APPENDIX 7 PRELIMINARY FLOODING ASSESSMENT

Costin Roe Consulting

PRECISION | COMMUNICATION | ACCOUNTABILITY

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12 November 2019

AWJ Civil
Attention: Mr Sedrick Dahdah
155 Newton Road
WETHERILL PARK NSW 2164

Dear Sir

Re: Williwa Street, Portland
Preliminary Flooding Assessment

Introduction

We provide this letter in relation to a proposed planning application at Williwa Street, Portland, NSW, and a request for a preliminary flooding assessment from Lithgow City Council.

The subject site comprises a total area of approximately 86 Ha. The site is bounded by Laurie Street and Williwa Street on the south, Creek Street, Forest Street and existing residential properties on the north, Carton Street and Kiln Street on the west and High Street on the east.

An overland flow path has been identified on the site located on the western portion of the site and conveying flows from upstream catchments south to north through the property.

This letter describes the flood and overland flow behaviour for the 1% Average Exceedance Probability (AEP) design storm event. This letter also discusses overland flow paths and flood extent, pre and post development flows, and the impact of development on upstream catchments. This letter also confirms the study methodology and calculations used within the assessment.

It is proposed to rezone the site to allow for residential development as shown in **Figure 1**.

Figure 1. Proposed Zoning

Existing Stormwater Drainage

There is an existing 1900 wide x 900 deep culvert beneath Williwa Road to the north of Saville Park. The capacity of this culvert is approx. $6m^3/s$.

A vegetated channel runs from the culvert under Williwa Street to the north-west, and towards 3x1800 deep culverts. These culverts have a capacity of approx. $29m^3/s$. Beyond the culverts, the channel continues to the north-west and towards a large storage dam associated with previous use on the land.

There is an existing stone planter box and bund to the north of Saville Park and Williwa Street constructed on the previous Portland Cement site with the intention of controlling overland flow from the upstream catchment and directing overland flow from Saville Park towards the drainage channel. The upstream catchment overland flow will be discussed further in the following section.

Reference to **Enclosure 4** should be made pertaining to existing culverts and flow paths on site.

Catchment Definition and Hydrology

An overland flow path is present through on the site. The flow path conveys stormwater from catchments to the south of the site, in a northerly direction through a series of open channels, culverts and storage dams (as part of previous activity on the land).

The upstream contributing catchment has an area of approximately 163 Ha and comprises a mix of rural, residential and bushland catchments, as seen in **Figure 2**. Given the relatively small upstream catchment, storms which would produce overland flow would be intense and short in duration. The catchment is sensitive to intense storms of short duration which result in rapidly increasing and decreasing flows and peak flows (and hence maximum flood depths) occurring over short durations.

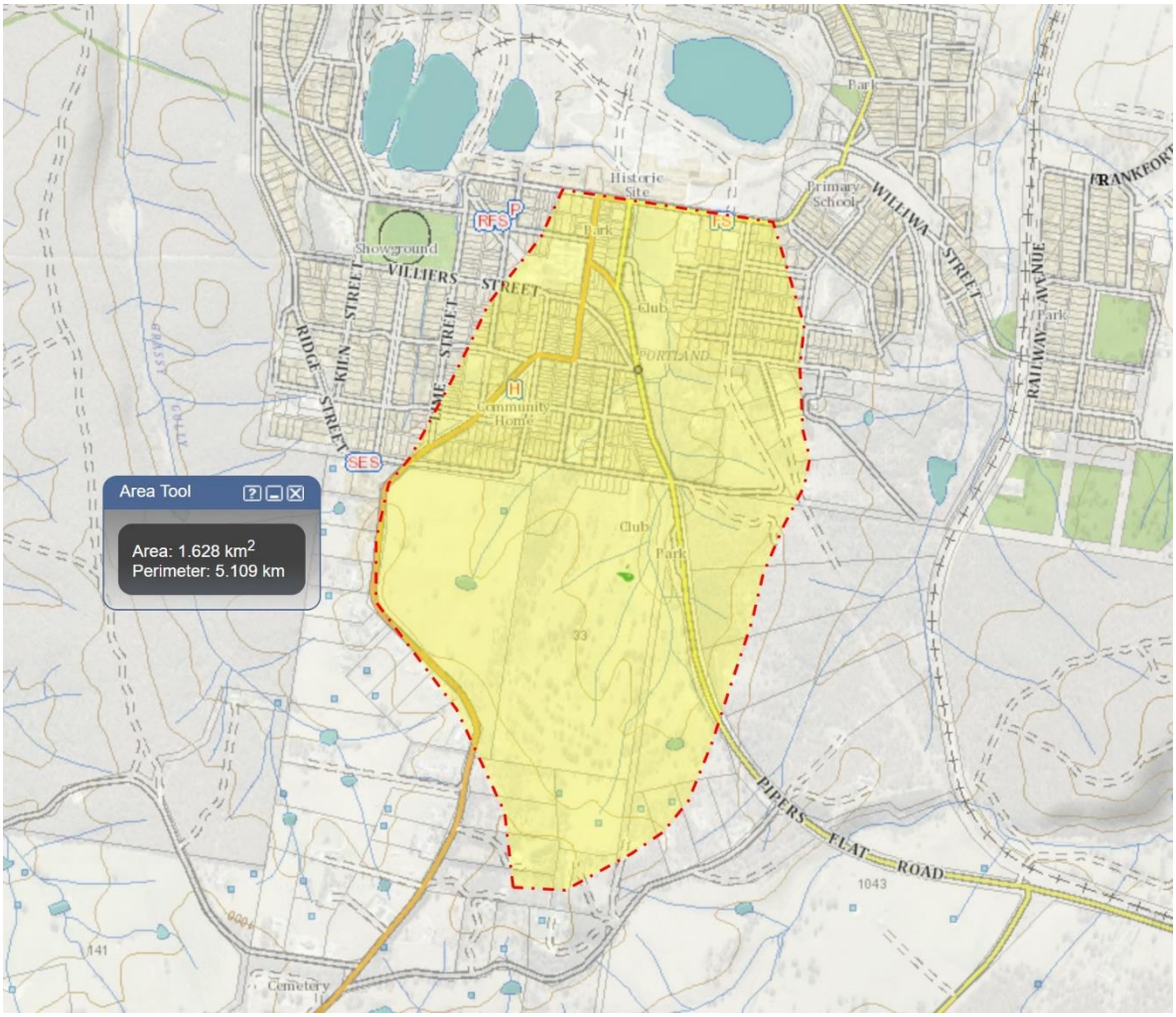


Figure 2. Upstream Catchment

An assessment of the 1% AEP design flows from the catchment has been made via the *Regional Flood Frequency Estimation Model* (ARR2016) tool. The 1% AEP design flow (at Williwa Street) has been calculated to be 32m^3/s with a lower bound confidence flow of 13.1m^3/s and an upper bound confidence flow of 78.7m^3/s.

A check of the above design flow against ARR87 rational method calculation shows that, with a time of concentration of 30 minutes (per Friends Equation) and 60% impervious surfaces, the 1% AEP peak of 27m^3/s can be expected.

We have conservatively adopted a 1% AEP design flow of 32m^3/s in our assessment.

It is further noted that we understand there are some flow storage areas present in Saville Park and other public areas south and upstream of the subject property. We have not allowed for these storages (which would expect to reduce the adopted peak flows), hence consider our assessment to be conservative in nature.

Flood Behaviour at Willawa Street

A review of flood behaviour has been made for the site has been made, beginning at Willawa Street and extending north through the site. Refer to drawing **Co14022.00-SK01** in **Enclosure 1** (and **Figure 3** below) which shows 1% AEP flow and estimate of flow extent.

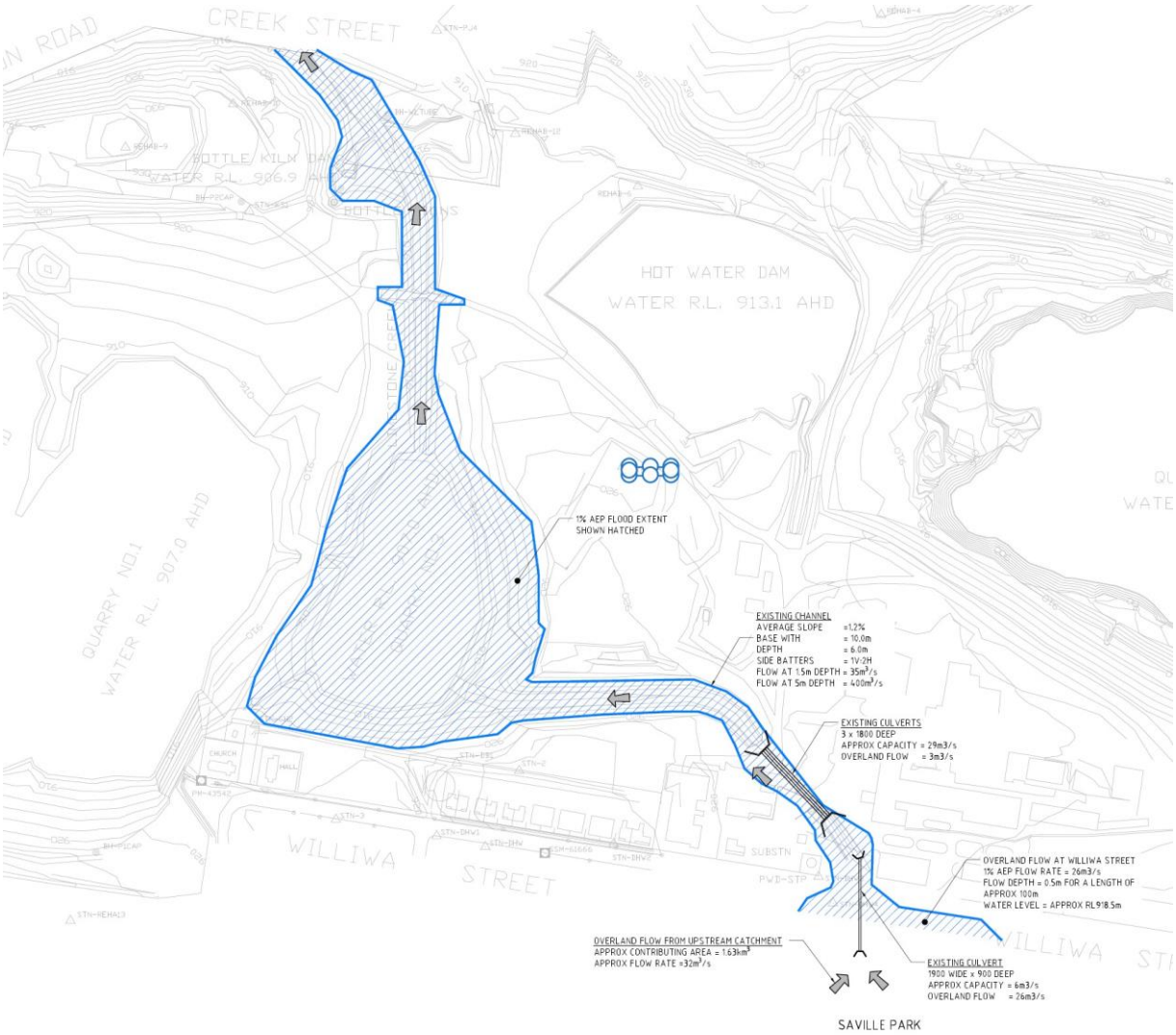


Figure 3. 1% AEP Flood Extent

At Willawa Street, approximately 6m^3/s will be captured and conveyed by the existing 1900w x 900d culvert under Williwa Street from Saville Park. This results in 26 m^3/s of overflow over the road carriageway. It is estimated that the maximum depth of flow at the low point in Willawa Street will be 0.5m over a length of approximately 100m. The existing bund and stone planter on the northern side of Williwa Street will contain overland flow in the roadway and direct overflow back to the open channel north of Willawa Road within the site.

The overland flow is then directed in a north-west direction into an open vegetated drainage channel and three 1800mm dimeter pipe culverts. These culverts have an estimated capacity of of 29m^3/s. A smaller resulting overflow of 3m^3/s can be expected at this hydraulic restriction.

The stormwater flows then continues north-west within an open vegetated drainage channel downstream of the triple culverts. This channel is expected to be able to convey the 1% AEP design flow with sufficient capacity and freeboard. This drainage channel then discharges to a a storage pond further to the north-west which then overflows further north through the subject site.

Based on our preliminary review of the overland flow paths and flooding on site, it is expected that the proposed residential development would have limited affect from, or affect to the existing flooding and overland flows from the 163 Ha contributing upstream catchment. Further discussion on differences in site flows are noted below.

Pre- and Post-Development Site Runoff

A review of the pre and post-development flows from the subject site (as shown in Figure 1) were calculated at the downstream end of the site. The predevelopment flows were based on a 100% pervious area, whereas the post development flows were based on a 50% pervious area. Both flows were based on a time of concentration of 30 minutes and consider the combination of site runoff and upstream catchment runoff. It is noted that the effect of storage from the three significant storage dams has note been included in the below review, however given that the majority of the site will be conveyed to one of the three storage basins prior to discharge the expected change in offsite flows are considered negligible.

The pre-development flow for the site (including flow from the upstream catchment) is approximately 37m3/s. The post development flow for the site is approximately 44m3/s.

The difference between the pre and post development flows (7m3/s) is approximately 19% of the total flow in the 1% AEP.

Consideration to the considerable storage in the three dams as noted above should be made pertaining to offsite runoff volumes. The change between pre and post development is considered minor, and our expectation of the flood extent and flow paths post-development will remain similar to existing.

Conclusion

This letter and associated enclosures are provided in relation to the flooding behaviour at Williwa Street, Portland and a proposed planning application for rezoning of the site for residential development.

The letter sets out the description of the subject site as well as upstream catchments affecting the site. This letter also details the flooding behaviour at Williwa Street and confirms the study methodology used in the flooding assessment.

The enclosed Costin Roe drawing show the approximate 1% AEP flood extent at Williwa Street and throughout the subject site. The review shows that the site will have limited affect on existing flood behaviour and that existing flood behaviour will have limited affect on the proposed development. It is our opinion that, subject to completion of more detailed assessment phases of the development and development assessment process, this property can be rezoned and developed without undue flood impacts or affectation.

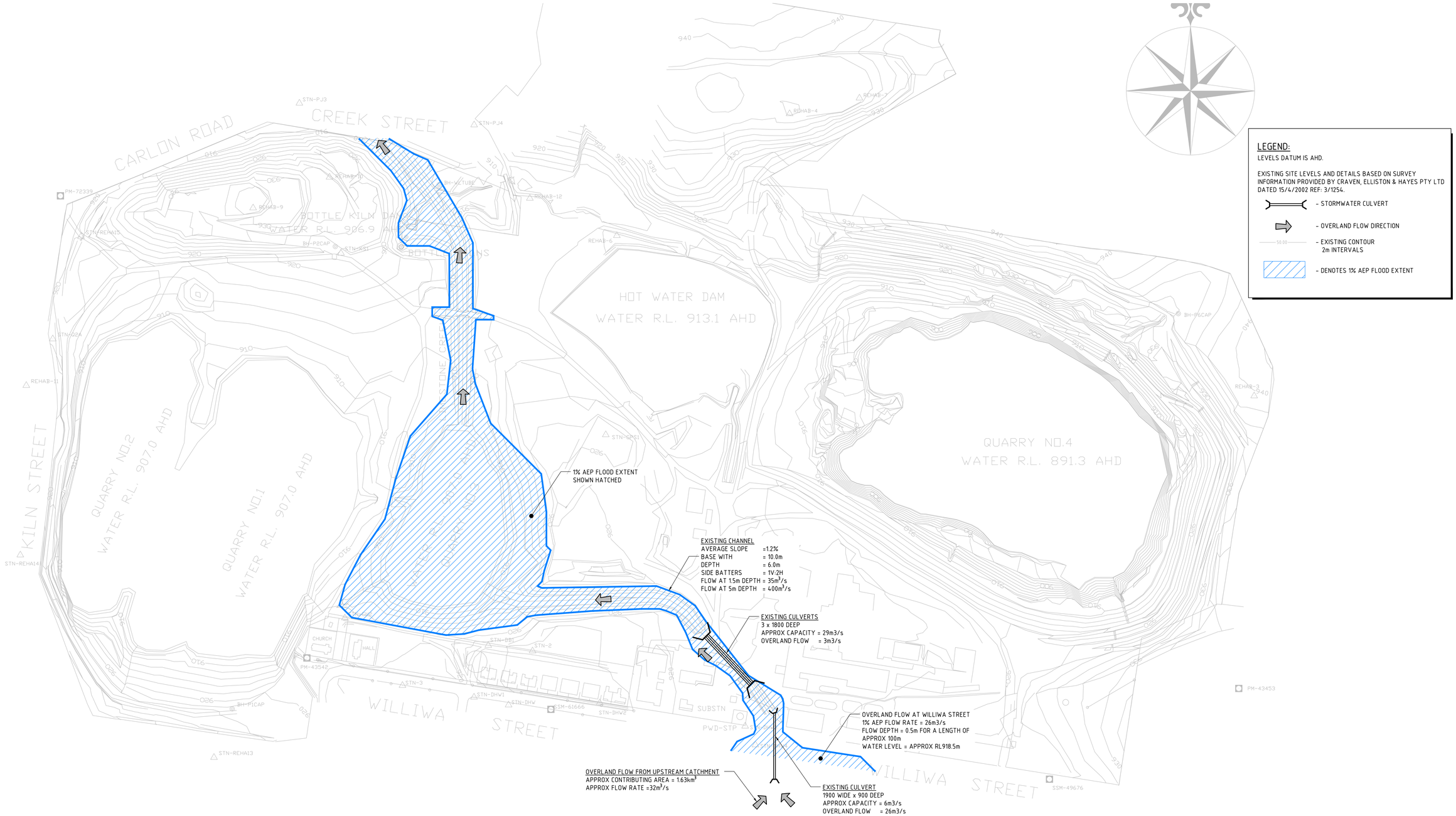
We trust the information contained in this letter addresses your current requirements pertaining to the preliminary flooding assessment at Williwa Street and that the provided documents will result in the timely approval of the works with council.

Yours faithfully,
COSTIN ROE CONSULTING PTY LTD

MARK WILSON MIEAust CPEng NER
Director

Encl;.

ENCLOSURE 1
COSTIN ROE CONSULTING SKETCH
Co14022.00-SK01


CREEK STREET
CARLON ROAD
BOTTLE KILN DAM
WATER R.L. 986.9 AHD
HOT WATER DAM
WATER R.L. 913.1 AHD
QUARRY NO.4
WATER R.L. 891.3 AHD
QUARRY NO2
WATER R.L. 907.0 AHD
QUARRY NO1
WATER R.L. 907.0 AHD
KILN STREET
WILLIWA STREET
WILLIWA STREET
STONE CUTTERS CREEK
STN-PJ3
STN-PJ4
STN-REHA15
STN-REHA14
STN-REHA13
STN-DB1
STN-DB2
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STN-DB40

ENCLOSURE 2
ARR RAINFALL INFORMATION

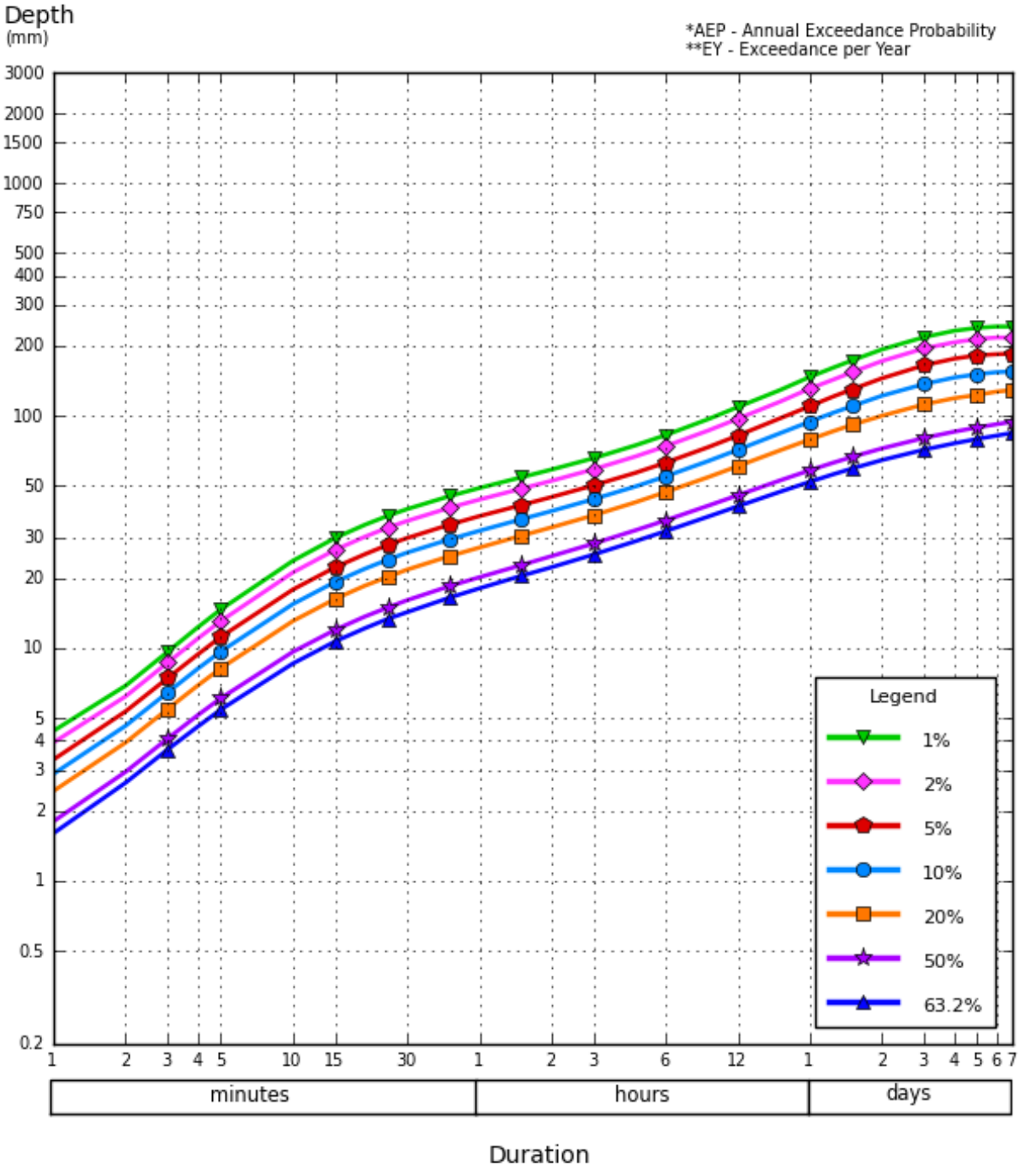
Label:Portland

Requested coordinate	Latitude: 33° 21' 05"	Longitude: 149° 59' 02"
Nearest grid cell	Latitude: 33.3625 (S)	Longitude: 149.9875 (E)

IFD Design Rainfall Depth (mm)

Issued: 27 September 2019

Rainfall depth in millimetres for Durations, Exceedance per Year (EY), and Annual Exceedance Probabilities (AEP).



ail - Mark@c... Nearmap SIX Maps

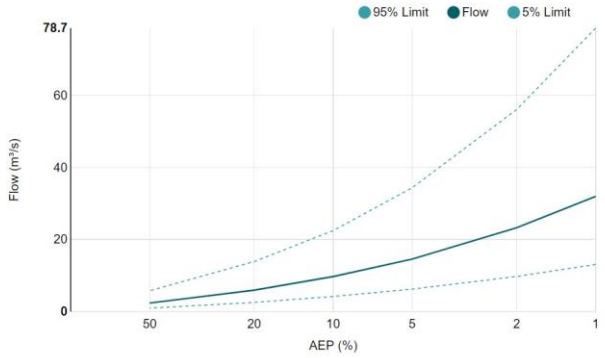
Table | Chart

Unit: mm

	Annual Exceedance Probability (AEP)						
Duration	**63.2%**	**50%#**	**20%***	**10%**	**5%**	**2%**	**1%**
1 min	1.60	1.80	2.43	2.88	3.32	3.93	4.41
2 min	2.64	2.94	3.93	4.64	5.35	6.21	6.90
3 min	3.67	4.09	5.48	6.46	7.45	8.68	9.66
4 min	4.60	5.15	6.91	8.16	9.40	11.0	12.3
5 min	5.45	6.10	8.21	9.69	11.2	13.1	14.7
10 min	8.60	9.66	13.1	15.5	17.9	21.2	23.8
15 min	10.7	12.0	16.3	19.3	22.3	26.5	29.8
20 min	12.2	13.7	18.6	22.0	25.4	30.2	34.0
25 min	13.4	15.0	20.3	24.1	27.9	33.1	37.2
30 min	14.3	16.1	21.8	25.8	29.8	35.3	39.7
45 min	16.5	18.5	24.9	29.4	34.0	40.2	45.1
1 hour	18.1	20.2	27.1	32.0	37.0	43.6	48.9
1.5 hour	20.5	22.8	30.5	35.9	41.3	48.6	54.4
2 hour	22.3	24.9	33.1	38.9	44.7	52.5	58.7
3 hour	25.3	28.2	37.3	43.8	50.2	58.9	65.7
4.5 hour	28.9	32.2	42.5	49.7	56.9	66.9	74.7
6 hour	31.9	35.5	47.0	54.9	62.9	74.0	82.6
9 hour	36.8	41.0	54.4	63.8	73.2	86.3	96.6
12 hour	40.8	45.5	60.7	71.4	82.2	97.1	109
18 hour	47.1	52.7	71.0	84.1	97.5	115	129
24 hour	52.0	58.3	79.1	94.4	110	131	147
30 hour	56.0	62.8	85.8	103	121	143	161
36 hour	59.3	66.5	91.4	110	130	154	173
48 hour	64.5	72.4	100	122	145	172	193
72 hour	71.5	80.3	112	137	165	195	218
96 hour	76.1	85.4	119	146	176	207	232
120 hour	79.5	89.1	123	151	182	214	239
144 hour	82.1	91.9	127	154	184	217	242
168 hour	84.4	94.3	129	155	185	217	242

ENCLOSURE 3
ARR FLOOD FREQUENCY ESTIMATION OUTPUT

Results | Regional Flood Frequency Estimation Model



AEP (%)	Discharge (m^3/s)	Lower Confidence Limit (5%) (m^3/s)	Upper Confidence Limit (95%) (m^3/s)
50	2.40	0.980	5.81
20	5.97	2.57	13.9
10	9.74	4.21	22.5
5	14.6	6.26	34.4
2	23.3	9.77	56.1
1	32.0	13.1	78.7

Input Data	
Date/Time	2019-11-11 16:48
Catchment Name	Portland
Latitude (Outlet)	-33.353104
Longitude (Outlet)	149.982625
Latitude (Centroid)	-33.363515
Longitude (Centroid)	149.979872
Catchment Area (km^2)	1.628
Distance to Nearest Gauged Catchment (km)	12.44
50% AEP 6 Hour Rainfall Intensity (mm/h)	5.911915
2% AEP 6 Hour Rainfall Intensity (mm/h)	12.297777
Rainfall Intensity Source (User/Auto)	Auto
Region	East Coast
Region Version	RFFE Model 2016 v1
Region Source (User/Auto)	Auto
Shape Factor	0.93
Interpolation Method	Natural Neighbour
Bias Correction Value	1.163

Statistics

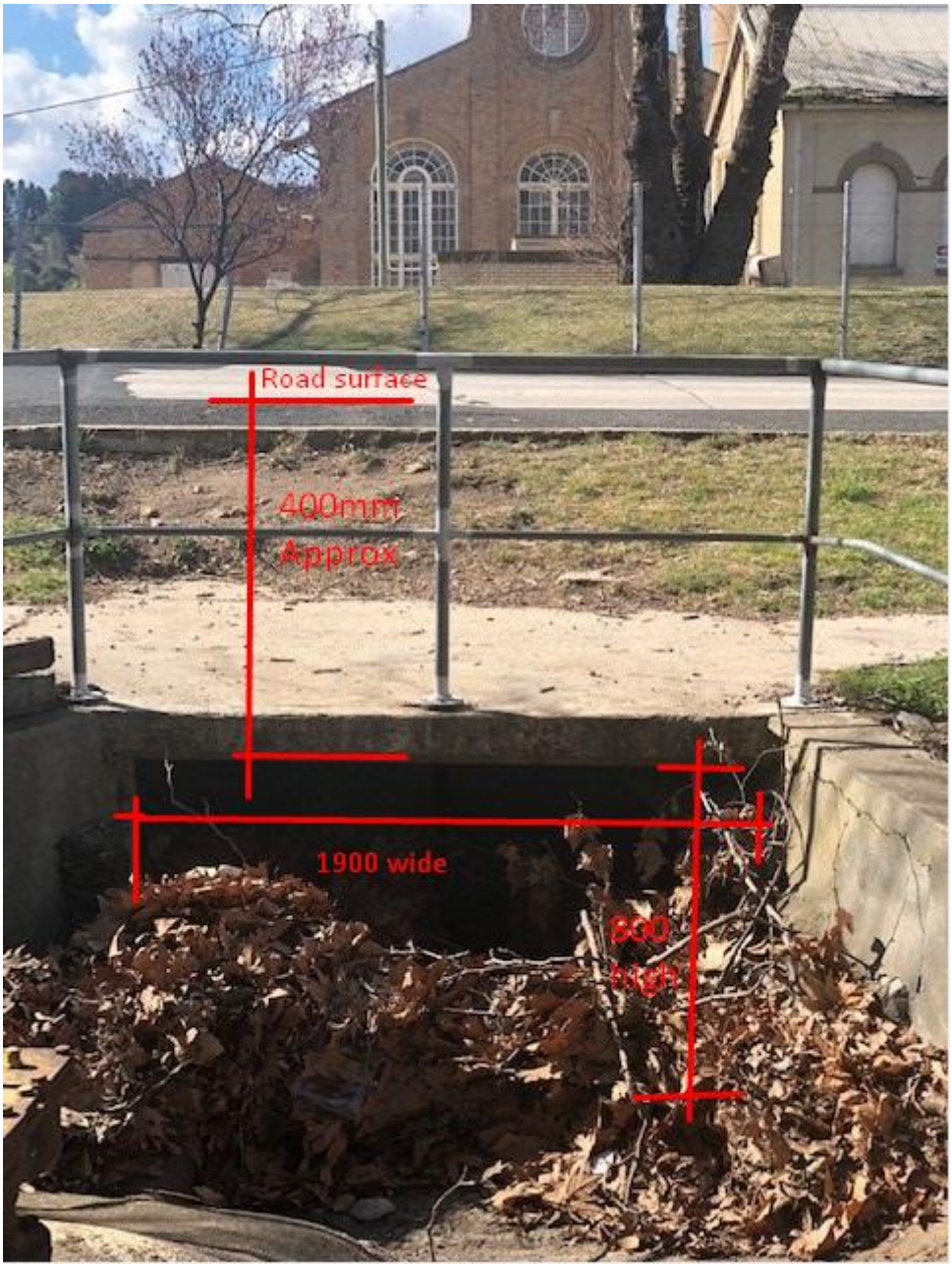
Variable	Value	Standard Dev
Mean	0.829	0.535
Standard Dev	1.099	0.151
Skew	0.119	0.026

Note: These statistics come from the nearest gauged catchment. Details.

Correlation		
1.000		
-0.330	1.000	
0.170	-0.280	1.000

Note: These statistics are common to each region. Details.

ENCLOSURE 4
SITE PHOTOS & DRAINAGE STRUCTURES



Willawa Street Culver

3x 1800mm RCP in site overland flow path.