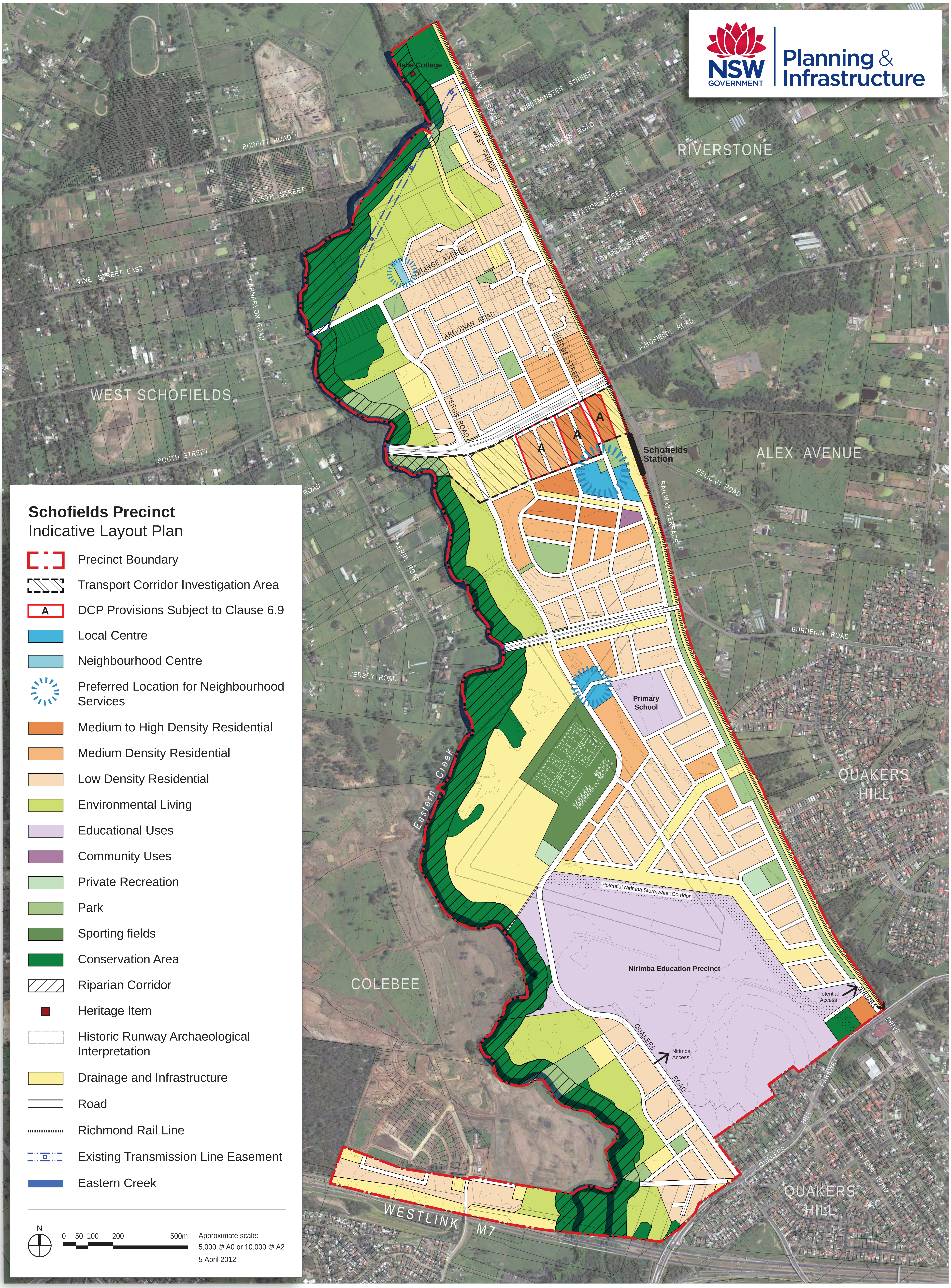
Attachment A

Indicative Layout Plan


NSW GOVERNMENT
Planning & Infrastructure
Schofields Precinct
Indicative Layout Plan
Precinct Boundary
Transport Corridor Investigation Area
DCP Provisions Subject to Clause 6.9
Local Centre
Neighbourhood Centre
Preferred Location for Neighbourhood Services
Medium to High Density Residential
Medium Density Residential
Low Density Residential
Environmental Living
Educational Uses
Community Uses
Private Recreation
Park
Sporting fields
Conservation Area
Riparian Corridor
Heritage Item
Historic Runway Archaeological Interpretation
Drainage and Infrastructure
Road
Richmond Rail Line
Existing Transmission Line Easement
Eastern Creek
N
0 50 100 200 500m
Approximate scale:
5,000 @ A0 or 10,000 @ A2
5 April 2012
RIVERSTONE
WEST SCHOFIELDS
ALEX AVENUE
QUAKERS HILL
COLEBEE
Hebe Cottage
Schofields Station
Primary School
Nirimba Education Precinct
Potential Nirimba Stormwater Corridor
Potential Access
Nirimba Access
Eastern Creek
WESTLINK M7
BURFITT ROAD
NORTH STREET
VINE STREET EAST
CARNARVON ROAD
SOUTH STREET
KERRY ROAD
JERSEY ROAD
GRANGE AVENUE
ARGOWAN ROAD
BRIDGE STREET
VERON ROAD
RAILWAY TERRACE
WEST PARADE
WESTMINSTER STREET
ST ALBANS ROAD
STATION STREET
ADVANCE STREET
SCHOFIELDS ROAD
PELICAN ROAD
BURDEKIN ROAD
QUAKERS ROAD
PARKWAY
A

Attachment B

Existing Water Course Locations and Categories Within the Schofields Precinct

Figure 8: Survey Reaches of Eastern Creek

Attachment C

Condition Assessment And Performance Evaluation Of Bioretention Systems - Practice Note 1: In Situ Measurement of Hydraulic Conductivity

CONDITION ASSESSMENT AND PERFORMANCE EVALUATION OF BIORETENTION SYSTEMS

PRACTICE NOTE 1: *In Situ* Measurement of Hydraulic Conductivity

Belinda Hatt, Sebastien Le Coustumer

April 2008

The Facility for Advancing Water Biofiltration (FAWB) aims to deliver its research findings in a variety of forms in order to facilitate widespread and successful implementation of biofiltration technologies. This Practice Note for *In Situ* Measurement of Hydraulic Conductivity is the first in a series of Practice Notes being developed to assist practitioners with the assessment of construction and operation of biofiltration systems.

1. SCOPE OF THE DOCUMENT

This Practice Note for *In Situ* Measurement of Hydraulic Conductivity is designed to complement FAWB's Guidelines for Soil Filter Media in Bioretention Systems, Version 2.01 (visit http://www.monash.edu.au/fawb/publications/index.html for a copy of these guidelines). However, the recommendations contained within this document are more widely applicable to assessing the hydraulic conductivity of filter media in existing biofiltration systems.

For new systems, this Practice Note ***does not*** remove the need to conduct laboratory testing of filter media prior to installation.

2. DETERMINATION OF HYDRAULIC CONDUCTIVITY

The recommended method for determining *in situ* hydraulic conductivity uses a single ring infiltrometer under constant head. The single ring infiltrometer consists of a small plastic or metal ring that is driven 50 mm into the soil filter media. It is a constant head test that is conducted for two different pressure heads (50 mm and 150 mm). The head is kept constant during all the experiments by pouring water into the ring. The frequency of readings of the volume poured depends on the filter media, but typically varies from 30 seconds to 5 minutes. The experiment is stopped when the infiltration rate is considered steady (i.e., when the volume poured per time interval remains constant for at least 30 minutes). This method has been used extensively (e.g. Reynolds and Elrick, 1990; Youngs *et al.*, 1993).

Note: This method measures the hydraulic conductivity at the surface of the soil filter media. In most cases, it is this top layer which controls the hydraulic conductivity of the system as a whole (i.e., the underlying drainage layer has a flow capacity several orders of magnitude higher than the filter media), as it is this layer where fine sediment will generally be deposited to form a "clogging layer". However this shallow test would not be appropriate for systems where the controlling layer is not the surface layer (e.g. where migration of fine material down through the filter media has caused clogging within the media). In this case, a 'deep ring' method is required; for further information on this method, please consult FAWB's report "Hydraulic performance of biofilter systems for stormwater management: lessons from a field study", available at www.monash.edu.au/fawb/publications/index.html.

2.1 Selection of monitoring points

For bioretention systems with a surface area less than 50 m^2, *in situ* hydraulic conductivity testing should be conducted at three points that are spatially distributed (Figure 1). For systems with a surface area greater than 50 m^2,an extra monitoring point should be added for every additional 100 m^2. It is ***essential*** that the monitoring point is flat and level. Vegetation should not be included in monitoring points.

Figure 1. Spatially distributed monitoring points

2.2 Apparatus

The following is required:

- 100 mm diameter PVC rings with a height of at least 220 mm. The bottom edge of the ring should be bevelled and the inside of the ring should be marked to indicate 50 mm and 150 mm above the filter media surface (Figure 2).
- 40 L water
- 100 mL, 250 mL and 1000 mL measuring cylinders
- Stopwatch
- Thermometer

- Measuring tape
- Spirit level
- Hammer
- Block of wood, approximately 200 x 200 mm

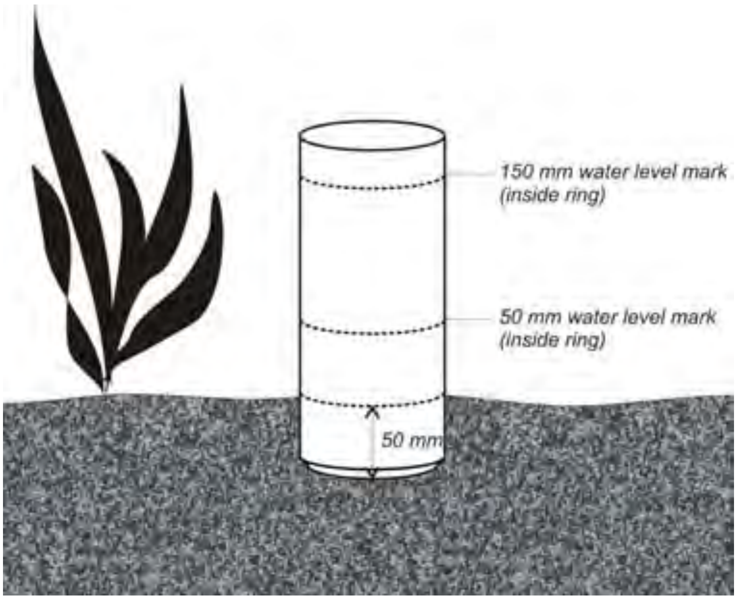


Figure 2. Diagram of single ring infiltrometer

2.3 Procedure

a. Carefully scrape away any surface covering (e.g. mulch, gravel, leaves) ***without disturbing*** the soil filter media surface (Figure 3b).

b. Locate the ring on the surface of the soil (Figure 3c), and then place the block of wood on top of the ring. Gently tap with the hammer to drive the ring 50 mm into the filter media (Figure 3d). Use the spirit level to check that the ring is level.

Note: It is ***essential*** that this the ring is driven in slowly and carefully to minimise disturbance of the filter media profile.

c. Record the initial water temperature.

d. Fill the 1000 mL measuring cylinder.

e. Using a different pouring apparatus, slowly fill the ring to a ponding depth of 50 mm, taking care to minimise disturbance of the soil surface (Figure 3f). Start the stopwatch when the water level reaches 50 mm.

f. Using the 1000 mL measuring cylinder, maintain the water level at 50 mm (Figure 3g). After 30 seconds, record the volume poured.

g. Maintain the water level at 50 mm, recording the time interval and volume required to do so.

Note: The time interval between recordings will be determined by the infiltration capacity of the filter media. For fast draining media, the time interval should not be greater than one minute however, for slow draining media, the time between recordings may be up to five minutes.

Note: The smallest measuring cylinder that can pour the volume required to maintain a constant water level for the measured time interval should be used for greater accuracy. For example, if the volume poured over one minute is 750 mL, then the 1000 mL measuring cylinder should be used. Similarly, if the volume poured is 50 mL, then the 100 mL measuring cylinder should be used.

h. Continue to repeat Step f until the infiltration rate is steady i.e., the volume poured per time interval remains constant for at least 30 minutes.

i. Fill the ring to a ponding depth of 150 mm (Figure 3h). Restart the stopwatch. Repeat steps e – g for this ponding depth.

Note: Since the filter media is already saturated, the time required to reach steady infiltration should be less than for the first ponding depth.

j. Record the final water temperature.

k. Enter the temperature, time, and volume data into a calculation spreadsheet (see "Practice Note 1_Single Ring Infiltration Test_Example Calculations.xls", available at www.monash.edu.au/fawb/publications/index.html, as an example).

2.4 Calculations

In order to calculate K_{fs} a 'Gardner's' behaviour for the soil should be assumed (Gardner, 1958 in Youngs *et al.*, 1993):

$$K(h) = K_{fs} e^{\alpha h} \qquad \text{Eqn. 1}$$

where K is the hydraulic conductivity, α is a soil pore structure parameter (large for sands and small for clay), and h is the negative pressure head. K_{fs} is then found using the following analytical expression (for a steady flow) (Reynolds and Elrick, 1990):

$$K_{fs} = \frac{G}{a}\left(\frac{Q_2 - Q_1}{H_2 - H_1}\right) \qquad \text{Eqn. 2}$$

where a is the ring radius, H_1 and H_2 are the first (50 mm) and second (150 mm) pressure heads, respectively, Q_1 and Q_2 are the steady flows for the first and second pressure heads, respectively, and G is a shape factor estimated as:

$$G = 0.316\frac{d}{a} + 0.184 \qquad \text{Eqn. 3}$$

where d is the depth of insertion of the ring and a is the ring radius.

G is nearly independent of soil hydraulic conductivity (i.e. K_{fs} and α) and ponding, if the ponding is greater than 50 mm.

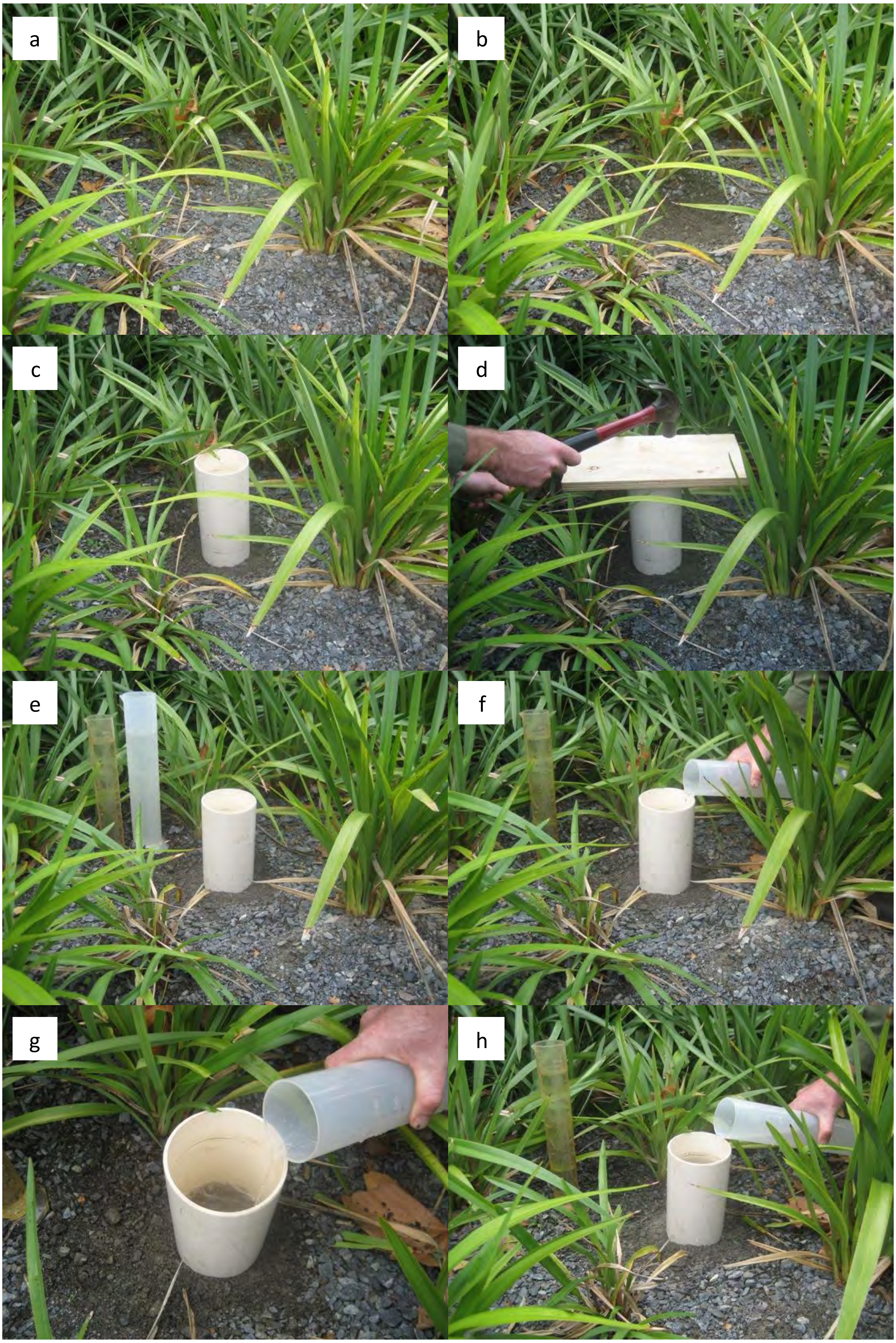


Figure 3. Measuring hydraulic conductivity

The possible limitations of the test are (Reynolds *et al.*, 2000): (1) the relatively small sample size due to the size of the ring, (2) soil disturbance during installation of the ring (compaction of the soil), and (3) possible edge flow during the experiments.

3 INTERPRETATION OF RESULTS

This test method has been shown to be relatively comparable to laboratory test methods (Le Coustumer *et al.*, 2008), taking into account the inherent variability in hydraulic conductivity testing and the heterogeneity of natural soil-based filter media. While correlation between the two test methods is low, results are not statistically different. In light of this, laboratory and field results are deemed comparable if they are within 50% of each other. In the same way, replicate field results are considered comparable if they differ by less than 50%. Where this is not the case, this is likely to be due to a localised inconsistency in the filter media, therefore additional measurement should be conducted at different monitoring points until comparable results are achieved. If this is not achieved, then an area-weighted average value may need to be calculated.

4 MONITORING FREQUENCY

Field testing of hydraulic conductivity should be carried out at least twice: (1) One month following commencement of operation, and (2) In the second year of operation to assess the impact of vegetation on hydraulic conductivity. Following this, hydraulic conductivity testing should be conducted every two years or when there has been a significant change in catchment characteristics (e.g., construction without appropriate sediment control).

REFERENCES

Gardner, W. R. (1958). Some steady-state solutions of the unsaturated moisture flow equation with application to evaporation from a water table. *Soil Science* **85**: 228-232.

Le Coustumer, S., T. D. Fletcher, A. Deletic and M. Potter (2008). Hydraulic performance of biofilter systems for stormwater management: lessons from a field study, Melbourne Water Corporation.

Reynolds, W. D., B. T. Bowman, R. R. Brunke, C. F. Drury and C. S. Tan (2000). Comparison of tension infiltrometer, pressure infiltrometer, and soil core estimates of saturated hydraulic conductivity. *Soil Science Society of America journal* **64**(2): 478-484.

Reynolds, W. D. and D. E. Elrick (1990). Ponded infiltration from a single ring: Analysis of steady flow. *Soil Science Society of America journal* **54**: 1233-1241.

Youngs, E. G., D. E. Elrick and W. D. Reynolds (1993). Comparison of steady flows from infiltration rings in "Green and Ampt" and "Gardner" soils. *Water Resources Research* **29**(6): 1647-1650.

Single Ring Infiltration Test

Site: ____

Date: ____

Constant water level = 50 mm		
Time (min)	Volume (mL)	Q (mL/s)

Constant water level = 150 mm		
Time (min)	Volume (mL)	Q (mL/s)

Attachment D

XP-RAFTS Ultimate Development Results – 100 Year ARI, 2880 Minute Storm

##
##
Eastern Creek - Post Dev for Schofields

Results for period from 0: 0.0 23/ 4/2007
                     to 4: 0.0 27/ 4/2007
##
##

ROUTING INCREMENT (MINS)	=	20.00
STORM DURATION (MINS)	=	2880.
RETURN PERIOD (YRS)	=	100.
BX	=	1.0000
TOTAL OF FIRST SUB-AREAS (ha)	=	10253.84
TOTAL OF SECOND SUB-AREAS (ha)	=	1521.49
TOTAL OF ALL SUB-AREAS (ha)	=	11775.33

SUMMARY OF CATCHMENT AND RAINFALL DATA

Link Label	Catch. Area #1 (ha)	Catch. Area #2 (ha)	Slope #1 (%)	Slope #2 (%)	% Impervious #1 (%)	% Impervious #2 (%)	Pern #1	Pern #2	B #1	B #2	Link No.
BUR0601045	2.710	4.400	2.630	2.630	5.000	100.0	.025	.015	.0217	.0020	1.000
BUR0600537	6.050	7.850	3.110	3.110	5.000	100.0	.025	.015	.0303	.0025	1.001
BUR6A00059	2.490	3.430	4.330	4.330	5.000	100.0	.025	.015	.0162	.0014	2.000
BUR0600403	.00001	0.000	1.000	0.000	0.000	0.000	.025	0.00	0.000	0.000	1.002
BUR0600076	3.520	4.530	1.740	1.740	5.000	100.0	.025	.015	.0305	.0025	1.003
BUR0004301	11.430	14.460	2.480	2.480	5.000	100.0	.025	.015	.0472	.0038	3.000
BUR0F00026	5.270	11.510	3.580	3.580	5.000	100.0	.025	.015	.0263	.0028	4.000
BUR0004184	.00001	0.000	.0010	0.000	0.000	0.000	.025	0.00	.0021	0.000	3.001
BUR0E00035	5.670	8.590	3.570	3.570	5.000	100.0	.025	.015	.0273	.0024	5.000
BUR0004087	.00001	0.000	.0010	0.000	0.000	0.000	.025	0.00	.0021	0.000	3.002
BUR0003845	2.550	3.620	1.770	1.770	5.000	100.0	.025	.015	.0256	.0022	3.003
BUR0003753	.00001	0.000	.0010	0.000	0.000	0.000	.025	0.00	.0021	0.000	1.004
BUR0500601	5.260	6.650	3.420	3.420	5.000	100.0	.025	.015	.0268	.0022	6.000
BUR0500360	2.360	3.630	2.830	2.830	5.000	100.0	.025	.015	.0194	.0017	6.001
BUR0500230	4.130	6.510	3.070	3.070	5.000	100.0	.025	.015	.0250	.0023	6.002
BUR0003644	4.160	4.490	.3100	.3100	5.000	100.0	.040	.025	.1102	.0117	1.005
BUR0D00206	15.450	21.080	1.830	1.830	5.000	100.0	.025	.015	.0642	.0054	7.000
BUR0003240	8.300	9.390	1.290	1.290	5.000	100.0	.025	.015	.0553	.0042	1.006
BUR0C00065	7.020	15.650	2.210	2.210	5.000	100.0	.025	.015	.0388	.0042	8.000
BUR0003104	.00001	0.000	.0010	0.000	0.000	0.000	.025	0.00	.0021	0.000	1.007
BUR0002857	4.260	6.180	2.200	2.200	5.000	100.0	.025	.015	.0300	.0026	1.008
BUR0002543	5.610	3.840	.8900	.8900	5.000	100.0	.040	.025	.0761	.0064	1.009
BUR3A00822	2.090	3.280	2.940	2.940	5.000	100.0	.025	.015	.0179	.0016	9.000
BUR3A00330	3.550	3.510	1.610	1.610	5.000	100.0	.040	.025	.0446	.0045	9.001
BUR0300722	4.790	7.180	2.910	2.910	5.000	100.0	.025	.015	.0277	.0024	10.00
BUR0300586	3.370	4.890	2.480	2.480	5.000	100.0	.025	.015	.0250	.0022	10.00
BUR0300406	2.150	3.220	2.180	2.180	5.000	100.0	.025	.015	.0211	.0019	10.00
BUR0300321	1.990	2.290	2.070	2.070	5.000	100.0	.025	.015	.0208	.0016	10.00
BUR3B00096	1.670	2.500	1.450	1.450	5.000	100.0	.025	.015	.0227	.0020	10.00
BUR3A00043	.00001	0.000	.0100	0.000	0.000	0.000	.025	0.00	.0006	0.000	1.010
BUR0300391	.00001	0.000	.0010	0.000	0.000	0.000	.025	0.00	.0021	0.000	11.00
BUR0001732	3.280	3.010	1.070	1.070	5.000	100.0	.040	.025	.0525	.0051	1.011
BU1732_out	.00001	0.000	.0010	0.000	0.000	0.000	.025	0.00	.0021	0.000	1.012
QUA0101615	10.660	16.330	3.070	3.070	5.000	100.0	.025	.015	.0409	.0036	12.00
QUA0101062	4.310	5.460	3.010	3.010	5.000	100.0	.025	.015	.0258	.0021	12.00
QUA0100585	12.570	17.830	2.490	2.490	5.000	100.0	.025	.015	.0495	.0042	12.00
QUA0100431	.00001	0.000	.0010	0.000	0.000	0.000	.025	0.00	.0021	0.000	12.00
QUA0100196	10.120	14.140	3.520	3.520	5.000	100.0	.025	.015	.0372	.0032	12.00
QUA0200817	11.950	19.240	2.170	2.170	5.000	100.0	.025	.015	.0516	.0047	13.00
QUA2A00160	3.220	5.380	3.830	3.830	5.000	100.0	.025	.015	.0197	.0018	14.00
QUA0200537	6.890	10.070	3.330	3.330	5.000	100.0	.025	.015	.0313	.0027	13.00
QUA0200255	4.360	4.390	4.430	4.430	5.000	100.0	.025	.015	.0214	.0015	13.00
QUA0005107	5.390	8.700	3.770	3.770	5.000	100.0	.025	.015	.0259	.0024	15.00
QUA0004992	8.830	9.940	3.440	3.440	5.000	100.0	.025	.015	.0350	.0027	15.00
QUA0004896	.00001	0.000	.0010	0.000	0.000	0.000	.025	0.00	.0021	0.000	13.00
QUA0004634	11.750	13.950	2.510	2.510	5.000	100.0	.025	.015	.0476	.0037	13.00
QUA0004358	6.740	8.670	2.360	2.360	5.000	100.0	.025	.015	.0367	.0030	13.01
QUA0004124	5.660	9.400	2.220	2.220	5.000	100.0	.025	.015	.0346	.0032	13.01
QUA0003665	14.840	21.220	1.070	1.070	5.000	100.0	.025	.015	.0822	.0070	13.01

QUA0003456	.00001	0.000	.0010	0.000	0.000	0.000	.025	0.00	.0021	0.000	12.01
QUA0002783	16.510	19.400	.5300	.5300	5.000	100.0	.025	.015	.1234	.0096	12.01
QUA0002566	.00001	0.000	.0010	0.000	0.000	0.000	.025	0.00	.0021	0.000	12.01
QUA0A00186	2.780	3.380	2.880	2.880	5.000	100.0	.025	.015	.0210	.0017	16.00
QUA0002425	8.830	10.150	.5300	.5300	5.000	100.0	.025	.015	.0891	.0068	12.01
QUA0002224	.00001	0.000	.1000	0.000	0.000	0.000	.025	0.00	.0002	0.000	12.01
QUA0001953	6.640	8.040	1.070	1.070	5.000	100.0	.040	.015	.0757	.0043	12.01
BUR1389S	0.4710	2.670	.2300	.2300	5.000	100.0	.025	.015	.0294	.0052	12.01
BUR0300259	3.280	3.010	1.070	1.070	5.000	100.0	.040	.025	.0525	.0051	17.00
BUR0001389	2.360	13.390	.2300	.2300	5.000	100.0	.025	.015	.0680	.0119	1.013
BUR0201275	11.760	16.830	2.660	2.660	5.000	100.0	.025	.015	.0462	.0040	18.00
BUR2D00153	4.700	8.060	3.120	3.120	5.000	100.0	.025	.015	.0265	.0025	19.00
BUR2C00064	7.090	9.350	2.350	2.350	5.000	100.0	.025	.015	.0378	.0031	20.00
BUR0201092	.00001	.00001	1.000	.0010	0.000	0.000	.025	.025	0.000	.0021	18.00
BUR0200783	5.420	9.660	2.280	2.280	5.000	100.0	.025	.015	.0334	.0032	18.00
BUR2B00053	2.620	4.130	.6900	.6900	5.000	100.0	.025	.015	.0415	.0037	21.00
BUR0200536	.00001	0.000	1.000	0.000	0.000	0.000	.025	0.00	0.000	0.000	18.00
BUR2A00278	4.940	7.410	2.250	2.250	5.000	100.0	.025	.015	.0320	.0028	22.00
BUR0200449	6.560	3.780	1.560	1.560	5.000	100.0	.040	.025	.0624	.0048	18.00
BUR449_Out	.00001	0.000	.0010	0.000	0.000	0.000	.025	0.00	.0021	0.000	18.00
BUR0000927	3.180	18.020	.5300	.5300	5.000	100.0	.025	.015	.0524	.0092	1.014
BUR0000587	3.290	18.660	.7700	.7700	5.000	100.0	.025	.015	.0443	.0078	1.015
QUA0001262	0.3400	19.970	.9900	.9900	5.000	100.0	.040	.015	.0168	.0071	23.00
BUR927S	7.080	2.240	.5300	.5300	5.000	100.0	.040	.015	.1112	.0031	24.00
QUA0000907	0.8200	15.570	.4100	.4100	5.000	100.0	.040	.015	.0412	.0097	23.00
BUR0A00261	4.590	4.590	.5100	.5100	5.000	100.0	.040	.015	.0905	.0046	1.016
BUR0100298	.00001	0.000	.5000	0.000	5.000	0.000	.025	0.00	0.000	0.000	25.00
BUR0100088	3.660	0.9200	.5000	.5000	5.000	100.0	.025	.015	.0580	.0020	25.00
BUR0100050	1.820	0.4500	.5400	.5400	5.000	100.0	.040	.025	.0544	.0027	25.00
BUR0100000	.00001	0.000	.0010	0.000	0.000	0.000	.025	0.00	.0021	0.000	25.00
BUR0000524	.00001	0.000	.0010	0.000	0.000	0.000	.025	0.00	.0021	0.000	26.00
BUR0000454	1.840	10.440	.8500	.8500	5.000	100.0	.025	.015	.0311	.0055	27.00
BUR1A00504	2.700	15.300	2.400	2.400	5.000	100.0	.025	.015	.0226	.0040	28.00
E1a	10.900	0.000	2.110	0.000	70.00	0.000	.025	0.00	.0110	0.000	29.00
E1a outlet	.00001	0.000	.0010	0.000	0.000	0.000	.025	0.00	.0021	0.000	29.00
Dummyi	.00001	0.000	.0010	0.000	0.000	0.000	.025	0.00	.0021	0.000	29.00
E1	20.950	0.000	2.110	0.000	70.00	0.000	.025	0.00	.0155	0.000	30.00
E1 outlet	.00001	0.000	.0010	0.000	0.000	0.000	.025	0.00	.0021	0.000	30.00
CulBR	.00001	0.000	.0010	0.000	0.000	0.000	.025	0.00	.0021	0.000	30.00
CulRTA	.00001	0.000	.0010	0.000	0.000	0.000	.025	0.00	.0021	0.000	29.00
E3	11.060	0.000	1.960	0.000	80.00	0.000	.025	0.00	.0098	0.000	31.00
E2	3.630	0.000	1.960	0.000	80.00	0.000	.025	0.00	.0055	0.000	32.00
Basin E3	.00001	0.000	.0010	0.000	0.000	0.000	.025	0.00	.0021	0.000	31.00
E3 outlet	.00001	0.000	.0010	0.000	0.000	0.000	.025	0.00	.0021	0.000	31.00
CulRTB	.00001	0.000	.0010	0.000	0.000	0.000	.025	0.00	.0021	0.000	31.00
BUR0100409	2.450	13.860	.7900	.7900	5.000	100.0	.025	.015	.0375	.0066	27.00
BUR0100200	5.100	5.100	.7900	.7900	5.000	100.0	.025	.015	.0549	.0039	33.00
BUR0000110	10.880	3.630	.2700	.2700	5.000	100.0	.040	.015	.1947	.0056	26.00
BUR0100613	.00001	0.000	.0010	0.000	0.000	0.000	.025	0.00	.0021	0.000	26.00
JWPDum2	.00001	0.000	.0010	0.000	0.000	0.000	.025	0.00	.0021	0.000	1.017
QUA0000039	9.190	3.940	.2800	.2800	5.000	100.0	.040	.025	.1751	.0115	34.00
QUA0000000	.00001	0.000	.0010	0.000	0.000	0.000	.025	0.00	.0021	0.000	34.00
34	.00001	0.000	.0100	0.000	0.000	0.000	.025	0.00	.0006	0.000	34.00
31	392.00	0.000	.7400	0.000	35.00	0.000	.025	0.00	.2174	0.000	35.00
23	243.10	198.90	.7600	.7600	95.00	5.000	.025	.025	.0635	.3759	36.00
24	141.40	60.600	.8900	.8900	95.00	5.000	.025	.025	.0443	.1873	37.00
25	122.10	99.900	.8400	.8400	95.00	5.000	.025	.025	.0423	.2500	38.00
26	142.80	95.200	1.070	1.070	95.00	5.000	.025	.025	.0406	.2161	39.00
13.01	.00001	0.000	.2000	0.000	0.000	0.000	.025	0.00	.0001	0.000	38.00
27	110.60	47.400	1.090	1.090	95.00	5.000	.025	.025	.0352	.1490	38.00
11.01	.00001	0.000	.2000	0.000	0.000	0.000	.025	0.00	.0001	0.000	36.00
28	70.400	57.600	1.230	1.230	95.00	5.000	.025	.025	.0262	.1552	36.00
29	123.60	82.400	.9800	.9800	95.00	5.000	.025	.025	.0394	.2094	40.00
11.03	.00001	0.000	.2000	0.000	0.000	0.000	.025	0.00	.0001	0.000	36.00
30	77.200	115.80	.8500	.8500	95.00	5.000	.025	.025	.0331	.2683	36.00
10.01	.00001	0.000	.2000	0.000	0.000	0.000	.025	0.00	.0001	0.000	35.00
32	95.000	0.000	.8900	0.000	20.00	0.000	.025	0.00	.1382	0.000	35.00
19	699.00	0.000	.7400	0.000	30.00	0.000	.025	0.00	.3197	0.000	41.00
10	217.00	0.000	.8000	0.000	3.000	0.000	.025	0.00	.4171	0.000	42.00
4	203.00	0.000	1.040	0.000	2.000	0.000	.025	0.00	.3691	0.000	43.00
2	401.00	0.000	.8600	0.000	2.500	0.000	.025	0.00	.5657	0.000	44.00
1	356.00	0.000	.8400	0.000	2.500	0.000	.025	0.00	.5381	0.000	45.00
501	.00001	0.000	.2000	0.000	0.000	0.000	.025	0.00	.0001	0.000	44.00

3	181.00	0.000	.8400	0.000	1.500	0.000	.025	0.00	.3955	0.000	44.00
4.01	.00001	0.000	.2000	0.000	0.000	0.000	.025	0.00	.0001	0.000	43.00
5	39.000	0.000	.5300	0.000	2.000	0.000	.025	0.00	.2191	0.000	43.00
Top (6)	418.00	0.000	.9500	0.000	1.500	0.000	.025	0.00	.5748	0.000	46.00
7	99.000	0.000	1.370	0.000	1.200	0.000	.025	0.00	.2295	0.000	47.00
1.01	.00001	0.000	.2000	0.000	0.000	0.000	.025	0.00	.0001	0.000	46.00
8	91.000	0.000	1.150	0.000	15.00	0.000	.025	0.00	.1400	0.000	46.00
9	221.00	0.000	.8500	0.000	2.500	0.000	.025	0.00	.4174	0.000	46.00
1.04	.00001	0.000	.2000	0.000	0.000	0.000	.025	0.00	.0001	0.000	42.00
11	213.00	0.000	1.310	0.000	3.000	0.000	.025	0.00	.3230	0.000	42.00
12	219.00	0.000	1.210	0.000	4.000	0.000	.025	0.00	.3267	0.000	42.00
13	175.00	0.000	1.160	0.000	3.500	0.000	.025	0.00	.3033	0.000	42.00
14	248.00	0.000	.6800	0.000	5.000	0.000	.025	0.00	.4457	0.000	42.01
15	140.00	0.000	1.110	0.000	4.000	0.000	.025	0.00	.2703	0.000	48.00
16	236.00	0.000	.9500	0.000	10.00	0.000	.025	0.00	.3022	0.000	49.00
701	.00001	0.000	.2000	0.000	0.000	0.000	.025	0.00	.0001	0.000	48.00
17	335.00	0.000	.7600	0.000	15.00	0.000	.025	0.00	.3391	0.000	48.00
1.09	.00001	0.000	.2000	0.000	0.000	0.000	.025	0.00	.0001	0.000	42.01
18	293.00	0.000	.9100	0.000	8.500	0.000	.025	0.00	.3657	0.000	42.01
1.11	.00001	0.000	.2000	0.000	0.000	0.000	.025	0.00	.0001	0.000	41.00
20	337.00	0.000	.9900	0.000	22.00	0.000	.025	0.00	.2380	0.000	41.00
21	391.00	0.000	.8200	0.000	12.00	0.000	.025	0.00	.3930	0.000	41.00
22	167.00	0.000	.6600	0.000	25.00	0.000	.025	0.00	.1850	0.000	41.00
1.15	.00001	0.000	.2000	0.000	0.000	0.000	.025	0.00	.0001	0.000	35.00
JWP40.00	1.680	9.520	.9400	.9400	5.000	100.0	.025	.015	.0282	.0050	50.00
JWP40.01	0.8200	4.640	.9400	.9400	5.000	100.0	.025	.015	.0195	.0034	50.00
JWP40.01-B	0.0500	0.2700	.9400	.9400	5.000	100.0	.025	.015	.0045	.0008	51.00
JWP40.02	2.630	0.2900	.9400	.9400	5.000	100.0	.040	.015	.0499	.0008	50.00
JWP40.03	13.190	1.470	.5000	.5000	5.000	100.0	.040	.015	.1582	.0026	50.00
JWP41.00	3.470	0.3900	2.000	2.000	5.000	100.0	.040	.015	.0396	.0006	52.00
JWP42.00	3.950	11.840	1.570	1.570	5.000	100.0	.025	.015	.0341	.0043	53.00
JWP43.00	0.7900	4.460	1.570	1.570	5.000	100.0	.025	.015	.0148	.0026	54.00
JWP42.01	1.450	8.230	.7100	.7100	5.000	100.0	.025	.015	.0301	.0053	53.00
JWP42.01-B	0.3300	1.900	.7100	.7100	5.000	100.0	.025	.015	.0139	.0025	55.00
JWP42.02	11.700	1.300	.7100	.7100	5.000	100.0	.025	.015	.0891	.0020	53.00
JWPDum1	.00001	0.000	.0010	0.000	0.000	0.000	.025	0.00	.0021	0.000	50.00
JWP45.00	0.3800	2.170	5.000	5.000	5.000	100.0	.025	.015	.0057	.0010	56.00
JWP46.00	0.3700	2.110	4.600	4.600	5.000	100.0	.025	.015	.0058	.0010	57.00
JWP47.00	0.4000	2.270	.5000	.5000	5.000	100.0	.025	.015	.0183	.0032	58.00
JWPDum3	.00001	0.000	.0010	0.000	0.000	0.000	.025	0.00	.0021	0.000	56.00
33	64.600	0.000	.9400	0.000	11.00	0.000	.025	0.00	.1492	0.000	35.00
1.17	.00001	0.000	.2000	0.000	0.000	0.000	.025	0.00	.0001	0.000	34.00
35	208.00	0.000	.7000	0.000	2.000	0.000	.025	0.00	.4555	0.000	1.018
EAS0901013	3.280	0.7500	2.400	2.400	5.000	100.0	.040	.015	.0351	.0008	59.00
EAS0900692	2.070	11.730	2.560	2.560	5.000	100.0	.025	.015	.0191	.0034	59.00
EAS900310S	1.110	6.260	2.310	2.310	5.000	100.0	.025	.015	.0145	.0025	59.00
EAS900310N	2.330	13.200	2.310	2.310	5.000	100.0	.025	.015	.0214	.0038	60.00
EAS0971E	1.290	7.340	1.150	1.150	5.000	100.0	.025	.015	.0223	.0039	59.00
EAS0900071	5.490	1.370	1.150	1.150	5.000	100.0	.040	.025	.0662	.0033	59.00
EAS0900000	.00001	0.000	.0010	0.000	0.000	0.000	.025	0.00	.0021	0.000	59.01
36	.00001	0.000	.0100	0.000	0.000	0.000	.025	0.00	.0006	0.000	59.01
1.19	.00001	0.000	.2000	0.000	0.000	0.000	.025	0.00	.0001	0.000	1.019
37	86.000	0.000	.3400	0.000	2.000	0.000	.025	0.00	.4126	0.000	1.020
E20	20.750	0.000	3.360	0.000	75.00	0.000	.025	0.00	.0113	0.000	61.00
E19	6.830	0.000	3.800	0.000	75.00	0.000	.025	0.00	.0060	0.000	62.00
E18b	3.660	0.000	1.080	0.000	60.00	0.000	.025	0.00	.0104	0.000	63.00
E18c	0.7500	0.000	2.140	0.000	70.00	0.000	.025	0.00	.0027	0.000	64.00
Basin E20	.00001	0.000	.0010	0.000	0.000	0.000	.025	0.00	.0021	0.000	61.00
E20 out	.00001	0.000	.0010	0.000	0.000	0.000	.025	0.00	.0021	0.000	61.00
CulJR	.00001	0.000	.0010	0.000	0.000	0.000	.025	0.00	.0021	0.000	61.00
E20 crit	.00001	0.000	.0010	0.000	0.000	0.000	.025	0.00	.0021	0.000	61.00
E18	18.500	18.500	1.080	1.080	0.000	100.0	.025	.015	.1141	.0065	61.01
E4	8.120	0.000	2.600	0.000	70.00	0.000	.025	0.00	.0085	0.000	65.00
E5	10.450	0.000	2.710	0.000	50.00	0.000	.025	0.00	.0136	0.000	66.00
E7	9.530	0.000	2.200	0.000	75.00	0.000	.025	0.00	.0093	0.000	67.00
E6a	6.390	0.000	1.330	0.000	80.00	0.000	.025	0.00	.0090	0.000	67.00
E6a outlet	.00001	0.000	.0010	0.000	0.000	0.000	.025	0.00	.0021	0.000	67.00
Cul E6a	.00001	0.000	.0010	0.000	0.000	0.000	.025	0.00	.0021	0.000	67.00
E6	8.570	0.000	1.330	0.000	80.00	0.000	.025	0.00	.0105	0.000	67.00
Cul E6	.00001	0.000	.0010	0.000	0.000	0.000	.025	0.00	.0021	0.000	67.00
Cul E5	.00001	0.000	.0010	0.000	0.000	0.000	.025	0.00	.0021	0.000	66.00
Basin E4	.00001	0.000	.0010	0.000	0.000	0.000	.025	0.00	.0021	0.000	65.00
E4 outlet	.00001	0.000	.0010	0.000	0.000	0.000	.025	0.00	.0021	0.000	65.00

E12a	2.940	0.000	4.200	0.000	70.00	0.000	.025	0.00	.0040	0.000	68.00
E12a out	.00001	0.000	.0010	0.000	0.000	0.000	.025	0.00	.0021	0.000	68.00
E9	4.080	0.000	3.100	0.000	85.00	0.000	.025	0.00	.0043	0.000	69.00
E10c	1.080	0.000	2.840	0.000	85.00	0.000	.025	0.00	.0023	0.000	70.00
E10b	1.910	0.000	2.840	0.000	5.000	0.000	.025	0.00	.0174	0.000	71.00
E8a	3.490	0.000	2.300	0.000	70.00	0.000	.025	0.00	.0058	0.000	72.00
E8b	12.340	0.000	2.300	0.000	50.00	0.000	.025	0.00	.0162	0.000	73.00
E11	8.680	0.000	2.670	0.000	70.00	0.000	.025	0.00	.0087	0.000	74.00
BasinE8upp	.00001	0.000	.0010	0.000	0.000	0.000	.025	0.00	.0021	0.000	71.00
E8upout	.00001	0.000	.0010	0.000	0.000	0.000	.025	0.00	.0021	0.000	71.00
E8c	2.740	0.000	2.300	0.000	85.00	0.000	.025	0.00	.0041	0.000	75.00
BasinE8low	.00001	0.000	.0010	0.000	0.000	0.000	.025	0.00	.0021	0.000	70.00
E8 outlet	.00001	0.000	.0010	0.000	0.000	0.000	.025	0.00	.0021	0.000	70.00
E10a	7.140	0.000	2.840	0.000	65.00	0.000	.025	0.00	.0083	0.000	76.00
E10a out	.00001	0.000	.0010	0.000	0.000	0.000	.025	0.00	.0021	0.000	76.00
CulBPRB	.00001	0.000	.0010	0.000	0.000	0.000	.025	0.00	.0021	0.000	70.00
DS E9	.00001	0.000	.0010	0.000	0.000	0.000	.025	0.00	.0021	0.000	69.00
node 6	.00001	0.000	.0010	0.000	0.000	0.000	.025	0.00	.0021	0.000	69.00
CulSRA	.00001	0.000	.0010	0.000	0.000	0.000	.025	0.00	.0021	0.000	65.00
E14	3.320	0.000	2.300	0.000	85.00	0.000	.025	0.00	.0045	0.000	77.00
E17	6.160	0.000	2.000	0.000	85.00	0.000	.025	0.00	.0067	0.000	78.00
node3	.00001	0.000	.0010	0.000	0.000	0.000	.025	0.00	.0021	0.000	78.00
E16	9.670	0.000	2.500	0.000	85.00	0.000	.025	0.00	.0076	0.000	79.00
E15	0.7800	0.000	4.160	0.000	80.00	0.000	.025	0.00	.0017	0.000	80.00
E12	2.380	0.000	4.200	0.000	70.00	0.000	.025	0.00	.0035	0.000	81.00
E13	14.470	0.000	2.550	0.000	70.00	0.000	.025	0.00	.0116	0.000	82.00
BasinE13m	.00001	0.000	.0010	0.000	0.000	0.000	.025	0.00	.0021	0.000	82.00
E13 Outlet	.00001	0.000	.0010	0.000	0.000	0.000	.025	0.00	.0021	0.000	82.00
CulSRB	.00001	0.000	.0010	0.000	0.000	0.000	.025	0.00	.0021	0.000	81.00
Dummy A	.00001	0.000	.0010	0.000	0.000	0.000	.025	0.00	.0021	0.000	81.00
CulBBEst	.00001	0.000	.0010	0.000	0.000	0.000	.025	0.00	.0021	0.000	77.00
Basin E16	.00001	0.000	.0010	0.000	0.000	0.000	.025	0.00	.0021	0.000	77.00
E16 out	.00001	0.000	.0010	0.000	0.000	0.000	.025	0.00	.0021	0.000	77.00
E18a	2.770	0.000	2.140	0.000	70.00	0.000	.025	0.00	.0054	0.000	83.00
E15a	1.580	0.000	4.160	0.000	50.00	0.000	.025	0.00	.0041	0.000	83.00
E16oldcrit	.00001	0.000	.0010	0.000	0.000	0.000	.025	0.00	.0021	0.000	77.00
CulBRTC	.00001	0.000	.0010	0.000	0.000	0.000	.025	0.00	.0021	0.000	65.00
JWP50.01	5.640	5.640	1.640	1.640	5.000	100.0	.025	.015	.0402	.0029	65.00
JWP50.02d	.00001	0.000	.0010	0.000	0.000	0.000	.025	0.00	.0021	0.000	61.01
JWP53.00	0.2900	1.640	6.000	6.000	5.000	100.0	.025	.015	.0045	.0008	84.00
56.00	1.850	10.460	1.640	1.640	5.000	100.0	.025	.015	.0225	.0039	85.00
JWP50.03	4.340	2.240	1.300	1.300	5.000	100.0	.040	.015	.0551	.0020	61.01
JWP51.00	2.340	13.240	1.630	1.630	5.000	100.0	.025	.015	.0255	.0045	86.00
JWP57.00	0.6200	3.490	1.030	1.030	5.000	100.0	.025	.015	.0161	.0028	87.00
JWP51.01	10.880	2.720	1.030	1.030	5.000	100.0	.025	.015	.0713	.0025	86.00
JWP54.00	0.3000	1.680	6.000	6.000	5.000	100.0	.025	.015	.0046	.0008	88.00
JWP55.00	0.7600	4.330	6.000	6.000	5.000	100.0	.025	.015	.0074	.0013	89.00
JWP50.04d	.00001	0.000	.0010	0.000	0.000	0.000	.025	0.00	.0021	0.000	61.01
JWP50.05	11.400	2.850	.9200	.9200	5.000	100.0	.025	.015	.0773	.0027	61.01
d6	.00001	0.000	.0010	0.000	75.00	0.000	.025	0.00	.0003	0.000	61.01
E34	4.510	0.000	4.510	0.000	75.00	0.000	.025	0.00	.0044	0.000	90.00
E24	6.660	0.000	1.140	0.000	40.00	0.000	.025	0.00	.0194	0.000	91.00
E24c	1.210	0.000	1.110	0.000	70.00	0.000	.025	0.00	.0048	0.000	92.00
E24b	3.670	0.000	1.110	0.000	50.00	0.000	.025	0.00	.0124	0.000	92.00
E30	15.530	0.000	2.920	0.000	75.00	0.000	.025	0.00	.0104	0.000	93.00
E29	7.140	0.000	1.180	0.000	75.00	0.000	.025	0.00	.0109	0.000	93.00
E28	21.270	0.000	1.910	0.000	70.00	0.000	.025	0.00	.0164	0.000	94.00
d16	.00001	0.000	.0010	0.000	0.000	0.000	.025	0.00	.0021	0.000	93.00
E27	4.030	0.000	1.350	0.000	75.00	0.000	.025	0.00	.0076	0.000	95.00
E23a	2.290	0.000	2.870	0.000	75.00	0.000	.025	0.00	.0039	0.000	96.00
E27a	3.100	0.000	1.350	0.000	10.00	0.000	.035	0.00	.0338	0.000	93.00
E27a out	.00001	0.000	.0010	0.000	0.000	0.000	.025	0.00	.0021	0.000	93.00
CulCR	.00001	0.000	.0010	0.000	0.000	0.000	.025	0.00	.0021	0.000	93.00
E23	7.520	0.000	2.870	0.000	75.00	0.000	.025	0.00	.0072	0.000	97.00
E22	16.100	0.000	1.710	0.000	70.00	0.000	.025	0.00	.0150	0.000	97.00
E24a	4.990	0.000	1.110	0.000	70.00	0.000	.025	0.00	.0101	0.000	98.00
Basin E22	.00001	0.000	.0010	0.000	0.000	0.000	.025	0.00	.0021	0.000	97.00
E22 out	.00001	0.000	.0010	0.000	0.000	0.000	.025	0.00	.0021	0.000	97.00
CulE22	.00001	0.000	.0010	0.000	0.000	0.000	.025	0.00	.0021	0.000	97.00
E26	11.110	0.000	.9400	0.000	75.00	0.000	.025	0.00	.0154	0.000	99.00
E25	11.490	0.000	2.380	0.000	75.00	0.000	.025	0.00	.0099	0.000	100.0
Basin E 25	.00001	0.000	.0010	0.000	0.000	0.000	.025	0.00	.0021	0.000	99.00
E25 out	.00001	0.000	.0010	0.000	0.000	0.000	.025	0.00	.0021	0.000	99.00

E22crit	.00001	0.000	.0010	0.000	0.000	0.000	.025	0.00	.0021	0.000	91.00
E22 ou#647	.00001	0.000	.0010	0.000	0.000	0.000	.025	0.00	.0021	0.000	91.00
E33	3.870	0.000	7.050	0.000	75.00	0.000	.025	0.00	.0033	0.000	101.0
CulRR	.00001	0.000	.0010	0.000	0.000	0.000	.025	0.00	.0021	0.000	101.0
E Crit	.00001	0.000	.0010	0.000	0.000	0.000	.025	0.00	.0021	0.000	90.00
E34a	10.990	20.400	2.000	2.000	5.000	100.0	.040	.015	.0720	.0051	102.0
JWP52.01d	.00001	0.000	.0010	0.000	0.000	0.000	.025	0.00	.0021	0.000	90.00
JWP58.00	0.4100	2.320	2.070	2.070	5.000	100.0	.025	.015	.0091	.0016	103.0
JWP52.02	5.820	0.3100	2.070	2.070	5.000	100.0	.025	.015	.0363	.0006	90.00
38	.00001	0.000	.0100	0.000	0.000	0.000	.025	0.00	.0006	0.000	61.01
1.21	.00001	0.000	.2000	0.000	0.000	0.000	.025	0.00	.0001	0.000	1.021
39	255.00	0.000	.6800	0.000	10.00	0.000	.025	0.00	.3717	0.000	1.022
40	729.00	0.000	.6000	0.000	18.00	0.000	.025	0.00	.5174	0.000	104.0
41	510.00	0.000	.5300	0.000	3.000	0.000	.025	0.00	.7988	0.000	104.0
42	234.00	0.000	.5700	0.000	1.000	0.000	.025	0.00	.5609	0.000	104.0
1.23	.00001	0.000	.2000	0.000	0.000	0.000	.025	0.00	.0001	0.000	1.023
E35	1.180	0.000	3.850	0.000	75.00	0.000	.025	0.00	.0024	0.000	105.0
d12	.00001	0.000	.0010	0.000	0.000	0.000	.025	0.00	.0021	0.000	105.0
E31a	5.160	0.000	4.700	0.000	85.00	0.000	.025	0.00	.0040	0.000	106.0
E32	5.910	0.000	5.950	0.000	85.00	0.000	.025	0.00	.0038	0.000	107.0
E31	7.940	0.000	4.700	0.000	85.00	0.000	.025	0.00	.0050	0.000	108.0
Basin E31	.00001	0.000	.0010	0.000	0.000	0.000	.025	0.00	.0021	0.000	106.0
E31 out	.00001	0.000	.0010	0.000	0.000	0.000	.025	0.00	.0021	0.000	106.0
CulRTE	.00001	0.000	.0010	0.000	0.000	0.000	.025	0.00	.0021	0.000	106.0
d3	.00001	0.000	.0010	0.000	0.000	0.000	.025	0.00	.0021	0.000	105.0
d4	.00001	0.000	.0010	0.000	0.000	0.000	.025	0.00	.0021	0.000	105.0
d5	.00001	0.000	.0010	0.000	0.000	0.000	.025	0.00	.0021	0.000	105.0
43	110.00	0.000	1.170	0.000	.5000	0.000	.025	0.00	.2707	0.000	1.024
Outlet	.00001	0.000	.4000	0.000	0.000	0.000	.025	0.00	.0001	0.000	1.025

Link Label	Average Intensity (mm/h)	Init. Loss #1 (mm)	Init. Loss #2	Cont. Loss #1 (mm/h)	Cont. Loss #2	Excess Rain #1 (mm)	Excess Rain #2	Peak Inflow (m^3/s)	Time to Peak	Link Lag mins
BUR0601045	6.380	5.000	1.000	1.000	0.000	257.53	305.24	0.5938	1120.	4.200
BUR0600537	6.380	5.000	1.000	1.000	0.000	257.53	305.24	1.750	1120.	1.100
BUR6A00059	6.380	5.000	1.000	1.000	0.000	257.53	305.24	0.4958	1120.	.5000
BUR0600403	6.380	1.000	0.000	0.000	0.000	305.24	0.000	2.245	1120.	2.700
BUR0600076	6.380	5.000	1.000	1.000	0.000	257.53	305.24	2.906	1120.	0.000
BUR0004301	6.380	5.000	1.000	1.000	0.000	257.53	305.24	2.142	1160.	1.000
BUR0F00026	6.380	5.000	1.000	1.000	0.000	257.53	305.24	1.414	1120.	.2000
BUR0004184	6.380	1.000	0.000	0.000	0.000	305.24	0.000	3.540	1120.	.8000
BUR0E00035	6.380	5.000	1.000	1.000	0.000	257.53	305.24	1.194	1120.	.3000
BUR0004087	6.380	1.000	0.000	0.000	0.000	305.24	0.000	4.734	1120.	2.000
BUR0003845	6.380	5.000	1.000	1.000	0.000	257.53	305.24	5.245	1120.	.8000
BUR0003753	6.380	1.000	0.000	0.000	0.000	305.24	0.000	8.151	1120.	.9000
BUR0500601	6.380	5.000	1.000	1.000	0.000	257.53	305.24	0.9899	1120.	2.000
BUR0500360	6.380	5.000	1.000	1.000	0.000	257.53	305.24	1.491	1120.	.9000
BUR0500230	6.380	5.000	1.000	1.000	0.000	257.53	305.24	2.377	1120.	1.900
BUR0003644	6.380	15.00	1.000	2.500	0.000	197.92	305.24	11.694	1200.	3.400
BUR0D00206	6.380	5.000	1.000	1.000	0.000	257.53	305.24	3.028	1160.	1.700
BUR0003240	6.380	5.000	1.000	1.000	0.000	257.53	305.24	16.145	1200.	1.100
BUR0C00065	6.380	5.000	1.000	1.000	0.000	257.53	305.24	1.897	1120.	.5000
BUR0003104	6.380	1.000	0.000	0.000	0.000	305.24	0.000	18.022	1200.	2.100
BUR0002857	6.380	5.000	1.000	1.000	0.000	257.53	305.24	18.881	1200.	2.600
BUR0002543	6.380	15.00	1.000	2.500	0.000	197.92	305.24	19.622	1200.	5.900
BUR3A00822	6.380	5.000	1.000	1.000	0.000	257.53	305.24	0.4492	1120.	4.100
BUR3A00330	6.380	15.00	1.000	2.500	0.000	197.92	305.24	1.007	1160.	2.750
BUR0300722	6.380	5.000	1.000	1.000	0.000	257.53	305.24	0.9944	1120.	1.100
BUR0300586	6.380	5.000	1.000	1.000	0.000	257.53	305.24	1.681	1120.	1.500
BUR0300406	6.380	5.000	1.000	1.000	0.000	257.53	305.24	2.129	1120.	.7000
BUR0300321	6.380	5.000	1.000	1.000	0.000	257.53	305.24	2.485	1120.	1.400
BUR3B00096	6.380	5.000	1.000	1.000	0.000	257.53	305.24	2.830	1120.	.8000
BUR3A00043	6.380	1.000	0.000	0.000	0.000	305.24	0.000	23.427	1200.	.4000
BUR0300391	6.380	1.000	0.000	0.000	0.000	305.24	0.000	0.0000	1100.	.8000
BUR0001732	6.380	15.00	1.000	2.500	0.000	197.92	305.24	23.922	1200.	0.000
BU1732_out	6.380	1.000	0.000	0.000	0.000	305.24	0.000	23.302	1200.	2.850
QUA0101615	6.380	5.000	1.000	1.000	0.000	257.53	305.24	2.240	1120.	4.600
QUA0101062	6.380	5.000	1.000	1.000	0.000	257.53	305.24	3.052	1120.	4.000
QUA0100585	6.380	5.000	1.000	1.000	0.000	257.53	305.24	5.563	1160.	1.300
QUA0100431	6.380	1.000	0.000	0.000	0.000	305.24	0.000	5.563	1160.	2.000
QUA0100196	6.380	5.000	1.000	1.000	0.000	257.53	305.24	7.571	1120.	1.600
QUA0200817	6.380	5.000	1.000	1.000	0.000	257.53	305.24	2.591	1160.	2.300

QUA2A00160	6.380	5.000	1.000	1.000	0.000	257.53	305.24	0.7214	1120.	1.300
QUA0200537	6.380	5.000	1.000	1.000	0.000	257.53	305.24	4.709	1120.	2.400
QUA0200255	6.380	5.000	1.000	1.000	0.000	257.53	305.24	5.441	1120.	2.100
QUA0005107	6.380	5.000	1.000	1.000	0.000	257.53	305.24	1.182	1120.	1.000
QUA0004992	6.380	5.000	1.000	1.000	0.000	257.53	305.24	2.731	1120.	.8000
QUA0004896	6.380	1.000	0.000	0.000	0.000	305.24	0.000	8.172	1120.	2.200
QUA0004634	6.380	5.000	1.000	1.000	0.000	257.53	305.24	10.278	1120.	2.300
QUA0004358	6.380	5.000	1.000	1.000	0.000	257.53	305.24	11.554	1120.	2.000
QUA0004124	6.380	5.000	1.000	1.000	0.000	257.53	305.24	12.577	1200.	3.800
QUA0003665	6.380	5.000	1.000	1.000	0.000	257.53	305.24	15.547	1160.	1.700
QUA0003456	6.380	1.000	0.000	0.000	0.000	305.24	0.000	22.756	1200.	5.600
QUA0002783	6.380	15.00	1.000	2.500	0.000	197.92	305.24	25.608	1200.	1.800
QUA0002566	6.380	1.000	0.000	0.000	0.000	305.24	0.000	25.608	1200.	1.200
QUA0A00186	6.380	5.000	1.000	1.000	0.000	257.53	305.24	0.5134	1120.	1.550
QUA0002425	6.380	5.000	1.000	1.000	0.000	257.53	305.24	27.665	1200.	1.700
QUA0002224	6.380	1.000	0.000	0.000	0.000	305.24	0.000	27.665	1200.	2.300
QUA0001953	6.380	15.00	1.000	2.500	0.000	197.92	305.24	28.842	1200.	5.800
BUR1389S	6.380	5.000	1.000	1.000	0.000	257.53	305.24	29.098	1200.	3.800
BUR0300259	6.380	15.00	1.000	2.500	0.000	197.92	305.24	0.4988	1160.	2.000
BUR0001389	6.380	5.000	1.000	1.000	0.000	257.53	305.24	54.178	1200.	3.600
BUR0201275	6.380	5.000	1.000	1.000	0.000	257.53	305.24	2.369	1160.	1.500
BUR2D00153	6.380	5.000	1.000	1.000	0.000	257.53	305.24	1.066	1120.	1.300
BUR2C00064	6.380	5.000	1.000	1.000	0.000	257.53	305.24	1.361	1120.	.5000
BUR0201092	6.380	1.000	1.000	0.000	0.000	305.24	305.24	4.788	1120.	2.600
BUR0200783	6.380	5.000	1.000	1.000	0.000	257.53	305.24	6.046	1120.	2.100
BUR2B00053	6.380	5.000	1.000	1.000	0.000	257.53	305.24	0.5578	1160.	.4000
BUR0200536	6.380	1.000	0.000	0.000	0.000	305.24	0.000	6.595	1160.	.7000
BUR2A00278	6.380	5.000	1.000	1.000	0.000	257.53	305.24	1.020	1120.	2.300
BUR0200449	6.380	15.00	1.000	2.500	0.000	197.92	305.24	8.431	1160.	0.000
BUR449_Out	6.380	1.000	0.000	0.000	0.000	305.24	0.000	8.220	1200.	3.700
BUR0000927	6.380	5.000	1.000	1.000	0.000	257.53	305.24	64.139	1200.	3.000
BUR0000587	6.380	5.000	1.000	1.000	0.000	257.53	305.24	65.950	1200.	2.000
QUA0001262	6.380	15.00	1.000	2.500	0.000	197.92	305.24	1.748	1120.	3.000
BUR927S	6.380	15.00	1.000	2.500	0.000	197.92	305.24	0.7217	1200.	2.500
QUA0000907	6.380	15.00	1.000	2.500	0.000	197.92	305.24	3.769	1160.	7.200
BUR0A00261	6.380	15.00	1.000	2.500	0.000	197.92	305.24	70.432	1200.	2.500
BUR0100298	6.380	1.000	0.000	0.000	0.000	305.24	0.000	0.0000	1100.	1.800
BUR0100088	6.380	15.00	1.000	2.500	0.000	197.92	305.24	0.3558	1160.	.3000
BUR0100050	6.380	15.00	1.000	2.500	0.000	197.92	305.24	0.5292	1200.	.4000
BUR0100000	6.380	1.000	0.000	0.000	0.000	305.24	0.000	0.5292	1200.	0.000
BUR0000524	6.380	1.000	0.000	0.000	0.000	305.24	0.000	0.0000	1100.	0.000
BUR0000454	6.380	5.000	1.000	1.000	0.000	257.53	305.24	1.047	1120.	1.000
BUR1A00504	6.380	5.000	1.000	1.000	0.000	257.53	305.24	1.534	1120.	1.700
E1a	6.380	0.000	0.000	0.000	0.000	283.41	0.000	0.9387	1120.	0.000
E1a outlet	6.380	0.000	0.000	0.000	0.000	232.47	0.000	0.7822	1200.	0.000
Dummyi	6.380	0.000	0.000	0.000	0.000	232.47	0.000	0.7822	1200.	0.000
E1	6.380	0.000	0.000	0.000	0.000	283.41	0.000	1.800	1120.	0.000
E1 outlet	6.380	0.000	0.000	0.000	0.000	232.47	0.000	1.529	1200.	0.000
CulBR	6.380	0.000	0.000	0.000	0.000	232.47	0.000	1.529	1200.	0.000
CulRTA	6.380	0.000	0.000	0.000	0.000	232.47	0.000	2.311	1200.	6.000
E3	6.380	0.000	0.000	0.000	0.000	290.69	0.000	0.9544	1120.	0.000
E2	6.380	0.000	0.000	0.000	0.000	290.69	0.000	0.3107	1120.	2.600
Basin E3	6.380	0.000	0.000	0.000	0.000	232.47	0.000	1.265	1120.	0.000
E3 outlet	6.380	0.000	0.000	0.000	0.000	232.47	0.000	1.066	1200.	0.000
CulRTB	6.380	25.00	0.000	2.500	0.000	193.45	0.000	1.066	1200.	6.000
BUR0100409	6.380	5.000	1.000	1.000	0.000	257.53	305.24	7.252	1200.	0.000
BUR0100200	6.380	5.000	1.000	1.000	0.000	257.53	305.24	0.8406	1160.	3.750
BUR0000110	6.380	15.00	1.000	2.500	0.000	197.92	305.24	9.019	1200.	.8500
BUR0100613	6.380	1.000	0.000	0.000	0.000	305.24	0.000	9.019	1200.	0.000
JWPDum2	6.380	1.000	0.000	0.000	0.000	305.24	0.000	79.613	1200.	0.000
QUA0000039	6.380	15.00	1.000	2.500	0.000	197.92	305.24	0.9920	1200.	0.000
QUA0000000	6.380	1.000	0.000	0.000	0.000	305.24	0.000	0.9920	1200.	0.000
34	6.380	1.000	0.000	0.000	0.000	305.24	0.000	0.9920	1200.	0.000
31	6.380	20.00	0.000	1.500	0.000	228.69	0.000	30.834	1160.	0.000
23	6.380	5.000	20.00	.2000	1.500	291.84	228.69	35.124	1200.	0.000
24	6.380	5.000	20.00	.2000	1.500	291.84	228.69	16.374	1180.	12.00
25	6.380	5.000	20.00	.2000	1.500	291.84	228.69	17.755	1200.	0.000
26	6.380	5.000	20.00	.2000	1.500	291.84	228.69	19.164	1180.	0.000
13.01	6.380	20.00	0.000	1.500	0.000	228.69	0.000	36.911	1180.	0.000
27	6.380	5.000	20.00	.2000	1.500	291.84	228.69	49.585	1200.	0.000
11.01	6.380	20.00	0.000	1.500	0.000	228.69	0.000	101.08	1200.	0.000
28	6.380	5.000	20.00	.2000	1.500	291.84	228.69	111.26	1200.	0.000
29	6.380	5.000	20.00	.2000	1.500	291.84	228.69	16.602	1180.	0.000

11.03	6.380	20.00	0.000	1.500	0.000	228.69	0.000	127.79	1200.	0.000
30	6.380	5.000	20.00	.2000	1.500	291.84	228.69	142.52	1200.	0.000
10.01	6.380	20.00	0.000	1.500	0.000	228.69	0.000	173.21	1200.	0.000
32	6.380	20.00	0.000	1.500	0.000	228.69	0.000	179.19	1200.	0.000
19	6.380	20.00	0.000	1.500	0.000	228.69	0.000	54.397	1200.	0.000
10	6.380	20.00	0.000	1.500	0.000	228.69	0.000	15.624	1200.	0.000
4	6.380	20.00	0.000	1.500	0.000	228.69	0.000	14.980	1200.	0.000
2	6.380	20.00	0.000	1.500	0.000	228.69	0.000	27.321	1200.	0.000
1	6.380	20.00	0.000	1.500	0.000	228.69	0.000	24.480	1200.	0.000
501	6.380	20.00	0.000	1.500	0.000	228.69	0.000	51.802	1200.	0.000
3	6.380	20.00	0.000	1.500	0.000	228.69	0.000	62.941	1240.	0.000
4.01	6.380	20.00	0.000	1.500	0.000	228.69	0.000	75.829	1240.	0.000
5	6.380	20.00	0.000	1.500	0.000	228.69	0.000	78.113	1240.	0.000
Top (6)	6.380	20.00	0.000	1.500	0.000	228.69	0.000	28.401	1200.	0.000
7	6.380	20.00	0.000	1.500	0.000	228.69	0.000	7.668	1200.	0.000
1.01	6.380	20.00	0.000	1.500	0.000	228.69	0.000	36.069	1200.	0.000
8	6.380	20.00	0.000	1.500	0.000	228.69	0.000	41.473	1220.	0.000
9	6.380	20.00	0.000	1.500	0.000	228.69	0.000	52.083	1260.	0.000
1.04	6.380	20.00	0.000	1.500	0.000	228.69	0.000	143.02	1240.	0.000
11	6.380	20.00	0.000	1.500	0.000	228.69	0.000	154.71	1240.	0.000
12	6.380	20.00	0.000	1.500	0.000	228.69	0.000	158.20	1280.	3.500
13	6.380	20.00	0.000	1.500	0.000	228.69	0.000	166.12	1280.	0.000
14	6.380	20.00	0.000	1.500	0.000	228.69	0.000	170.35	1340.	0.000
15	6.380	20.00	0.000	1.500	0.000	228.69	0.000	10.735	1200.	0.000
16	6.380	20.00	0.000	1.500	0.000	228.69	0.000	18.081	1200.	0.000
701	6.380	20.00	0.000	1.500	0.000	228.69	0.000	28.816	1200.	0.000
17	6.380	20.00	0.000	1.500	0.000	228.69	0.000	47.344	1220.	0.000
1.09	6.380	20.00	0.000	1.500	0.000	228.69	0.000	205.86	1300.	0.000
18	6.380	20.00	0.000	1.500	0.000	228.69	0.000	209.98	1360.	0.000
1.11	6.380	20.00	0.000	1.500	0.000	228.69	0.000	228.71	1340.	0.000
20	6.380	20.00	0.000	1.500	0.000	228.69	0.000	234.62	1360.	0.000
21	6.380	20.00	0.000	1.500	0.000	228.69	0.000	243.99	1280.	0.000
22	6.380	20.00	0.000	1.500	0.000	228.69	0.000	248.27	1320.	0.000
1.15	6.380	20.00	0.000	1.500	0.000	228.69	0.000	400.87	1220.	0.000
JWP40.00	6.380	5.000	1.000	1.000	0.000	257.53	305.24	0.9567	1120.	1.000
JWP40.01	6.380	5.000	1.000	1.000	0.000	257.53	305.24	1.418	1120.	1.000
JWP40.01-B	6.380	5.000	1.000	1.000	0.000	257.53	305.24	0.0272	1120.	0.000
JWP40.02	6.380	15.00	1.000	2.500	0.000	197.92	305.24	1.584	1200.	4.100
JWP40.03	6.380	15.00	1.000	2.500	0.000	197.92	305.24	2.696	1200.	0.000
JWP41.00	6.380	15.00	1.000	2.500	0.000	197.92	305.24	0.2973	1160.	0.000
JWP42.00	6.380	5.000	1.000	1.000	0.000	257.53	305.24	1.325	1120.	2.700
JWP43.00	6.380	5.000	1.000	1.000	0.000	257.53	305.24	0.4450	1120.	2.500
JWP42.01	6.380	5.000	1.000	1.000	0.000	257.53	305.24	2.598	1120.	1.000
JWP42.01-B	6.380	5.000	1.000	1.000	0.000	257.53	305.24	0.1912	1120.	1.000
JWP42.02	6.380	5.000	1.000	1.000	0.000	257.53	305.24	3.808	1140.	0.000
JWPDum1	6.380	1.000	0.000	0.000	0.000	305.24	0.000	6.711	1180.	0.000
JWP45.00	6.380	5.000	1.000	1.000	0.000	257.53	305.24	0.2160	1120.	8.000
JWP46.00	6.380	5.000	1.000	1.000	0.000	257.53	305.24	0.2100	1120.	5.000
JWP47.00	6.380	5.000	1.000	1.000	0.000	257.53	305.24	0.2257	1120.	3.000
JWPDum3	6.380	1.000	0.000	0.000	0.000	305.24	0.000	0.6153	1200.	0.000
33	6.380	20.00	0.000	1.500	0.000	228.69	0.000	398.17	1240.	0.000
1.17	6.380	20.00	0.000	1.500	0.000	228.69	0.000	398.81	1240.	0.000
35	6.380	20.00	0.000	1.500	0.000	228.69	0.000	442.21	1280.	0.000
EAS0901013	6.380	15.00	1.000	2.500	0.000	197.92	305.24	0.3121	1140.	0.000
EAS0900692	6.380	5.000	1.000	1.000	0.000	257.53	305.24	1.475	1160.	3.500
EAS900310S	6.380	5.000	1.000	1.000	0.000	257.53	305.24	2.100	1120.	.5000
EAS900310N	6.380	5.000	1.000	1.000	0.000	257.53	305.24	1.323	1120.	.5000
EAS0971E	6.380	5.000	1.000	1.000	0.000	257.53	305.24	4.158	1120.	1.500
EAS0900071	6.380	15.00	1.000	2.500	0.000	197.92	305.24	4.548	1200.	.6000
EAS0900000	6.380	1.000	0.000	0.000	0.000	305.24	0.000	4.548	1200.	0.000
36	6.380	20.00	0.000	1.500	0.000	228.69	0.000	4.548	1200.	0.000
1.19	6.380	20.00	0.000	1.500	0.000	228.69	0.000	444.68	1220.	0.000
37	6.380	20.00	0.000	1.500	0.000	228.69	0.000	444.96	1300.	0.000
E20	6.380	0.000	0.000	0.000	0.000	287.05	0.000	1.780	1120.	0.000
E19	6.380	0.000	0.000	0.000	0.000	287.05	0.000	0.5874	1120.	0.000
E18b	6.380	0.000	0.000	0.000	0.000	276.13	0.000	0.3156	1120.	0.000
E18c	6.380	0.000	0.000	0.000	0.000	283.41	0.000	0.0648	1120.	0.000
Basin E20	6.380	0.000	0.000	0.000	0.000	232.47	0.000	2.748	1120.	0.000
E20 out	6.380	0.000	0.000	0.000	0.000	232.47	0.000	2.401	1200.	0.000
CulJR	6.380	1.000	0.000	0.000	0.000	305.24	0.000	2.401	1200.	2.800
E20 crit	6.380	0.000	0.000	0.000	0.000	232.47	0.000	2.401	1200.	6.000
E18	6.380	5.000	0.000	1.000	0.000	257.53	305.24	5.420	1200.	0.000
E4	6.380	0.000	0.000	0.000	0.000	283.41	0.000	0.7053	1120.	0.000

E5	6.380	0.000	0.000	0.000	0.000	268.85	0.000	0.8979	1120.	3.300
E7	6.380	0.000	0.000	0.000	0.000	287.05	0.000	0.8282	1120.	3.300
E6a	6.380	0.000	0.000	0.000	0.000	290.69	0.000	1.381	1120.	0.000
E6a outlet	6.380	0.000	0.000	0.000	0.000	232.47	0.000	0.7060	1220.	0.000
Cul E6a	6.380	25.00	0.000	2.500	0.000	193.45	0.000	0.7060	1220.	3.300
E6	6.380	0.000	0.000	0.000	0.000	290.69	0.000	1.406	1200.	0.000
Cul E6	6.380	0.000	0.000	0.000	0.000	232.47	0.000	1.406	1200.	4.400
Cul E5	6.380	0.000	0.000	0.000	0.000	232.47	0.000	2.264	1120.	0.000
Basin E4	6.380	0.000	0.000	0.000	0.000	232.47	0.000	2.970	1120.	0.000
E4 outlet	6.380	0.000	0.000	0.000	0.000	232.47	0.000	2.912	1200.	0.000
E12a	6.380	0.000	0.000	0.000	0.000	283.41	0.000	0.2514	1120.	0.000
E12a out	6.380	0.000	0.000	0.000	0.000	232.47	0.000	0.1947	1200.	0.000
E9	6.380	0.000	0.000	0.000	0.000	294.32	0.000	0.3500	1120.	0.000
E10c	6.380	0.000	0.000	0.000	0.000	294.32	0.000	0.0942	1120.	0.000
E10b	6.380	0.000	0.000	0.000	0.000	236.10	0.000	0.1595	1120.	0.000
E8a	6.380	0.000	0.000	0.000	0.000	283.41	0.000	0.2982	1120.	0.000
E8b	6.380	0.000	0.000	0.000	0.000	268.85	0.000	1.056	1120.	0.000
E11	6.380	0.000	0.000	0.000	0.000	283.41	0.000	0.7561	1120.	0.000
BasinE8upp	6.380	0.000	0.000	0.000	0.000	232.47	0.000	2.270	1120.	0.000
E8upout	6.380	0.000	0.000	0.000	0.000	232.47	0.000	2.154	1200.	0.000
E8c	6.380	0.000	0.000	0.000	0.000	294.32	0.000	0.2342	1120.	0.000
BasinE8low	6.380	0.000	0.000	0.000	0.000	232.47	0.000	2.471	1200.	0.000
E8 outlet	6.380	0.000	0.000	0.000	0.000	232.47	0.000	2.445	1200.	4.400
E10a	6.380	0.000	0.000	0.000	0.000	279.77	0.000	0.6164	1120.	0.000
E10a out	6.380	0.000	0.000	0.000	0.000	232.47	0.000	0.5537	1200.	3.300
CulBPRB	6.380	25.00	0.000	2.500	0.000	193.45	0.000	2.999	1200.	0.000
DS E9	6.380	0.000	0.000	0.000	0.000	232.47	0.000	3.337	1200.	2.000
node 6	6.380	0.000	0.000	0.000	0.000	232.47	0.000	3.337	1200.	3.000
CulSRA	6.380	0.000	0.000	0.000	0.000	232.47	0.000	6.443	1200.	5.000
E14	6.380	0.000	0.000	0.000	0.000	294.32	0.000	0.2840	1120.	0.000
E17	6.380	0.000	0.000	0.000	0.000	294.32	0.000	0.5305	1120.	0.000
node3	6.380	0.000	0.000	0.000	0.000	232.47	0.000	0.5305	1120.	6.000
E16	6.380	0.000	0.000	0.000	0.000	294.32	0.000	0.8422	1120.	0.000
E15	6.380	0.000	0.000	0.000	0.000	290.69	0.000	0.0670	1120.	0.000
E12	6.380	0.000	0.000	0.000	0.000	283.41	0.000	0.2045	1120.	1.700
E13	6.380	0.000	0.000	0.000	0.000	283.41	0.000	1.238	1120.	0.000
BasinE13m	6.380	0.000	0.000	0.000	0.000	232.47	0.000	1.238	1120.	0.000
E13 Outlet	6.380	0.000	0.000	0.000	0.000	232.47	0.000	0.8481	1220.	0.000
CulSRB	6.380	25.00	0.000	2.500	0.000	193.45	0.000	1.041	1200.	7.800
Dummy A	6.380	0.000	0.000	0.000	0.000	232.47	0.000	1.041	1200.	0.000
CulBBEst	6.380	25.00	0.000	2.500	0.000	193.45	0.000	2.695	1200.	0.000
Basin E16	6.380	0.000	0.000	0.000	0.000	232.47	0.000	2.695	1200.	0.000
E16 out	6.380	0.000	0.000	0.000	0.000	232.47	0.000	2.450	1200.	2.500
E18a	6.380	0.000	0.000	0.000	0.000	283.41	0.000	0.2354	1120.	3.670
E15a	6.380	0.000	0.000	0.000	0.000	268.85	0.000	0.3739	1120.	0.000
E16oldcrit	6.380	0.000	0.000	0.000	0.000	232.47	0.000	2.808	1200.	0.000
CulBRTC	6.380	0.000	0.000	0.000	0.000	232.47	0.000	9.252	1200.	3.500
JWP50.01	6.380	5.000	1.000	1.000	0.000	257.53	305.24	10.176	1200.	0.000
JWP50.02d	6.380	1.000	0.000	0.000	0.000	305.24	0.000	15.596	1200.	0.000
JWP53.00	6.380	5.000	1.000	1.000	0.000	257.53	305.24	0.1627	1120.	1.500
56.00	6.380	5.000	1.000	1.000	0.000	257.53	305.24	1.051	1120.	2.000
JWP50.03	6.380	15.00	1.000	2.500	0.000	197.92	305.24	17.281	1200.	2.500
JWP51.00	6.380	5.000	1.000	1.000	0.000	257.53	305.24	1.327	1120.	2.900
JWP57.00	6.380	5.000	1.000	1.000	0.000	257.53	305.24	0.3476	1120.	1.000
JWP51.01	6.380	5.000	1.000	1.000	0.000	257.53	305.24	2.675	1200.	0.000
JWP54.00	6.380	5.000	1.000	1.000	0.000	257.53	305.24	0.1670	1120.	0.000
JWP55.00	6.380	5.000	1.000	1.000	0.000	257.53	305.24	0.4311	1120.	0.000
JWP50.04d	6.380	1.000	0.000	0.000	0.000	305.24	0.000	20.522	1200.	1.250
JWP50.05	6.380	15.00	1.000	2.500	0.000	197.92	305.24	21.621	1200.	0.000
d6	6.380	0.000	0.000	0.000	0.000	287.05	0.000	21.621	1200.	0.000
E34	6.380	0.000	0.000	0.000	0.000	287.05	0.000	0.3869	1120.	3.670
E24	6.380	0.000	0.000	0.000	0.000	261.58	0.000	0.5725	1120.	0.000
E24c	6.380	0.000	0.000	0.000	0.000	283.41	0.000	0.1055	1120.	1.500
E24b	6.380	0.000	0.000	0.000	0.000	268.85	0.000	0.4228	1120.	5.600
E30	6.380	0.000	0.000	0.000	0.000	287.05	0.000	1.331	1120.	5.000
E29	6.380	0.000	0.000	0.000	0.000	287.05	0.000	1.949	1120.	0.000
E28	6.380	0.000	0.000	0.000	0.000	283.41	0.000	1.830	1120.	0.000
d16	6.380	0.000	0.000	0.000	0.000	232.47	0.000	3.779	1120.	3.000
E27	6.380	0.000	0.000	0.000	0.000	287.05	0.000	0.3459	1120.	0.000
E23a	6.380	0.000	0.000	0.000	0.000	287.05	0.000	0.1969	1120.	3.500
E27a	6.380	0.000	0.000	0.000	0.000	239.74	0.000	4.564	1120.	0.000
E27a out	6.380	0.000	0.000	0.000	0.000	232.47	0.000	4.042	1200.	0.000
CulCR	6.380	25.00	0.000	2.500	0.000	193.45	0.000	4.042	1200.	6.100

E23	6.380	0.000	0.000	0.000	0.000	287.05	0.000	0.6505	1120.	6.000
E22	6.380	0.000	0.000	0.000	0.000	283.41	0.000	2.029	1120.	0.000
E24a	6.380	0.000	0.000	0.000	0.000	283.41	0.000	0.4328	1120.	0.000
Basin E22	6.380	0.000	0.000	0.000	0.000	232.47	0.000	2.462	1120.	0.000
E22 out	6.380	0.000	0.000	0.000	0.000	232.47	0.000	1.860	1200.	0.000
CulE22	6.380	25.00	0.000	2.500	0.000	193.45	0.000	1.860	1200.	0.000
E26	6.380	0.000	0.000	0.000	0.000	287.05	0.000	0.9533	1120.	0.000
E25	6.380	0.000	0.000	0.000	0.000	287.05	0.000	0.9898	1120.	0.000
Basin E 25	6.380	0.000	0.000	0.000	0.000	232.47	0.000	1.943	1120.	0.000
E25 out	6.380	0.000	0.000	0.000	0.000	232.47	0.000	1.489	1200.	3.900
E22crit	6.380	0.000	0.000	0.000	0.000	232.47	0.000	8.337	1200.	0.000
E22 ou#647	6.380	0.000	0.000	0.000	0.000	232.47	0.000	8.337	1200.	8.000
E33	6.380	0.000	0.000	0.000	0.000	287.05	0.000	0.3318	1120.	0.000
CulRR	6.380	25.00	0.000	2.500	0.000	193.45	0.000	0.3091	1200.	16.70
E Crit	6.380	0.000	0.000	0.000	0.000	232.47	0.000	9.020	1200.	0.000
E34a	6.380	15.00	1.000	2.500	0.000	197.92	305.24	2.571	1160.	0.000
JWP52.01d	6.380	1.000	0.000	0.000	0.000	305.24	0.000	11.561	1200.	0.000
JWP58.00	6.380	5.000	1.000	1.000	0.000	257.53	305.24	0.2326	1120.	3.300
JWP52.02	6.380	15.00	1.000	2.500	0.000	197.92	305.24	12.256	1200.	0.000
38	6.380	20.00	0.000	1.500	0.000	228.69	0.000	33.877	1200.	0.000
1.21	6.380	20.00	0.000	1.500	0.000	228.69	0.000	462.55	1300.	0.000
39	6.380	20.00	0.000	1.500	0.000	228.69	0.000	467.61	1320.	0.000
40	6.380	20.00	0.000	1.500	0.000	228.69	0.000	52.832	1200.	0.000
41	6.380	20.00	0.000	1.500	0.000	228.69	0.000	79.895	1260.	0.000
42	6.380	20.00	0.000	1.500	0.000	228.69	0.000	91.500	1300.	0.000
1.23	6.380	20.00	0.000	1.500	0.000	228.69	0.000	557.30	1320.	0.000
E35	6.380	0.000	0.000	0.000	0.000	287.05	0.000	0.1029	1120.	0.000
d12	6.380	0.000	0.000	0.000	0.000	232.47	0.000	0.0941	1200.	0.000
E31a	6.380	0.000	0.000	0.000	0.000	294.32	0.000	0.4428	1120.	3.900
E32	6.380	0.000	0.000	0.000	0.000	294.32	0.000	0.5065	1120.	3.300
E31	6.380	0.000	0.000	0.000	0.000	294.32	0.000	0.6867	1120.	0.000
Basin E31	6.380	0.000	0.000	0.000	0.000	232.47	0.000	1.636	1120.	0.000
E31 out	6.380	0.000	0.000	0.000	0.000	232.47	0.000	1.322	1200.	0.000
CulRTE	6.380	25.00	0.000	2.500	0.000	193.45	0.000	1.322	1200.	0.000
d3	6.380	0.000	0.000	0.000	0.000	232.47	0.000	1.416	1200.	0.000
d4	6.380	0.000	0.000	0.000	0.000	232.47	0.000	1.416	1200.	0.000
d5	6.380	0.000	0.000	0.000	0.000	232.47	0.000	1.416	1200.	0.000
43	6.380	20.00	0.000	1.500	0.000	228.69	0.000	561.48	1320.	0.000
Outlet	6.380	20.00	0.000	1.500	0.000	228.69	0.000	561.48	1320.	0.000

SUMMARY OF BASIN RESULTS

Link Label	Time to Peak	Peak Inflow (m^3/s)	Time to Peak	Peak Outflow (m^3/s)	Total Inflow (m^3)	Basin Vol. Avail	Basin Vol. Used	Basin Stage Used
BUR0003753	1120.	8.151	1200.	8.664	280288.	0.0000	9.1700	35.884
BUR0001732	1200.	23.92	1200.	23.30	804027.	0.0000	5658.8	25.394
QUA0004358	1120.	11.55	1180.	11.34	397290.	0.0000	7234.5	43.886
QUA0003665	1160.	15.55	1200.	15.21	543472.	0.0000	16974.1	38.425
BUR0200449	1160.	8.431	1200.	8.219	287660.	0.0000	11479.4	25.911
BUR0A00261	1200.	70.43	1200.	70.06	.250E+07	0.0000	13210.7	19.941
E1a	1120.	.9387	1200.	.7822	30879.5	0.0000	1729.9	25.874
E1	1120.	1.800	1200.	1.529	59350.5	0.0000	3042.6	27.818
Basin E3	1120.	1.265	1200.	1.066	42683.5	0.0000	2536.2	28.887
BUR0100409	1200.	7.251	1200.	7.108	271723.	0.0000	4895.1	19.528
JWP40.01	1120.	1.418	1200.	1.334	49632.3	0.0000	1868.4	21.219
JWP42.01	1120.	2.598	1140.	2.636	90766.1	0.0000	1997.7	21.579
JWP45.00	1120.	.2160	1200.	.2019	7597.6	0.0000	678.28	31.089
JWP46.00	1120.	.2100	1200.	.1959	7388.9	0.0000	643.32	25.584
JWP47.00	1120.	.2257	1200.	.2175	7954.9	0.0000	917.77	21.298
EAS0971E	1120.	4.158	1200.	4.017	143816.	0.0000	11627.9	18.736
Basin E20	1120.	2.747	1200.	2.401	91360.4	0.0000	10879.2	30.804
E6a	1120.	1.380	1220.	.7060	45911.6	0.0000	7843.1	38.030
Basin E4	1120.	2.969	1200.	2.911	121907.	0.0000	2164.4	24.697
E12a	1120.	.2514	1200.	.1947	8328.5	0.0000	482.66	24.847
BasinE8upp	1120.	2.269	1200.	2.153	72149.6	0.0000	5763.0	36.615
BasinE8low	1200.	2.471	1200.	2.444	83392.9	0.0000	2212.3	35.109
E10a	1120.	.6164	1200.	.5537	19967.8	0.0000	1985.2	36.107
BasinE13m	1120.	1.237	1220.	.8481	40993.0	0.0000	4373.8	35.140
Basin E16	1200.	2.695	1200.	2.450	106342.	0.0000	3847.0	22.875
56.00	1120.	1.050	1140.	1.015	36671.5	0.0000	2702.4	16.176
JWP51.00	1120.	1.327	1200.	1.239	46412.9	0.0000	7903.6	18.906

JWP55.00	1120.	.4311	1200.	.4008	15164.7	0.0000	444.66	18.166
E27a	1120.	4.563	1200.	4.041	150867.	0.0000	14340.2	26.592
Basin E22	1120.	2.461	1200.	1.859	81325.1	0.0000	6904.6	19.899
Basin E 25	1120.	1.943	1200.	1.488	64847.2	0.0000	7591.6	23.244
E33	1120.	.3318	1200.	.3091	11103.4	0.0000	244.16	39.591
E35	1120.	.1029	1200.	.0941	3385.4	0.0000	251.04	0.6276
Basin E31	1120.	1.636	1200.	1.322	55922.5	0.0000	4033.5	20.953

SUMMARY OF BASIN OUTLET RESULTS

Link Label	No. of	S/D Factor (m)	Dia (m)	Width (m)	Pipe Length (m)	Pipe Slope (%)
BUR0003753	3.0		1.066	0.000	31.700	1.640
BUR0001732	3.0		2.440	2.440	20.000	0.2000
QUA0004358	3.0	1.000		0.000	12.500	3.754
QUA0003665	4.0	1.000		0.000	10.000	3.368
BUR0200449	1.0		1.860	2.000	13.000	0.5000
BUR0A00261	1.0	1.000		0.000	20.000	0.2000
E1a	1.0	1.000		0.000	20.000	0.2000
E1	1.0	1.000		0.000	20.000	0.2000
Basin E3	1.0	1.000		0.000	20.000	0.2000
BUR0100409	1.0	1.000		0.000	20.000	0.2000
JWP40.01	1.0	1.000		0.000	20.000	0.2000
JWP42.01	1.0	1.000		0.000	20.000	0.2000
JWP45.00	1.0	1.000		0.000	20.000	0.2000
JWP46.00	1.0	1.000		0.000	20.000	0.2000
JWP47.00	1.0	1.000		0.000	20.000	0.2000
EAS0971E	1.0	1.000		0.000	20.000	0.2000
Basin E20	1.0	1.000		0.000	20.000	0.2000
E6a	1.0	1.000		0.000	20.000	0.2000
Basin E4	1.0	1.000		0.000	20.000	0.2000
E12a	1.0	1.000		0.000	20.000	0.2000
BasinE8upp	1.0	1.000		0.000	20.000	0.2000
BasinE8low	1.0	1.000		0.000	20.000	0.2000
E10a	1.0	1.000		0.000	20.000	0.2000
BasinE13m	1.0	1.000		0.000	20.000	0.2000
Basin E16	1.0	1.000		0.000	20.000	0.2000
56.00	1.0	1.000		0.000	20.000	0.2000
JWP51.00	1.0	1.000		0.000	20.000	0.2000
JWP55.00	1.0	1.000		0.000	20.000	0.2000
E27a	1.0	1.000		0.000	20.000	0.2000
Basin E22	1.0	1.000		0.000	20.000	0.2000
Basin E 25	1.0	1.000		0.000	20.000	0.2000
E33	1.0	1.000		0.000	20.000	0.2000
E35	1.0	1.000		0.000	20.000	0.2000
Basin E31	1.0	1.000		0.000	20.000	0.2000

SUMMARY OF CHANNEL/FLOODWAY DATA AND RESULT

Link Label	Ave. Vel. (m/s)	Ave. Rough. (n)	Flow Depth (m)	Max. Flow (m^3/s)	No. of Pipes	Pipe Dia. (m)	Pipe Slope (%)	Pipe Flow (m3^/s)
13.01	1.08	.0402	2.625	36.852	1.0	0.000	0.000	0.000
11.01	4.24	.0150	1.525	100.99	1.0	0.000	0.000	0.000
11.03	1.76	.0447	2.825	127.20	1.0	0.000	0.000	0.000
10.01	0.946	.0467	3.200	171.75	1.0	0.000	0.000	0.000
501	0.512	.0886	2.134	51.382	1.0	0.000	0.000	0.000
4.01	0.630	.0700	2.637	75.705	1.0	0.000	0.000	0.000
1.01	0.342	.0810	2.761	35.779	1.0	0.000	0.000	0.000
8	0.484	.0801	3.200	40.616	1.0	0.000	0.000	0.000
1.04	0.441	.0776	4.541	142.83	1.0	0.000	0.000	0.000
11	0.453	.0750	5.950	149.36	1.0	0.000	0.000	0.000
13	0.368	.0715	5.075	161.22	1.0	0.000	0.000	0.000
701	0.319	.1436	2.731	27.702	1.0	0.000	0.000	0.000
1.09	0.352	.0700	5.281	201.85	1.0	0.000	0.000	0.000
1.11	0.389	.0786	6.225	226.76	1.0	0.000	0.000	0.000
20	0.475	.0729	5.719	233.64	1.0	0.000	0.000	0.000
21	0.574	.0721	4.937	243.48	1.0	0.000	0.000	0.000
1.15	0.403	.0700	5.537	390.05	1.0	0.000	0.000	0.000
1.17	0.610	.0740	5.075	395.62	1.0	0.000	0.000	0.000
1.19	0.635	.0700	5.131	440.75	1.0	0.000	0.000	0.000

1.21	0.548	.0700	5.787	458.08	1.0	0.000	0.000	0.000
40	0.505	.0839	2.625	50.752	1.0	0.000	0.000	0.000
41	0.529	.0718	2.397	79.675	1.0	0.000	0.000	0.000
1.23	0.473	.0732	6.544	556.98	1.0	0.000	0.000	0.000

Run completed at: 4th May 2012   7:47:54

Attachment E

Flood Evacuation Strategy

MOLINO STEWART
ENVIRONMENT & NATURAL HAZARDS

11 May 2012

Daniel Gardiner
Water Resources Engineer
J.Wyndham Prince
580 High Street
Penrith NSW 2750

Dear Daniel,

Re: Schofields Precinct Flood Evacuation Strategy

In response to your request for advice, we have prepared a flood evacuation strategy for the proposed Schofields Precinct. The strategy has been based upon modelling undertaken using the SES Timeline Evacuation Model. This report outlines the data used in the model and strategy development, the methodology used to develop the strategy, any other considerations taken into account and finally the strategy itself.

Data Provided

The following data have been used to develop the Schofields Precinct flood evacuation strategy:

- Schofields Precinct Indicative Layout Plan Version 5 (23/01/2012), provided by J.Wyndham Prince.
- Dwelling Densities for each of the zones within the Indicative Layout Plan, provided by J.Wyndham Prince.
- Flood extents for local flooding for the 1 in 100 year ARI and PMF events in ESRI Shapefile format, provided by J.Wyndham Prince.
- Flood extents for the regional Hawkesbury-Nepean flooding for the 1 in 100 year ARI and PMF events, provided by J. Wyndham Prince.
- A flood hydrograph and levels for the upstream boundary of the site for the local PMF, provided by J. Wyndham Prince.
- Contours of the development Precinct based on ALS Data, provided by J.Wyndham Prince
- WaterRIDE flood modelling of the regional PMF event
- Regional evacuation model for the Hawkesbury Nepean Valley, prepared by Molino Stewart for the Department of Planning.
- Expected number of cars to evacuate from the Nirimba Educational Precinct, provided by J.Wyndham Prince.
- Assurance that capacity of channels and culverts and bridges over these channels within the site exceed the flow of a 1 in 500 year event, provided by J.Wyndham Prince.

Evacuation Precincts.

The SES regional flood evacuation strategy for the Hawkesbury Nepean is to evacuate people from areas which will become inundated or isolated before their evacuation routes are cut. The intention is for people to find accommodation with family or friends or otherwise to travel to the regional evacuation centre at the Sydney Olympic Park. The preferred route to Sydney Olympic Park for evacuation traffic from this part of the floodplain requires travel along the M7 and M2 motorways.

Evacuation traffic from Windsor and McGraths Hill will use Windsor Road to reach the M7 while evacuation traffic from Bligh Park and Windsor Downs will use Richmond Road.

For the purpose of this evacuation assessment, the site was divided into six distinct precincts based on their proximity to evacuation routes from the site. Additionally, when determining the precinct boundaries, consideration was given to avoid crossing local drainage infrastructure where ever possible. These precincts are shown in Figure 1 of **Attachment A**. Evacuation Precinct 4 consists entirely of the Nirimba Education Precinct.

The evacuation route for each precinct was assumed to be as follows:

- Precinct 1 will evacuate east across either the existing Westminster Bridge Road onto Boundary Road then Schofields Road to Windsor Road, or alternatively through a proposed new bridge at Schofields Road to Windsor Road
- Precinct 2 will evacuate to the east across the railway on the proposed Burdekin Rd bridge, down Burdekin Rd, continue onto the Stanhope Parkway to Sunnyholt Road and then to the M7
- Precinct 3 will evacuate via Nirimba Drive to the south and then onto Douglas Road, Eastern Road and Quakers Hill Parkway and then west onto the M7
- Precinct 4 will evacuate to the south using the Warawara Circuit onto Quakers Hill Parkway and then west onto the M7
- Precinct 5 will evacuate to the south using Quakers Road onto Quakers Hill Parkway and then west onto the M7
- Precinct 6 will evacuate to the south using Symonds Road onto Richmond Road then travel west onto the M7.

Examination of each of the routes shows that all of the evacuation routes are constrained to a single lane. However, Precincts 3, 4 and 5 will all have single lanes converging onto the two lane Quakers Hill Parkway, therefore these three precincts were analysed as a combined precinct using two lanes for evacuation modelling.

By evacuating Precincts 1 and 2 onto Windsor Road, as opposed to South onto the issue of converging traffic on the M7 is mitigated. Therefore, evacuation east to Windsor Road (for Precincts 1 and 2) is preferable.

Evacuation Numbers

Within each evacuation precinct, the area of the different residential zones within the regional PMF inundation extent was calculated. These were then multiplied by the dwelling densities provided by J.Wyndham Prince (Table 1). The number of dwellings was then multiplied by a factor of 1.8 to determine the number of cars per dwelling (Statistics from the Australian Bureau of Statistics suggest that in metropolitan areas near railway lines car ownership does not exceed 1.8 vehicles per dwelling). . The estimated number of cars per precinct is provided in Table 2.

Data for the Nirimba Precinct could only be obtained based upon the number of people on site, rather than the number of cars per dwelling. Therefore, the number of cars for Precinct 4 (Nirimba) has been calculated based upon a count of the current car parking spaces using Google Earth. It was calculated that there were sufficient car parking spaces on site for approximately 25% of the peak number of people using the Education Precinct. It was then assumed that the ratio of maximum number of people to car parking availability will not change in future development. The future number of vehicles on campus was therefore calculated to be 2,453.

Table 1. Dwelling Density for residential zones

Zone	Density (Dwellings/Hectare)
Environmental Living	0.3
Low Density Residential	17.5
Medium Density Residential	30
Medium to High Density Residential	40

Table 2. Car numbers for each evacuation precinct by zone

Evacuation Precinct	Environ mental Living	Low Density Residential	Medium Density Residential	Medium to High Density Residential	Nirimba Education Precinct	Total
1	11	842	32	0	N/A	885
2	5	577	556	195	N/A	1333
3	0	353	51	12	N/A	416
4	0	0	0	0	1,652 2,453*	
5	7	311	0	0	N/A	318
6	1	70	0	0	N/A	71
Total	24	2153	639	207		

*Note: Estimated future cars based upon estimated maximum people on site per day within a 25 year timeframe.

<u>Evacuation Modelling</u>

a. Hawkesbury-Nepean (Regional) Flooding

Examination of the WaterRIDE files for the Regional PMF shows that:

- By the time that the level reaches 16.3 m AHD the properties in Ellesmere Avenue and adjacent properties on Grange Avenue in the northern section of Precinct 1 are isolated due to flood waters cutting Grange Avenue to their east and west.
- Oban Street is a cul de sac whose bottom end would also be cut by flood waters by the time the level reaches 16.3 m AHD and properties in that street would not be able to evacuate.

- Should the Westminster Street Bridge be removed, West Parade north of Grange Avenue becomes isolated by 17.5 m AHD.
- Properties on Bridge Street south of Grange Avenue would be isolated by 17.5 m AHD flooding regardless of the removal of Westminster Street Bridge because both ends of their street would be cut by flood waters.
- By the time flood waters reach 23.7 m AHD properties in Precinct 6 to the west of Symonds Road are isolated but would be above the PMF.

The remaining Precincts are generally not isolated and have rising evacuation routes, however significant flooding occurs from 19.8 m AHD in Precincts 2, 3, 4 and 5 and from 21.75 m AHD significant flooding occurs in Precinct 6. The majority of the Schofields Precinct is inundated by the regional PMF peak at 26.33 m AHD. Those premises that are not inundated may still require evacuation due prolonged loss of essential services (electricity, water, sewer).

i. Vehicular Evacuation

Flood evacuation modelling has been undertaken using the SES Timeline Evacuation Model (Opper, 2004) which assumes a maximum evacuation rate of 600 vehicles per hour per lane. It also allows one hour for people to accept a warning after they have been door knocked and a further hour to prepare to evacuate. A travel safety factor is added to account for delays along the evacuation route should there be breakdowns, accidents, fallen trees or power lines or local flooding. The travel safety factor is proportional to the time calculated for all of the cars to evacuate.

For the Hawkesbury-Nepean Valley the Bureau of Meteorology has advised that it can provide at least 9 hours warning of any level being reached, based on fallen rain. Additionally, the model assumes that the SES has mobilised prior to the warning being issued, with this decision based on forecast rainfall. In summary, the model assumes that there will be 9 hours available for evacuation and at least 3 of those hours will be taken up with people accepting the warning, preparing to evacuate and being delayed along the evacuation route.

The Nirimba Education Precinct has been treated in the same fashion as a residential development, where evacuation is completed based upon progressive door-knocking residences, then a warning acceptance time and warning lag time is applied before the first vehicle is evacuated. It is believed that the Education Precinct would not require door knocking as it would have an emergency evacuation system in place. Therefore the treatment of Nirimba Education Precinct within the model is a conservative estimate of time taken to evacuate.

Evacuation times required, and surplus time have been calculated and shown in Table 3, the precincts have been grouped based upon their evacuation route. The results show that the evacuation of the site can be completed successfully within the 9 hour period, with a minimum surplus time of 3.1 hours (Precincts 2).

Sensitivity testing was undertaken by increasing the vehicles per dwelling from 1.8 to 2. Table 3 summarises the evacuation for the sensitivity test and shows that there would still be ample surplus time.

It is likely that sections of the evacuation route off site will not have the capacity to pass a 1 in 500 year ARI event flow. However, this has been partially taken into account in the traffic safety factor applied, and in addition, the surplus time available ensures that this is not likely to pose a significant risk to the evacuation of the site.

Table 3. Evacuation Modelling Results

Precincts	**Time (hours)**			
	Time Required	**Surplus Time**	**Time Required (2 vehicles per dwelling)**	**Surplus Time (2 vehicles per dwelling)**
Precinct 1	4.5	4.5	4.6	4.4
Precinct 2	5.9	3.1	6.2	2.8
Precincts 3, 4 and 5	5	4	5.1	3.9
Precincts 3, 4 and 5 with future Nirimba Development	5.7	3.3	5.7	3.3
Precinct 6	3.1	5.9	3.1	5.9

ii. Regional Traffic Convergence

Windsor Road and Richmond Road as well as the M7 Motorway will need to be used by existing evacuation traffic from Windsor, McGraths Hill, Bligh Park and Windsor Downs. However, all of these areas must evacuate before the river level reaches 17.3 m AHD by which time their evacuation routes would be cut.

There are existing properties in Precinct 1 which would need to evacuate before this level is reached and that evacuation traffic could potentially converge with the regional evacuation traffic on Windsor Road. However, the numbers are relatively small and could queue on local roads within Schofields and Quakers Hill until the other evacuation traffic has dissipated. Similarly, if it is decided to evacuate the isolated areas of Precinct 6 they may have to converge with the evacuation traffic on Richmond Road, there is little opportunity for queuing of this traffic and it would need to be given precedence over the regional evacuation traffic.

Should the proposed Riverstone West Industrial Precinct proceed, it would be evacuating at the same time as Windsor and McGraths Hill and would need to use local roads in Schofields and Quakers Hill to reach the M7 Motorway. This traffic would need to queue on these roads until other evacuation traffic using the M7 Motorway had dissipated. These queues would still be dissipating as evacuation of the Schofields Precinct begins and may block evacuation of Precincts 1 and 2 and take up capacity on the M7 Motorway required for the evacuation of the remaining Precincts.

Should the proposed Marsden Park Residential Development proceed, it would be evacuating at the same time as Schofields and would add to the evacuation traffic on Richmond Road and the M7 Motorway.

Because both Schofields and Marsden Park developments are adjacent to land above the PMF evacuation traffic convergence issues may be able to be avoided if these evacuees are directed to evacuate locally and not travel onto the M7 Motorway. However, if the Schofields evacuation traffic cannot leave the site because of other evacuation traffic queues, there is limited opportunity within the Schofields Precincts for evacuation traffic to queue above the PMF. It may be possible to queue this evacuation traffic within local road systems in Schofields and Quakers Hill.

iii. Pedestrian Evacuation

There are a number of reasons that the evacuation of the site would not proceed according to the evacuation plan. This could include residents deciding not to evacuate or delaying evacuation beyond what has been modelled, obstructions to the evacuation path or a lack of resources to effectively carry out the evacuation.

The regional PMF peak level is 26.4 m AHD. Examination of the data, presented in Figure 2, shows that all precincts except Precinct 5 have areas above this level. Precinct 5 is adjacent to land above the PMF. All of the proposed new development within the Precincts will have roads rising to the areas above the PMF which means that should people fail to evacuate by vehicle they can walk to flood free land. However, the existing residential areas within Precinct 1 that would be isolated as described earlier do not have rising road access to flood free land and therefore could be trapped and overwhelmed by flood waters. Provision could be made in the new development to provide them with appropriate pedestrian access to flood free land.

Eastern Creek (Local) Flooding

Flood waters coming down Eastern Creek can also flood the development. The PMF event from this local flooding rises to its peak water level of 23.2 m AHD within approximately 2 hours of exceeding the local 1 in 100 year ARI event. Figure 3 shows the rate of rise of the water level at the upstream end of the site for the Local PMF event. From 21 m AHD (approximately the 1 in 100 year ARI level) significant sections of the development are inundated, with the water rising approximately a metre within the first 15 minutes.

The Bureau of Meteorology is unable to provide a quantified flood warning for Eastern Creek and therefore the only flood warning that residents receive may be the arrival of flood waters on their property. This suggests there will not be enough time for planned vehicular evacuation. It is expected that residents will need to evacuate locally, either by walking or driving to higher ground nearby. They should evacuate to areas above the regional PMF level of 26.4 m AHD. Figure 2 shows the elevation across the site overlaid with both the local and regional PMF extents.

The furthest anyone would need to walk would be about 1 km. Assuming that people are carrying goods or assisting children or the elderly it could take up to 30 minutes for people to walk this distance. The Environmental Living areas, which are on the edge of the local 1 in 100 year ARI flood extent, are at the lowest elevation within the Precincts and could experience flood waters rising 1.5 m within that time. This assumes that they leave their premises as soon as the flood waters arrive. Depending on the gradient of the route along which they travel this could lead to people having to wade through hazardous flood waters.

Recommendations

Evacuation Plan for Schofields Precinct

In light of the preceding discussion, an evacuation plan can be developed for the Schofields Precinct which is consistent with the SES strategy for the Valley as set out in its Hawkesbury Nepean Flood Emergency Sub Plan (2005). The plan would require:

- Evacuation of the existing sections of Precinct 1 that will be isolated (as described earlier) when the Bureau of Meteorology is forecasting a level of 16.4 m AHD at Windsor Bridge.

- Evacuation of the areas of Precinct 6 that would become isolated (as described earlier) when the Bureau of Meteorology is forecasting a level of 23.7 m AHD.
- Evacuation and closure of the Nirimba Education Precinct when the Bureau of Meteorology is forecasting a level exceeding 21 m AHD at Windsor Bridge.
- Evacuation of the lowest parts of the remainder of Precinct 1 and 6 and Precincts 2 - 5 when the Bureau of Meteorology is forecasting a level of 21 m AHD at Windsor Bridge and progressive evacuations of higher areas as the forecast level rises.
- Give flood evacuation traffic from the Schofields precinct priority over flood evacuation traffic from Riverstone West Industrial Precinct, reduce the scale of the Riverstone West Industrial Precinct or in some other way manage the potential blocking of Schofields evacuation traffic by evacuation traffic from Riverstone West.
- Direct evacuation traffic from Schofields and Marsden Park residential development areas to local evacuation centres in Blacktown Local Government Area or nearby to avoid convergence of traffic on the M7 Motorway, particularly if Riverstone West Industrial Precinct proceeds.

Following these steps will trigger an evacuation in floods somewhere between a 1 in 60 and 1 in 100 year event for the isolated sections of Precinct 1, between a 1 in 500 and 1 in 1,500 year event for the isolated sections of Precinct 6 and between a 1 in 100 and PMF event for the remainder of Precincts 1 and 6 and all of Precincts 2, 3, 4 and 5.

Design and Construction

As a result of our modelling and analysis we make the following recommendations regarding the final form of the development:

- Ensure all new roads are above the 1 in 100 flood level and that there is a rising pedestrian route (and preferably vehicular route) from every residential property to land above the regional PMF level
- Maintain the Westminster Street Bridge to allow the existing and new residences along West Parade north of Grange Avenue to evacuate without the risk of isolation.
- Construct a road linking Grange Avenue to Argowan Street along the ridgeline to enable residences along Grange Avenue and Ellesmere Avenue to evacuate south without the risk of isolation.
- Construct a pedestrian access from the park at the top of Oban Street west to the proposed road behind it to allow existing residences within the Oban Street cul de sac to evacuate west without the risk of isolation.
- Maintain the pedestrian bridge over the railway line at Bridge Street to allow the residences on Bridge Street to evacuate without risk of isolation.
- Require any development to have two storeys within the environmental living zones and any other areas where there is a risk of people being overtaken by floodwaters when escaping local flooding. Require such buildings to be designed and constructed to remain structurally sound as a safe refuge in a local PMF.
- Ensure all residential buildings within the environmental living zones have minimum floor levels, including garage floor levels above the 1 in 100 ARI flood level and that vehicular access from the buildings to the local road is above this level.
- Maintain an alarm for the Nirimba Education Precinct that will activate at an appropriate level (probably less than 19m AHD) to trigger a timely evacuation from local flooding.

If you require any further assistance in assessing and managing flood risks at the site please do not hesitate to ask.

Yours faithfully

For Molino Stewart Pty Ltd

Steven Molino

Principal

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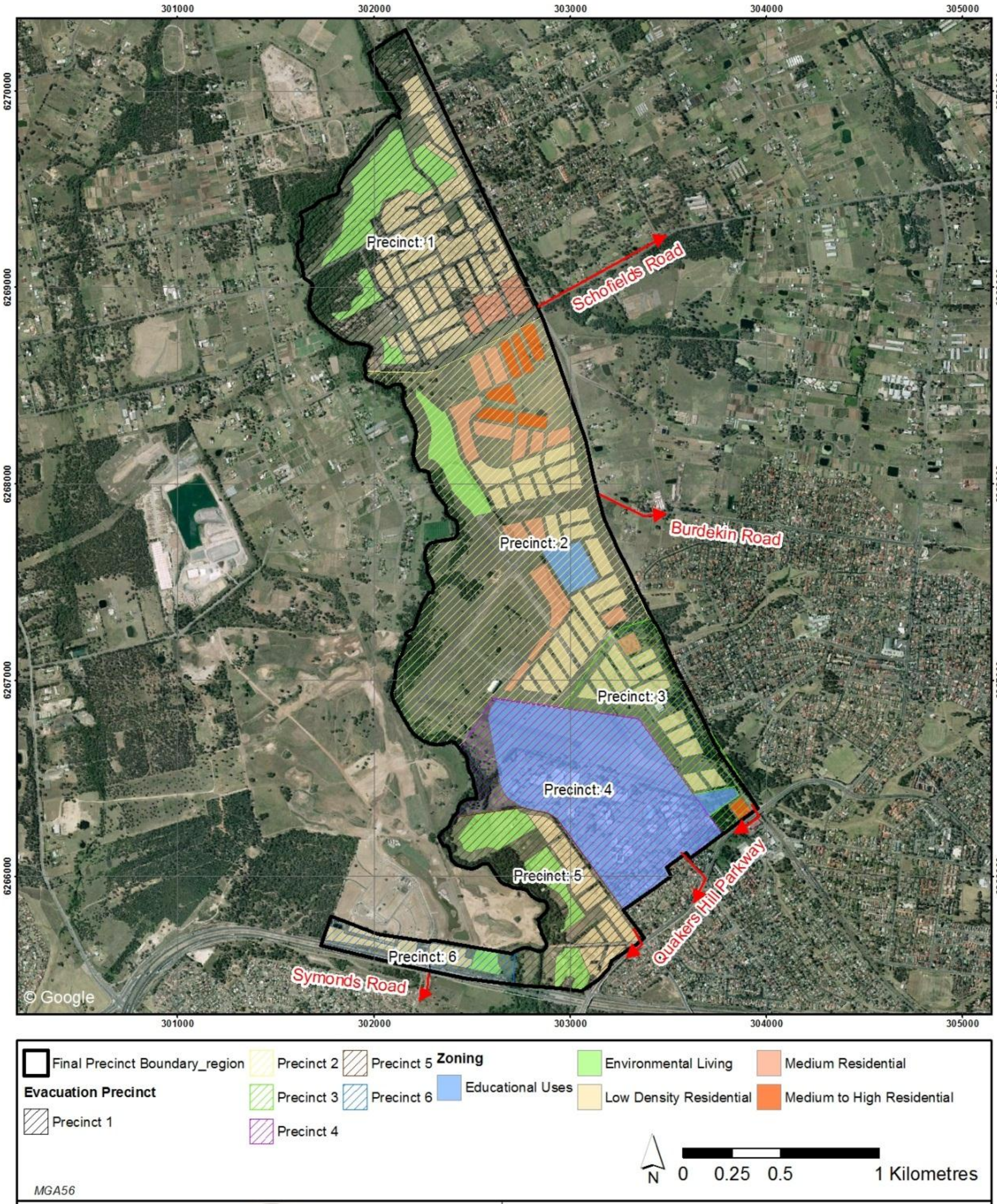

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Schofields Precinct Flood Evacuation Plan
Figure 1. Site and Evacuation Routes

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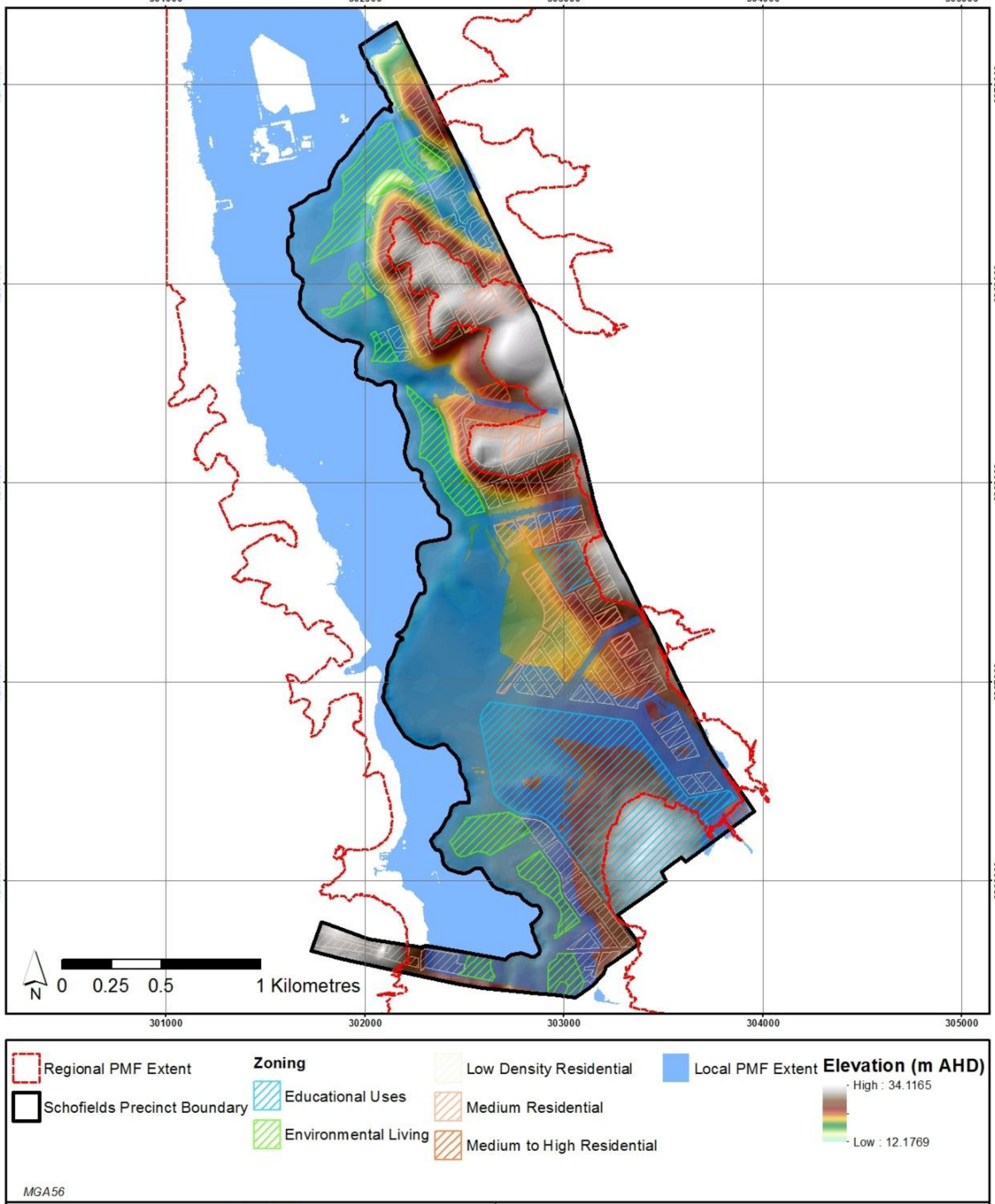

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Schofields Precinct Flood Evacuation Plan
Figure 2. Flood Extents

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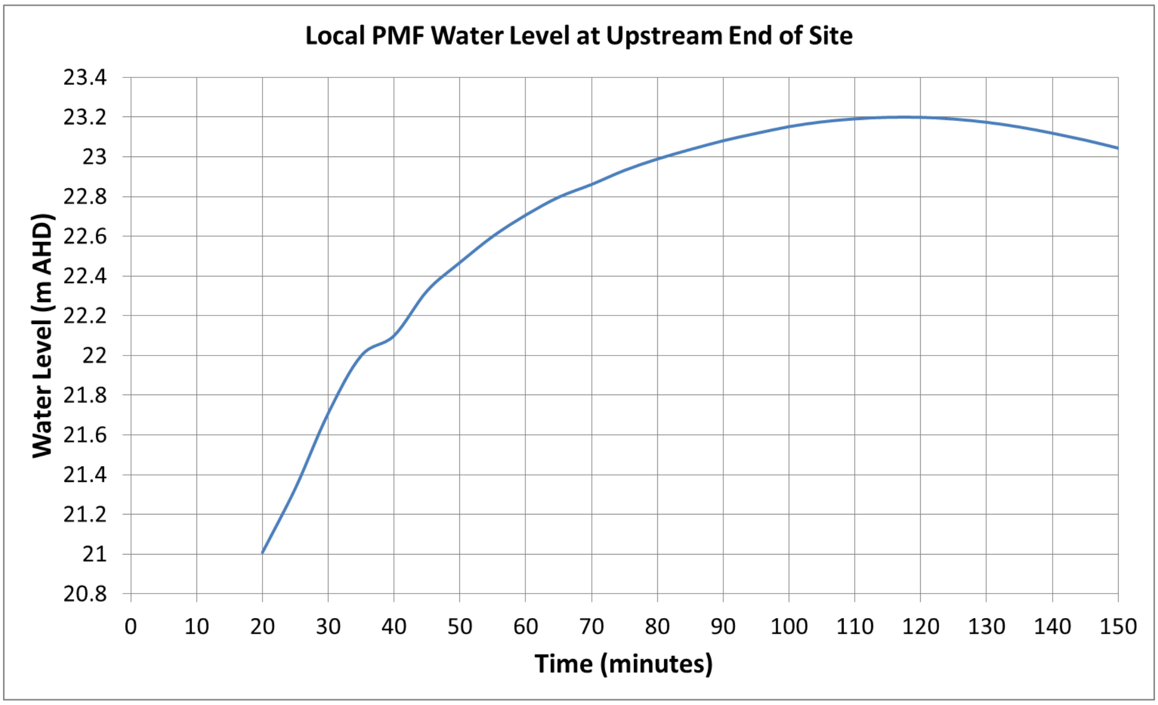

Figure 3. Local PMF hydrograph

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