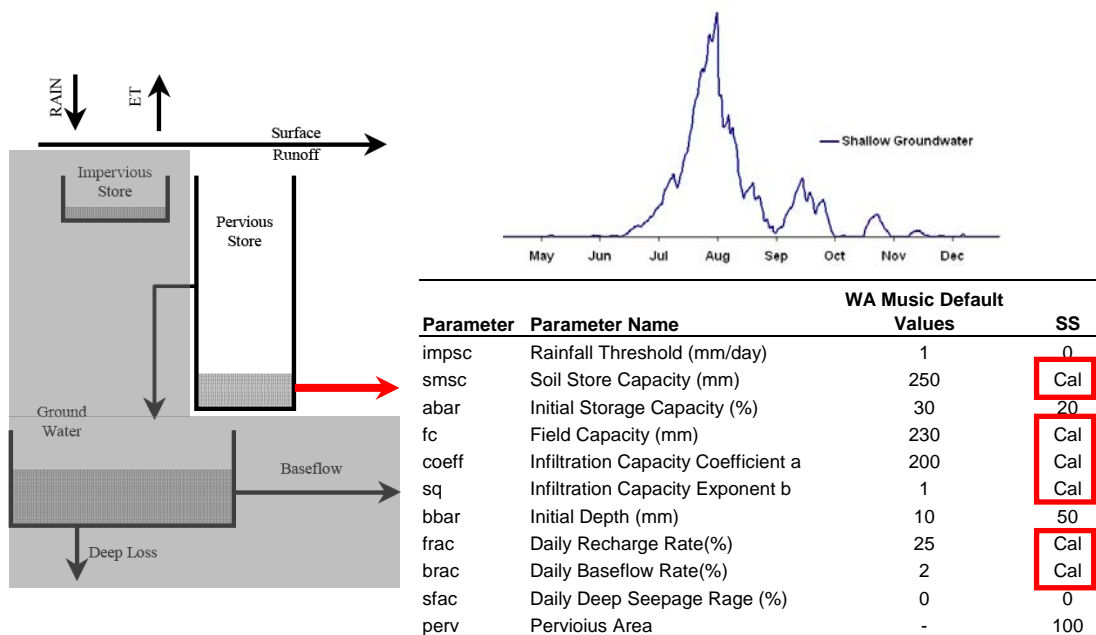


Figure 4: Isolation of the Pervious store in SymHyd to represent the shallow groundwater fraction of the SCP hydrograph; and music parameter table.

5 parameters need to be calibrated: *soil store capacity, field capacity, infiltration capacity coefficient and exponent, daily recharge rate and daily baseflow rate*. The *total area* of the shallow groundwater node must equal to that of the deep groundwater node and represents the pervious area of the catchment. The remainder parameters to use are listed in the SS column of the parameter table.

Deep groundwater

A pervious source node is used to represent the deep groundwater fraction of a SCP hydrograph. This is achieved by setting the parameters to isolate the fraction of water that is deep groundwater (Figure 5).

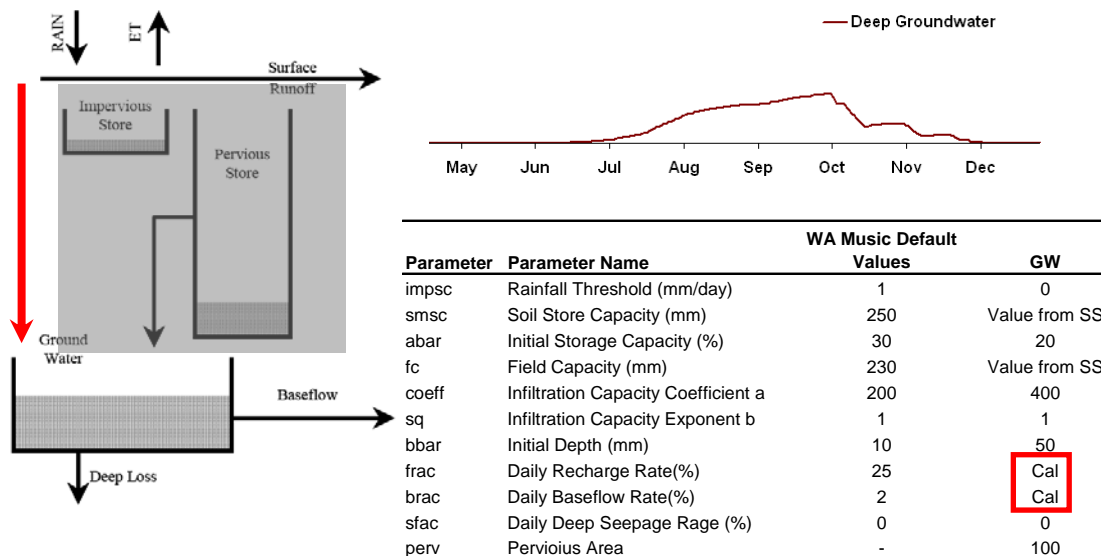


Figure 5: Isolation of the Groundwater store in SymHyd to represent the deep groundwater fraction of the SCP hydrograph; and music parameter table.

Two parameters must be calibrated, *daily recharge* and *daily baseflow* rates. Values of soil store capacity and of the field capacity are taken from the calibrated values used in the shallow groundwater node. The remainder of the parameters to use are listed in the SS column of the parameter table

3. Obtaining Calibrated Parameters for MUSIC

The Coastal Catchment Initiative Water Sensitive Urban Design program has funded the calibration of MUSIC model parameters against modelled flow data for areas that are being subjected to development pressure. These areas are shown in Figure 6 and include the Provence, Vasse-Newtown and Ambergate developments in Geographe Bay and the following Swan Canning Catchments:

- Ellen Brook catchment,
- Henley Brook catchment,
- Helm Street catchment,
- Ellis Brook catchment,
- Bennett Brook,
- Southern River
- Bickley Brook
- Upper Swan, and
- Lower Canning

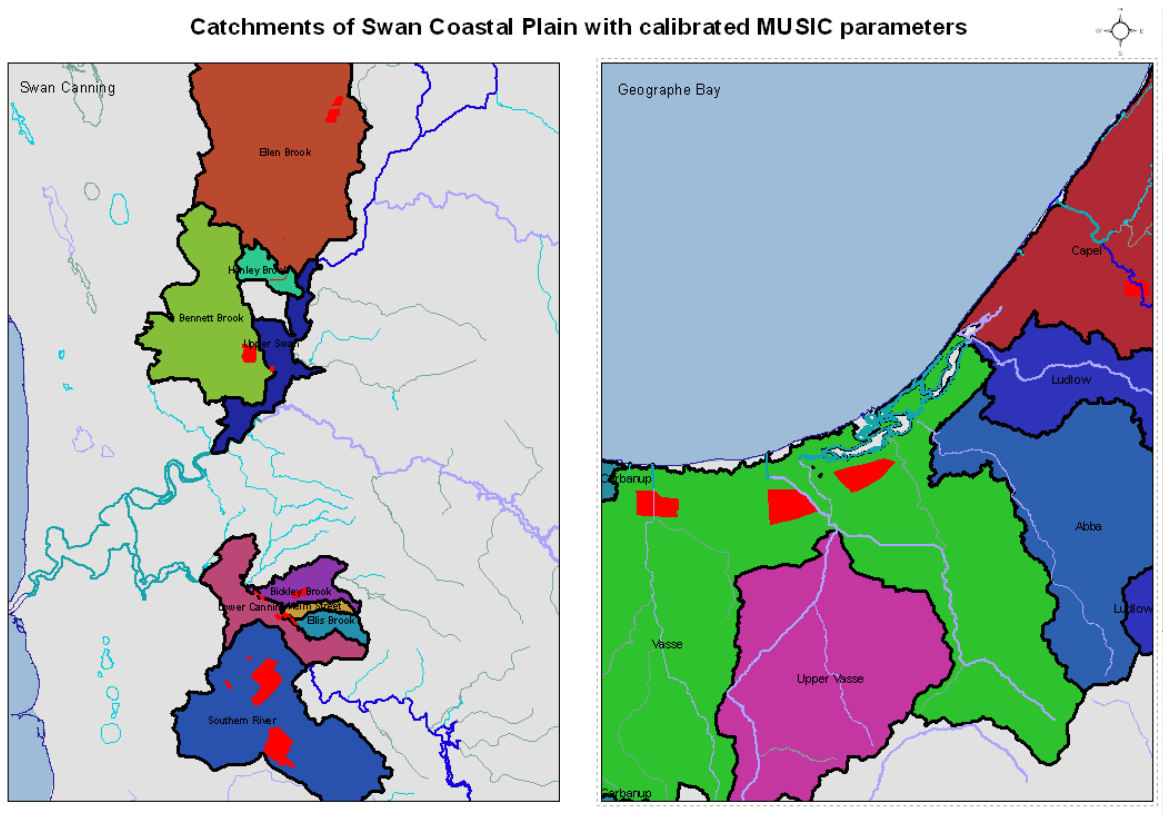


Figure 6: Regions of the Swan Coastal Plain with calibrated MUSIC parameters

The calibrated MUSIC parameter values for these catchments are located in Appendix 1.

For areas outside of these calibrated zones Swan Coastal Plain users are cautioned against using the default parameter values embedded within the software and are directed to the Water Corporation’s *MUSIC Guidelines for Perth* (Water Corporation, 2007) which address’s several of the generic MUSIC modelling issues for Perth and includes specific model parameter values and recommended changes for effective representation of stormwater sources and treatment measures. These MUSIC guidelines are located in Appendix 2 and can also be found on the Water Corporations website www.watercorporation.com.au.

APPENDIX 1: Calibrated MUSIC values for the Swan Coastal Plain

Western Ambergate Parameters:

1. Urban Source Node	2. Shallow GW Source Node	3. Deep GW Source Node
<p>Page 2: Rainfall-Runoff Parameters <u>Impervious area properties</u> Rainfall threshold: 1.38 mm</p> <p><u>Pervious Area properties</u> Soil Storage Capacity: 300 mm Initial Storage (% of capacity): 20 Field Capacity (mm): 175 Infiltration Capacity Coefficient -a: 260.0 Infiltration Capacity Coefficient -b: 1.80</p> <p><u>Groundwater properties</u> Initial Depth (mm): 50 Daily Recharge Rate: 30.0 % Daily Baseflow: 8.5% Daily Deep seepage Rate: 0.0 %</p> <p>Page 3: TSS <u>Base Flow Concentrations</u> Mean - 1.081 Std Dev - 0.343 Stochastically generated</p> <p><u>Storm Flow Concentrations</u> Mean - 1.047 Std Dev - 0.276 Stochastically generated</p> <p>Serial Correlation (r sq): 0</p> <p>Page 4: TP <u>Base Flow Concentrations</u> Mean: -0.624 Std Dev - 0.178 Stochastically generated</p> <p><u>Storm Flow Concentrations</u> Mean: -0.643 Std Dev: 0.165 Stochastically generated</p> <p>Serial Correlation (r sq): 0</p> <p>Page 5: TN <u>Base Flow Concentrations</u> Mean: 0.421 Std Dev : 0.144 Stochastically generated</p> <p><u>Storm Flow Concentrations</u> Mean: 0.576 Std Dev: 0.138 Stochastically generated</p> <p>Serial Correlation (r sq): 0</p>	<p>Page 2: Rainfall-Runoff Parameters <u>Impervious area properties</u> Rainfall threshold: 0 mm</p> <p><u>Pervious Area properties</u> Soil Storage Capacity: 300 mm Initial Storage (% of capacity): 20 % Field Capacity (mm): 175 Infiltration Capacity Coefficient -a: 260.0 Infiltration Capacity Coefficient -b: 1.80</p> <p><u>Groundwater properties</u> Initial Depth (mm): 50 mm Daily Recharge Rate: 30.0 % Daily Baseflow: 8.5 % Daily Deep seepage Rate: 0.0</p> <p>Page 3: TSS <u>Base Flow Concentrations</u> Mean: 0.9 Std Dev: 0.13 Stochastically generated</p> <p><u>Storm Flow Concentrations</u> Mean: 1.900 Std Dev: 0.2 Stochastically generated</p> <p>Serial Correlation (r sq): 0</p> <p>Page 4: TP <u>Base Flow Concentrations</u> Mean: -0.620 Std Dev: 0.190 Stochastically generated</p> <p><u>Storm Flow Concentrations</u> Mean: -0.450 Std Dev: 0.250 Stochastically generated</p> <p>Serial Correlation (r sq): 0</p> <p>Page 5: TN <u>Base Flow Concentrations</u> Mean: 0.280 Std Dev : 0.120 Stochastically generated</p> <p><u>Storm Flow Concentrations</u> Mean: 0.386 Std Dev: 0.190 Stochastically generated</p> <p>Serial Correlation (r sq): 0</p>	<p>Page 2: Rainfall-Runoff Parameters <u>Impervious area properties</u> Rainfall threshold: 0 mm</p> <p><u>Pervious Area properties</u> Soil Storage Capacity: 300mm Initial Storage (% of capacity): 20 Field Capacity (mm): 175 Infiltration Capacity Coefficient -a: 400.0 Infiltration Capacity Coefficient -b: 1.0</p> <p><u>Groundwater properties</u> Initial Depth (mm): 50 Daily Recharge Rate: 10.0 % Daily Baseflow: 1.5 % Daily Deep seepage Rate: 0.0</p> <p>Page 3: TSS <u>Base Flow Concentrations</u> Mean: 0.9 Std Dev: 0.13 Stochastically generated</p> <p><u>Storm Flow Concentrations</u> Mean: 1.900 Std Dev: 0.2 Stochastically generated</p> <p>Serial Correlation (r sq): 0</p> <p>Page 4: TP <u>Base Flow Concentrations</u> Mean: -0.620 Std Dev: 0.190 Stochastically generated</p> <p><u>Storm Flow Concentrations</u> Mean: -0.450 Std Dev: 0.250 Stochastically generated</p> <p>Serial Correlation (r sq): 0</p> <p>Page 5: TN <u>Base Flow Concentrations</u> Mean: 0.280 Std Dev : 0.120 Stochastically generated</p> <p><u>Storm Flow Concentrations</u> Mean: 0.386 Std Dev: 0.190 Stochastically generated</p> <p>Serial Correlation (r sq): 0</p>

Eastern Ambergate Parameters:

1. Urban Source Node	2. Shallow GW Source Node	3. Deep GW Source Node
<p>Page 2: Rainfall-Runoff Parameters <u>Impervious area properties</u> Rainfall threshold: 1.38 mm</p> <p><u>Pervious Area properties</u> Soil Storage Capacity: 300 mm Initial Storage (% of capacity): 20 Field Capacity (mm): 175 Infiltration Capacity Coefficient -a: 260.0 Infiltration Capacity Coefficient -b: 1.80</p> <p><u>Groundwater properties</u> Initial Depth (mm): 50 Daily Recharge Rate: 30.0 % Daily Baseflow: 8.5% Daily Deep seepage Rate: 0.0 %</p> <p>Page 3: TSS <u>Base Flow Concentrations</u> Mean - 1.081 Std Dev - 0.343 Stochastically generated</p> <p><u>Storm Flow Concentrations</u> Mean - 1.047 Std Dev - 0.276 Stochastically generated</p> <p>Serial Correlation (r sq): 0</p> <p>Page 4: TP <u>Base Flow Concentrations</u> Mean: -0.624 Std Dev - 0.178 Stochastically generated</p> <p><u>Storm Flow Concentrations</u> Mean: -0.643 Std Dev: 0.165 Stochastically generated</p> <p>Serial Correlation (r sq): 0</p> <p>Page 5: TN <u>Base Flow Concentrations</u> Mean: 0.421 Std Dev : 0.144 Stochastically generated</p> <p><u>Storm Flow Concentrations</u> Mean: 0.576 Std Dev: 0.138 Stochastically generated</p> <p>Serial Correlation (r sq): 0</p>	<p>Page 2: Rainfall-Runoff Parameters <u>Impervious area properties</u> Rainfall threshold: 0 mm</p> <p><u>Pervious Area properties</u> Soil Storage Capacity: 470 mm Initial Storage (% of capacity): 20 % Field Capacity (mm): 245 mm Infiltration Capacity Coefficient -a: 220.0 Infiltration Capacity Coefficient -b: 0.565</p> <p><u>Groundwater properties</u> Initial Depth (mm): 50 mm Daily Recharge Rate: 10.0 % Daily Baseflow: 50.0 % Daily Deep seepage Rate: 0.0</p> <p>Page 3: TSS <u>Base Flow Concentrations</u> Mean: 0.9 Std Dev: 0.13 Stochastically generated</p> <p><u>Storm Flow Concentrations</u> Mean: 1.900 Std Dev: 0.2 Stochastically generated</p> <p>Serial Correlation (r sq): 0</p> <p>Page 4: TP <u>Base Flow Concentrations</u> Mean: -0.620 Std Dev: 0.190 Stochastically generated</p> <p><u>Storm Flow Concentrations</u> Mean: -0.450 Std Dev: 0.250 Stochastically generated</p> <p>Serial Correlation (r sq): 0</p> <p>Page 5: TN <u>Base Flow Concentrations</u> Mean: 0.280 Std Dev : 0.120 Stochastically generated</p> <p><u>Storm Flow Concentrations</u> Mean: 0.386 Std Dev: 0.190 Stochastically generated</p> <p>Serial Correlation (r sq): 0</p>	<p>Page 2: Rainfall-Runoff Parameters <u>Impervious area properties</u> Rainfall threshold: 0 mm</p> <p><u>Pervious Area properties</u> Soil Storage Capacity: 470mm Initial Storage (% of capacity): 20 % Field Capacity (mm): 245 mm Infiltration Capacity Coefficient -a: 400.0 Infiltration Capacity Coefficient -b: 1.0</p> <p><u>Groundwater properties</u> Initial Depth (mm): 50 Daily Recharge Rate: 10.0 % Daily Baseflow: 1.5 % Daily Deep seepage Rate: 0.0</p> <p>Page 3: TSS <u>Base Flow Concentrations</u> Mean: 0.9 Std Dev: 0.13 Stochastically generated</p> <p><u>Storm Flow Concentrations</u> Mean: 1.900 Std Dev: 0.2 Stochastically generated</p> <p>Serial Correlation (r sq): 0</p> <p>Page 4: TP <u>Base Flow Concentrations</u> Mean: -0.620 Std Dev: 0.190 Stochastically generated</p> <p><u>Storm Flow Concentrations</u> Mean: -0.450 Std Dev: 0.250 Stochastically generated</p> <p>Serial Correlation (r sq): 0</p> <p>Page 5: TN <u>Base Flow Concentrations</u> Mean: 0.280 Std Dev : 0.120 Stochastically generated</p> <p><u>Storm Flow Concentrations</u> Mean: 0.386 Std Dev: 0.190 Stochastically generated</p> <p>Serial Correlation (r sq): 0</p>

Provence Parameters:

The Calibration for the Provence development was found to involve very little baseflow, or shallow flow, so all parameters could be calibrated for the one SimHyd model. Therefore, MUSIC can be implemented to this catchment using the standard technique (without the hydrological fix). The parameters are given below:

1. Urban Source Node

Page 2: Rainfall-Runoff Parameters

Impervious area properties

Rainfall threshold: 0 mm

Pervious Area properties--

Initial Storage (% of capacity): 20 %

Field Capacity (mm): 110 mm

Infiltration Capacity Coefficient -a: 25.0

Infiltration Capacity Coefficient -b: 1.50

Groundwater properties

Initial Depth (mm): 50 mm

Daily Recharge Rate: 1.0%

Daily Baseflow: 1.0%

Daily Deep seepage Rate: 0.00

Page 3: TSS

Base Flow Concentrations

Mean - 1.081

Std Dev - 0.343

Stochastically generated

Storm Flow Concentrations

Mean - 1.047

Std Dev - 0.276

Stochastically generated

Serial Correlation (r sq): 0

Page 4: TP

Base Flow Concentrations

Mean: -0.624

Std Dev - 0.178

Stochastically generated

Storm Flow Concentrations

Mean: -0.643

Std Dev: 0.165

Stochastically generated

Serial Correlation (r sq): 0

Page 5: TN

Base Flow Concentrations

Mean: 0.421

Std Dev : 0.144

Stochastically generated

Storm Flow Concentrations

Mean: 0.576

Std Dev: 0.138

Stochastically generated

Serial Correlation (r sq): 0

Eastern Vasse Newtown Parameters:

1. Urban Source Node	2. Shallow GW Source Node	3. Deep GW Source Node
<p>Page 2: Rainfall-Runoff Parameters <u>Impervious area properties</u> Rainfall threshold: 2.35 mm</p> <p><u>Pervious Area properties</u> Soil Storage Capacity: 400 mm Initial Storage (% of capacity): 20 % Field Capacity (mm): 175 mm Infiltration Capacity Coefficient -a: 140.0 Infiltration Capacity Coefficient -b: 1.00</p> <p><u>Groundwater properties</u> Initial Depth (mm): 50 Daily Recharge Rate: 15.0 % Daily Baseflow: 24.0% Daily Deep seepage Rate: 0.0 %</p> <p>Page 3: TSS <u>Base Flow Concentrations</u> Mean - 1.081 Std Dev - 0.343 Stochastically generated</p> <p><u>Storm Flow Concentrations</u> Mean - 1.047 Std Dev - 0.276 Stochastically generated</p> <p>Serial Correlation (r sq): 0</p> <p>Page 4: TP <u>Base Flow Concentrations</u> Mean: -0.624 Std Dev - 0.178 Stochastically generated</p> <p><u>Storm Flow Concentrations</u> Mean: -0.643 Std Dev: 0.165 Stochastically generated</p> <p>Serial Correlation (r sq): 0</p> <p>Page 5: TN <u>Base Flow Concentrations</u> Mean: 0.421 Std Dev : 0.144 Stochastically generated</p> <p><u>Storm Flow Concentrations</u> Mean: 0.576 Std Dev: 0.138 Stochastically generated</p> <p>Serial Correlation (r sq): 0</p>	<p>Page 2: Rainfall-Runoff Parameters <u>Impervious area properties</u> Rainfall threshold: 0 mm</p> <p><u>Pervious Area properties</u> Soil Storage Capacity: 400 mm Initial Storage (% of capacity): 20 % Field Capacity (mm): 175 mm Infiltration Capacity Coefficient -a: 140.0 Infiltration Capacity Coefficient -b: 1.00</p> <p><u>Groundwater properties</u> Initial Depth (mm): 50 mm Daily Recharge Rate: 15.0 % Daily Baseflow: 24.0 % Daily Deep seepage Rate: 0.0 %</p> <p>Page 3: TSS <u>Base Flow Concentrations</u> Mean: 0.9 Std Dev: 0.13 Stochastically generated</p> <p><u>Storm Flow Concentrations</u> Mean: 1.900 Std Dev: 0.2 Stochastically generated</p> <p>Serial Correlation (r sq): 0</p> <p>Page 4: TP <u>Base Flow Concentrations</u> Mean: -0.620 Std Dev: 0.190 Stochastically generated</p> <p><u>Storm Flow Concentrations</u> Mean: -0.450 Std Dev: 0.250 Stochastically generated</p> <p>Serial Correlation (r sq): 0</p> <p>Page 5: TN <u>Base Flow Concentrations</u> Mean: 0.280 Std Dev : 0.120 Stochastically generated</p> <p><u>Storm Flow Concentrations</u> Mean: 0.386 Std Dev: 0.190 Stochastically generated</p> <p>Serial Correlation (r sq): 0</p>	<p>Page 2: Rainfall-Runoff Parameters <u>Impervious area properties</u> Rainfall threshold: 0 mm</p> <p><u>Pervious Area properties</u> Soil Storage Capacity: 400mm Initial Storage (% of capacity): 20 Field Capacity (mm): 175 mm Infiltration Capacity Coefficient -a: 400.0 Infiltration Capacity Coefficient -b: 1.0</p> <p><u>Groundwater properties</u> Initial Depth (mm): 50 Daily Recharge Rate: 2.5 % Daily Baseflow: 4.5 % Daily Deep seepage Rate: 0.0 %</p> <p>Page 3: TSS <u>Base Flow Concentrations</u> Mean: 0.9 Std Dev: 0.13 Stochastically generated</p> <p><u>Storm Flow Concentrations</u> Mean: 1.900 Std Dev: 0.2 Stochastically generated</p> <p>Serial Correlation (r sq): 0</p> <p>Page 4: TP <u>Base Flow Concentrations</u> Mean: -0.620 Std Dev: 0.190 Stochastically generated</p> <p><u>Storm Flow Concentrations</u> Mean: -0.450 Std Dev: 0.250 Stochastically generated</p> <p>Serial Correlation (r sq): 0</p> <p>Page 5: TN <u>Base Flow Concentrations</u> Mean: 0.280 Std Dev : 0.120 Stochastically generated</p> <p><u>Storm Flow Concentrations</u> Mean: 0.386 Std Dev: 0.190 Stochastically generated</p> <p>Serial Correlation (r sq): 0</p>

Western Vasse Newtown Parameters:

1. Urban Source Node	2. Shallow GW Source Node	3. Deep GW Source Node
<p>Page 2: Rainfall-Runoff Parameters <u>Impervious area properties</u> Rainfall threshold: 2.60 mm</p> <p><u>Pervious Area properties</u> Soil Storage Capacity: 390 mm Initial Storage (% of capacity): 20 % Field Capacity (mm): 280 mm Infiltration Capacity Coefficient -a: 350.0 Infiltration Capacity Coefficient -b: 0.30</p> <p><u>Groundwater properties</u> Initial Depth (mm): 50 Daily Recharge Rate: 10.0 % Daily Baseflow: 30.0 % Daily Deep seepage Rate: 0.0 %</p> <p>Page 3: TSS <u>Base Flow Concentrations</u> Mean - 1.081 Std Dev - 0.343 Stochastically generated</p> <p><u>Storm Flow Concentrations</u> Mean - 1.047 Std Dev - 0.276 Stochastically generated</p> <p>Serial Correlation (r sq): 0</p> <p>Page 4: TP <u>Base Flow Concentrations</u> Mean: -0.624 Std Dev - 0.178 Stochastically generated</p> <p><u>Storm Flow Concentrations</u> Mean: -0.643 Std Dev: 0.165 Stochastically generated</p> <p>Serial Correlation (r sq): 0</p> <p>Page 5: TN <u>Base Flow Concentrations</u> Mean: 0.421 Std Dev : 0.144 Stochastically generated</p> <p><u>Storm Flow Concentrations</u> Mean: 0.576 Std Dev: 0.138 Stochastically generated</p> <p>Serial Correlation (r sq): 0</p>	<p>Page 2: Rainfall-Runoff Parameters <u>Impervious area properties</u> Rainfall threshold: 0 mm</p> <p><u>Pervious Area properties</u> Soil Storage Capacity: 390 mm Initial Storage (% of capacity): 20 % Field Capacity (mm): 280 mm Infiltration Capacity Coefficient -a: 350.0 Infiltration Capacity Coefficient -b: 0.30</p> <p><u>Groundwater properties</u> Initial Depth (mm): 50 mm Daily Recharge Rate: 10.0 % Daily Baseflow: 30.0 % Daily Deep seepage Rate: 0.0</p> <p>Page 3: TSS <u>Base Flow Concentrations</u> Mean: 0.9 Std Dev: 0.13 Stochastically generated</p> <p><u>Storm Flow Concentrations</u> Mean: 1.900 Std Dev: 0.2 Stochastically generated</p> <p>Serial Correlation (r sq): 0</p> <p>Page 4: TP <u>Base Flow Concentrations</u> Mean: -0.620 Std Dev: 0.190 Stochastically generated</p> <p><u>Storm Flow Concentrations</u> Mean: -0.450 Std Dev: 0.250 Stochastically generated</p> <p>Serial Correlation (r sq): 0</p> <p>Page 5: TN <u>Base Flow Concentrations</u> Mean: 0.280 Std Dev : 0.120 Stochastically generated</p> <p><u>Storm Flow Concentrations</u> Mean: 0.386 Std Dev: 0.190 Stochastically generated</p> <p>Serial Correlation (r sq): 0</p>	<p>Page 2: Rainfall-Runoff Parameters <u>Impervious area properties</u> Rainfall threshold: 0 mm</p> <p><u>Pervious Area properties</u> Soil Storage Capacity: 390 mm Initial Storage (% of capacity): 20 % Field Capacity (mm): 280 mm Infiltration Capacity Coefficient -a: 400.0 Infiltration Capacity Coefficient -b: 1.0</p> <p><u>Groundwater properties</u> Initial Depth (mm): 50 Daily Recharge Rate: 9.0 % Daily Baseflow: 1.5 % Daily Deep seepage Rate: 0.0</p> <p>Page 3: TSS <u>Base Flow Concentrations</u> Mean: 0.9 Std Dev: 0.13 Stochastically generated</p> <p><u>Storm Flow Concentrations</u> Mean: 1.900 Std Dev: 0.2 Stochastically generated</p> <p>Serial Correlation (r sq): 0</p> <p>Page 4: TP <u>Base Flow Concentrations</u> Mean: -0.620 Std Dev: 0.190 Stochastically generated</p> <p><u>Storm Flow Concentrations</u> Mean: -0.450 Std Dev: 0.250 Stochastically generated</p> <p>Serial Correlation (r sq): 0</p> <p>Page 5: TN <u>Base Flow Concentrations</u> Mean: 0.280 Std Dev : 0.120 Stochastically generated</p> <p><u>Storm Flow Concentrations</u> Mean: 0.386 Std Dev: 0.190 Stochastically generated</p> <p>Serial Correlation (r sq): 0</p>

Swan Canning Parameters:

1. Urban Source Node	2. Shallow GW Source Node	3. Deep GW Source Node
<p>Page 2: Rainfall-Runoff Parameters <u>Impervious area properties</u> Rainfall threshold:</p> <p><u>Pervious Area properties</u> Soil Storage Capacity: Initial Storage (% of capacity): Field Capacity (mm): Infiltration Capacity Coefficient -a: Infiltration Capacity Coefficient -b:</p> <p><u>Groundwater properties</u> Initial Depth (mm): Daily Recharge Rate: Daily baseflow: Daily Deep seepage Rate:</p> <p>Page 3: TSS <u>Base Flow Concentrations</u> Mean: Std Dev: Stochastically generated</p> <p><u>Storm Flow Concentrations</u> Mean: Std Dev: Stochastically generated</p> <p>Serial Correlation (r sq): 0</p> <p>Page 4: TP <u>Base Flow Concentrations</u> Mean: Std Dev: Stochastically generated</p> <p><u>Storm Flow Concentrations</u> Mean: Std Dev: Stochastically generated</p> <p>Serial Correlation (r sq): 0</p> <p>Page 5: TN <u>Base Flow Concentrations</u> Mean: Std Dev : Stochastically generated</p> <p><u>Storm Flow Concentrations</u> Mean: Std Dev: Stochastically generated</p> <p>Serial Correlation (r sq): 0</p>	<p>Page 2: Rainfall-Runoff Parameters <u>Impervious area properties</u> Rainfall threshold:</p> <p><u>Pervious Area properties</u> Soil Storage Capacity: Initial Storage (% of capacity): Field Capacity (mm): Infiltration Capacity Coefficient -a: Infiltration Capacity Coefficient -b:</p> <p><u>Groundwater properties</u> Initial Depth (mm): Daily Recharge Rate: Daily baseflow: Daily Deep seepage Rate:</p> <p>Page 3: TSS <u>Base Flow Concentrations</u> Mean: Std Dev: Stochastically generated</p> <p><u>Storm Flow Concentrations</u> Mean: Std Dev: Stochastically generated</p> <p>Serial Correlation (r sq): 0</p> <p>Page 4: TP <u>Base Flow Concentrations</u> Mean: Std Dev: Stochastically generated</p> <p><u>Storm Flow Concentrations</u> Mean: Std Dev: Stochastically generated</p> <p>Serial Correlation (r sq): 0</p> <p>Page 5: TN <u>Base Flow Concentrations</u> Mean: Std Dev : Stochastically generated</p> <p><u>Storm Flow Concentrations</u> Mean: Std Dev: Stochastically generated</p> <p>Serial Correlation (r sq): 0</p>	<p>Page 2: Rainfall-Runoff Parameters <u>Impervious area properties</u> Rainfall threshold:</p> <p><u>Pervious Area properties</u> Soil Storage Capacity: Initial Storage (% of capacity): Field Capacity (mm): Infiltration Capacity Coefficient -a: Infiltration Capacity Coefficient -b:</p> <p><u>Groundwater properties</u> Initial Depth (mm): Daily Recharge Rate: Daily baseflow: Daily Deep seepage Rate:</p> <p>Page 3: TSS <u>Base Flow Concentrations</u> Mean: Std Dev: Stochastically generated</p> <p><u>Storm Flow Concentrations</u> Mean: Std Dev: Stochastically generated</p> <p>Serial Correlation (r sq): 0</p> <p>Page 4: TP <u>Base Flow Concentrations</u> Mean: Std Dev: Stochastically generated</p> <p><u>Storm Flow Concentrations</u> Mean: Std Dev: Stochastically generated</p> <p>Serial Correlation (r sq): 0</p> <p>Page 5: TN <u>Base Flow Concentrations</u> Mean: Std Dev : Stochastically generated</p> <p><u>Storm Flow Concentrations</u> Mean: Std Dev: Stochastically generated</p> <p>Serial Correlation (r sq): 0</p>

