

Appendix 1

Director-General Requirements Checklist

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Table 14
Director-General's Requirements (related to surface water)
(Department of Planning and Infrastructure – DZP Proposal SSD-5251)

Paraphrased Requirement	Relevant Section(s)
A detailed assessment of potential impacts on the quality and quantity of existing surface and ground water resources, including: <ul style="list-style-type: none"> impacts on affected licensed water users and basic landholder rights; and impacts on riparian, ecological, geomorphological and hydrological values of watercourses, including environmental flows. 	Section 4
A detailed site water balance, including a description of site water demands, water disposal methods (inclusive of volume and frequency of any water discharges), water supply infrastructure and water storage structures.	Sections 5 & 6
An assessment of proposed water discharge quantities and quality/ies against receiving water quality and flow objectives.	Sections 5 & 9
An assessment of proposed modifications to surface water management, including modelling the redistribution of waters and an assessment of the impact on neighbouring properties and the associated watercourse and floodplain.	Sections 4 & 5
Identification of any licensing requirements or other approvals under the Water Act 1912 and/or Water Management Act 2000	Section 6.3
Demonstration that water for the construction and operation of the development can be obtained from an appropriately authorised and reliable supply in accordance with the operating rules of any relevant <i>Water Sharing Plan</i> (WSP).	Section 6
A description of the measures proposed to ensure the development can operate in accordance with the requirements of any relevant WSP or water source embargo.	Section 6.3
A detailed description of the proposed water management system (including sewage), water monitoring program and other measures to mitigate surface and groundwater impacts.	Section 9

Table 15
Dept. of Primary Industries. Office of Water Requirements (related to surface water)

Paraphrased Requirement	Relevant Section(s)
Confirm water supplies for construction and operation are sourced from an appropriately authorised and reliable supply	Section 6
Identify site water demands, water sources, disposal methods, water storage structures. Detail water reticulation infrastructure to and within the DZP Site. Maximise Reuse.	Sections 5 & 6
An impact assessment on adjacent licensed water users, Riparian ecosystems.	Section 4
An assessment of the existing base flow contributions to surface water systems.	Section 3.1.2.3
An impact assessment on the construction, operation and final landform of the proposed on-site waste rock emplacement, evaporative basins, residue storage and other potentially contaminating activities.	Section 4
An assessment of any proposed modification to surface water management including modelling of redistribution of waters.	Sections 4 to 6
An impact assessment of any proposed works within or adjacent to watercourses. Assessment of "Controlled Activities".	Section 4
Prepare a <i>Surface Water Management Plan</i> to integrate the proposed water balance and management for the DZP Site and identify mitigating and monitoring requirements for water quality and volume.	Sections 5, 6, 9 & 10. Figure 27.
Provide details on existing and proposed water licencing requirements.	Section 6.3
Ensure adequate mitigating and monitoring requirements to address surface water impacts.	Sections 9 & 10

Table 16
Catchment Management Authority (Central West) Surface Water Requirements

Paraphrased Requirement	Relevant Section(s)
An assessment of the surface water impacts particularly in terms of flow and potential for contamination	Section 4
An assessment of the potential water demands during operation.	Section 6
Demonstrate adequate water supply.	Section 6
A Flood Assessment	Appendices 2 & 3

Table 17
NSW EPA Surface Water Requirements

Paraphrased Requirement	Relevant Section(s)
<p>The EIS should address the following:</p> <ul style="list-style-type: none"> • There is no pollution of waters (including surface and groundwater) 	<p>Section 4.1.4 Section 4.1.10</p>
<ul style="list-style-type: none"> • Polluted water (including process waters, wash down waters, polluted stormwater or sewage) is captured onsite and collected, treated and beneficially' reused, where safe and practical to do so. 	<p>Section 6 Section 7</p>
<ul style="list-style-type: none"> • The Project is assessed in relation to the relevant NSW Water Quality Objectives as defined in the individual catchment action plans and against ANZECC 2000 water quality criteria. 	<p>Section 9</p>
<p>Construction activities will need to demonstrate best practice sediment and erosion control and management in accordance with the reference document Managing Urban Stormwater: Soils and Construction (NSW Landcom 2004).</p>	<p>Section 4.1.4 Section 4.2 Section 4.3 Section 4.4</p>
<p>The EIS should identify potential impact on watercourses and the management and mitigation measures that will be implemented where works are conducted in the vicinity of watercourses.</p>	<p>Sections 4.2 to 4.4</p>
<p>The EIS should demonstrate how the project will contribute to achieving the most current government endorsed Water Quality and River Flow Objectives for each of the relevant catchments and should utilise the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (2000).</p>	<p>Section 9</p>
<p>A detailed water balance must be prepared to model water management through the life cycle of the project.</p>	<p>Section 6</p>
<p>Where an off-site discharge is proposed, the EIS will need to identify:</p> <ul style="list-style-type: none"> • Details regarding proposed discharges i.e. treatment requirements, infrastructure to enable a discharge etc. • All proposed discharge points; • Estimates of the frequency and volume of discharges; and • Likely water quality to be discharged. 	<p>Section 5 Table 7</p>

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Appendix 2

DZP Pre-development HEC-RAS Flood Modelling Data

Note: A copy of this Appendix is available on the Project CD

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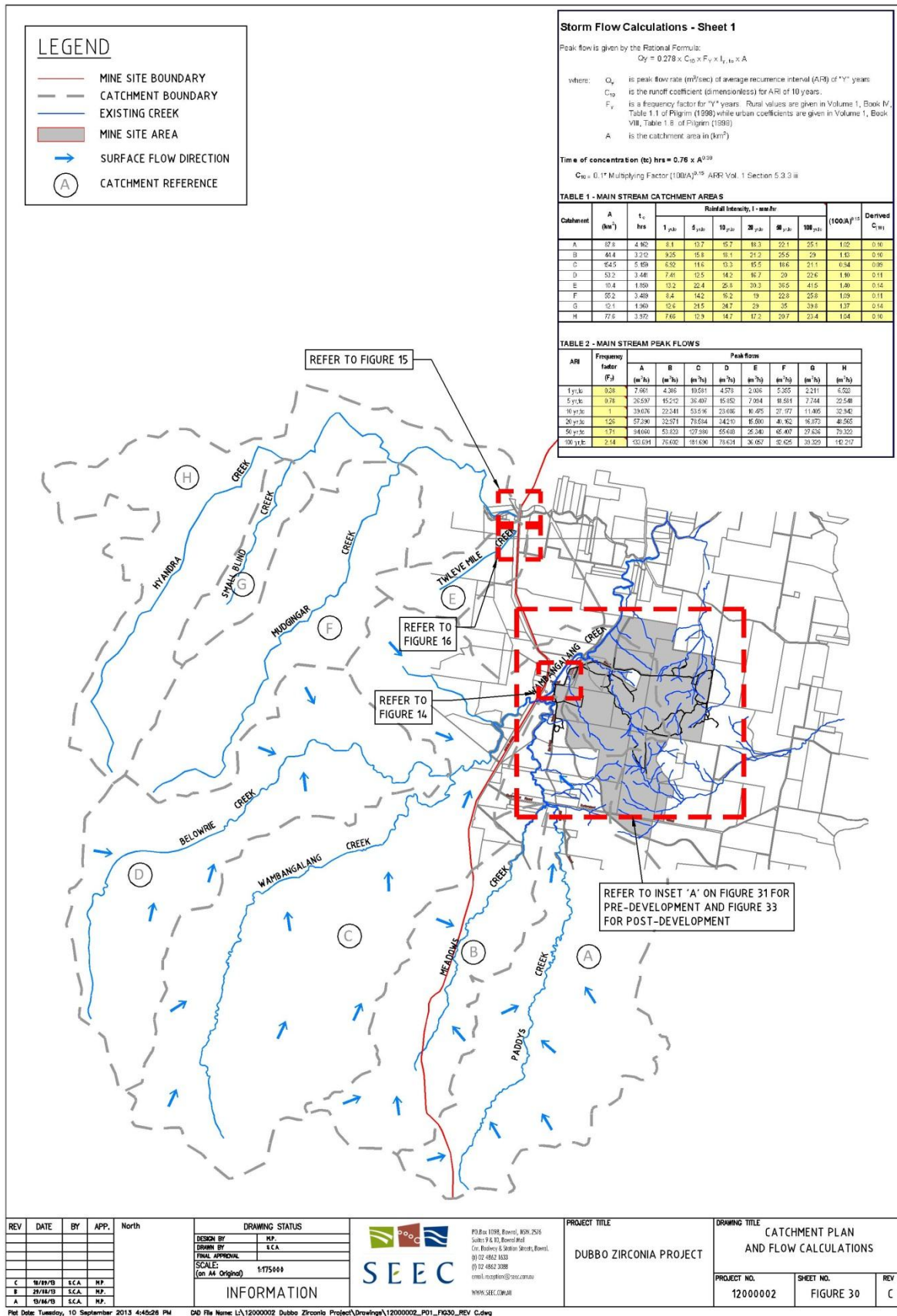




Figure 31 Catchment Plan and Flow Calculations DZP Site – Pre Development

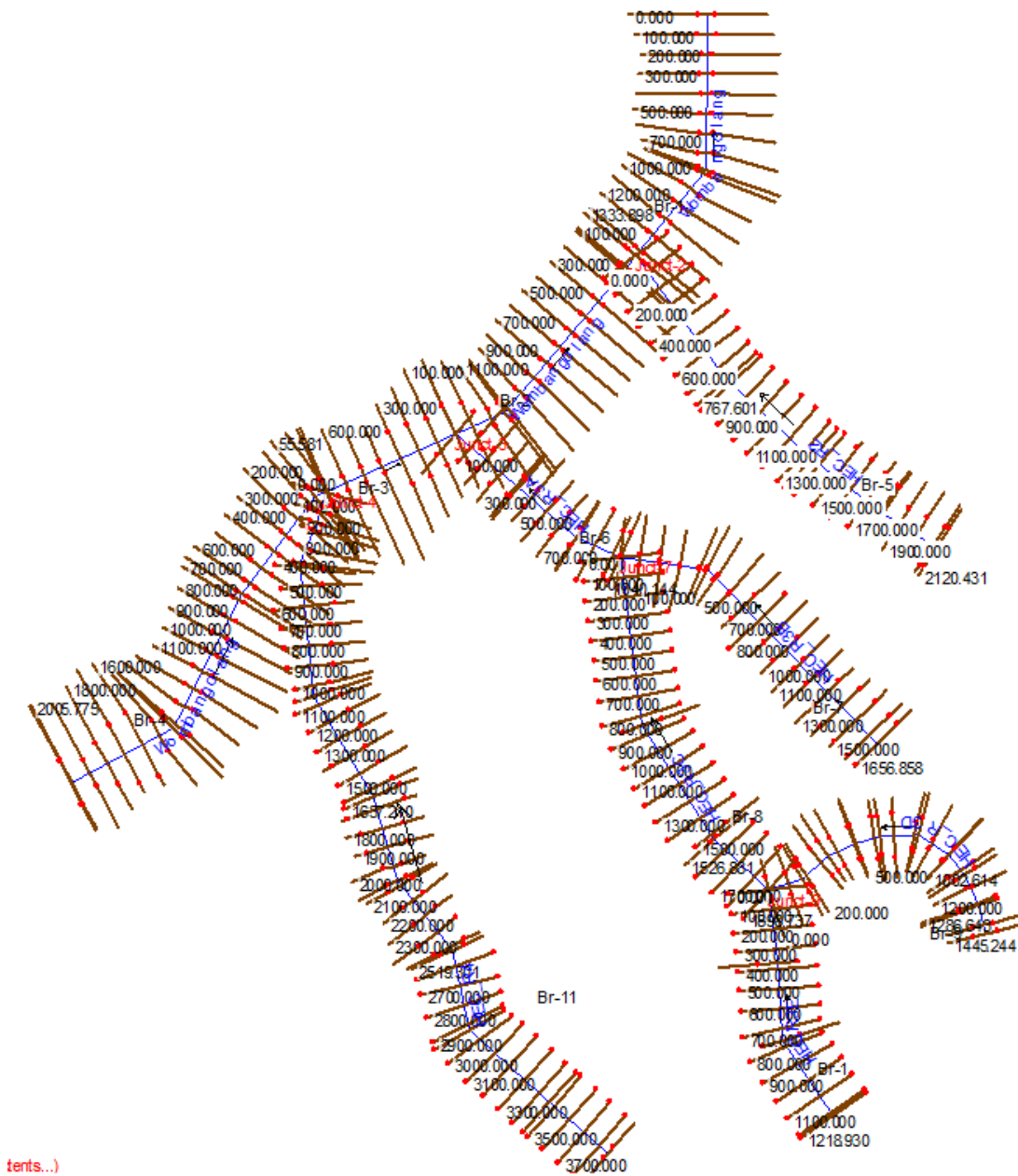


Figure 31 **HEC-RAS Model, General Stream Geometry Layout – Pre-development**

Table 18
Pre-Development Hec-Ras Output Data

Dubbo Zirconia Project - Pre-development HEC-RAS Output Data														
Profile HEC-RAS	Output Plan:	Table Plan	Standard 1 Profile:	Table 100YR	ARI	1								
#	Rivers	=	8											
#	Hydraulic	=	11											
#	River	=	235											
#	Plans	=	1											
#	Profiles	=	1											
	River (m3/s)	Reach (m)	River (m)	Sta (m)	Profile (m)	Q (m3/s)	Total (m/s)	Min (m2)	Ch (m)	El	W.S.	Elev	Crit	W.S.
	Wambangalang	Br-4	2005.775	100YR	ARI	476.24	279	284.09	284.57	0.007	3.070	154.89	69.51	0.66
	Wambangalang	Br-4	2000	100YR	ARI	476.24	279	283.9	284.51	0.008	3.480	136.77	57.77	0.72
	Wambangalang	Br-4	1900	100YR	ARI	476.24	279	284.21	284.25	0.000	0.920	523.37	185.99	0.15
	Wambangalang	Br-4	1800	100YR	ARI	476.24	280	284.15	284.2	0.001	1.020	505.32	574.58	0.23
	Wambangalang	Br-4	1700	100YR	ARI	476.24	279	284.05	284.1	0.001	0.970	503.66	639.21	0.26
	Wambangalang	Br-4	1600	100YR	ARI	476.24	279	283.95	284	0.001	0.990	479.29	243.64	0.23
	Wambangalang	Br-4	1500	100YR	ARI	476.24	278	283.67	283.85	0.003	1.860	255.74	139.16	0.44
	Wambangalang	Br-4	1422.297	100YR	ARI	476.24	278	283.45	283.64	0.002	1.910	249.28	103.9	0.39
	Wambangalang	Br-4	1400	100YR	ARI	476.24	279	283.33	283.56	0.004	2.150	221.18	116.42	0.5
	Wambangalang	Br-4	1300	100YR	ARI	476.24	278	283.07	283.27	0.002	1.980	244.06	155.59	0.38
	Wambangalang	Br-4	1200	100YR	ARI	476.24	277.41	282.84	283.05	0.002	2.010	236.88	90.29	0.4
	Wambangalang	Br-4	1100	100YR	ARI	476.24	277	282.68	282.84	0.002	1.770	269.76	99.53	0.34
	Wambangalang	Br-4	1000	100YR	ARI	476.24	277	282.43	282.66	0.002	2.120	229.12	89.82	0.36
	Wambangalang	Br-4	900	100YR	ARI	476.24	277	282.33	282.48	0.001	1.730	283.89	149.7	0.31
	Wambangalang	Br-4	800	100YR	ARI	476.24	276	282.11	282.32	0.002	2.030	240.08	144.74	0.36
	Wambangalang	Br-4	700	100YR	ARI	476.24	276.93	281.96	282.15	0.002	2.000	285.02	215.45	0.34
	Wambangalang	Br-4	662.176	100YR	ARI	476.24	276	281.83	282.05	0.002	2.140	261.23	188.67	0.36
	Wambangalang	Br-4	600	100YR	ARI	476.24	276	281.71	281.91	0.002	2.070	276.26	213.57	0.35
	Wambangalang	Br-4	500	100YR	ARI	476.24	276	281.69	281.76	0.001	1.240	453	325.14	0.24
	Wambangalang	Br-4	400	100YR	ARI	476.24	276	281.46	281.63	0.002	1.910	309.31	274.4	0.36
	Wambangalang	Br-4	300	100YR	ARI	476.24	276	281.1	281.4	0.003	2.420	209.19	205.51	0.44
	Wambangalang	Br-4	200	100YR	ARI	476.24	276	280.78	281.01	0.005	2.130	223.93	149.05	0.55
	Wambangalang	Br-4	100	100YR	ARI	476.24	275	280.66	280.77	0.001	1.480	336.66	166.96	0.27
	Wambangalang	Br-4	55.581	100YR	ARI	476.24	275	280.65	280.72	0.001	1.180	423.61	201.99	0.21
	Wambangalang	Br-4	0	100YR	ARI	476.24	275	280.62	280.68	0.001	1.150	430.45	200.84	0.21
	Wambangalang	Br-3	711.552	100YR	ARI	505.15	275	280.61	280.68	0.001	1.220	428.49	199.92	0.23
	Wambangalang	Br-3	700	100YR	ARI	505.15	275	280.58	280.67	0.001	1.350	392.91	193.72	0.25
	Wambangalang	Br-3	600	100YR	ARI	505.15	275	280.29	280.53	0.002	2.190	246.2	153.45	0.38
	Wambangalang	Br-3	500	100YR	ARI	505.15	275	280.13	280.33	0.002	1.970	271.53	219.27	0.36
	Wambangalang	Br-3	400	100YR	ARI	505.15	275	279.38	278.58	279.970	0.007	3.41	147.95	55.68
	Wambangalang	Br-3	300	100YR	ARI	505.15	274	279.14	279.31	0.004	1.830	275.31	199.31	0.5
	Wambangalang	Br-3	200	100YR	ARI	505.15	274	279.07	279.13	0.001	1.100	460.33	184.19	0.22
	Wambangalang	Br-3	100	100YR	ARI	505.15	273	278.91	279.03	0.001	1.520	333.39	119.42	0.29
	Wambangalang	Br-3	0	100YR	ARI	505.15	274	278.95	278.97	0.000	0.560	906.96	314.12	0.1
	Wambangalang	Br-2	1296.494	100YR	ARI	570.38	274	278.95	278.97	0.000	0.630	905.46	314.05	0.12
	Wambangalang	Br-2	1200	100YR	ARI	570.38	273	278.69	278.9	0.003	2.070	294.78	155.51	0.42
	Wambangalang	Br-2	1100	100YR	ARI	570.38	273	278.56	278.71	0.001	1.730	343.07	148.31	0.3
	Wambangalang	Br-2	1022.736	100YR	ARI	570.38	273	278.52	278.63	0.001	1.440	407.58	166.55	0.24
	Wambangalang	Br-2	1000	100YR	ARI	570.38	273	278.51	278.61	0.001	1.410	416.39	168.88	0.24
	Wambangalang	Br-2	900	100YR	ARI	570.38	272	278.32	278.5	0.001	1.880	325.94	182.99	0.32
	Wambangalang	Br-2	800	100YR	ARI	570.38	272	278.22	278.38	0.001	1.800	377.53	209.55	0.28
	Wambangalang	Br-2	700	100YR	ARI	570.38	271	278.06	278.26	0.001	2.030	355.49	258.31	0.32
	Wambangalang	Br-2	600	100YR	ARI	570.38	271	277.89	278.12	0.001	2.190	323.26	220.93	0.34
	Wambangalang	Br-2	500	100YR	ARI	570.38	272	277.7	277.96	0.002	2.300	303.1	251.23	0.37
	Wambangalang	Br-2	400	100YR	ARI	570.38	271	277.54	277.79	0.002	2.260	309.7	254.58	0.36
	Wambangalang	Br-2	300	100YR	ARI	570.38	270	277.45	277.63	0.001	1.890	371.73	317.36	0.3
	Wambangalang	Br-2	200	100YR	ARI	570.38	270	277.12	275.08	277.450	0.002	2.57	250.47	330.84
	Wambangalang	Br-2	100	100YR	ARI	570.38	270	277.1	277.25	0.001	1.770	431.72	385.56	0.27
	Wambangalang	Br-2	80.867	100YR	ARI	570.38	270	277.07	277.23	0.001	1.830	405.46	410.06	0.29
	Wambangalang	Br-2	0	100YR	ARI	570.38	270	276.96	277.12	0.002	1.830	389.88	312.54	0.35
	Wambangalang	Br-1	1333.898	100YR	ARI	582.67	270	276.97	277.11	0.003	1.790	391.65	314	0.4
	Wambangalang	Br-1	1300	100YR	ARI	582.67	270	276.89	277.05	0.001	1.990	445.91	370.19	0.31
	Wambangalang	Br-1	1200	100YR	ARI	582.67	271	276.73	276.92	0.001	2.120	420.07	402.99	0.34
	Wambangalang	Br-1	1100	100YR	ARI	582.67	270	276.66	276.78	0.001	1.730	530.46	432.72	0.28
	Wambangalang	Br-1	1000	100YR	ARI	582.67	269	276.6	276.68	0.001	1.560	613.9	435.21	0.24
	Wambangalang	Br-1	900	100YR	ARI	582.67	269.56	276.29	276.37	0.001	1.490	535.08	420.61	0.3
	Wambangalang	Br-1	800	100YR	ARI	582.67	269	276.21	276.29	0.001	1.390	657.37	434.91	0.21
	Wambangalang	Br-1	778.899	100YR	ARI	582.67	269	276.16	276.26	0.001	1.560	532.64	431.03	0.26
	Wambangalang	Br-1	700	100YR	ARI	582.67	269	276.12	276.2	0.001	1.420	633.22	460.47	0.23
	Wambangalang	Br-1	600	100YR	ARI	582.67	269	275.91	276.01	0.001	1.630	571.71	475.74	0.27
	Wambangalang	Br-1	500	100YR	ARI	582.67	269	275.77	275.89	0.001	1.860	533.07	508.26	0.3
	Wambangalang	Br-1	400	100YR	ARI	582.67	270	275.57	273.96	275.750	0.002	2.14	478.92	557.83
	Wambangalang	Br-1	300	100YR	ARI	582.67	269.94	274.84	273.76	275.410	0.006	3.37	172.82	63.73
	Wambangalang	Br-1	200	100YR	ARI	582.67	268	274.57	273.05	274.940	0.003	2.78	279.15	357.31
	Wambangalang	Br-1	100	100YR	ARI	582.67	268	274.46	273.19	274.620	0.002	1.96	454.81	604.71
	Wambangalang	Br-1	0	100YR	ARI	582.67	268	272.88	272.88	274.040	0.016	4.77	122.11	52.95
	HEC_R4	Br-11	3857.907	100YR	ARI	17.95	346	347.17	347.17	347.450	0.015	2.35	7.64	13.93
	HEC_R4	Br-11	3800	100YR	ARI	17.95	346	346.28	346.28	346.420	0.019	1.61	11.11	41.68
	HEC_R4	Br-11	3700	100YR	ARI	17.95	341.81	343.04	343.04	343.350	0.015	2.48	7.24	11.78

HEC_R4	Br-11	3600	100YR	ARI	17.95	337.97	338.74	338.74	339.010	0.015	2.31	7.76	14.48
HEC_R4	Br-11	3500	100YR	ARI	17.95	336	336.67	336.67	336.880	0.017	2.03	8.83	21.34
HEC_R4	Br-11	3468.873	100YR	ARI	17.95	335.19	335.92	335.92	336.130	0.017	2.01	8.94	22.07
HEC_R4	Br-11	3400	100YR	ARI	17.95	334	334.46	334.46	334.620	0.017	1.78	10.09	31.15
HEC_R4	Br-11	3300	100YR	ARI	17.95	332.14	332.61	332.61	332.740	0.019	1.58	11.36	44.29
HEC_R4	Br-11	3200	100YR	ARI	17.95	330	330.34	330.34	330.460	0.019	1.53	11.71	48.57
HEC_R4	Br-11	3100	100YR	ARI	17.95	327	327.6	327.6	327.770	0.017	1.85	9.72	28.16
HEC_R4	Br-11	3000	100YR	ARI	17.95	325.52	325.84	325.82	325.900	0.015	1.13	15.87	88.43
HEC_R4	Br-11	2925.901	100YR	ARI	17.95	324.05	324.47	324.47	324.580	0.021	1.47	12.21	57.32
HEC_R4	Br-11	2900	100YR	ARI	17.95	323.2	323.75	323.75	323.910	0.020	1.79	10	33.35
HEC_R4	Br-11	2800	100YR	ARI	17.95	321	321.69	321.83	0.012	1.660	10.84	27.63	0.84
HEC_R4	Br-11	2700	100YR	ARI	17.95	319.93	320.15	320.15	320.220	0.023	1.2	14.9	101.07
HEC_R4	Br-11	2600	100YR	ARI	17.95	317	317.36	317.33	317.480	0.013	1.55	11.58	34.69
HEC_R4	Br-11	2519.301	100YR	ARI	17.95	315.93	316.23	316.21	316.320	0.016	1.36	13.21	56.84
HEC_R4	Br-11	2500	100YR	ARI	17.95	315.59	315.9	315.9	315.990	0.019	1.34	13.37	67.31
HEC_R4	Br-11	2400	100YR	ARI	17.95	314.04	314.38	314.34	314.420	0.013	0.86	20.87	153.33
HEC_R4	Br-11	2300	100YR	ARI	17.95	312.53	312.56	312.56	312.660	0.025	0.25	12.44	62.01
HEC_R4	Br-11	2200	100YR	ARI	17.95	310.38	311.31	311.32	0.000	0.200	59.4	167.92	0.15
HEC_R4	Br-11	2100	100YR	ARI	17.95	308.79	308.95	308.95	309.040	0.021	0.87	14.19	78.58
HEC_R4	Br-11	2073.693	100YR	ARI	17.95	308	308.48	308.54	0.006	1.100	16.36	45.76	0.59
HEC_R4	Br-11	2000	100YR	ARI	17.95	307.41	307.71	307.71	307.810	0.020	1.43	12.58	60.28
HEC_R4	Br-11	1900	100YR	ARI	17.95	304.97	305.22	305.21	305.310	0.018	1.29	13.94	71.15
HEC_R4	Br-11	1800	100YR	ARI	17.95	303	303.26	303.26	303.340	0.022	1.26	14.25	87.54
HEC_R4	Br-11	1700	100YR	ARI	17.95	301	301.36	301.43	0.009	1.100	16.32	64.26	0.7
HEC_R4	Br-11	1637.21	100YR	ARI	17.95	300.16	300.49	300.49	300.590	0.020	1.42	12.61	60.77
HEC_R4	Br-11	1600	100YR	ARI	17.95	299.3	299.83	299.78	299.920	0.011	1.3	13.76	48.65
HEC_R4	Br-11	1500	100YR	ARI	17.95	298.15	298.34	298.34	298.410	0.021	1.13	15.82	110.99
HEC_R4	Br-11	1400	100YR	ARI	17.95	296.35	296.6	296.57	296.650	0.015	0.96	18.75	130.99
HEC_R4	Br-11	1300	100YR	ARI	17.95	294.52	294.71	294.7	294.750	0.025	0.9	19.91	221.03
HEC_R4	Br-11	1200	100YR	ARI	17.95	292.29	292.7	292.68	292.770	0.016	1.13	15.83	90.96
HEC_R4	Br-11	1100	100YR	ARI	17.95	290.35	290.82	290.82	290.920	0.021	1.34	13.38	72.64
HEC_R4	Br-11	1051.679	100YR	ARI	17.95	287.67	288.2	288.19	288.330	0.018	1.6	11.18	41.53
HEC_R4	Br-11	1000	100YR	ARI	17.95	286.57	287.22	287.22	287.380	0.019	1.74	10.31	33.84
HEC_R4	Br-11	900	100YR	ARI	17.95	284.85	285.29	285.28	285.380	0.017	1.34	13.44	62.81
HEC_R4	Br-11	800	100YR	ARI	17.95	282.98	283.54	283.53	283.670	0.017	1.58	11.39	40.91
HEC_R4	Br-11	700	100YR	ARI	17.95	282.44	282.89	282.77	282.920	0.004	0.77	23.33	82.28
HEC_R4	Br-11	600	100YR	ARI	17.95	281.82	282.06	282.06	282.120	0.024	1.08	16.65	139.95
HEC_R4	Br-11	500	100YR	ARI	17.95	281.22	281.61	281.62	0.002	0.470	38.37	158.99	0.3
HEC_R4	Br-11	400	100YR	ARI	17.95	280.17	281.08	281.08	281.140	0.040	1.08	16.56	198.86
HEC_R4	Br-11	380.015	100YR	ARI	17.95	276	280.69	280.69	0.000	0.110	167.59	56.4	0.02
HEC_R4	Br-11	300	100YR	ARI	17.95	276	280.69	280.69	0.000	0.100	174.91	61.55	0.02
HEC_R4	Br-11	200	100YR	ARI	17.95	276	280.69	280.69	0.000	0.090	209.64	143.7	0.02
HEC_R4	Br-11	159.438	100YR	ARI	17.95	276	280.69	280.69	0.000	0.080	242.73	165.86	0.01
HEC_R4	Br-11	100	100YR	ARI	17.95	276	280.69	280.69	0.000	0.060	327.59	183.63	0.01
HEC_R4	Br-11	0	100YR	ARI	17.95	275	280.69	280.69	0.000	0.040	488.95	227.46	0.01
HEC_R3E	Br-1	1218.93	100YR	ARI	11.42	374.21	374.52	374.52	374.600	0.023	1.22	9.4	63.7
HEC_R3E	Br-1	1200	100YR	ARI	11.42	372.57	373.14	373.14	373.250	0.022	1.45	7.87	39.44
HEC_R3E	Br-1	1100	100YR	ARI	11.42	365	365.48	365.48	365.650	0.018	1.84	6.21	18.29
HEC_R3E	Br-1	1000	100YR	ARI	11.42	359.15	359.94	359.94	360.160	0.017	2.11	5.43	12.38
HEC_R3E	Br-1	900	100YR	ARI	11.42	354	354.55	354.55	354.750	0.017	1.95	5.85	15.47
HEC_R3E	Br-1	800	100YR	ARI	11.42	350.73	351.34	351.34	351.510	0.018	1.79	6.39	19.82
HEC_R3E	Br-1	764.249	100YR	ARI	11.42	347.69	348.05	348.05	348.170	0.019	1.53	7.51	32.32
HEC_R3E	Br-1	700	100YR	ARI	11.42	344.08	344.76	344.76	344.940	0.017	1.89	6.04	16.76
HEC_R3E	Br-1	600	100YR	ARI	11.42	339.55	340.22	340.22	340.380	0.018	1.77	6.45	20.06
HEC_R3E	Br-1	500	100YR	ARI	11.42	336.37	337.05	337.05	337.220	0.018	1.84	6.22	18.64
HEC_R3E	Br-1	400	100YR	ARI	11.42	333.76	334.19	334.23	0.007	0.900	12.73	54.48	0.59
HEC_R3E	Br-1	371.002	100YR	ARI	11.42	332.73	333.27	333.27	333.410	0.019	1.71	7.19	26.74
HEC_R3E	Br-1	300	100YR	ARI	11.42	330.35	331.01	331.01	331.220	0.016	2.02	5.65	13.58
HEC_R3E	Br-1	200	100YR	ARI	11.42	327	327.8	327.8	328.010	0.017	2.02	5.66	14.02
HEC_R3E	Br-1	100	100YR	ARI	11.42	325	325.77	325.77	325.910	0.018	1.66	6.9	23.92
HEC_R3E	Br-1	0	100YR	ARI	11.42	322	322.95	322.98	0.001	0.650	17.69	27.26	0.26
HEC_R3D	Br-9	1445.244	100YR	ARI	10.26	367.38	367.9	367.9	368.040	0.019	1.67	6.15	22.18
HEC_R3D	Br-9	1400	100YR	ARI	10.26	366.02	366.44	366.44	366.580	0.019	1.63	6.31	23.73
HEC_R3D	Br-9	1300	100YR	ARI	10.26	359	359.43	359.43	359.610	0.018	1.96	5.53	15.57
HEC_R3D	Br-9	1286.643	100YR	ARI	10.26	358.33	358.88	358.88	359.040	0.016	1.86	5.97	18.76
HEC_R3D	Br-9	1200	100YR	ARI	10.26	354	354.59	354.59	354.780	0.017	1.93	5.32	14.04
HEC_R3D	Br-9	1127.824	100YR	ARI	10.26	351.18	351.75	351.75	351.910	0.017	1.8	5.71	17.21
HEC_R3D	Br-9	1100	100YR	ARI	10.26	351	351.27	351.27	351.390	0.020	1.52	6.76	29.05
HEC_R3D	Br-9	1002.614	100YR	ARI	10.26	346.74	347.3	347.3	347.450	0.018	1.71	6	20.05
HEC_R3D	Br-9	1000	100YR	ARI	10.26	346.6	347.18	347.18	347.330	0.019	1.68	6.11	22.09
HEC_R3D	Br-9	900	100YR	ARI	10.26	343.97	344.52	344.45	344.650	0.010	1.6	6.43	15.27
HEC_R3D	Br-9	818.845	100YR	ARI	10.26	343	343.39	343.39	343.540	0.019	1.71	5.98	21.18
HEC_R3D	Br-9	800	100YR	ARI	10.26	342	342.38	342.38	342.490	0.020	1.47	6.97	31.39
HEC_R3D	Br-9	700	100YR	ARI	10.26	339	339.53	339.53	339.720	0.017	1.94	5.27	13.88
HEC_R3D	Br-9	626.136	100YR	ARI	10.26	337	337.73	337.89	0.011	1.740	5.89	13.26	0.83
HEC_R3D	Br-9	600	100YR	ARI	10.26	337	337.38	337.38	337.510	0.019	1.61	6.37	24
HEC_R3D	Br-9	500	100YR	ARI	10.26	334	334.67	334.67	334.910	0.016	2.18	4.71	9.82
HEC_R3D	Br-9	495.583	100YR	ARI	10.26	334	334.57	334.57	334.790	0.016	2.06	4.97	11.45
HEC_R3D	Br-9	400	100YR	ARI	10.26	332	332.55	332.55	332.760	0.017	2.01	5.09	12.45
HEC_R3D	Br-9	349.933	100YR	ARI	10.26	331	331.55	331.55	331.740	0.017	1.94	5.28	13.9
HEC_R3D	Br-9	300	100YR	ARI	10.26	330	330.58	330.58	330.760	0.017	1.89	5.43	15.22
HEC_R3D	Br-9	200	100YR	ARI	10.26	327.04	327.56	327.53	327.680	0.013	1.51	6.78	21.91
HEC_R3D	Br-9	172.22	100YR	ARI	10.26	326.63	327.16	327.16	327.250	0.017	1.36	7.52	34.51
HEC_R3D	Br-9	100	100YR	ARI	10.26	324.69	325.21	325.21	325.370	0.019	1.73	5.94	20.06

AUSTRALIAN ZIRCONIA LTD

Dubbo Zirconia Project

Report No. 545/05

SPECIALIST CONSULTANT STUDIES

Part 4: Surface Water Assessment

HEC_R3D	Br-9	0	100YR	ARI	10.26	320.39	322.98	322.98	0.000	0.060	166.78	97.1	0.01
HEC_R3C	Br-8	1898.737	100YR	ARI	33.7	322	322.67	322.67	322.950	0.015	2.33	14.45	26.19
HEC_R3C	Br-8	1800	100YR	ARI	33.7	319	319.94	319.94	320.260	0.014	2.53	13.31	20.71
HEC_R3C	Br-8	1700	100YR	ARI	33.7	316	317.35	317.35	317.760	0.014	2.83	11.9	14.83
HEC_R3C	Br-8	1600	100YR	ARI	33.7	314.55	315.72	315.72	315.990	0.016	2.3	14.67	28.11
HEC_R3C	Br-8	1526.881	100YR	ARI	33.7	312	313.2	313.2	313.580	0.014	2.73	12.34	16.6
HEC_R3C	Br-8	1500	100YR	ARI	33.7	312	312.79	312.79	313.120	0.014	2.52	13.37	20.91
HEC_R3C	Br-8	1400	100YR	ARI	33.7	309.05	310.52	310.52	310.960	0.013	2.94	11.48	13.38
HEC_R3C	Br-8	1300	100YR	ARI	33.7	307	308.6	308.6	309.040	0.014	2.96	11.4	12.93
HEC_R3C	Br-8	1200	100YR	ARI	33.7	305	306.54	306.77	0.006	2.160	15.58	14.58	0.67
HEC_R3C	Br-8	1100	100YR	ARI	33.7	303.78	305.37	305.37	305.930	0.013	3.29	10.23	9.43
HEC_R3C	Br-8	1000	100YR	ARI	33.7	302	303.82	303.82	304.380	0.013	3.3	10.21	9.25
HEC_R3C	Br-8	900	100YR	ARI	33.7	300	302.12	302.28	0.004	1.780	18.9	17.51	0.55
HEC_R3C	Br-8	850.418	100YR	ARI	33.7	299	300.78	300.78	301.380	0.013	3.62	10.18	8.69
HEC_R3C	Br-8	800	100YR	ARI	33.7	298	299.68	299.94	0.006	2.240	15.01	13.81	0.69
HEC_R3C	Br-8	700	100YR	ARI	33.7	297	298.5	298.5	299.050	0.014	3.28	10.26	9.5
HEC_R3C	Br-8	600	100YR	ARI	33.7	296	297.29	297.4	0.003	1.480	22.7	24.4	0.49
HEC_R3C	Br-8	500	100YR	ARI	33.7	296	296.78	296.87	0.011	1.350	25.01	83.08	0.78
HEC_R3C	Br-8	400	100YR	ARI	33.7	295	295.33	295.33	295.470	0.018	1.69	19.94	69.32
HEC_R3C	Br-8	300	100YR	ARI	33.7	292	292.88	292.88	293.250	0.014	2.68	12.6	17.49
HEC_R3C	Br-8	200	100YR	ARI	33.7	290	291.25	291.25	291.620	0.014	2.68	12.59	17.51
HEC_R3C	Br-8	100	100YR	ARI	33.7	289	290.13	290.36	0.010	2.090	16.09	24.43	0.82
HEC_R3C	Br-8	0	100YR	ARI	33.7	287.76	288.86	288.86	289.170	0.015	2.48	13.57	22.23
HEC_R3B	Br-7	1656.858	100YR	ARI	8.63	344.5	345.16	345.16	0.064	0.330	25.96	83.68	0.19
HEC_R3B	Br-7	1600	100YR	ARI	8.63	342	343.16	343.16	0.022	0.310	28.19	46.07	0.12
HEC_R3B	Br-7	1500	100YR	ARI	8.63	338.71	339.46	339.47	0.074	0.480	17.93	36.73	0.22
HEC_R3B	Br-7	1400	100YR	ARI	8.63	334.63	336.05	336.05	0.020	0.300	28.91	44.78	0.12
HEC_R3B	Br-7	1300	100YR	ARI	8.63	331	331.76	331.78	0.156	0.670	12.91	28.27	0.32
HEC_R3B	Br-7	1200	100YR	ARI	8.63	327	327.95	327.95	0.017	0.300	28.36	38.11	0.11
HEC_R3B	Br-7	1100	100YR	ARI	8.63	324	325.04	325.06	0.061	0.500	17.13	28.34	0.21
HEC_R3B	Br-7	1000	100YR	ARI	8.63	320.41	321.29	321.29	0.026	0.320	26.97	45.9	0.13
HEC_R3B	Br-7	900	100YR	ARI	8.63	314	314.63	314.7	0.427	1.160	7.45	15.17	0.53
HEC_R3B	Br-7	800	100YR	ARI	8.63	310	311.15	311.16	0.012	0.270	32.51	41.55	0.1
HEC_R3B	Br-7	700	100YR	ARI	8.63	308	308.95	308.96	0.053	0.490	17.77	27.69	0.19
HEC_R3B	Br-7	600	100YR	ARI	8.63	304	305.25	305.3	0.027	0.440	12.93	28.36	0.15
HEC_R3B	Br-7	500	100YR	ARI	8.63	301	302.44	302.45	0.029	0.430	20.22	24.15	0.15
HEC_R3B	Br-7	440.614	100YR	ARI	8.63	300	301.32	301.33	0.007	0.230	24.68	60.71	0.07
HEC_R3B	Br-7	400	100YR	ARI	8.63	298	299.58	299.61	0.008	0.270	17.93	36.46	0.08
HEC_R3B	Br-7	300	100YR	ARI	8.63	295	296.16	296.03	296.350	0.564	1.66	4.87	13.72
HEC_R3B	Br-7	200	100YR	ARI	8.63	293	293.96	293.37	293.990	0.007	0.2	22.51	54
HEC_R3B	Br-7	100	100YR	ARI	8.63	291	291.3	291.3	291.400	2.027	1.45	5.94	27.88
HEC_R3B	Br-7	0	100YR	ARI	8.63	287.18	288.94	288.94	0.000	0.040	52.46	76.2	0.01
HEC_R3A	Br-6	1040.144	100YR	ARI	45.88	287.7	288.87	288.94	0.004	1.180	38.93	76.33	0.53
HEC_R3A	Br-6	1000	100YR	ARI	45.88	287	288.49	288.68	0.010	1.910	24.05	44.8	0.83
HEC_R3A	Br-6	900	100YR	ARI	45.88	286	287.41	287.33	287.620	0.011	2.04	22.48	39.41
HEC_R3A	Br-6	800	100YR	ARI	45.88	285	286.07	286.07	286.330	0.015	2.27	20.19	38.91
HEC_R3A	Br-6	795.55	100YR	ARI	45.88	285	285.89	286.03	0.005	1.630	28.09	37.76	0.6
HEC_R3A	Br-6	700	100YR	ARI	45.88	284	284.94	284.94	285.260	0.015	2.51	18.28	30.12
HEC_R3A	Br-6	600	100YR	ARI	45.88	283	283.96	284.1	0.006	1.620	28.36	47.37	0.67
HEC_R3A	Br-6	500	100YR	ARI	45.88	282	282.87	282.87	283.140	0.015	2.3	19.93	37.67
HEC_R3A	Br-6	415.369	100YR	ARI	45.88	281	281.56	281.67	0.006	1.450	31.67	59.83	0.64
HEC_R3A	Br-6	400	100YR	ARI	45.88	280.26	281.32	281.28	281.530	0.012	2.02	22.69	43.75
HEC_R3A	Br-6	300	100YR	ARI	45.88	279	279.9	279.9	280.170	0.015	2.28	20.08	38.55
HEC_R3A	Br-6	200	100YR	ARI	45.88	277	278.95	278.98	0.000	0.670	68.76	56.79	0.19
HEC_R3A	Br-6	100	100YR	ARI	45.88	274.5	278.97	278.97	0.000	0.100	507.95	309.21	0.02
HEC_R3A	Br-6	0	100YR	ARI	45.88	273	278.97	278.97	0.000	0.050	1035.91	325.51	0.01
HEC_R2	Br-5	2120.431	100YR	ARI	12.29	324.49	325.09	325.09	325.240	0.018	1.74	7.08	23.55
HEC_R2	Br-5	2100	100YR	ARI	12.29	322.42	323.23	323.23	323.430	0.017	2.01	6.11	15.26
HEC_R2	Br-5	2000	100YR	ARI	12.29	318	318.43	318.43	318.570	0.019	1.69	7.29	25.5
HEC_R2	Br-5	1900	100YR	ARI	12.29	314.62	315.15	315.15	315.290	0.019	1.67	7.37	26.76
HEC_R2	Br-5	1800	100YR	ARI	12.29	311	311.66	311.77	0.011	1.510	8.15	22.16	0.79
HEC_R2	Br-5	1784.115	100YR	ARI	12.29	311	311.4	311.4	311.560	0.018	1.76	7	22.25
HEC_R2	Br-5	1700	100YR	ARI	12.29	309	309.37	309.37	309.520	0.018	1.73	7.11	23.33
HEC_R2	Br-5	1600	100YR	ARI	12.29	306.85	307.24	307.24	307.360	0.019	1.58	7.76	30.2
HEC_R2	Br-5	1500	100YR	ARI	12.29	303.86	304.36	304.36	304.500	0.019	1.66	7.38	26.8
HEC_R2	Br-5	1400	100YR	ARI	12.29	301	301.52	301.52	301.720	0.017	1.98	6.22	15.83
HEC_R2	Br-5	1351.698	100YR	ARI	12.29	300	300.61	300.61	300.840	0.016	2.12	5.79	12.62
HEC_R2	Br-5	1300	100YR	ARI	12.29	298	298.88	298.88	299.200	0.015	2.51	4.9	7.72
HEC_R2	Br-5	1200	100YR	ARI	12.29	296	296.79	296.79	297.100	0.015	2.46	5	8.23
HEC_R2	Br-5	1100	100YR	ARI	12.29	294	294.69	294.66	294.890	0.014	1.98	6.2	13.33
HEC_R2	Br-5	1000	100YR	ARI	12.29	293	293.33	293.3	293.430	0.015	1.42	8.68	33.89
HEC_R2	Br-5	900	100YR	ARI	12.29	291.59	291.91	291.88	291.980	0.014	1.1	11.17	58.97
HEC_R2	Br-5	800	100YR	ARI	12.29	290	290.18	290.18	290.250	0.022	1.22	10.1	66.69
HEC_R2	Br-5	767.601	100YR	ARI	12.29	288.59	289.14	289.2	0.009	1.070	11.47	47.81	0.7
HEC_R2	Br-5	700	100YR	ARI	12.29	287.92	288.19	288.19	288.280	0.021	1.33	9.24	50.8
HEC_R2	Br-5	600	100YR	ARI	12.29	285.74	285.96	285.95	286.010	0.024	0.99	12.39	114.91
HEC_R2	Br-5	500	100YR	ARI	12.29	283.4	283.63	283.63	283.710	0.023	1.21	10.14	67.19
HEC_R2	Br-5	400	100YR	ARI	12.29	281.05	281.32	281.32	281.400	0.022	1.28	9.63	58.78
HEC_R2	Br-5	300	100YR	ARI	12.29	278.89	279.34	279.28	279.410	0.010	1.13	10.84	44.07
HEC_R2	Br-5	200	100YR	ARI	12.29	277.5	277.89	277.89	278.000	0.020	1.46	8.44	38.81
HEC_R2	Br-5	100	100YR	ARI	12.29	276.22	277.13	277.13	0.000	0.150	79.85	237.8	0.08
HEC_R2	Br-5	0	100YR	ARI	12.29	270	277.13	277.13	0.000	0.010	1248.73	400	0

Appendix 3

DZP Post-development HEC-RAS Flood Modelling Data

Note: A copy of this Appendix is available on the Project CD

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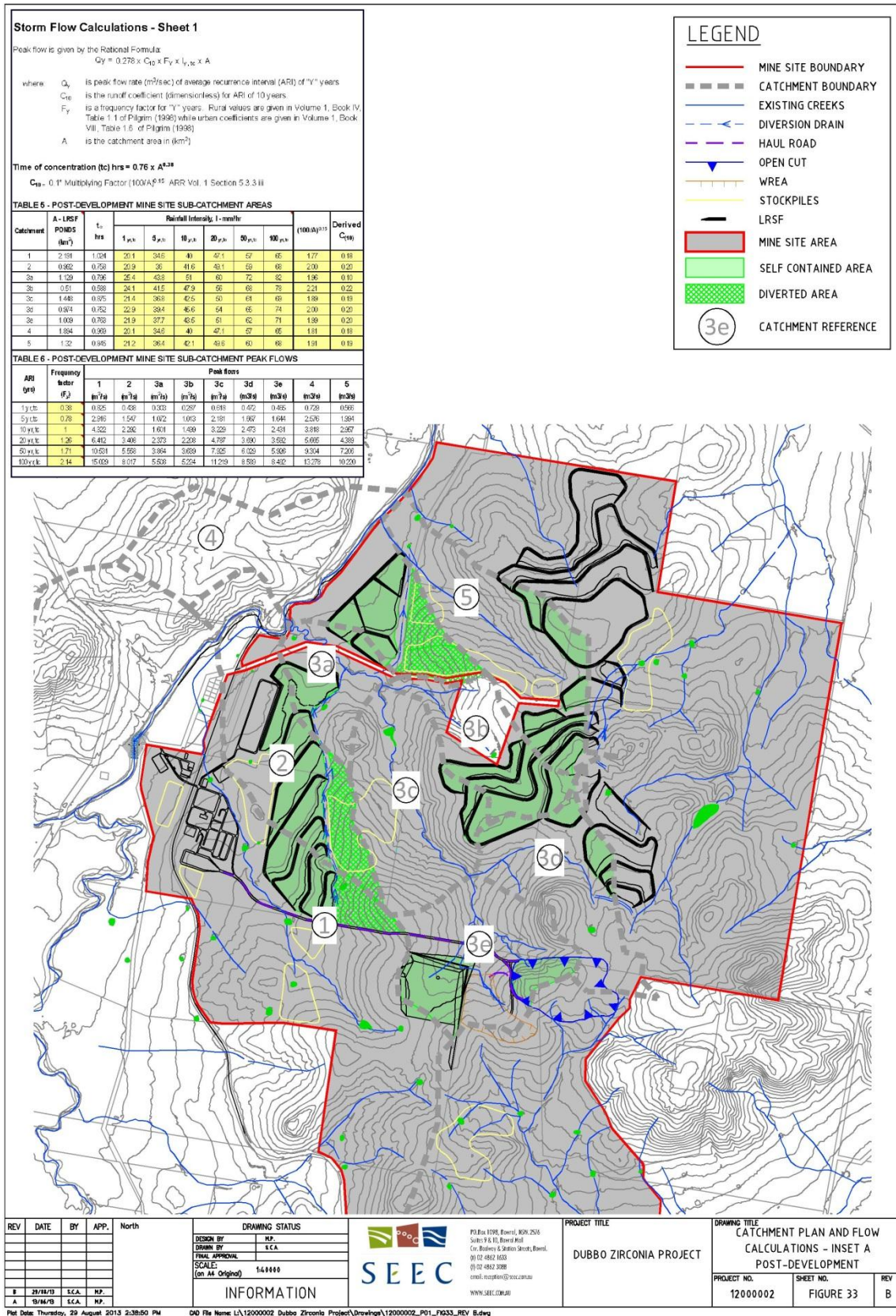


Figure 32 Catchment Plan and Flow Calculations - DZP Site, Post Development

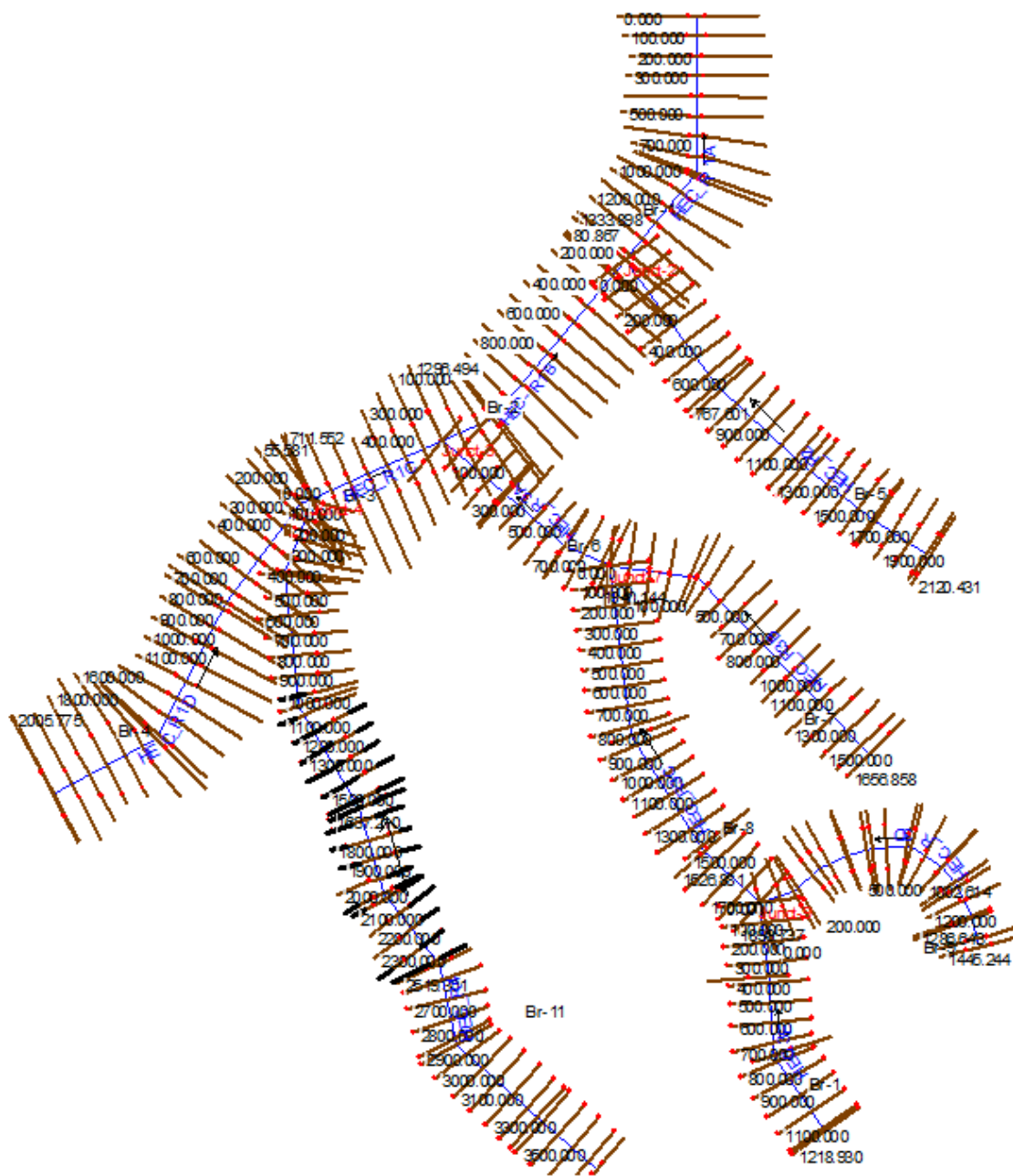


Figure 33 HEC-RAS Model, General Stream Geometry Layout

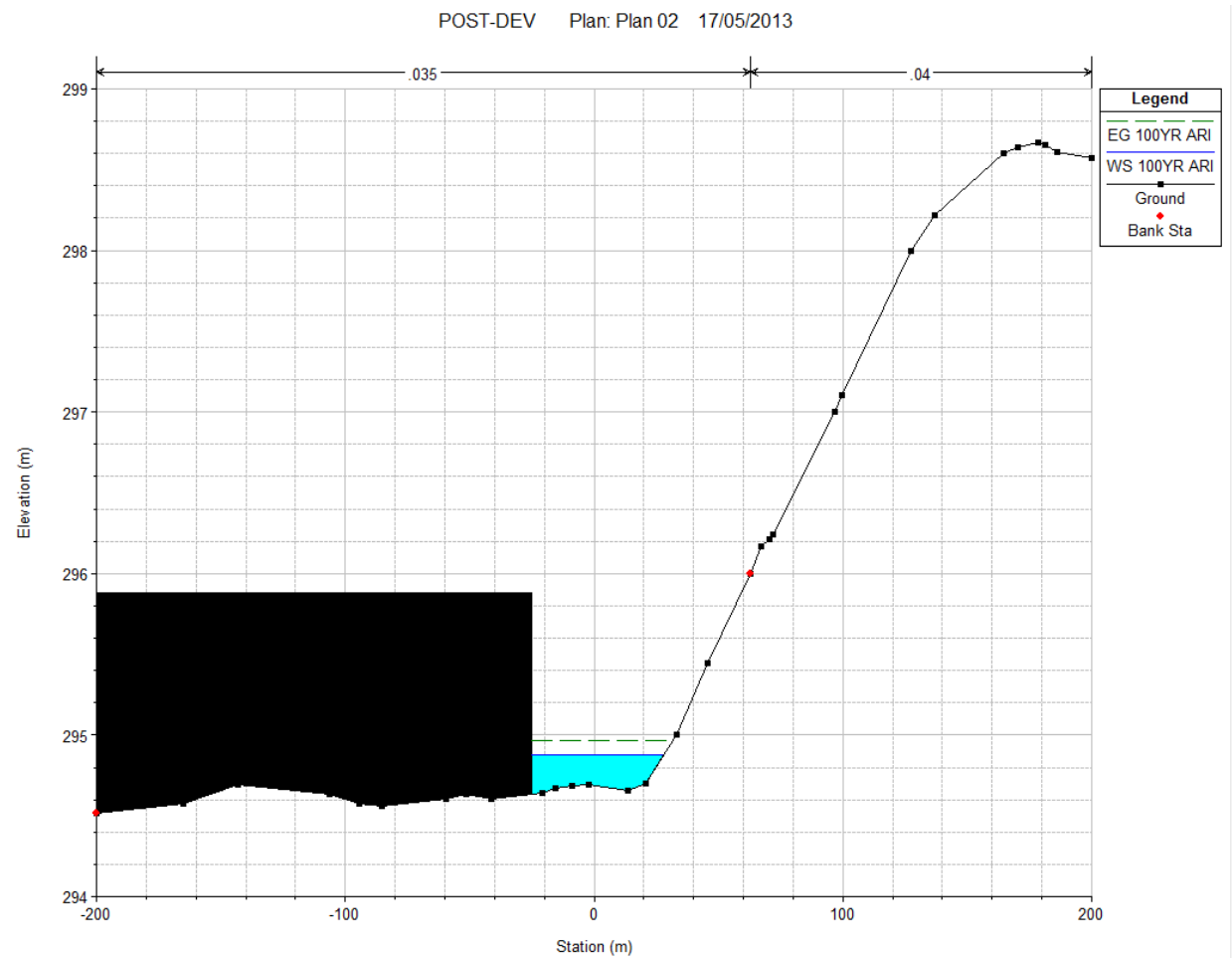


Figure 34 Post-development HEC_R4 – River Station 1300

Figure 35 shows the DZP Site as an obstruction to the left. To the right is an LRSF cell. The level of the DZP Site area/bunding would have a minimum freeboard of 1m from the 100yr ARI storm event top water level (typical).

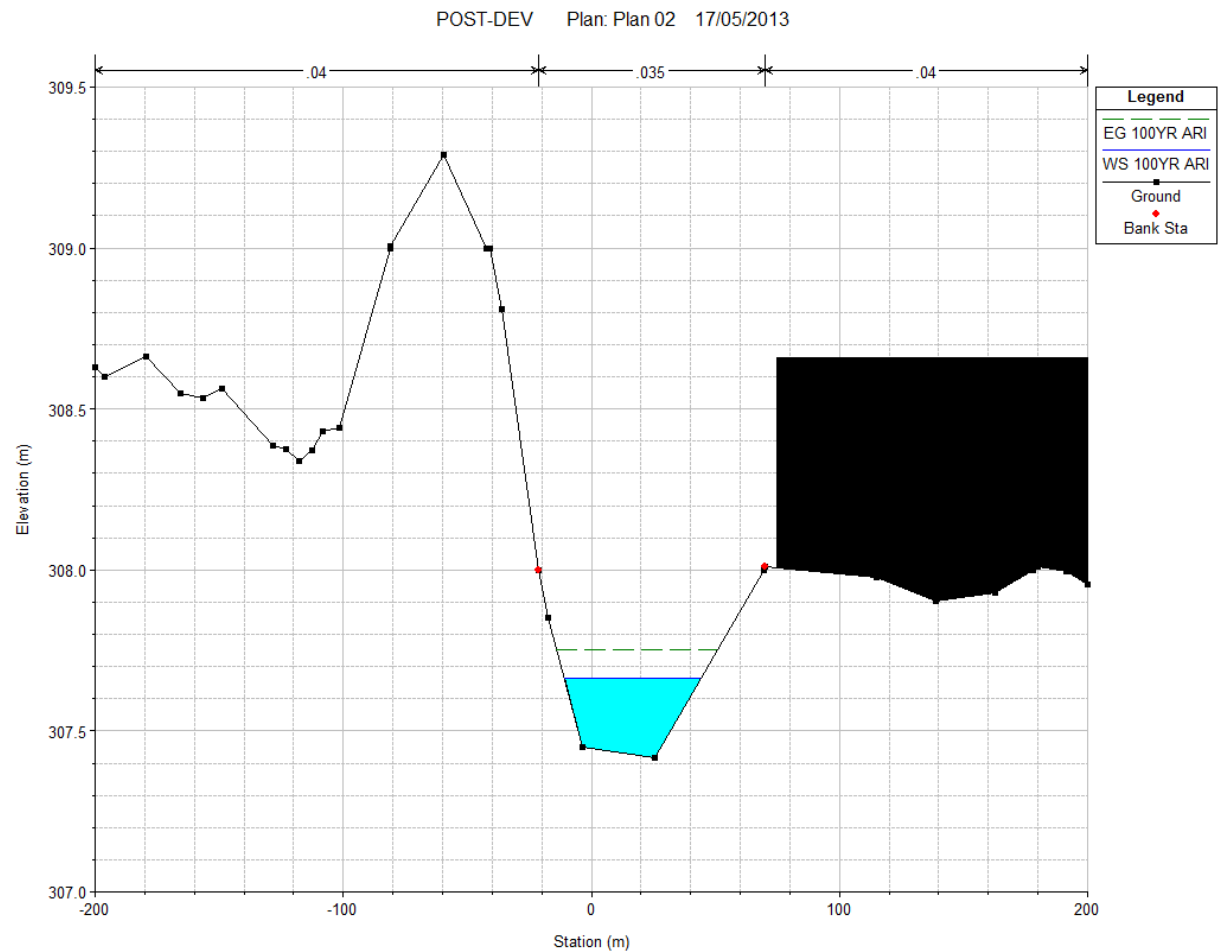


Figure 35 Post-development HEC_R4 – River Station 2000

Figure 36 shows LRSF pond as an obstruction to the right. The level of the LRSF area/bunding would have a minimum freeboard of 1m from the 100yr ARI storm event top water level (typical).

Table 19
Post-development HEC-RAS Output Data

Profile HEC-RAS	Output Plan:	Table Plan	-	Standard 2 Profile:	Table 100YR	1 ARI											
#	Rivers	=		11													
#	Hydraulic	Reaches	=		11												
#	River	Stations	=		235												
#	Plans	=		1													
#	Profiles	=		1													
	River (m3/s)	Reach (m)	River (m)	Sta (m)	Profile (m)	Q (m3/s)	Total (m/s)	Min (m2)	Ch (m)	El	W.S.	Elev	Crit	W.S.	E.G.		
HEC_R4	Br-11	3857.907	100YR	ARI	13	346	347.08	347.05	347.29	0.013136	2.03	6.41	12.93	0.92			
HEC_R4	Br-11	3800	100YR	ARI	13	346	346.23	346.23	346.34	0.019861	1.46	8.91	40.77	1			
HEC_R4	Br-11	3700	100YR	ARI	13	341.81	342.67	342.88	343.32	0.048654	3.58	3.63	8.28	1.73			
HEC_R4	Br-11	3600	100YR	ARI	13	337.97	338.48	338.61	338.92	0.038827	2.92	4.45	11.79	1.52			
HEC_R4	Br-11	3500	100YR	ARI	13	336	336.57	336.57	336.75	0.0173	1.9	6.85	19	1.01			
HEC_R4	Br-11	3468.873	100YR	ARI	13	335.19	335.75	335.83	336.03	0.031434	2.33	5.57	17.76	1.33			
HEC_R4	Br-11	3400	100YR	ARI	13	334	334.39	334.38	334.52	0.017478	1.63	8	28.51	0.98			
HEC_R4	Br-11	3300	100YR	ARI	13	332.14	332.55	332.55	332.66	0.019557	1.48	8.76	38.73	1			
HEC_R4	Br-11	3200	100YR	ARI	13	330	330.26	330.28	330.39	0.026755	1.58	8.22	41.76	1.14			
HEC_R4	Br-11	3100	100YR	ARI	13	327	327.45	327.5	327.68	0.027475	2.08	6.24	21.39	1.23			
HEC_R4	Br-11	3000	100YR	ARI	13	325.52	325.8	325.78	325.85	0.01554	1.01	12.81	84.27	0.83			
HEC_R4	Br-11	2925.901	100YR	ARI	13	324.05	324.43	324.43	324.52	0.021163	1.32	9.84	54.9	1			
HEC_R4	Br-11	2900	100YR	ARI	13	323.2	323.63	323.68	323.84	0.032779	2.02	6.44	26.44	1.3			
HEC_R4	Br-11	2800	100YR	ARI	13	321	321.61	321.55	321.72	0.010633	1.47	8.86	25.14	0.79			
HEC_R4	Br-11	2700	100YR	ARI	13	319.93	320.12	320.12	320.18	0.024116	1.08	12.04	100.24	0.99			
HEC_R4	Br-11	2600	100YR	ARI	13	317	317.23	317.26	317.4	0.032019	1.84	7.08	32.89	1.26			
HEC_R4	Br-11	2519.301	100YR	ARI	13	315.93	316.2	316.17	316.26	0.013402	1.15	11.26	54.55	0.81			
HEC_R4	Br-11	2500	100YR	ARI	13	315.59	315.89	315.88	315.98	0.016488	1.28	10.15	48.86	0.9			
HEC_R4	Br-11	2400	100YR	ARI	13	314.04	314.47	314.44	314.51	0.012873	0.95	13.68	86.15	0.76			
HEC_R4	Br-11	2300	100YR	ARI	13	312.53	312.94	312.92	313	0.018321	1.06	12.22	84.66	0.89			
HEC_R4	Br-11	2200	100YR	ARI	13	310.38	311.22	311.22	311.31	0.015655	1.31	9.9	44.34	0.89			
HEC_R4	Br-11	2100	100YR	ARI	13	308.79	309.07	309.08	309.15	0.031582	1.3	10.04	77.88	1.15			
HEC_R4	Br-11	2073.693	100YR	ARI	13	308	308.41	308.29	308.46	0.005367	0.97	13.42	42.6	0.55			
HEC_R4	Br-11	2000	100YR	ARI	13	307.41	307.66	307.66	307.75	0.021219	1.32	9.85	55.15	1			
HEC_R4	Br-11	1900	100YR	ARI	13	304.97	305.16	305.17	305.25	0.029873	1.36	9.54	65.74	1.14			
HEC_R4	Br-11	1800	100YR	ARI	13	303	303.22	303.22	303.29	0.022865	1.18	11	76.9	1			
HEC_R4	Br-11	1700	100YR	ARI	13	301	301.31	301.25	301.36	0.008981	0.99	13.16	59.69	0.67			
HEC_R4	Br-11	1637.21	100YR	ARI	13	300.16	300.44	300.44	300.54	0.020598	1.4	9.27	46.96	1.01			
HEC_R4	Br-11	1600	100YR	ARI	13	299.3	299.78	299.72	299.85	0.009887	1.2	10.85	39.81	0.73			
HEC_R4	Br-11	1500	100YR	ARI	13	298.16	298.52	298.5	298.63	0.015016	1.5	8.66	30.53	0.9			
HEC_R4	Br-11	1400	100YR	ARI	13	296.52	296.83	296.83	296.94	0.019449	1.45	8.99	40.94	0.99			
HEC_R4	Br-11	1300	100YR	ARI	13	294.63	294.88	294.87	294.96	0.019879	1.31	9.89	52.88	0.97			
HEC_R4	Br-11	1200	100YR	ARI	13	292.44	293.07	293.05	293.2	0.015654	1.62	8.05	26.38	0.93			
HEC_R4	Br-11	1100	100YR	ARI	13	290.97	291.14	291.14	291.2	0.025844	0.99	13.1	130.15	1			
HEC_R4	Br-11	1051.679	100YR	ARI	13	287.67	287.99	288.13	288.51	0.127609	3.2	4.06	22.81	2.42			
HEC_R4	Br-11	1000	100YR	ARI	13	287.72	287.84	287.84	287.9	0.029471	1.12	11.62	106.59	1.08			
HEC_R4	Br-11	900	100YR	ARI	13	284.85	285.24	285.23	285.32	0.017	1.21	10.76	57.89	0.89			
HEC_R4	Br-11	800	100YR	ARI	13	282.98	283.47	283.46	283.59	0.017713	1.48	8.77	35.51	0.95			
HEC_R4	Br-11	700	100YR	ARI	13	282.44	282.85	282.73	282.87	0.003657	0.67	19.36	79.49	0.43			
HEC_R4	Br-11	600	100YR	ARI	13	281.82	282.04	282.04	282.09	0.025769	0.97	13.39	137.19	0.99			
HEC_R4	Br-11	500	100YR	ARI	13	281.22	281.57	281.42	281.58	0.001624	0.41	32.05	152.88	0.28			
HEC_R4	Br-11	400	100YR	ARI	13	280.17	281.06	281.06	281.11	0.045736	1	13.06	197.75	1.24			
HEC_R4	Br-11	380.015	100YR	ARI	13	276	280.65	276.52	280.65	0.000002	0.08	172.2	60.93	0.01			
HEC_R4	Br-11	300	100YR	ARI	13	276	280.65	280.65	0.000001	0.07	203.42	138.12	0.01				
HEC_R4	Br-11	200	100YR	ARI	13	276	280.65	280.65	0.000001	0.06	235.5	161.47	0.01				
HEC_R4	Br-11	159.438	100YR	ARI	13	276	280.65	280.65	0.000001	0.04	319.56	179.75	0.01				
HEC_R4	Br-11	0	100YR	ARI	13	275	280.65	280.65	0	0.03	479.05	220.61	0				
HEC_R3D	Br-9	1445.244	100YR	ARI	10	367.38	367.89	367.89	368.03	0.018854	1.66	6.04	21.99	1.01			
HEC_R3D	Br-9	1400	100YR	ARI	10	366.02	366.34	366.44	366.64	0.056861	2.4	4.16	19.85	1.68			
HEC_R3D	Br-9	1300	100YR	ARI	10	359	359.27	359.43	359.78	0.083656	3.28	3.2	13.3	2.09			
HEC_R3D	Br-9	1286.643	100YR	ARI	10	358.33	358.8	358.87	359.06	0.031854	2.36	4.56	16.6	1.34			
HEC_R3D	Br-9	1200	100YR	ARI	10	354	354.4	354.58	354.97	0.076174	3.32	3.01	10.96	2.02			
HEC_R3D	Br-9	1127.824	100YR	ARI	10	351.18	351.7	351.74	351.91	0.02545	2.05	4.87	16.04	1.19			
HEC_R3D	Br-9	1100	100YR	ARI	10	351	351.27	351.27	351.38	0.019727	1.5	6.65	28.94	1			
HEC_R3D	Br-9	1002.614	100YR	ARI	10	346.74	347.15	347.29	347.63	0.02555	3.07	3.26	16.75	2.22			
HEC_R3D	Br-9	1000	100YR	ARI	10	346.6	347.09	347.18	347.38	0.056394	2.38	4.19	20.08	1.67			
HEC_R3D	Br-9	900	100YR	ARI	10	343.97	344.51	344.44	344.64	0.010105	1.59	6.29	15.17	0.79			
HEC_R3D	Br-9	818.845	100YR	ARI	10	343	343.39	343.39	343.53	0.018948	1.69	5.93	21.11	1.02			
HEC_R3D	Br-9	800	100YR	ARI	10	342	342.24	342.38	342.72	0.0146009	3.07	3.26	21.78	2.54			
HEC_R3D	Br-9	700	100YR	ARI	10	339	339.53	339.53	339.72	0.016928	1.93	5.18	13.78	1			
HEC_R3D	Br-9	626.136	100YR	ARI	10	337	337.55	337.66	337.92	0.037058	2.7	3.7	10.64	1.46			
HEC_R3D	Br-9	600	100YR	ARI	10	337	337.38	337.38	337.51	0.018733	1.6	6.25	23.86	1			
HEC_R3D	Br-9	500	100YR	ARI	10	334	334.54	334.66	334.96	0.035636	2.88	3.47	8.78	1.46			
HEC_R3D	Br-9	495.583	100YR	ARI	10	334	334.51	334.56	334.78	0.022898	2.32	4.32	10.89	1.17			
HEC_R3D	Br-9	400	100YR	ARI	10	332	332.52	332.55	332.75	0.019389	2.11	4.73	12.13	1.08			
HEC_R3D	Br-9	349.933	100YR	ARI	10	331	331.51	331.54	331.74	0.021262	2.09	4.78	13.3	1.11			
HEC_R3D	Br-9	300	100YR	ARI	10	330	330.56	330.57	330.75	0.018126	1.9	5.25	14.99	1.03			
HEC_R3D	Br-9	200	100YR	ARI	10	327.04	327.42	327.52	327.75	0.057845	2.56	3.91	17.17	1.71			
HEC_R3D	Br-9	172.22	100YR	ARI	10	326.63	327.15	327.15	327.24	0.017215	1.35	7.42	34.44	0.93			
HEC_R3D	Br-9	100	100YR	ARI	10	324.69	325.13	325.21	325.4	0.04097	2.28	4.38	17.65	1.46			
HEC_R3D	Br-9	0	100YR	ARI	10	320.39	322.97	320.73	322.97	0.000002	0.06	165.65	96.87	0.01			
HEC_R3C	Br-8	1898.737	100YR	ARI	33	322	322.66	322.66	322.94	0.014974	2						

HEC_R3C	Br-8	1526.881	100YR	ARI	33	312	312.91	313.19	313.83	0.051364	4.26	7.74	14.36	1.85
HEC_R3C	Br-8	1500	100YR	ARI	33	312	312.78	312.78	313.1	0.014367	2.51	13.16	20.8	1.01
HEC_R3C	Br-8	1400	100YR	ARI	33	309.05	310.28	310.5	311.05	0.030119	3.89	8.48	11.92	1.47
HEC_R3C	Br-8	1300	100YR	ARI	33	307	308.55	308.58	309.03	0.014615	3.04	10.86	12.43	1.04
HEC_R3C	Br-8	1200	100YR	ARI	33	305	305.95	306.21	306.82	0.035279	4.15	7.96	11.38	1.58
HEC_R3C	Br-8	1100	100YR	ARI	33	303.78	305.36	305.36	305.9	0.013503	3.28	10.07	9.37	1.01
HEC_R3C	Br-8	1000	100YR	ARI	33	302	303.7	303.8	304.37	0.017326	3.63	9.09	8.72	1.13
HEC_R3C	Br-8	900	100YR	ARI	33	300	302.09	301.57	302.26	0.003718	1.79	18.4	16.72	0.55
HEC_R3C	Br-8	850.418	100YR	ARI	33	299	300.77	300.77	301.35	0.01311	3.6	10.02	8.63	1.02
HEC_R3C	Br-8	800	100YR	ARI	33	298	299.66	299.37	299.92	0.005927	2.23	14.77	13.72	0.69
HEC_R3C	Br-8	700	100YR	ARI	33	297	298.49	298.49	299.03	0.013644	3.27	10.1	9.46	1.01
HEC_R3C	Br-8	600	100YR	ARI	33	296	297.28	296.86	297.39	0.003034	1.47	22.47	24.33	0.49
HEC_R3C	Br-8	500	100YR	ARI	33	296	296.78	296.87	0.010858	1.33	24.76	82.63	0.78	
HEC_R3C	Br-8	400	100YR	ARI	33	295	295.32	295.32	295.47	0.018517	1.68	19.64	69.12	1.01
HEC_R3C	Br-8	300	100YR	ARI	33	292	292.74	292.87	293.28	0.025053	3.25	10.15	16.43	1.32
HEC_R3C	Br-8	200	100YR	ARI	33	290	291.24	291.24	291.6	0.013956	2.67	12.35	17.27	1.01
HEC_R3C	Br-8	100	100YR	ARI	33	289	290.11	289.95	290.34	0.00955	2.11	15.64	23.51	0.83
HEC_R3C	Br-8	0	100YR	ARI	33	287.76	288.85	288.85	289.16	0.014818	2.47	13.36	22.12	1.01
HEC_R3B	Br-7	1656.858	100YR	ARI	3	344.5	344.91	344.7	344.91	0.085405	0.31	9.61	42.08	0.21
HEC_R3B	Br-7	1600	100YR	ARI	3	342	342.72	342.72	0.021842	0.24	12.33	28.13	0.12	
HEC_R3B	Br-7	1500	100YR	ARI	3	338.71	339.17	339.18	0.067082	0.34	8.78	27.97	0.19	
HEC_R3B	Br-7	1400	100YR	ARI	3	334.63	335.61	335.61	0.022082	0.24	12.56	29.67	0.12	
HEC_R3B	Br-7	1300	100YR	ARI	3	331	331.52	331.52	0.099699	0.43	6.96	21.06	0.24	
HEC_R3B	Br-7	1200	100YR	ARI	3	327	327.52	327.53	0.021379	0.23	13.27	33.23	0.11	
HEC_R3B	Br-7	1100	100YR	ARI	3	324	324.72	324.28	324.73	0.038265	0.32	9.27	20.95	0.16
HEC_R3B	Br-7	1000	100YR	ARI	3	320.41	320.92	320.92	0.037921	0.26	11.6	36.61	0.15	
HEC_R3B	Br-7	900	100YR	ARI	3	314	314.49	314.5	0.131794	0.56	5.4	13.68	0.28	
HEC_R3B	Br-7	800	100YR	ARI	3	310	310.66	310.67	0.017968	0.22	13.91	32.87	0.11	
HEC_R3B	Br-7	700	100YR	ARI	3	308	308.7	308.7	0.021407	0.26	11.43	22.86	0.12	
HEC_R3B	Br-7	600	100YR	ARI	3	304	304.8	304.82	0.091151	0.58	5.14	9.02	0.25	
HEC_R3B	Br-7	500	100YR	ARI	3	301	302.02	302.02	0.013346	0.26	11.49	16.05	0.1	
HEC_R3B	Br-7	440.614	100YR	ARI	3	300	300.75	300.75	0.039222	0.38	7.93	14.38	0.16	
HEC_R3B	Br-7	400	100YR	ARI	3	298	299.29	299.3	0.010372	0.25	9.85	18.8	0.09	
HEC_R3B	Br-7	300	100YR	ARI	3	295	295.87	295.93	0.393135	1.09	2.75	5.38	0.49	
HEC_R3B	Br-7	200	100YR	ARI	3	293	293.75	293.19	293.75	0.00698	0.17	13.01	33.17	0.07
HEC_R3B	Br-7	100	100YR	ARI	3	291	291.16	291.16	291.23	2.555564	1.15	2.61	20.6	1.03
HEC_R3B	Br-7	0	100YR	ARI	3	287.18	288.95	287.64	288.95	0.000018	0.02	52.74	76.37	0
HEC_R3A	Br-6	1040.144	100YR	ARI	46	287.7	288.87	288.55	288.94	0.004186	1.18	39.02	76.43	0.53
HEC_R3A	Br-6	1000	100YR	ARI	46	287	288.49	288.68	0.010318	1.91	24.1	44.86	0.83	
HEC_R3A	Br-6	900	100YR	ARI	46	286	287.41	287.33	287.62	0.010875	2.04	22.54	39.46	0.86
HEC_R3A	Br-6	800	100YR	ARI	46	285	286.07	286.07	286.34	0.015272	2.28	20.21	38.92	1.01
HEC_R3A	Br-6	795.55	100YR	ARI	46	285	285.44	285.66	286.16	0.065635	3.75	12.26	33.33	1.98
HEC_R3A	Br-6	700	100YR	ARI	46	284	284.92	284.92	285.26	0.016128	2.57	17.87	29.81	1.06
HEC_R3A	Br-6	600	100YR	ARI	46	283	283.96	283.79	284.1	0.006365	1.62	28.41	47.42	0.67
HEC_R3A	Br-6	500	100YR	ARI	46	282	282.87	282.87	283.14	0.015201	2.3	19.97	37.7	1.01
HEC_R3A	Br-6	415.369	100YR	ARI	46	281	281.56	281.42	281.67	0.006013	1.45	31.73	59.84	0.64
HEC_R3A	Br-6	400	100YR	ARI	46	280.26	281.33	281.29	281.53	0.012036	2.02	22.74	43.77	0.9
HEC_R3A	Br-6	300	100YR	ARI	46	279	279.91	279.91	280.17	0.015322	2.29	20.1	38.57	1.01
HEC_R3A	Br-6	200	100YR	ARI	46	277	278.89	277.92	278.92	0.000496	0.71	65.14	55.4	0.21
HEC_R3A	Br-6	100	100YR	ARI	46	274.5	278.91	278.91	0.000004	0.1	488.63	304.57	0.02	
HEC_R3A	Br-6	0	100YR	ARI	46	273	278.91	278.91	0.000001	0.05	1015.46	324.38	0.01	
HEC_R2	Br-5	2120.431	100YR	ARI	11	324.49	325.06	325.06	325.21	0.018837	1.7	6.47	22.65	1.01
HEC_R2	Br-5	2100	100YR	ARI	11	322.42	322.9	323.19	324.18	0.211264	5.02	2.19	9.22	8.29
HEC_R2	Br-5	2000	100YR	ARI	11	318	318.98	318.41	318.55	0.023619	1.79	6.14	23.55	1.12
HEC_R2	Br-5	1900	100YR	ARI	11	314.62	315.05	315.13	315.31	0.046833	2.26	4.88	22.12	1.53
HEC_R2	Br-5	1800	100YR	ARI	11	311	311.63	311.56	311.74	0.010300	1.45	7.59	21.44	0.78
HEC_R2	Br-5	1794.115	100YR	ARI	11	311	311.37	311.37	311.52	0.018238	1.71	6.42	21.63	1
HEC_R2	Br-5	1700	100YR	ARI	11	309	309.29	309.34	309.51	0.032421	2.04	5.4	21.84	1.3
HEC_R2	Br-5	1600	100YR	ARI	11	306.85	307.21	307.21	307.34	0.019777	1.54	7.12	29.83	1.01
HEC_R2	Br-5	1500	100YR	ARI	11	303.86	304.26	304.34	304.51	0.043005	2.19	5.02	22.25	1.47
HEC_R2	Br-5	1400	100YR	ARI	11	301	301.47	301.49	301.68	0.019911	2.03	5.41	15.05	1.08
HEC_R2	Br-5	1351.698	100YR	ARI	11	300	300.56	300.57	300.79	0.017219	2.12	5.2	12.14	1.03
HEC_R2	Br-5	1300	100YR	ARI	11	298	298.58	298.82	299.31	0.050527	3.79	2.91	6.1	1.75
HEC_R2	Br-5	1200	100YR	ARI	11	296	296.74	296.74	297.03	0.015217	2.38	4.62	8	1
HEC_R2	Br-5	1100	100YR	ARI	11	294	294.52	294.62	294.88	0.032595	2.66	4.13	11.04	1.39
HEC_R2	Br-5	1000	100YR	ARI	11	293	293.3	293.29	293.4	0.015495	1.38	7.97	32.95	0.9
HEC_R2	Br-5	900	100YR	ARI	11	291.59	291.9	291.87	291.96	0.013412	1.06	10.37	57.19	0.79
HEC_R2	Br-5	800	100YR	ARI	11	290	290.16	290.16	290.24	0.022919	1.18	9.3	64.97	1
HEC_R2	Br-5	767.601	100YR	ARI	11	288.59	288.97	289.07	289.24	0.04203	2.28	4.83	19.89	1.48
HEC_R2	Br-5	700	100YR	ARI	11	287.92	288.17	288.17	288.26	0.021564	1.29	8.55	50.26	1
HEC_R2	Br-5	600	100YR	ARI	11	285.74	285.95	285.95	286	0.023653	0.95	11.53	113.93	0.96
HEC_R2	Br-5	500	100YR	ARI	11	283.4	283.59	283.62	283.7	0.049064	1.51	7.31	62.85	1.41
HEC_R2	Br-5	400	100YR	ARI	11	281.05	281.3	281.3	281.38	0.022872	1.24	8.89	57.7	1.01
HEC_R2	Br-5	300	100YR	ARI	11	278.89	279.32	279.27	279.38	0.009923	1.08	10.17	42.98	0.71
HEC_R2	Br-5	200	100YR	ARI	11	277.5	277.87	277.87	277.98	0.02104	1.44	7.66	37.17	1.01
HEC_R2	Br-5	100	100YR	ARI	11	276.22	277.08	276.58	277.08	0.000165	0.16	68.39	235.35	0.1
HEC_R2	Br-5	0	100YR	ARI	11	270	277.08	277.08	0	0.01	1229.4	400	0	
HEC_R1D	Br-4	2005.775	100YR	ARI	476.24	279	284.09	283.22	284.57	0.006718	3.08	154.86	69.5	0.66
HEC_R1D	Br-4	2000	100YR	ARI	476.24	279	283.9	284.51	0.007975	3.48	136.74	57.76	0.72	
HEC_R1D	Br-4	1900	100YR	ARI	476.24	279	284.21	284.25	0.000312	0.92	523.29	185.91	0.15	
HEC_R1D	Br-4	1800	100YR	ARI	476.24	280	284.15	284.2	0.000877	1.02	505.04	574.44	0.23	
HEC_R1D	Br-4	1700	100YR	ARI	476.24	279	284.05	284.1	0.001148	0.97	503.27	639.16	0.26	
HEC_R1D	Br-4	1600	100YR	ARI	476.24	279	283.95	284	0.000819	0.99	479.12	243.56	0.23	
HEC_R1D	Br-4	1500	100YR	ARI	476.24	278	283.67	283.85	0.003153	1.86	255.61	139.07	0.44	
HEC_R1D	Br-4	1422.297	100YR	ARI	476.24	278	283.45	283.64	0.002331	1.91	249.16	103.85	0.39	

HEC_R1D	Br-4	1000	100YR	ARI	476.24	277	282.43	282.65	0.001794	2.12	228.8	89.58	0.37	
HEC_R1D	Br-4	900	100YR	ARI	476.24	277	282.32	282.48	0.001357	1.73	283.28	148.93	0.31	
HEC_R1D	Br-4	800	100YR	ARI	476.24	276	282.11	282.32	0.00173	2.03	239.33	142.84	0.36	
HEC_R1D	Br-4	700	100YR	ARI	476.24	276.93	281.95	282.15	0.00158	2	283.58	213.75	0.34	
HEC_R1D	Br-4	662.176	100YR	ARI	476.24	276	281.82	282.05	0.001741	2.15	259.88	187.22	0.36	
HEC_R1D	Br-4	600	100YR	ARI	476.24	276	281.7	281.91	0.001637	2.08	274.59	212.08	0.35	
HEC_R1D	Br-4	500	100YR	ARI	476.24	276	281.68	281.75	0.000853	1.25	450.22	324	0.24	
HEC_R1D	Br-4	400	100YR	ARI	476.24	276	281.45	281.62	0.00183	1.92	305.66	273.06	0.36	
HEC_R1D	Br-4	300	100YR	ARI	476.24	276	281.08	281.38	0.002811	2.45	204.61	203.59	0.45	
HEC_R1D	Br-4	200	100YR	ARI	476.24	276	280.74	280.98	0.005618	2.18	218.07	144.16	0.57	
HEC_R1D	Br-4	100	100YR	ARI	476.24	275	280.61	280.73	0.001113	1.51	329.34	163.69	0.28	
HEC_R1D	Br-4	55.581	100YR	ARI	476.24	275	280.61	280.68	0.000644	1.2	414.64	196.92	0.22	
HEC_R1D	Br-4	0	100YR	ARI	476.24	275	280.57	280.64	0.000684	1.17	421.12	196.42	0.22	
HEC_R1C	Br-3	711.552	100YR	ARI	494	275	280.56	280.64	0.000741	1.21	419.91	195.84	0.23	
HEC_R1C	Br-3	700	100YR	ARI	494	275	280.54	280.63	0.000854	1.34	384.63	189.32	0.25	
HEC_R1C	Br-3	600	100YR	ARI	494	275	280.25	280.49	0.002013	2.17	239.83	147.72	0.38	
HEC_R1C	Br-3	500	100YR	ARI	494	275	280.09	280.28	0.001847	1.96	261.93	213.25	0.36	
HEC_R1C	Br-3	400	100YR	ARI	494	275	279.35	278.54	0.006458	3.38	146.19	55.3	0.66	
HEC_R1C	Br-3	300	100YR	ARI	494	274	279.07	279.25	0.004836	1.88	262.43	193.26	0.52	
HEC_R1C	Br-3	200	100YR	ARI	494	274	279	279.07	0.000726	1.1	448.99	178.5	0.22	
HEC_R1C	Br-3	100	100YR	ARI	494	273	278.85	278.97	0.001207	1.52	326.02	117.25	0.29	
HEC_R1C	Br-3	0	100YR	ARI	494	274	278.89	278.9	0.000155	0.56	887.22	313.26	0.1	
HEC_R1A	Br-1	1333.898	100YR	ARI	562	270	276.92	277.07	0.002453	1.8	375.96	300.87	0.39	
HEC_R1A	Br-1	1300	100YR	ARI	562	270	276.84	277.01	0.001172	1.97	429.1	361.7	0.3	
HEC_R1A	Br-1	1200	100YR	ARI	562	271	276.68	276.87	0.00145	2.11	401.84	390.05	0.34	
HEC_R1A	Br-1	1100	100YR	ARI	562	270	276.61	276.73	0.001013	1.72	509.9	430.07	0.28	
HEC_R1A	Br-1	1000	100YR	ARI	562	269	276.55	276.63	0.000759	1.55	593	434.12	0.24	
HEC_R1A	Br-1	900	100YR	ARI	562	269.56	276.24	276.33	0.001415	1.49	516.15	419.44	0.31	
HEC_R1A	Br-1	800	100YR	ARI	562	269	276.17	276.24	0.000578	1.38	637.94	432.26	0.21	
HEC_R1A	Br-1	778.899	100YR	ARI	562	269	276.12	276.22	0.000923	1.54	513.35	429.3	0.26	
HEC_R1A	Br-1	700	100YR	ARI	562	269	276.07	276.15	0.000684	1.41	612.44	458.13	0.23	
HEC_R1A	Br-1	600	100YR	ARI	562	269	275.87	275.97	0.001006	1.62	551.66	473.73	0.27	
HEC_R1A	Br-1	500	100YR	ARI	562	269	275.72	275.85	0.001252	1.87	509.22	504.67	0.31	
HEC_R1A	Br-1	400	100YR	ARI	562	270	275.5	273.9	0.00184	2.21	438.49	554.29	0.37	
HEC_R1A	Br-1	300	100YR	ARI	562	269.94	274.8	273.69	0.005968	3.29	170.59	63.03	0.64	
HEC_R1A	Br-1	200	100YR	ARI	562	268	274.53	272.99	0.002904	2.74	265.79	324.69	0.46	
HEC_R1A	Br-1	100	100YR	ARI	562	268	274.39	273.12	0.002481	2.02	415.77	593.7	0.41	
HEC_R1A	Br-1	0	100YR	ARI	562	268	272.8	272.8	0.015985	4.77	117.82	51.64	1.01	
HEC_3E	Br-1	1218.93	100YR	ARI	12	374.21	374.53	374.53	0.029017	1.22	9.82	65.64	1.01	
HEC_3E	Br-1	1200	100YR	ARI	12	372.57	373.03	373.15	0.0231741	3.24	3.7	32.27	3.06	
HEC_3E	Br-1	1100	100YR	ARI	12	365	365.38	365.49	0.038558	2.6	4.61	14.5	1.47	
HEC_3E	Br-1	1000	100YR	ARI	12	359.15	359.75	359.96	0.076428	3.63	3.3	10.52	2.07	
HEC_3E	Br-1	900	100YR	ARI	12	354	354.46	354.57	0.04149	2.72	4.42	13.77	1.53	
HEC_3E	Br-1	800	100YR	ARI	12	350.73	351.31	351.36	0.026203	2.09	5.73	18.79	1.21	
HEC_3E	Br-1	764.249	100YR	ARI	12	347.69	347.87	348.06	0.074693	4.68	2.56	22.08	4.39	
HEC_3E	Br-1	700	100YR	ARI	12	344.08	344.74	344.77	0.021447	2.08	5.77	16.39	1.12	
HEC_3E	Br-1	600	100YR	ARI	12	339.55	340.03	340.23	0.115928	3.68	3.26	13.98	2.43	
HEC_3E	Br-1	500	100YR	ARI	12	336.37	337.06	337.06	0.017872	1.86	6.47	19	1.02	
HEC_3E	Br-1	400	100YR	ARI	12	333.76	334.2	334.13	0.00676	0.91	13.18	54.59	0.59	
HEC_3E	Br-1	371.002	100YR	ARI	12	332.73	333.28	333.28	0.018903	1.73	7.47	27.07	1.02	
HEC_3E	Br-1	300	100YR	ARI	12	330.35	330.98	331.03	0.02318	2.34	5.13	12.93	1.19	
HEC_3E	Br-1	200	100YR	ARI	12	327	327.68	327.82	0.043988	2.95	4.06	11.66	1.6	
HEC_3E	Br-1	100	100YR	ARI	12	325	325.78	325.78	0.017235	1.67	7.2	24.18	0.97	
HEC_3E	Br-1	0	100YR	ARI	12	322	322.94	322.44	0.001077	0.69	17.28	26.96	0.28	
HEC_R1B	Br-2	1296.494	100YR	ARI	552	274	278.88	278.9	0.000198	0.62	885.87	313.2	0.12	
HEC_R1B	Br-2	1200	100YR	ARI	552	273	278.63	278.84	0.00259	2.06	285.15	151.17	0.42	
HEC_R1B	Br-2	1100	100YR	ARI	552	273	278.51	278.65	0.001162	1.71	334.7	143.21	0.29	
HEC_R1B	Br-2	1022.736	100YR	ARI	552	273	278.46	278.57	0.000781	1.42	398.23	159.56	0.24	
HEC_R1B	Br-2	1000	100YR	ARI	552	273	278.45	278.55	0.00074	1.39	406.91	162.56	0.24	
HEC_R1B	Br-2	900	100YR	ARI	552	272	278.27	278.44	0.0013	1.86	316.03	177.67	0.31	
HEC_R1B	Br-2	800	100YR	ARI	552	272	278.17	278.32	0.00103	1.77	366.23	202.41	0.28	
HEC_R1B	Br-2	700	100YR	ARI	552	271	278.01	278.2	0.001279	2.01	341.54	247.94	0.32	
HEC_R1B	Br-2	600	100YR	ARI	552	271	277.84	278.06	0.001453	2.17	311.81	212.16	0.34	
HEC_R1B	Br-2	500	100YR	ARI	552	272	277.65	277.9	0.001716	2.27	290.46	237.05	0.36	
HEC_R1B	Br-2	400	100YR	ARI	552	271	277.49	277.73	0.001678	2.23	297.01	242.39	0.36	
HEC_R1B	Br-2	300	100YR	ARI	552	270	277.4	277.57	0.001131	1.86	355.95	301.72	0.3	
HEC_R1B	Br-2	200	100YR	ARI	552	270	277.07	275.04	0.002454	2.53	235.46	328.04	0.43	
HEC_R1B	Br-2	100	100YR	ARI	552	270	277.06	277.2	0.00096	1.75	413.28	382.33	0.27	
HEC_R1B	Br-2	80.867	100YR	ARI	552	270	277.02	277.18	0.001052	1.81	385.86	407.3	0.29	
HEC_R1B	Br-2	0	100YR	ARI	552	270	276.91	277.07	0.001776	1.82	374.78	299.85	0.35	

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