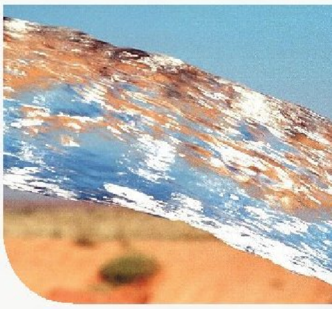

MULGA ROCK URANIUM PROJECT

SURFACE WATER ASSESSMENT AND MANAGEMENT PLAN

REPORT FOR VIMY RESOURCES

OCTOBER 2015

Rockwater
HYDROGEOLOGICAL AND ENVIRONMENTAL CONSULTANTS

Report No. 345-0-1/15/01c

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REVISION	AUTHOR	REVIEW	ISSUED
Rev 1	J Goh	P Wharton	6/7/15
Rev 1b	P Wharton		25/8/15
Rev 1c	M Taylor		29/10/15

1 INTRODUCTION

Vimy Resources Ltd (Vimy) has commissioned Rockwater Pty Ltd to carry out a surface water investigation, including a preliminary concept surface water management analysis and design, and prepare a report covering the proposed Mulga Rocks Uranium Project deposits. This report is written to include sufficient detail for Mining Approval requirements.

1.1 SCOPE AND DELIVERABLES

The scope and deliverables of this report include the following:

- Identification of catchment areas and lake systems likely to impact the planned pits, including identification of flow paths from each catchment with the potential to impact the pits.
- Hydrological analysis of the catchment areas in order to estimate peak run-off for rainfall events of between 1-in-2 and 1-in-100 years average recurrence intervals (ARI), and the extreme Probable Maximum Precipitation (PMP) events.
- Examination of historical rainfall records from nearby stations in order to assess the maximum total rainfall and ARIs.
- Preparation of Intensity Frequency Duration (IFD) Rainfall curves using the polynomials as recommended by the Australian Rainfall & Run-off (AR&R) publication (1987).
- Estimation of water depths following various rainfall events in each catchment and total losses due to evaporation and infiltration, and assessment of the impact on the planned pits, if any.
- Carry out relevant surface water hydraulic analysis in order to assess extent, depth and velocity of natural flow paths that might impact the pits and infrastructure.
- If warranted, preliminary design of conceptual flood protection levees around the perimeters of pits.
- Make recommendations for the design of appropriate flood protection which will be implemented at the detail design stage.

1.2 INFORMATION PROVIDED BY VIMY

The following information was provided by Vimy:

- A large-scale plan showing the relative locations of the Mulga Rock Uranium Project deposits and infrastructure, and adjoining catchment areas and lake systems.
- 1.0 m contour interval LIDAR data superimposed on a proposed layout plan of pits, internal road network and waste dumps.

- Recorded daily rainfall figures from the three project climate stations from 2009 to 2014.
- The July 2009 Landloch report on the potential impact of surface water run-off on a waste dump landform for Tropicana Gold Joint Project.
- The June 2009 GHD report on the Surface Water Assessment for Tropicana Joint Venture.
- Satellite imagery showing locations of ponded water in the area on 7 March 2011 following a major rainfall event.

2 SURFACE CATCHMENT HYDROLOGY

Only Catchment A (Figure 1) has been demarcated and assessed to potentially impact the Mulga Rock Uranium Project (MRUP) mine pits. This catchment comprises largely flat land with porous soil and has no defined stream channels to cumulatively collect run-off discharge it at a single point. Instead, the catchment generally slopes from an average elevation of about 400m AHD on the northern watershed to an elevation of about 350m AHD in the south as it approaches the MRUP deposits.

During a major rainfall event, it is probable that run-off would take the form of wide sheet flow in a southerly direction. Infiltration will commence with the rainfall event, and recorded evidence suggests that significant evaporation will start only about three days after the rainfall stops. By the time the peak flow reaches the undulating areas where the planned pits and infrastructure are to be located, it is most likely that much of the flow will have been lost through infiltration. This is supported by actual observations. Following the February 2011 rainfall event when approximately 250 mm of rain fell over a period of eight days including 160 mm over a 72-hour period, the satellite imagery taken on 7 March 2011 did not show any ponded water in low-lying areas in the vicinity of the proposed pits and overburden landforms. Ponded water can only be seen in a few isolated clay-pans (Appendix A).

Vimy geologists report that no perched water has been intersected during drilling at Mulga Rock. This indicates that water infiltrating after major rainfall events can move readily down to the water table. The thin cryptogam (biological soil crust) which occurs extensively in dunal areas (SWC, 2015) could form a minor impediment to infiltration.

Faulting of sediments has continued into the Holocene – fault zones (if permeable) might provide preferred pathways for water to infiltrate.

Large fires such as the one in November 2014 that burnt 80% of the Mulga Rock project area will reduce evapotranspiration losses in the short term, but are unlikely to have a significant impact on runoff characteristics.

An examination of the LIDAR contour information suggests that any residual discharge from Catchment A, if not completely lost through infiltration, will probably flow through 14 entry points (marked A1 to A14 in Figure 2) and then through a series of low-lying depressions that progressively overflow and spill from one to the next until infiltration causes the flow to cease. Consequently, it is unlikely that any flow will reach mining areas even for the Probable Maximum Precipitation event when a total rainfall of about 270 mm rainfall could occur over a period of 72 hours.

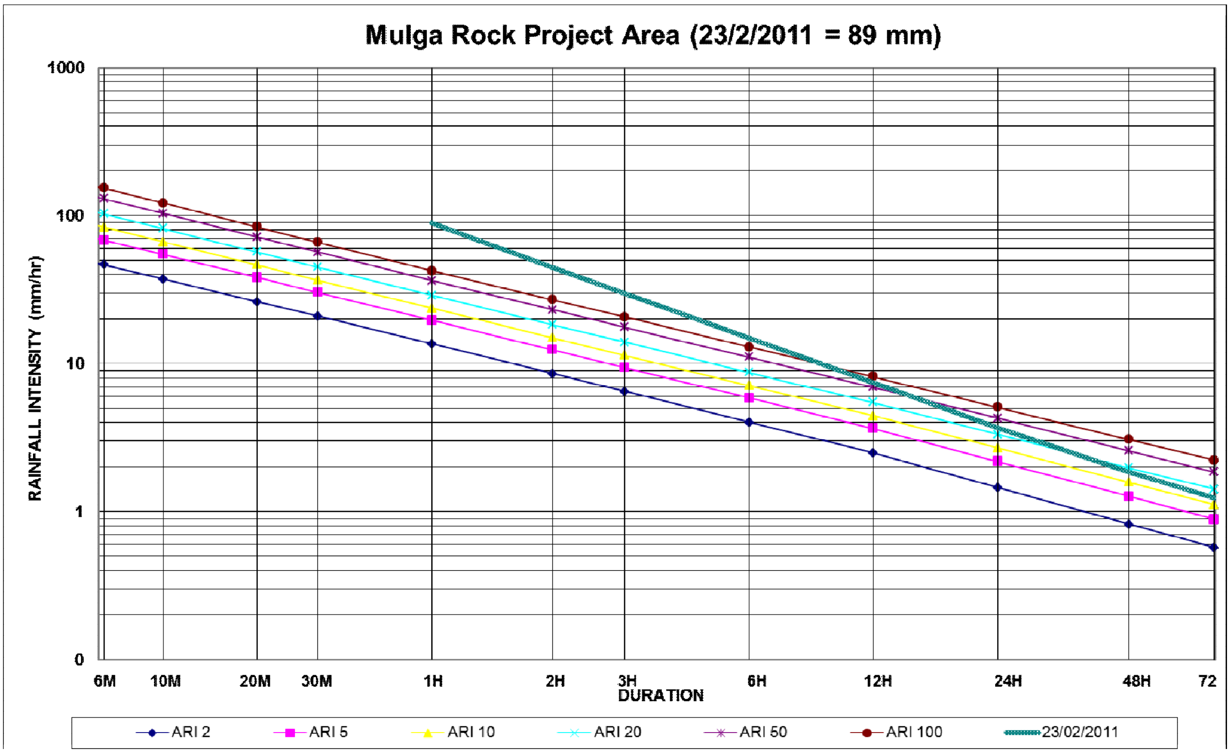
Although flows are unlikely to occur, a comprehensive hydrological analysis has been conducted for Catchment A using the Rational method for the Arid Zone of W.A. as described in the AR&R (1987) publication.

As well as the main Catchment A, 12 local catchments were identified to likely contribute discharge at the mine pits and infrastructure (Figures 3 to 5). These local catchments are all independent of Catchment A. The catchment areas were identified and demarcated from aerial photography and the 1.0 m and 5.0 m contour plans provided by Vimy. This information was used in the peak flow analyses given in Appendix B.

2.1 RAINFALL ANALYSIS

The IFD curves for the Mulga Rock area were prepared using the set of polynomials recommended by AR&R (1987). The IFD tables and curves are included in Appendix B. Text-Figure 1 below shows the IFD plot for the Mulga Rock area and the highest 24-hour recorded rainfall in February 2011.

Text-Figure 1: IFD of Mulga Rock Uranium Project Area and February 2011 Rainfall Event



The Probable Maximum Precipitation (ARI of 1-in-2000 years) for the area has also been computed using the CRC_FORGE method and the results are given in Table 1 below.

Table 1: Total Rainfall including Probable Maximum Precipitation (PMP)

	ARI / Total Rainfall (mm)									
Duration (Hours)	**2**	**5**	**10**	**20**	**50**	**100**	**200**	**500**	**1000**	**2000**
24	34.93	52.32	64.50	80.19	102.94	121.94	138.65	162.00	180.72	200.15
48	39.53	60.60	75.66	95.05	123.50	147.52	168.17	197.47	221.09	245.70
72	41.10	63.95	80.49	101.81	133.33	160.10	182.74	215.19	241.35	268.64

The IFD information is required to estimate the peak flows of Catchment A, and the 12 local catchments within the mine site area.

The data in Table 1 can be compared with actual 72-hour rainfalls measured at various stations in February 2011 (Table 2), and January 2014 (Leonora). These indicate that the 2011 rainfall was of a 20- to 100-year ARI.

Table 2: 72-Hours Rainfall at Mulga Rock Gauges, and Laverton and Leonora

Date	**Airstrip 904**	**Date**	**Emperor 908**	**Date**	**Shogun 907**	**Date**	**Laverton Aero 12305**	**Date**	**Leonora Aero 12046**
22/02/2011	18.5	22/02/2011	33.4	22/02/2011	26.6	16/02/2011	20.2	22/01/2014	33.2
23/02/2011	55.9	23/02/2011	89	23/02/2011	85.8	17/02/2011	110.2	23/01/2014	117.8
24/02/2011	21.1	24/02/2011	34.6	24/02/2011	36.8	18/02/2011	40.6	24/01/2014	0.2
Total (mm)	**95.5**	**Total (mm)**	**157**	**Total (mm)**	**149.2**	**Total (mm)**	**171**	**Total (mm)**	**148**

2.1.1 Impact of Climate Change

The Trend Maps for rainfall given in the Bureau of Meteorology website under Climate Change and Variability indicate that total annual rainfall at Mulga Rock has increased by about 20 mm every 10 years from 1970 to 2014. This can be seen in interpolated annual rainfall data for Mulga Rock (Fig. 6) obtained from the SILO climate database and Data Drill, hosted by the Queensland Government Department of Science, Information Technology and Innovation. There have been higher than average rainfalls in most years since 1990 and the 10-year moving average has been up to 62 mm above the long-term annual average rainfall.

These increases in rainfall have been incorporated in this assessment. Any additional increase of, say, 40 mm over the period of mining at Mulga Rock will have negligible impact on the findings of this report.

2.2 TIME OF CONCENTRATION

The time of concentration is required to estimate the critical storm duration for peak flow in each catchment. This was estimated using Equation 1, which is the most conservative method of those recommended by AR&R (1987):

$$t_c = 0.76 \cdot A^{0.38}$$ **Equation 1**

Where:

t_c is the time of concentration (hours)

A is the catchment area (km^2)

2.3 RATIONAL METHOD

The first technique used in peak-flow estimation was the statistical Rational Method as presented in Equation 2.

$$Q_y = 0.278 \cdot C_y \cdot I_{tcy} \cdot A$$ **Equation 2**

Where:

Q_y is the peak flow for return period *y* years (m^3/s)

0.278 is a dimensionless metric conversion factor

C_y is the runoff coefficient for *y* years (dimensionless)

I_{tcy} is rainfall intensity (mm/hr)

A is catchment area (km^2)

2.4 HYDROLOGY RESULTS FOR CATCHMENT A

As discussed above, the peak flows calculated for Catchment A for the various ARI cannot be applied directly in this assessment. Instead, simplistically, the peak flows have been apportioned to flow in the 14 entry points numbered E1 to E14 as shown in Figure 2.

The catchment characteristics and results for Catchment A are presented in Tables 3 and 4. The calculated peak flows discharging into each of the 14 entry points, given in Table 4, do not include the large infiltration losses that will occur and limit any flows.

Table 3: Characteristics of Catchment A

Catchment	A (km^2)	L (km)
A	551	20

Notes: A = area of catchment
L = length of catchment

The design peak discharge, including the Probable Maximum Flood (PMF) is presented in Table 4.

Table 4: Peak Discharge of Catchment A including Probable Maximum Flood (PMF)

	ARI (Years)									
Discharge (m^3/s)	**2**	**5**	**10**	**20**	**50**	**100**	**200**	**500**	**1000**	**2000**
Q	16	49	86	135	216	299	342	459	692	1161
Q/14	1.14	3.5	6.14	9.64	15.43	21.36	24.43	32.79	49.43	82.93

From the recorded and computed results of total rainfall for durations of up to 72 hours, when compared to measured infiltration losses, it is postulated that in all probability most of the precipitation will be lost through infiltration, even if the 1-in-2000 year ARI (PMP) rainfall event. Therefore, the peak discharges computed using the rational method (Table 4) are unrealistically overestimated for the porous soil at Mulga Rock. In reality, there will be very little surface runoff except during an immediately following a major rainfall event.

The July 2009 Landloch report for the Tropicana Gold Project, (Page 10 Table 4) indicated measured infiltration rates ranging from 44mm/hr to 171 mm/hr. Also, the June 2009 GHD report (Section 2.4.2, Page 16, Table 3) indicates infiltration rates of about 150 to 530 mm/hr for sandy soil and about 40mm/hr for the clay-pan area. The soils at Mulga Rock are expected to have similar infiltration rates to those at Tropicana. Based on this information it is probable that following a rainfall event, most of the precipitation will be infiltrated within 48 hours and any residual flows reaching the 14 entry locations identified, will be very small.

Consequently, no major flood mitigation measures are warranted to protect mine pits and infrastructure. Nevertheless, this report presents hydraulic analyses for theoretical 1-in-100 year ARI peak flows and flood risk for the project areas for a worst (unrealistic) case.

2.5 HYDROLOGY RESULTS FOR LOCAL CATCHMENTS

Local catchments in the project area have been identified in order to assess the potential impact on the mine pits and infrastructure. These have been identified as catchments ED1 to ED3 at the Emperor deposit; catchments SD1 to SD3 at the Shogun deposit; and catchments AWD1 to AWD5 at the Ambassador West deposit. No local catchments were identified that could impact the Ambassador East deposit (Note, Ambassador West and Ambassador East pits were proposed as part of the initial MRUP however they are now combined into one Ambassador pit in the current MRUP). The catchments are shown in Figures 3 to 5, and the catchment characteristics and hydrological results are presented in Tables 5 and 6.

Table 5: Characteristics of Local Catchments

Catchment	A (km^2)	L (km)
ED1	1.2	2.0
ED2	3.63	1.86
ED3	1.99	2.5
SD1	1.72	1.93
SD2	1.53	0.85
SD3	3.44	2.0
AWD1	2.66	2.5
AWD2	1.85	2.03
AWD3	0.97	1.48
AWD4	0.40	0.82
AWD5	0.34	0.80
AWD6	0.64	0.66

Notes: A = area of catchment
L = length of catchment

Table 6: Peak Discharge of local catchments including Probable Maximum Flood (PMF)

	ARI (Years)									
Discharge (m3/s)	**2**	**5**	**10**	**20**	**50**	**100**	**200**	**500**	**1000**	**2000**
ED1	0.52	1.56	2.68	4.19	6.67	9.20	10.51	14.11	21.27	35.69
ED2	1.09	3.22	5.55	8.67	13.80	19.02	21.74	29.18	43.99	73.81
ED3	0.61	1.81	3.12	4.87	7.74	10.67	12.19	16.36	24.67	41.39
SD1	0.61	1.81	3.11	4.87	7.74	10.66	12.19	16.36	24.66	41.38
SD2	0.79	2.33	4.02	6.29	10.01	13.79	15.76	21.15	31.88	53.49
SD3	1.01	3.00	5.17	8.08	12.86	17.72	20.25	27.18	40.98	68.75
AWD1	0.76	2.25	3.88	6.06	9.64	13.29	15.18	20.38	30.72	51.55
AWD2	0.63	1.87	3.22	5.03	8.00	11.03	12.60	16.91	25.50	42.78
AWD3	0.44	1.31	2.26	3.53	5.62	7.76	8.86	11.90	17.94	30.09
AWD4	0.29	0.85	1.47	2.30	3.68	5.07	5.80	7.78	11.74	19.69
AWD5	0.25	0.76	1.31	2.05	3.28	4.53	5.18	6.95	10.47	17.57
AWD6	0.45	1.34	2.31	3.61	5.76	7.95	9.09	12.20	18.39	30.85

3 SURFACE CATCHMENT RUNOFF HYDRAULICS

3.1 MANNING'S AND CONTINUITY EQUATIONS

Manning's equation and the continuity equation were used to identify the extents, depths and velocities of natural flows and diverted flows, in the vicinity of the pits and infrastructure. Based on this information, the size, shape and configuration of a proposed system of perimeter levees and drains around the pit and at each infrastructure site could be determined.

Manning's equation (Equation 4) was used to estimate flow velocity V (m/s):

$$V = \frac{1}{n} \cdot \left(\frac{A}{P} \right)^{2/3} \cdot (S)^{1/2}$$

Equation 4

Where:

n is a dimensionless roughness coefficient
A is the wetted waterway area (m^2)
P is the wetted perimeter (m)
S is the hydraulic gradient (m/m)

The continuity equation (Equation 5) was used to estimate flow Q (m^3/s):

$$Q = A \cdot V$$

Equation 5

Where:

A is the waterway area in (m^2)
V is the velocity (m/s)

The results of the hydraulic calculations for each cross-section are given in Appendix C.

4 IDENTIFICATION OF NATURAL FLOW PATHS LIKELY TO IMPACT THE PROJECT AREA

The approximate locations where residual water from Catchment A could flow into the mining areas and impact on the pits and overburden landforms have been identified and named as A1 to A14 (Figure 2). These locations were selected where definable channels could be identified from the contour plans. As discussed, the total 1-in-100 year ARI peak flows for Catchment A were simplistically divided into 14 equal portions to obtain a value of 15.43 m^3/s for each entry location. This value was used in the hydraulic analysis.

Whether or not flood waters from these inlets could impact on the mine pits and infrastructure depends on their location and profile of the flow paths. The potential impact of each flow-path is discussed below.

- A1 to A8 flow towards the Emperor deposit and infrastructure, and so could potentially impact them;
- A9 to A10 flows are unlikely to impact the Shogun deposit and infrastructure. There is a depression at 324.00 m AHD approximately 1.0 km upstream of the deposit where the flow from A9 will pond over an area of 1.0 km^2 and infiltrate. The flow from A10 will also not affect the Shogun deposit as it is about 1.5 km to the east and flowing in a southerly direction to a low area with an elevation of about 323.00 m AHD.

- Flows from A11 to A14 will not impact the Ambassador East or Ambassador West deposits and infrastructure. They will all terminate in depressions located 1.0 to 2.0 km from the pits and infrastructure (Ambassador West and Ambassador East pits were proposed as part of the initial MRUP however they are now combined into one Ambassador pit in the current MRUP).

Overall, there are many low-lying inter-dunal areas within the project area that provide a large storage capacity for surface water to pond and infiltrate. Some small local catchments that could collect enough surface water to potentially impact the mine pits and infrastructure, if no infiltration occurred. These catchments are as follows:

- The main area of the Emperor deposit receives water from Catchment A. Local catchment ED1 is up-gradient of a small south-western part of the deposit, and Catchments ED2 and ED3 direct water towards a small eastern part (Figure 3). Near this deposit there are many depressions that could receive water from either the local catchments or from Catchment A. Much of the deposit is located in a generally low area, with the lowest point being at 313.0 m AHD. The flow from Catchment A and local Catchments ED2 and ED3 could flow towards that low point. Flow towards the western part of the main deposit continues to a depression at 308.0 m AHD to the south-east. Local Catchment ED1 was identified to have impact on a small western part of the Emperor deposit where flows would terminate in a depression at 316 m AHD on the margin of the deposit.
- Three local catchments (Catchments SD1 to SD3) could impact on the Shogun deposit (Fig. 4). Catchment SD1 has a natural flow path through the deposit and a proposed overburden landform and continues to a depression at 311 m AHD west of the deposit. Catchments SD2 and SD3 have flows towards low areas located within the southern and northern ends of the deposit, respectively.
- Seven local catchments (Catchments AWD1 to AWD7) could also impact on the planned pits and infrastructure at the Ambassador West deposit (Fig. 5). The natural flow paths of Catchments AWD1 and AWD2 are through the southern part of the deposit and end at two separate depressions. Catchments AWD3 and AWD6 have flows towards the centre of Ambassador West deposit.
- No local catchments were identified that would have an impact on the Ambassador East deposit.

Note that the Ambassador West and Ambassador East pits were proposed as part of the initial MRUP however they are now combined into one Ambassador pit in the current MRUP.

The natural flow paths of Catchment A are represented on the mine layout plans (Figures 2 to 5) as complete blue lines with the arrow heads at the lowest points of the depressions where the flows will pond. Similarly, the dashed blue lines represent the natural flow paths of the local catchments. The turquoise dashed lines represent the proposed diverted flow paths that are presented in Figures 3 to 5.

5 HYDRAULIC ANALYSIS FOR EMPEROR DEPOSIT

Hydraulic analysis was conducted on drainage lines A1 to A8 in Catchment A (Fig. 2) for the 1-in-100 year peak flow of 15.43 m^3/s, and assuming the worst (and unrealistic case) of no infiltration loss. The analysis also includes flows in the three local catchments (ED1 to ED3). Twelve cross sections were selected up-gradient of the Emperor deposit to represent the flow regime (Fig. 3). The hydraulic results are summarised in Tables 7 and 8. The cross sections with the theoretical 1-in-100 year ARI flood levels are presented as text-figures 2 to 6.

Table 7: Catchment Flows to Emperor Deposit with no Infiltration Loss

Cross Section	Contributing Catchments	100 Year ARI Flow (m^3/s)
XS1	A1	15.43
XS1A	ED1	9.20
XS2	A1	15.43
XS3	A2	15.43
XS4	A3	15.43
XS5	A4	15.43
XS6	A5 + 0.5*A6	23.15
XS7	A6	15.43
XS8	A7 + A8	30.86
XS9	A7 + A8	30.86
XS10	A7 + A8	30.86
XS11	ED2	19.02
XS11A	ED2 + ED3	29.69
XS12	A1 + A2	30.86

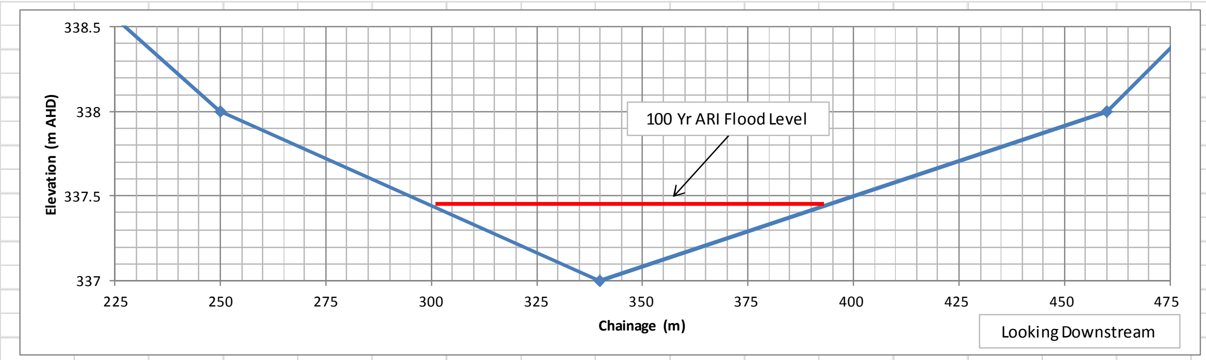
Table 8: Summary of 100-year ARI Flood Levels at Emperor Deposit Cross-Sections with no Infiltration Loss

Cross-Section	100 Year ARI Flow (m^3/s)	Flood Level Elevation (m AHD)	Maximum Depth (mm)	Maximum Velocity (m/s)	Extent of Flood Level (m)
XS1	15.43	337.44	440	0.78	90
XS1A	9.20	316.72	720	1.01	25
XS2	15.43	333.52	520	0.87	68
XS3	15.43	331.51	510	0.8	74
XS4	15.43	333.05	550	0.8	65
XS5	15.43	331.95	450	0.74	95
XS6	23.15	326.51	510	0.57	160
XS7	15.43	327.51	510	0.67	100
XS8	30.86	324.52	520	0.68	170
XS9	30.86	323.83	830	0.92	82
XS10	30.86	323.09	390	0.64	200
XS11	19.02	323.21	210	0.6	165
XS11A	29.69	318.54	640	0.81	112
XS12	30.86	320.08	1080	0.57	275

5.1 IMPACT FROM FLOW PATHS A1 TO A8

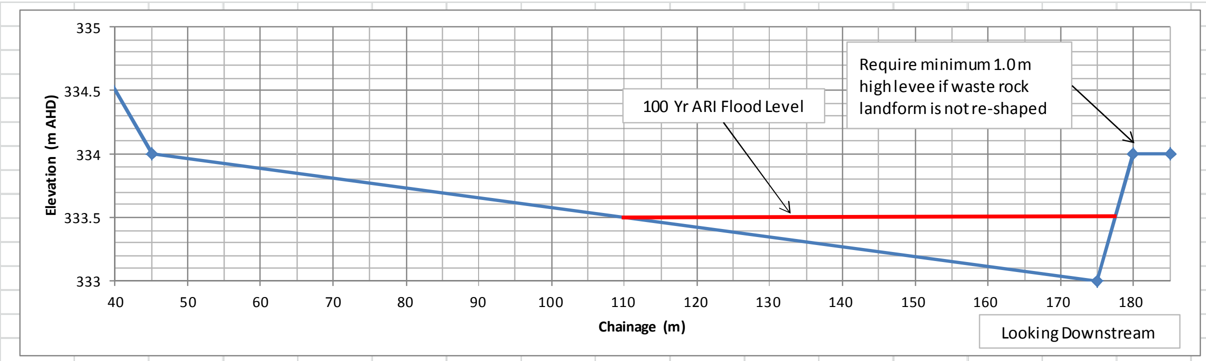
The apportioned discharge (A1) of 15.43 m^3/s from Catchment A flowing towards the south-west of the Emperor deposit would be approximately 440 mm deep and 90 m wide (Text-Fig. 2).

Text-Figure 2: Cross-section XS1



The natural path of this flow is in the south-easterly direction as it joins the flow from A2 to pond at 306.0 m AHD in a depression about 2 km south-east of the Emperor deposit (Figure 3). The layout plan shows a proposed overburden landform in the flow path of A1. If this landform is built the flow will be redirected to the north of the landform. The depth of the redirected flow would be approximately 520 mm and with a width of 68 m (Text-Fig.3).

Text-Figure 3: Cross-section XS2



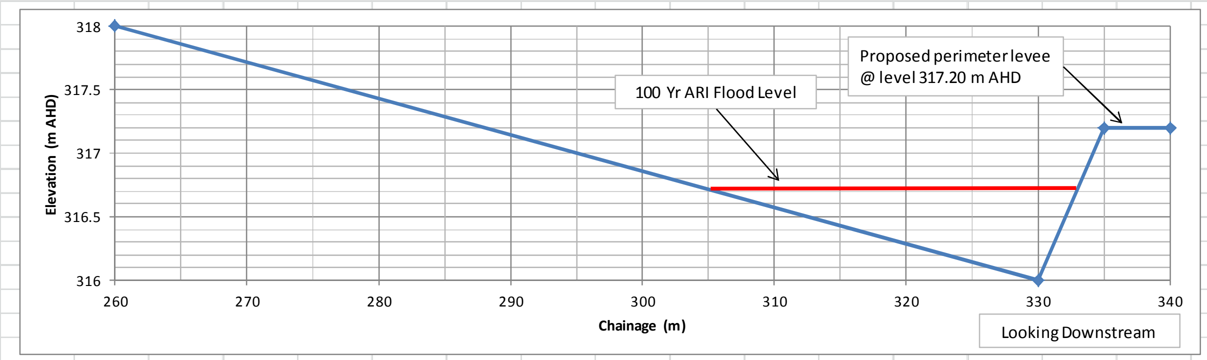
The theoretical flow depths and widths in the other flow paths are given in Table 8. As stated in Section 2 above, actual flows will be small or negligible because of infiltration losses. It is recommended that a continuous system of drains and nominal levees be constructed along the western, northern and southern sides of the deposit and pits to divert any flows, and to promote the infiltration of run-off.

5.2 IMPACT FROM LOCAL CATCHMENT ED1

The local Catchment ED1 of the small, south-western part of the Emperor deposit would have a 1-in-100 year ARI peak flow of 9.20 m^3/s without infiltration. This would discharge at the north-western edge of the small deposit where there is a depression at a level of 316 m AHD.

At location XS1A the depth of flow would be 720 mm with a width of 25 m for the peak flow (Text-Fig.4).

Text-Figure 4: Cross-section XS1A



Similar to the previous recommendation, only a nominal levee is recommended to wrap around the western, northern and north-eastern perimeters of a pit in the deposit, from EDL19-EDL20-EDL21-EDL22, as shown in Figure 3.

5.3 IMPACT FROM LOCAL CATCHMENTS ED2 AND ED3

The local catchments ED2 and ED3 have flows towards a possible small pit in an eastern part of the Emperor deposit. They have theoretical 1-in-100 year ARI peak flows of 19.02 and 10.67 m^3/s, respectively. The flows, without diversion, are likely to end up in small depressions south and south-east of Emperor (Fig. 3).

At location XS11 the 1 in 100 year ARI peak discharge with no losses is 210 mm with a width of 165 m (Text-Fig.5).

At the cross-section location XS11A, the theoretical 1-in-100 year ARI peak flow is the combination of catchments ED2 and ED3 at a rate of 26.69 m^3/s with a flow depth of 640 mm, running 112 m wide (Text-Fig.6).

With infiltration loss, only minimal protection is recommended with a low levee around the small deposit/pit keyed in at both ends to the overburden landform.

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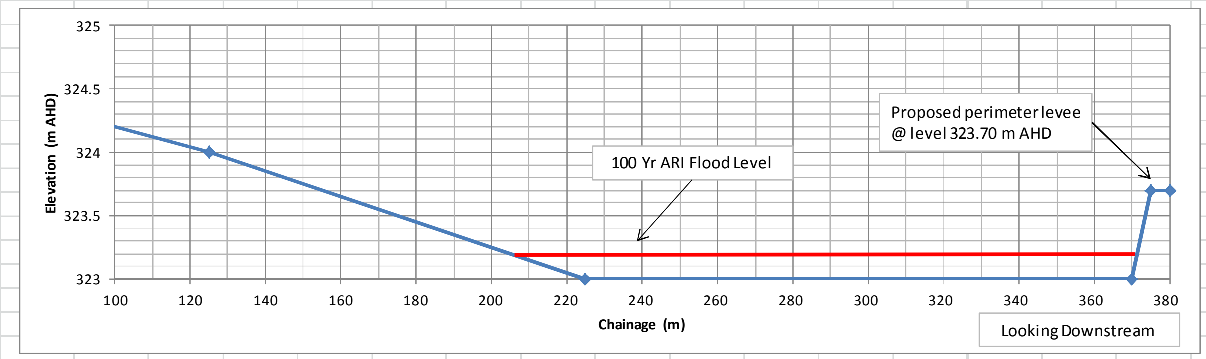
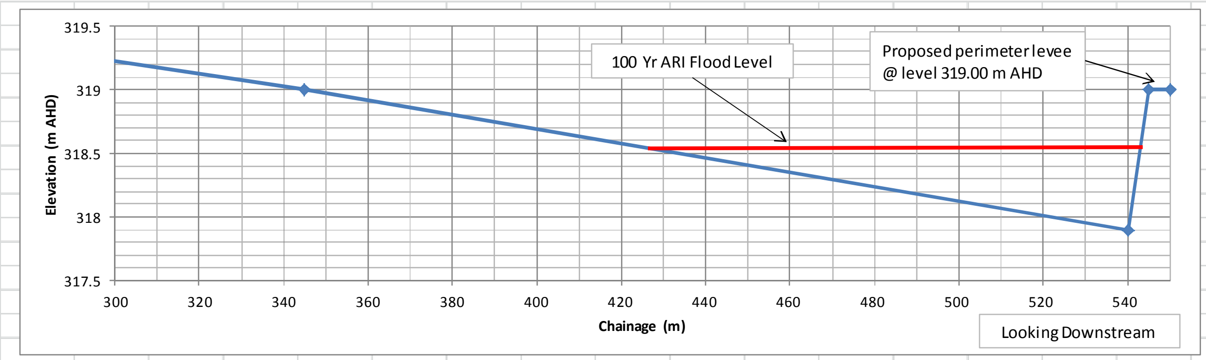
Text-Figure 5: Cross-section XS11



Text-Figure 6: Cross-Section XS11A



6 HYDRAULIC ANALYSIS FOR SHOGUN DEPOSIT

There are three local catchments with the potential to impact the Shogun deposit and infrastructure, and three cross-sections on the drainage lines from the two main catchments SD1 and SD3 (Fig. 4). The hydraulic results are summarised in Tables 9 and 10, again assuming no infiltration.

Table 9: Catchment Flow Contributions to Shogun Cross-Sections

Cross Section	Contributing Catchments	100 Year ARI Flow (m^3/s)
XS13	SD1	10.66
XS14	SD3	17.72
XS15	SD3	17.72

Table 10: Summary of 100 year ARI Flood Levels at Shogun Cross-sections

Cross-Section	100 Year ARI Flow (m^3/s)	Flood Level Elevation (m AHD)	Maximum Depth (mm)	Maximum Velocity (m/s)	Extent of Flood Level (m)
XS13	10.66	319.20	200	0.54	105
XS14	17.72	324.57	570	0.69	98
XS15	17.72	329.25	550	1.15	46

6.1 IMPACT FROM FLOW PATHS A9 AND A10

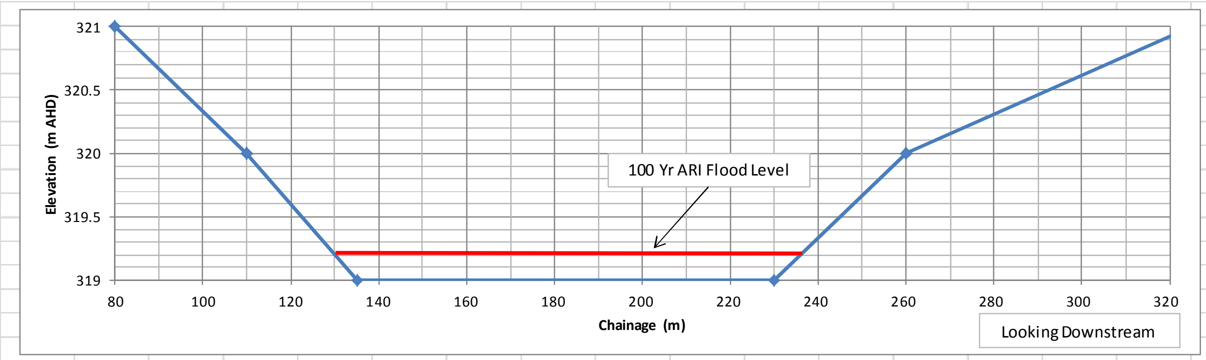
Discharge from Catchment A in flow paths A9 and A10 will not impact the Shogun deposit and infrastructure, as any water flowing in those drainage lines will discharge to depressions upstream of the deposit.

6.2 IMPACT FROM LOCAL CATCHMENT SD1

The local catchment SD1 is located immediately east of Shogun Deposit and has a theoretical 1-in-100 year ARI peak flow of 10.66 m^3/s. This discharges directly through the middle of the deposit to a depression at a level 311.00 m AHD located just west of the proposed overburden landform.

At the cross section location XS13 just upstream of the deposit the indicated depth of flow for the 1-in-100 year ARI flood is 540 mm and width 105 m (Text-Fig.7). Without diversion and if there was no infiltration loss, the flow from the catchment would discharge into a pit in the deposit.

Text-Figure 7: Cross-Section XS13



The most feasible option is probably to construct a straight levee from SDL1 to SDL4, tied in to high ground at both ends. Depending on the local contour the flow will spread sideways and infiltrate into the ground without adversely impacting on the road and the pit. At the detailed design stage the impact of redirecting the flow to the road should be considered.

6.3 IMPACT FROM LOCAL CATCHMENT SD2

The local catchment SD2 is located at the southern end of Shogun Deposit and without infiltration, would have a 1-in-100 year ARI peak flow of 13.19 m^3/s. This discharges into a depression in the southern end of the deposit at a level of 318.0 m AHD.

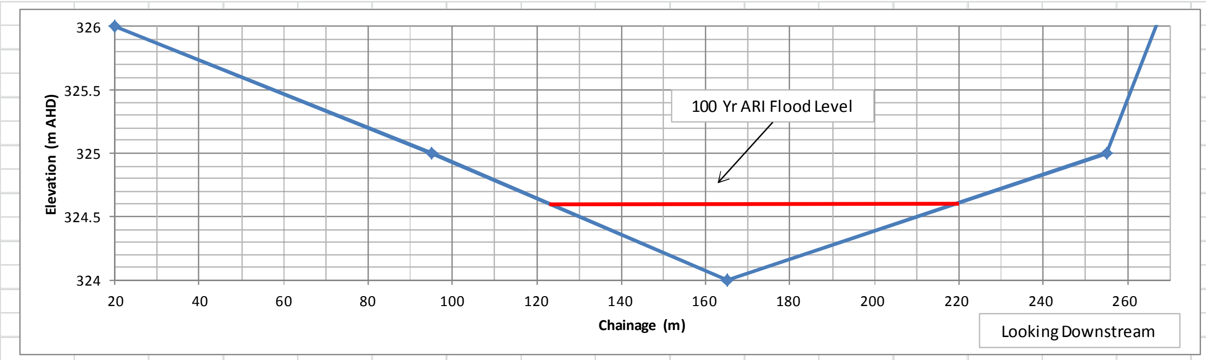
For the 1-in-100 year ARI with no losses, a levee system about 1,800 m long and up to 3.0 m high would be needed to dam the water and allow it to spread and infiltrate. With infiltration losses only a nominal levee (safety bund) will be required over a short distance that can be tied into higher ground at each end.

6.4 IMPACT FROM LOCAL CATCHMENT SD3

The local catchment SD3 is located north of the Shogun deposit and has a theoretical 1-in-100 year ARI peak flow of 17.72 m^3/s. This flows to the northern end of the deposit and then to a depression at a level of 316.0 m AHD, west of the northern end of the deposit.

At the cross section location XS14, parallel to the perimeter of the deposit the 1-in-100 year ARI flow depth is 640 mm with a width of 98 m (Text-Fig.8). A diversion will be needed to divert the flow around a pit in the deposit.

Text-Figure 8: Cross-Section XS14



In theory this would require the construction of a high levee to dam the flow and allow it to pond and infiltrate. The levee would be 550 m long from SDL13 to SDL19 and up to 4 m high. However, with infiltration the 1-in-100 year peak flow will be much smaller, and so only a nominal levee system is probably warranted to retain any residual flows. This levee requirement is to be included at the detailed design stage.

7 HYDRAULIC ANALYSIS FOR AMBASSADOR WEST DEPOSIT

Four local catchments, AWD1 to 3 and AWD7 have the potential to impact pits in the Ambassador West deposit (Fig. 5). Five cross sections were identified and analysed in order to assess the flood impact from local catchments on the deposit – the locations are shown in Figure 5. The hydraulic results are summarised in Tables 11 and 12, assuming there is no infiltration. More rigorous assessment taking infiltration losses into consideration will be needed in the design stage.

Note, Ambassador West and Ambassador East pits were proposed as part of the initial MRUP however they are now combined into one Ambassador pit in the current MRUP. Additional project design considerations will be necessary to accommodate predicted surface water flows surrounding the Ambassador pit.

Table 11: Catchment Flows to Ambassador West Cross-Sections

Cross Section	Contributing Catchments	100 Year ARI Flow (m^3/s)
XS16	AWDD2	11.03
XS17	0.5*AWD3	3.88
XS18	AWD3	7.76
XS19	AWD5	4.53
XS20	AWD1	13.29

Table 12: Summary of 100-year ARI Flood Levels at Ambassador West Cross-sections

Cross-Section	100 Year ARI Flow (m^3/s)	Flood Level Elevation (m AHD)	Maximum Depth (mm)	Maximum Velocity (m/s)	Extent of Flood Level (m)
XS16	11.03	335.14	200	0.54	105
XS17	3.88	337.29	640	0.75	105
XS18	7.76	331.06	630	1.28	47
XS19	4.53	337.75	200	0.54	105
XS20	13.29	328.19	290	0.48	123

7.1 IMPACT FROM FLOW PATHS A11 TO A13

Flow paths A11 to A13 from Catchment A will not impact the Ambassador West deposit and infrastructure. These flows will enter the area along poorly defined drainage lines and will pond in depressions located 1.0 km to 2.0 km up-stream of the deposit and infrastructure (Fig. 5).

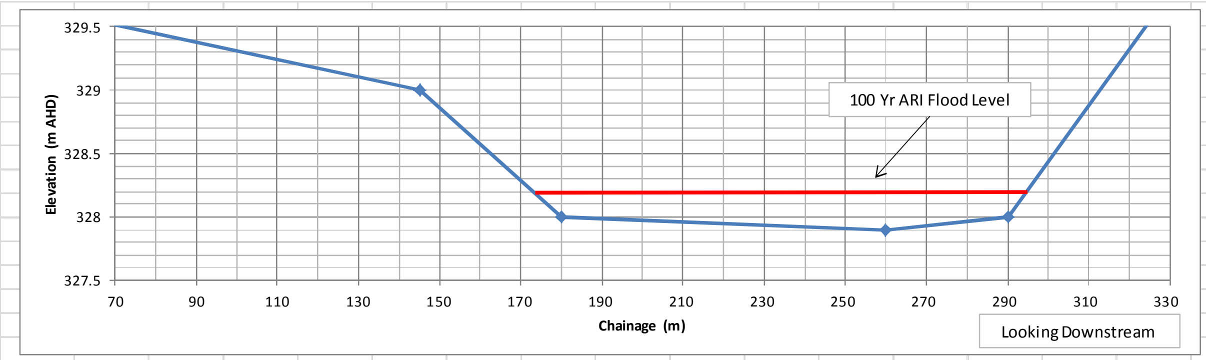
The ponded water is expected to dry up quickly through infiltration and evaporation.

7.2 IMPACT FROM LOCAL CATCHMENT AWD1

The local Catchment AWD1 is located near the south-western perimeter of Ambassador West deposit and has a calculated 1-in-100 year ARI peak flow of 13.29 m^3/s. The natural flow path of this discharge is through the southern end of the deposit to pond in a depression with a level of 321.0 m AHD. Any excess water would flow to a larger depression to the south-east at an elevation of 318 m AHD.

At cross-section XS20 upstream of the deposit, the flow for the 1-in-100 year ARI flood is up to 0.29 m deep and 123 m wide (Text-Fig.9). Bunding will be needed to prevent flow into pits in the deposit.

Text-Figure 9: Cross-section XS20



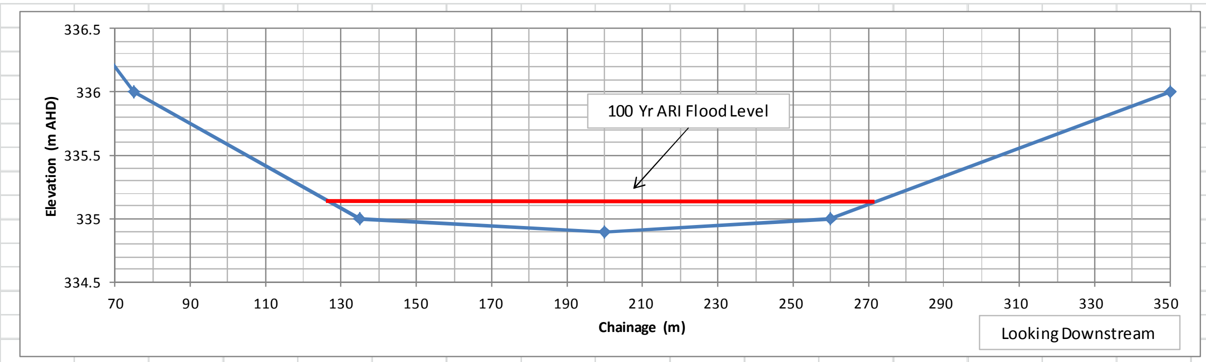
A low levee acting as a dam is proposed from points AWDL1 to AWDL3 as shown in Figure 5. The height of this levee should be finalised during the detailed design stage.

7.3 IMPACT FROM LOCAL CATCHMENT AWD2

The local Catchment AWD2 is west of Ambassador West Deposit and has a calculated 1-in-100 year ARI peak flow of 11.03 m^3/s. The natural flow path in the catchment is to the south-east through a proposed overburden landform and then through the deposit before ponding in a depression at a level of 318.00 m AHD (Fig. 5).

At cross section XS16 upstream of the deposit the 1-in-100 year ARI flow is up to 0.24 m deep and 143 m wide (Text-Fig.10). It is likely to flow against the toe of the overburden landform and follow the topography to join up with the drainage from catchment AWD1.

Text-Figure 10: Cross-section XS16



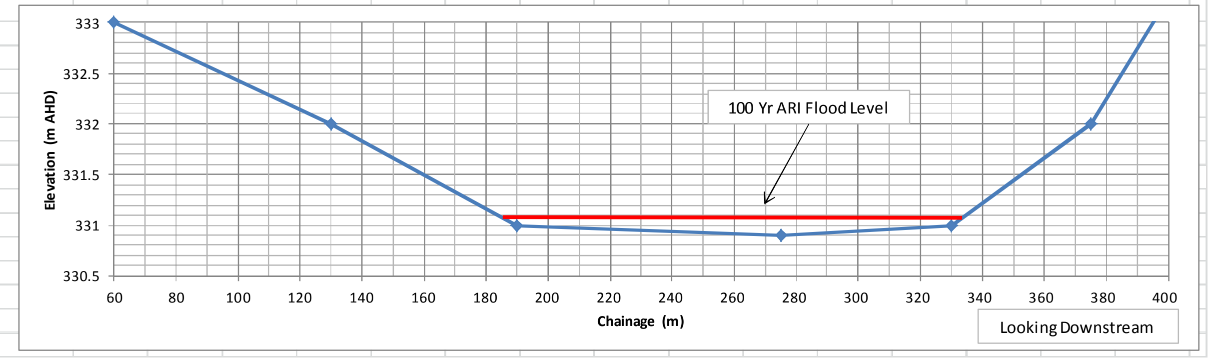
The nominal levee proposed to retain and infiltrate any flows from catchment AWD1 would also be used for the flows from this catchment.

7.4 IMPACT FROM LOCAL CATCHMENT AWD3

The local Catchment AWD3 is located on the north-western side of the Ambassador West deposit and has a calculated 1-in-100 year ARI peak flow of 7.76 m^3/s. The natural flow path from the catchment is to a depression in the middle of the deposit at a level of 328.0 m AHD (Ambassador West and Ambassador East pits were proposed as part of the initial MRUP however they are now combined into one Ambassador pit in the current MRUP).

At the cross section XS18, upstream of the pit perimeter, the 1-in-100 year ARI flow is up to 0.16 m deep and 150 m wide (Text-Fig.11). As with flows in the other catchments, the flow will probably be greatly reduced through infiltration before it reaches the deposit. However, a nominal levee acting as a dam is proposed from points AWDL8 to AWDL10, as shown in Figure 5.

Text-Figure 11: Cross-Section XS18



7.5 IMPACT FROM LOCAL CATCHMENT AWD4

The local Catchment AWD4 is located north of the Ambassador West deposit and drains in an easterly direction to the proposed above-ground Tailings Storage Facility (TSF), with a 1-in-100 year ARI peak flow of 5.07 m^3/s. The natural path of this flow is to the depression located at the eastern end of the planned TSF with a ground level of 334.0 m AHD.

Once the TSF is constructed it is expected that flows in this catchment will be diverted to the south to combine with flows from catchment AWD3.

7.6 IMPACT FROM LOCAL CATCHMENT AWD5

Catchment AWD5 is immediately north of AWD4 at the north-western corner of the planned TSF with a 1-in-100 year ARI peak flow of 4.53 m^3/s. The natural path of this flow is also to the depression at the eastern end of the TSF area.

Flows from this catchment will be retained by the wall of the TSF until the water infiltrates and evaporates.

7.7 IMPACT FROM LOCAL CATCHMENTS AWD6 AND AWD7

The local Catchments AWD6 and AWD7 are located adjacent to each other and flow towards the eastern side of the deposit and planned overburden landform, with calculated 1-in-100 year ARI peak flows of 7.95 m^3/s and 6.71 m^3/s, respectively. They discharge into two separate depressions – AWD6 to one with a level of 328 m AHD near the edge of the deposit, and AWD7 into another in a small, separate part of the deposit at a the ground level of 326 m AHD.

When the overburden landform is constructed the flow in AWD6 will be diverted south to combine with flow from catchment AWD7. A nominal levee/safety bund will be needed between the overburden landform and higher ground to the south to prevent flow into pits in the deposit.

8 HYDRAULICS OF AMBASSADOR EAST DEPOSIT

Flows from Catchment A will not impact the Ambassador East Deposit and infrastructure. The flow path (A14, Fig. 5) leads to a depression with a low point at 337.0 m AHD, and any water reaching the depression will pond and infiltrate. Even if this flow was able to break out over the 4 m ridge surrounding the depression and have enough head to flow another 1.5 km, it would pond and infiltrate in another depression at a level of 332.0 m AHD and would not reach the deposit.

There are no local catchment areas identified that could affect the Ambassador East Deposit. The contour plan shows that the deposit and infrastructure is surrounded by high ground on the southern, western and northern sides, whereas the eastern perimeter is on high ground that slopes down into a large low depression with a level of 330.0 m AHD.

There are, therefore, no flood mitigation requirements for the Ambassador East Deposit.

Ambassador West and Ambassador East pits were proposed as part of the initial MRUP however they are now combined into one Ambassador pit in the current MRUP. Additional project design considerations will be necessary to accommodate predicted surface water flows surrounding the Ambassador pit.

9 COMMENTS ON AIRSTRIP AND ROAD SYSTEM

Surface water management for the airstrip and waterway crossings within the internal road network have not been addressed in this report. Drainage at the airstrip has probably already been addressed if required. There is a need at the detailed design stage to identify the waterway crossings. Depending on the serviceability of the road network, a simple sheeted floodway system is probably all that is required. At some major crossings where more-frequent flows may have occurred, nominal drainage culverts may be warranted.

10 CONCLUDING COMMENTS AND SUMMARY

10.1 HYDROLOGY OF CATCHMENT A

The Mulga Rock Uranium Project could potentially be impacted by runoff from Catchment A and 12 local catchments located in the vicinity of the uranium deposits. Details of the catchments can be summarised as follows:

- Catchment A has a total area of approximately 550 km^2 and a simplistic main stream length of 20 km. It generally slopes to the south and water flows could enter the project area at 14 identifiable locations.
- The total peak discharge of Catchment A was computed to be approximately 16 m^3/s for the 1-in-2 year ARI, and 300 m^3/s for the 1-in-100 year ARI events.
- These flows have been simplistically divided into 14 equal portions based on the assumption that the identified channels leading towards the project area will convey the discharge without any infiltration losses. The apportioned flows used for each channel are approximately 1.1 m^3/s and 21 m^3/s for the 1-in-2 and 1-in-100 year ARI events, respectively.
- The total estimated 72-hour rainfalls for the 1-in-2 and 1-in-100 year ARI events were calculated as 41 mm and 160 mm, respectively.
- The Probable Maximum Precipitation (PMP, 1-in-2000 year ARI) for 72 hours is 268 mm.
- The measured infiltration loss rates for sandy soil in this area range from 44 mm/hr to 171 mm/hr, based on the July 2009 Landloch Report for Tropicana Gold Project.
- The June 2009 GHD Report for Tropicana Joint Venture measured infiltration rates ranging from 150 mm/hr to 530 mm/hr for the sandy soil and about 40 mm/hr for the clay-pan areas.

Based on the above information it is probable that following a major rainfall event most of the precipitation will be lost through the process of infiltration within 48 hours, and only insignificant residual flows could reach the 14 entry locations to impact the project area.

It was therefore concluded that surface water flow from Catchment A is unlikely to significantly impact the mine pits and infrastructure, and so no major flood mitigation measures are warranted to protect the mine pits and infrastructure from any catastrophic failure. This conclusion is supported by satellite imagery for 7th March 2011, after a major rainfall event from 22 to 24 February 2011. Only residual ponded water in isolated clay-pans was observable.

10.2 IMPACT FROM LOCAL CATCHMENTS

Twelve local catchments have been identified in the immediate vicinity of the uranium deposits that have the potential to impact mine pits and infrastructure.

- The largest calculated 1-in-100 year ARI peak flow from these local catchments, with no infiltration losses, is 19 m^3/s; and 74 m^3/s for the 1-in-2000 year ARI (PMP) event.
- When taking infiltration losses into consideration, using the same rationale as for Catchment A hydrology, these flows are considered to be unrealistic. However, unlike Catchment A, some small residue flows from these catchments will probably reach the pits and infrastructure areas due to close proximity. Most of the flows will be lost as they pond in a series of depressions upstream of the pits. The ponded water should completely infiltrate within 24 hours.

10.3 HYDRAULICS OF SURFACE FLOWS

Although the calculated peak flows for the catchments have been shown to be unrealistically high, hydraulic analyses have been carried out at relevant cross sections to determine the theoretical flood mitigation requirements for the 1-in-100 year ARI peak flows, ignoring the infiltration losses.

In reality, runoff flows and volumes from these catchments will be small because of high infiltration losses, and the flows can be prevented from entering the pits by construction of the usual perimeter safety bunds where there is no protection provided by overburden landforms and the proposed above-ground tailings storage facility (TSF).

10.3.1 Airstrip and Road Crossings

No significant surface water concerns have been identified at the airstrip.

Several flow paths could impact on the road system, and at some locations a simple low-level floodway and nominal drainage culvert may be required.

Dated: **29 October 2015** **Rockwater Pty Ltd**

M. Taylor

for Jerome Goh
Hydrologist/Engineer

P H Wharton

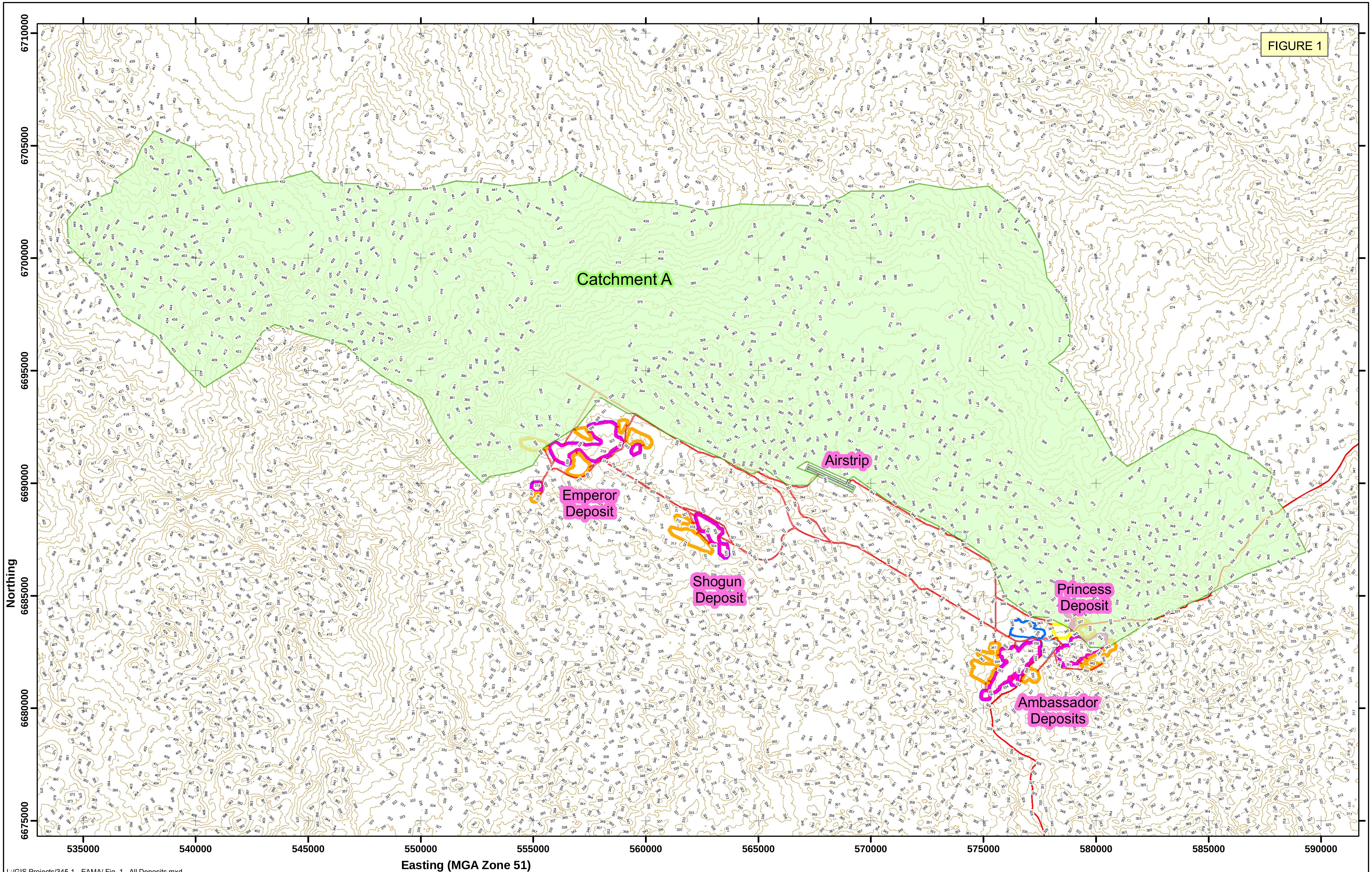
P H Wharton
Principal

REFERENCES

Australian Rainfall and Runoff (AR&R) 1987, A Guide to Flood Estimation, Volume 1. The Institution of Engineers, Australia, Canberra.

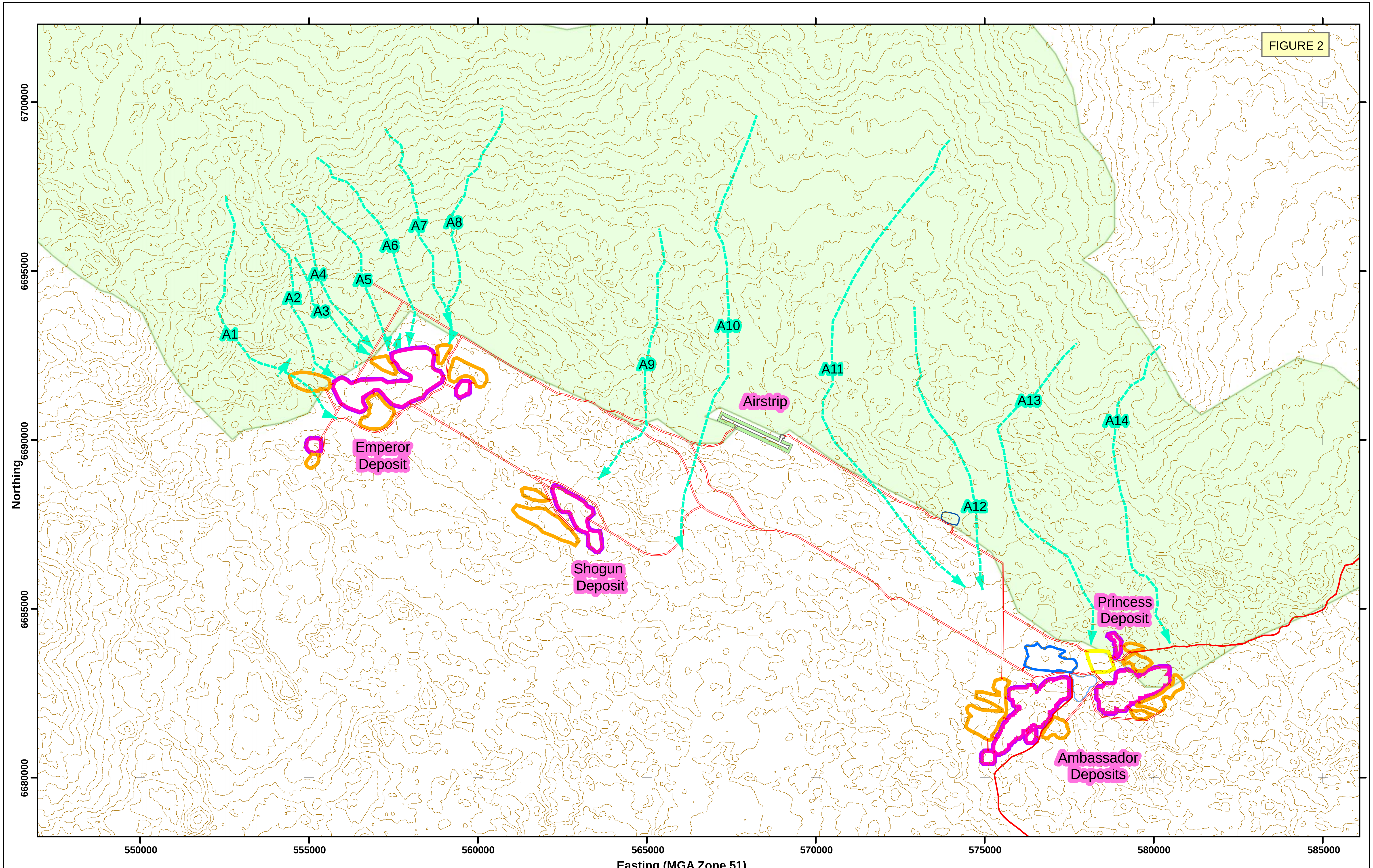
SWC (Soilwater Consultants), 2015, Terrain analysis and materials characterization for the Mulga Rock uranium project. Report to Vimy Resources.

FIGURES



L:/GIS Projects/345-1 - EAMA/ Fig. 1 - All Deposits.mxd

Client: Vimy Resources Ltd Project: Mulga Rock Project Hyrdological Study Date: June 2015 Dwg. No: 345.0.1/15/1-1	Catchment Proposed Pit Waste Rock Landform (WRL)	Road Nework Tailings Storage Facility	1:150,000	OVERALL LAYOUT PLAN AND CATCHMENT A Rockwater PROPRIETARY LIMITED



L:/GIS Projects/345-1 - EAMA/ Fig. 1 - All Deposits.mxd

Client:	Vimy Resources Ltd
Project:	Mulga Rock Project Hyrdological Study
Date:	June 2015
Dwg. No:	345.0.1/15/1-2

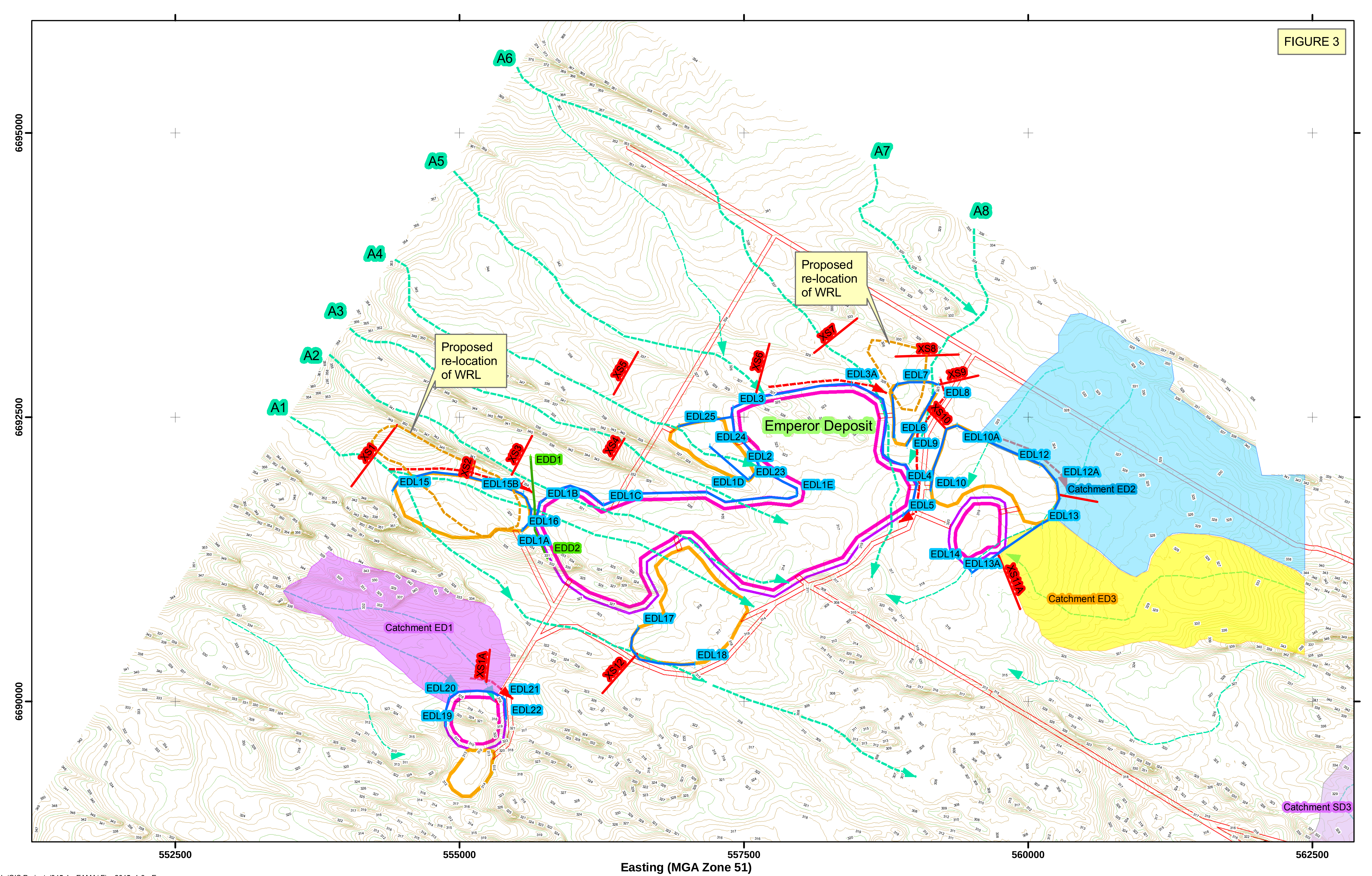
- Catchment A
- Proposed Pit
- Waste Rock Landform (WRL)
- Road Nework
- Tailings Storage Facility

N

1:100,000

DRAINAGE LINES A1 TO A14 ENTRANCE LOCATIONS

Rockwater PROPRIETARY LIMITED



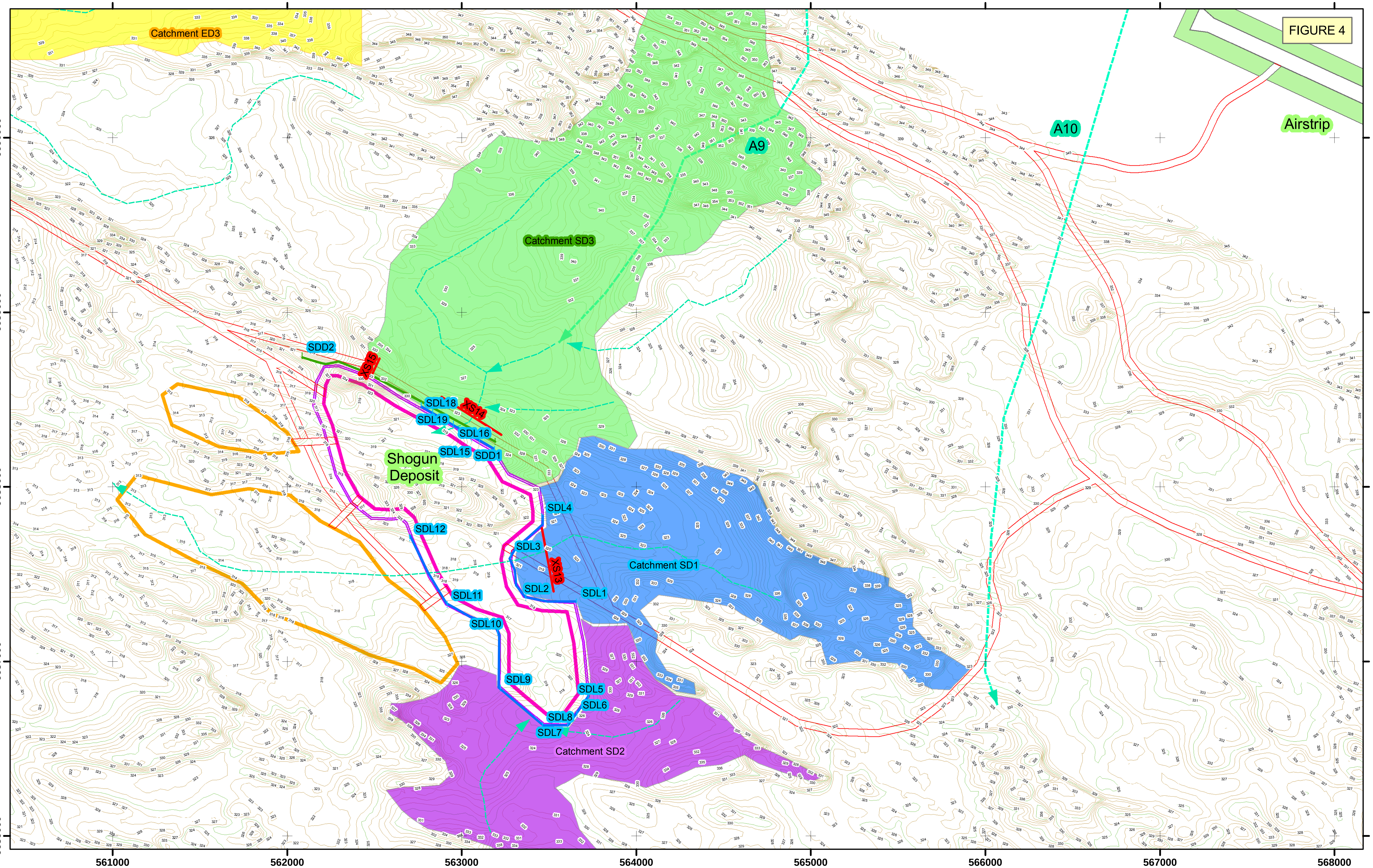
Client: Vimy Resources Ltd
Project: Mulga Rock Project Hydrological Study
Date: June 2015
Dwg. No: 345.0.1/15/1-3

Drainage Line
Proposed Pit
Waste Rock Landform (WRL)
Road Nework
Long-Section
Cross-Section
Re-location of Infrastructure
Re-Directed Flow
Proposed Drain

1:30,000

EMPEROR DEPOSIT
LIDAR CONTOURS, SECTIONS
CATCHMENT AREAS
AND FLOOD MANAGEMENT OPTIONS

Rockwater PROPRIETARY LIMITED



L:/GIS Projects/345-1 - EAMA/ Fig. 2015_1-4 - Shogun

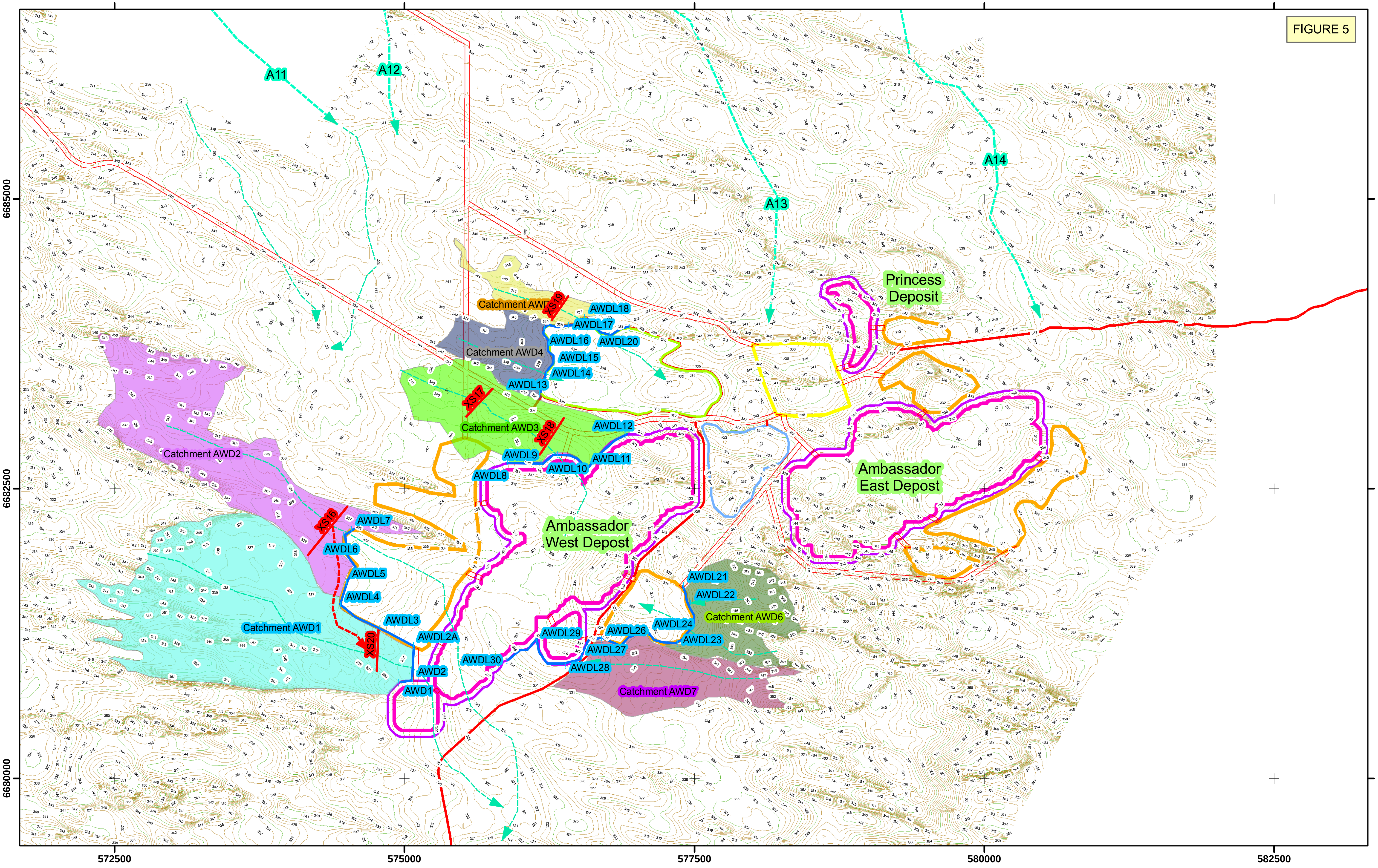
Client:	Vimy Resources Ltd
Project:	Mulga Rock Project Hyrdological Study
Date:	June 2015
Dwg. No:	345.1/15/1-4

Proposed Pit
Waste Rock Landform (WRL)
Road Nework
Long-Section
Cross-Section
Drainge Line
Proposed Drain

1:20,000

SHOGUN DEPOSIT LIDAR CONTOURS, SECTIONS, CATCHMENTS AREAS AND FLOOD MANAGEMENT OPTIONS

Rockwater PROPRIETARY LIMITED



L:/GIS Projects/345-1 - EAMA/ Fig. 2015_1-5 - Ambassador and Princess

Client: Vimy Resources Ltd
Project: Mulga Rock Project Hyrdological Study
Date: June 2015
Dwg. No: 345.0.1/15/1-5

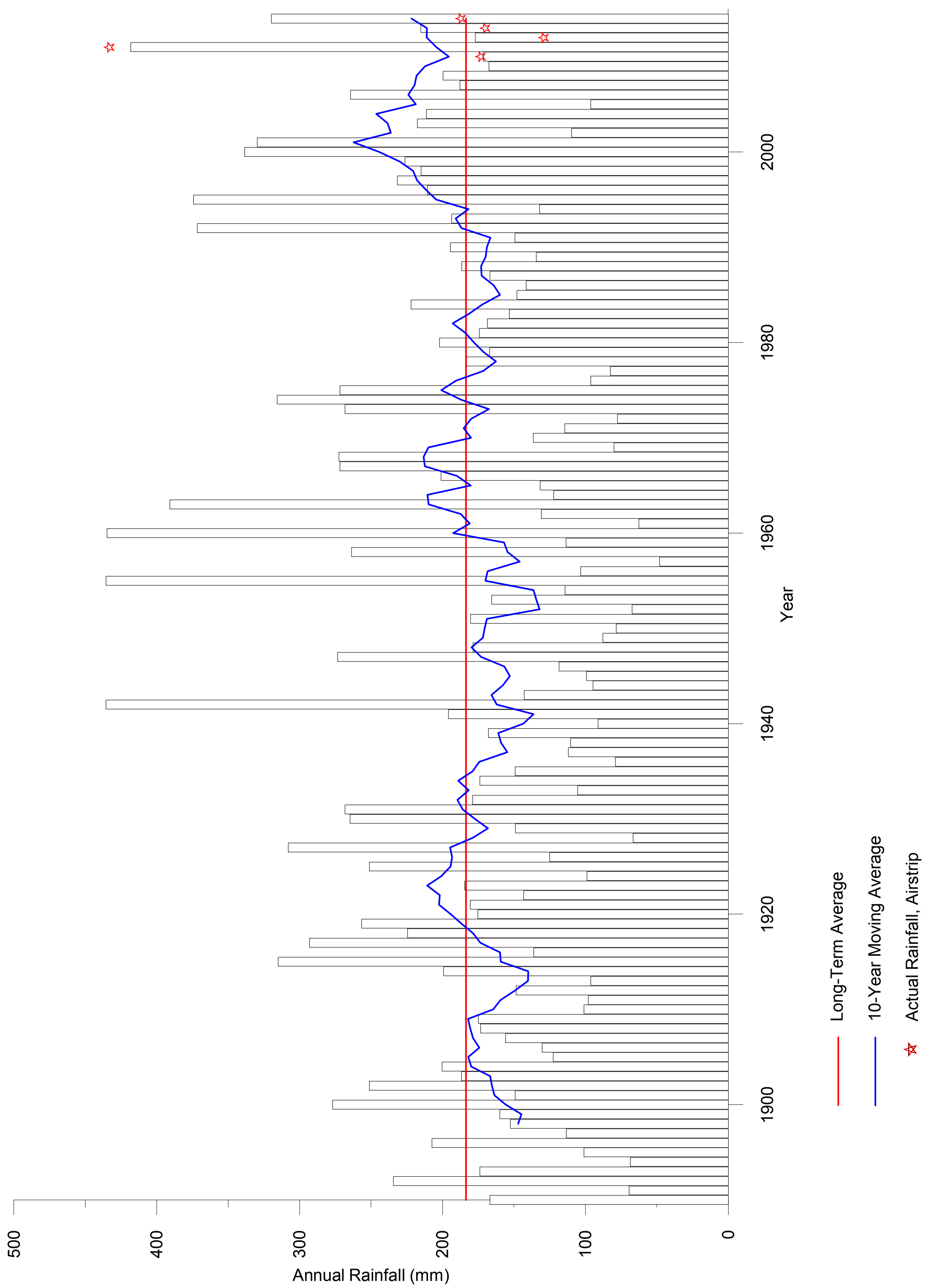
Tailings Storage Facility
Proposed Pit
Waste Rock Landform (WRL)
Plant and Administration
Evaporation/ Transfer Pond
Road Nework
Long-section
Cross-Section
Drainage Line
Re-Directed Flow

1:30,000

AMBASSADOR AND PRINCESS DEPOSITS LIDAR CONTOURS, SECTIONS, CATCHMENTS AREAS AND FLOOD MANAGEMENT OPTIONS

Rockwater PROPRIETARY LIMITED

FIGURE 6



drill an rainfall.grf

Client: Vimy Resources

Project: Mulga Rock

Date: August 2015

Dwg. No: 345-0/15/5-6

INTERPOLATED ANNUAL RAINFALLS FOR

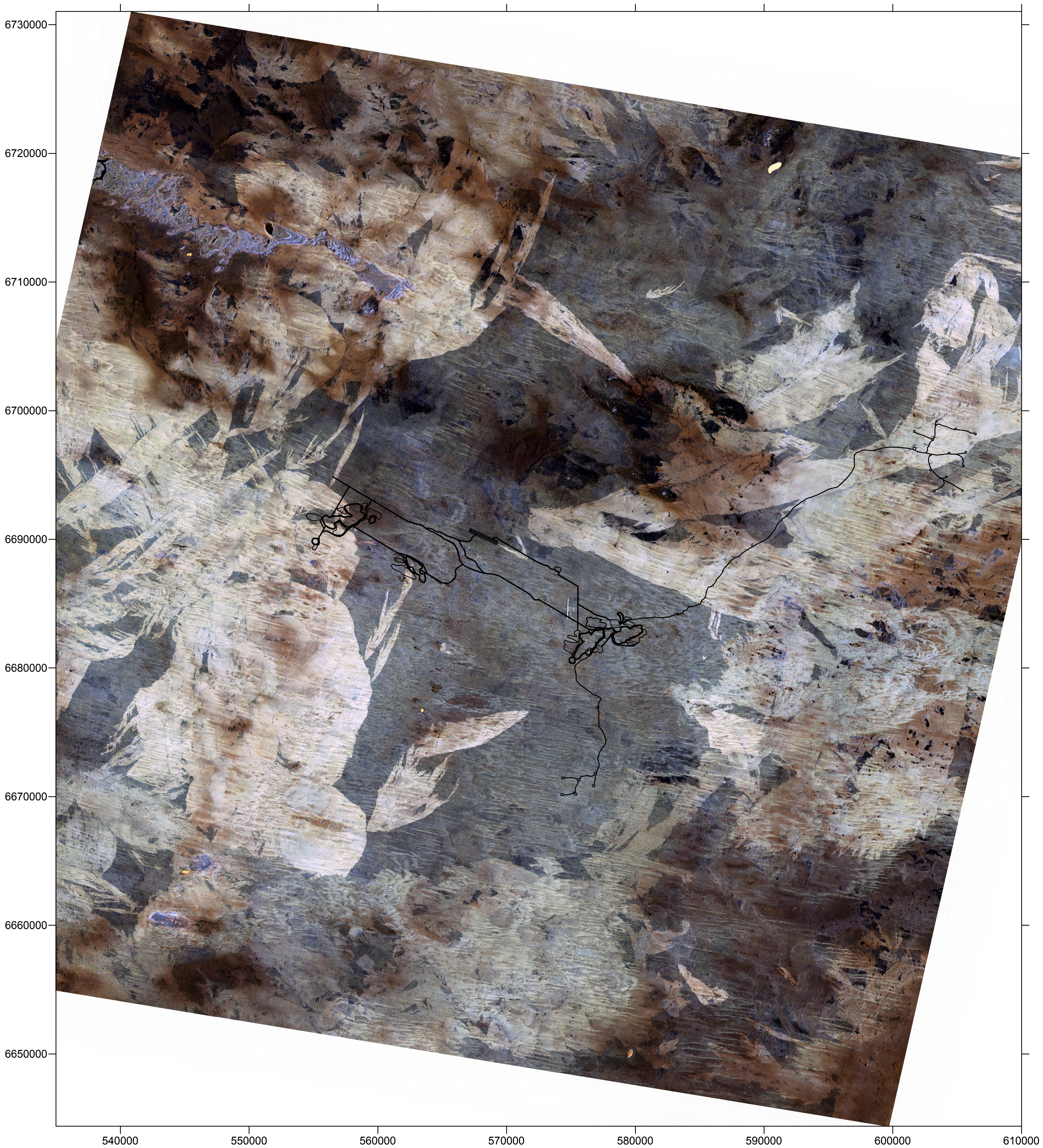
MULGA ROCK (DATA DRILL)

Rockwater Pty Ltd

APPENDIX A

SATELLITE IMAGE 7 MARCH 2011

Enhanced Satellite Image 7 March 2011



APPENDIX B

HYDROLOGICAL CALCULATIONS

AUSTRALIAN RAINFALL AND RUNOFF VOLUME 1 & 2 (1987)
RATIONAL AND INDEX METHODS - WESTERN AUSTRALIA

REGION: **ARID INTERIOR**

LOCATION: Mulga Rock Project Area

CATCHMENT: Catchment A

i. Wandoo Woodland (75-100% cleared) - Loamy Soils

Catchment	A (km^2)	L (km)	S_e (m/km)	P (mm)	C_L %
Characteristics	551	20	[redacted]		

RATIONAL METHOD:

Care needs to be taken when catchment characteristics fall outside the following:

A =	59	km^2
L =	11.5	km
S_e =	5.71	m/km
P =	255	mm

$Q_Y = 0.278 C_Y . I_{tc,Y} . A$ .... **(1.1)**

$t_c = 0.76 A^{0.38}$ .... **(1.29)**

t_c = 8.365 hours

$C_{10} = 3.46 \times 10^{-1} L^{-0.42}$ .... **(1.30)**

C_{10} = 0.098

Frequency Factors (C_Y/C_{10})

	ARI (years)					
	2	5	10	20	50	*100*
C_Y/C_{10}	0.34	0.70	1.00	1.28	1.62	*1.91*

100 year ARI extroplated using the power trendline

Therefore:

	ARI (years)					
	2	5	10	20	50	100
C_Y	0.033	0.069	0.098	0.126	0.159	0.188

AUSTRALIAN RAINFALL AND RUNOFF VOLUME 1 & 2 (1987)
RATIONAL AND INDEX METHODS - WESTERN AUSTRALIA

REGION: **ARID INTERIOR**

LOCATION: Mulga Rock Project Area

CATCHMENT: Catchment A

RATIONAL METHOD:
CONTINUES

DETERMINE AVERAGE RAINFALL INTENSITY FOR DESIGN DURATION

t_c = 8.365 hours

P_D = 0.962 .... **A(3.8)**
P_L = 0.000
P_U = 1.126
N = 0.854

Intensity upper and lower bound parameters

	ARI (Years)					
	2	5	10	20	50	100
I_L	13.683	19.677	23.730	28.955	36.384	42.482
I_U	2.495	3.655	4.453	5.481	6.956	8.176

Use Equation A(3.9)

Duration	ARI (Years) [mm/hr]					
(hours)	2	5	10	20	50	100
8.365	3.197	4.672	5.684	6.986	8.853	10.396

Calculate peak discharge using equation (1.1)

Discharge	ARI (Years)					
(m^3/s)	2	5	10	20	50	100
Q	16.37	49.26	85.60	134.68	216.00	299.23

AUSTRALIAN RAINFALL AND RUNOFF VOLUME 1 & 2 (1987)
RATIONAL AND INDEX METHODS - WESTERN AUSTRALIA

REGION: **ARID INTERIOR**

LOCATION: Mulga Rock Project Area

CATCHMENT: Catchment ED1

i. Wandoo Woodland (75-100% cleared) - Loamy Soils

Catchment	A (km^2)	L (km)	S_e (m/km)	P (mm)	C_L %
Characteristics	1.44	2.0	[redacted]		

RATIONAL METHOD:

Care needs to be taken when catchment characteristics fall outside the following:

A =	59	km^2
L =	11.5	km
S_e =	5.71	m/km
P =	255	mm

$Q_Y = 0.278 C_Y . I_{tc,Y} . A$ .... **(1.1)**

$t_c = 0.76 A^{0.38}$ .... **(1.29)**

$t_c =$ 0.873 hours

$C_{10} = 3.46 \times 10^{-1} L^{-0.42}$ .... **(1.30)**

$C_{10} =$ 0.259

Frequency Factors (C_Y/C_{10})

	ARI (years)					
	2	5	10	20	50	*100*
C_Y/C_{10}	0.34	0.70	1.00	1.28	1.62	*1.91*

100 year ARI extroplated using the power trendline

Therefore:

	ARI (years)					
	2	5	10	20	50	100
C_Y	0.088	0.181	0.259	0.331	0.419	0.494

AUSTRALIAN RAINFALL AND RUNOFF VOLUME 1 & 2 (1987)
RATIONAL AND INDEX METHODS - WESTERN AUSTRALIA

REGION: **ARID INTERIOR**

LOCATION: Mulga Rock Project Area

CATCHMENT: Catchment ED1

RATIONAL METHOD:
CONTINUES

DETERMINE AVERAGE RAINFALL INTENSITY FOR DESIGN DURATION

t_c = 0.873 hours

P_D = -0.059 .... **A(3.8)**
P_L = -0.837
P_U = 0.000
N = 0.930

Intensity upper and lower bound parameters

	ARI (Years)					
	2	5	10	20	50	100
I_L	46.676	68.516	83.554	102.914	130.720	153.749
I_U	13.683	19.677	23.730	28.955	36.384	42.482

Use Equation A(3.9)

Duration	ARI (Years) [mm/hr]					
(hours)	2	5	10	20	50	100
0.873	14.912	21.474	25.918	31.645	39.795	46.488

Calculate peak discharge using equation (1.1)

Discharge	ARI (Years)					
(m^3/s)	2	5	10	20	50	100
Q	0.52	1.56	2.68	4.19	6.67	9.20

AUSTRALIAN RAINFALL AND RUNOFF VOLUME 1 & 2 (1987)
RATIONAL AND INDEX METHODS - WESTERN AUSTRALIA

REGION: **ARID INTERIOR**

LOCATION: Mulga Rock Project Area

CATCHMENT: Catchment ED2

i. Wandoo Woodland (75-100% cleared) - Loamy Soils

Catchment	A (km^2)	L (km)	S_e (m/km)	P (mm)	C_L %
Characteristics	3.63	1.86	[redacted]	[redacted]	[redacted]

RATIONAL METHOD:

Care needs to be taken when catchment characteristics fall outside the following:

A =	59	km^2
L =	11.5	km
S_e =	5.71	m/km
P =	255	mm

$Q_Y = 0.278C_Y.I_{tc,Y}.A$ .... **(1.1)**

$t_c = 0.76A^{0.38}$ .... **(1.29)**

$t_c =$ 1.240 hours

$C_{10} = 3.46 \times 10^{-1} L^{-0.42}$ .... **(1.30)**

$C_{10} =$ 0.267

Frequency Factors (C_Y/C_{10})

	ARI (years)					
	2	5	10	20	50	*100*
C_Y/C_{10}	0.34	0.70	1.00	1.28	1.62	*1.91*

100 year ARI extroplated using the power trendline

Therefore:

	ARI (years)					
	2	5	10	20	50	100
C_Y	0.091	0.187	0.267	0.341	0.432	0.510

AUSTRALIAN RAINFALL AND RUNOFF VOLUME 1 & 2 (1987)
RATIONAL AND INDEX METHODS - WESTERN AUSTRALIA

REGION: **ARID INTERIOR**

LOCATION: Mulga Rock Project Area

CATCHMENT: Catchment ED2

RATIONAL METHOD:
CONTINUES

DETERMINE AVERAGE RAINFALL INTENSITY FOR DESIGN DURATION

t_c = 1.240 hours

P_D = 0.094 .... **A(3.8)**
P_L = 0.000
P_U = 1.126
N = 0.084

Intensity upper and lower bound parameters

	ARI (Years)					
	2	5	10	20	50	100
I_L	13.683	19.677	23.730	28.955	36.384	42.482
I_U	2.495	3.655	4.453	5.481	6.956	8.176

Use Equation A(3.9)

Duration	ARI (Years) [mm/hr]					
(hours)	2	5	10	20	50	100
1.240	11.863	17.086	20.623	25.182	31.669	36.998

Calculate peak discharge using equation (1.1)

Discharge	ARI (Years)					
(m^3/s)	2	5	10	20	50	100
Q	1.09	3.22	5.55	8.67	13.80	19.02

AUSTRALIAN RAINFALL AND RUNOFF VOLUME 1 & 2 (1987)
RATIONAL AND INDEX METHODS - WESTERN AUSTRALIA

REGION: **ARID INTERIOR**

LOCATION: Mulga Rock Project Area

CATCHMENT: Catchment ED3

i. Wandoo Woodland (75-100% cleared) - Loamy Soils

Catchment	A (km^2)	L (km)	S_e (m/km)	P (mm)	C_L %
Characteristics	1.99	2.5	[redacted]		

RATIONAL METHOD:

Care needs to be taken when catchment characteristics fall outside the following:

A =	59	km^2
L =	11.5	km
S_e =	5.71	m/km
P =	255	mm

$Q_Y = 0.278 C_Y . I_{tc,Y} . A$ .... **(1.1)**

$t_c = 0.76 A^{0.38}$ .... **(1.29)**

t_c = 0.987 hours

$C_{10} = 3.46 \times 10^{-1} L^{-0.42}$ .... **(1.30)**

C_{10} = 0.235

Frequency Factors (C_Y/C_{10})

	ARI (years)					
	2	5	10	20	50	*100*
C_Y/C_{10}	0.34	0.70	1.00	1.28	1.62	*1.91*

100 year ARI extroplated using the power trendline

Therefore:

	ARI (years)					
	2	5	10	20	50	100
C_Y	0.080	0.165	0.235	0.301	0.381	0.450

AUSTRALIAN RAINFALL AND RUNOFF VOLUME 1 & 2 (1987)
RATIONAL AND INDEX METHODS - WESTERN AUSTRALIA

REGION: **ARID INTERIOR**

LOCATION: Mulga Rock Project Area

CATCHMENT: Catchment ED3

RATIONAL METHOD:
CONTINUES

DETERMINE AVERAGE RAINFALL INTENSITY FOR DESIGN DURATION

t_c = 0.987 hours

P_D = -0.006 .... **A(3.8)**
P_L = -0.837
P_U = 0.000
N = 0.993

Intensity upper and lower bound parameters

	ARI (Years)					
	2	5	10	20	50	100
I_L	46.676	68.516	83.554	102.914	130.720	153.749
I_U	13.683	19.677	23.730	28.955	36.384	42.482

Use Equation A(3.9)

Duration	ARI (Years) [mm/hr]					
(hours)	2	5	10	20	50	100
0.987	13.797	19.842	23.931	29.202	36.698	42.850

Calculate peak discharge using equation (1.1)

Discharge	ARI (Years)					
(m^3/s)	2	5	10	20	50	100
Q	0.61	1.81	3.12	4.87	7.74	10.67

AUSTRALIAN RAINFALL AND RUNOFF VOLUME 1 & 2 (1987)
RATIONAL AND INDEX METHODS - WESTERN AUSTRALIA

REGION: **ARID INTERIOR**

LOCATION: Mulga Rock Project Area

CATCHMENT: Catchment SD1

i. Wandoo Woodland (75-100% cleared) - Loamy Soils

Catchment	A (km^2)	L (km)	S_e (m/km)	P (mm)	C_L %
Characteristics	1.72	1.93	[redacted]		

RATIONAL METHOD:

Care needs to be taken when catchment characteristics fall outside the following:

A =	59	km^2
L =	11.5	km
S_e =	5.71	m/km
P =	255	mm

$Q_Y = 0.278 C_Y . I_{tc,Y} . A$ .... **(1.1)**

$t_c = 0.76 A^{0.38}$ .... **(1.29)**

t_c = 0.934 hours

$C_{10} = 3.46 \times 10^{-1} L^{-0.42}$ .... **(1.30)**

C_{10} = 0.263

Frequency Factors (C_Y/C_{10})

	ARI (years)					
	2	5	10	20	50	*100*
C_Y/C_{10}	0.34	0.70	1.00	1.28	1.62	*1.91*

100 year ARI extroplated using the power trendline

Therefore:

	ARI (years)					
	2	5	10	20	50	100
C_Y	0.089	0.184	0.263	0.336	0.425	0.502

AUSTRALIAN RAINFALL AND RUNOFF VOLUME 1 & 2 (1987)
RATIONAL AND INDEX METHODS - WESTERN AUSTRALIA

REGION: **ARID INTERIOR**

LOCATION: Mulga Rock Project Area

CATCHMENT: Catchment SD1

RATIONAL METHOD:
CONTINUES

DETERMINE AVERAGE RAINFALL INTENSITY FOR DESIGN DURATION

t_c = 0.934 hours

P_D = -0.030 .... **A(3.8)**
P_L = -0.837
P_U = 0.000
N = 0.965

Intensity upper and lower bound parameters

	ARI (Years)					
	2	5	10	20	50	100
I_L	46.676	68.516	83.554	102.914	130.720	153.749
I_U	13.683	19.677	23.730	28.955	36.384	42.482

Use Equation A(3.9)

Duration	ARI (Years) [mm/hr]					
(hours)	2	5	10	20	50	100
0.934	14.290	20.564	24.810	30.283	38.067	44.459

Calculate peak discharge using equation (1.1)

Discharge	ARI (Years)					
(m^3/s)	2	5	10	20	50	100
Q	0.61	1.81	3.11	4.87	7.74	10.66

AUSTRALIAN RAINFALL AND RUNOFF VOLUME 1 & 2 (1987)
RATIONAL AND INDEX METHODS - WESTERN AUSTRALIA

REGION: **ARID INTERIOR**

LOCATION: Mulga Rock Project Area

CATCHMENT: Catchment SD2

i. Wandoo Woodland (75-100% cleared) - Loamy Soils

Catchment	A (km^2)	L (km)	S_e (m/km)	P (mm)	C_L %
Characteristics	1.53	0.85			

RATIONAL METHOD:

Care needs to be taken when catchment characteristics fall outside the following:

A =	59	km^2
L =	11.5	km
S_e =	5.71	m/km
P =	255	mm

$Q_Y = 0.278 C_Y . I_{tc,Y} . A$ .... **(1.1)**

$t_c = 0.76 A^{0.38}$ .... **(1.29)**

$t_c =$ 0.893 hours

$C_{10} = 3.46 \times 10^{-1} L^{-0.42}$ .... **(1.30)**

$C_{10} =$ 0.370

Frequency Factors (C_Y/C_{10})

	ARI (years)					
	2	5	10	20	50	*100*
C_Y/C_{10}	0.34	0.70	1.00	1.28	1.62	*1.91*

100 year ARI extroplated using the power trendline

Therefore:

	ARI (years)					
	2	5	10	20	50	100
C_Y	0.126	0.259	0.370	0.474	0.600	0.708

AUSTRALIAN RAINFALL AND RUNOFF VOLUME 1 & 2 (1987)
RATIONAL AND INDEX METHODS - WESTERN AUSTRALIA

REGION: **ARID INTERIOR**

LOCATION: Mulga Rock Project Area

CATCHMENT: Catchment SD2

RATIONAL METHOD:
CONTINUES

DETERMINE AVERAGE RAINFALL INTENSITY FOR DESIGN DURATION

t_c = 0.893 hours

P_D = -0.049 .... **A(3.8)**
P_L = -0.837
P_U = 0.000
N = 0.942

Intensity upper and lower bound parameters

	ARI (Years)					
	2	5	10	20	50	100
I_L	46.676	68.516	83.554	102.914	130.720	153.749
I_U	13.683	19.677	23.730	28.955	36.384	42.482

Use Equation A(3.9)

Duration	ARI (Years) [mm/hr]					
(hours)	2	5	10	20	50	100
0.893	14.697	21.160	25.535	31.175	39.198	45.787

Calculate peak discharge using equation (1.1)

Discharge	ARI (Years)					
(m^3/s)	2	5	10	20	50	100
Q	0.79	2.33	4.02	6.29	10.01	13.79

AUSTRALIAN RAINFALL AND RUNOFF VOLUME 1 & 2 (1987)
RATIONAL AND INDEX METHODS - WESTERN AUSTRALIA

REGION: **ARID INTERIOR**

LOCATION: Mulga Rock Project Area

CATCHMENT: Catchment SD3

i. Wandoo Woodland (75-100% cleared) - Loamy Soils

Catchment	A (km^2)	L (km)	S_e (m/km)	P (mm)	C_L %
Characteristics	3.44	2	[redacted]		

RATIONAL METHOD:

Care needs to be taken when catchment characteristics fall outside the following:

A =	59	km^2
L =	11.5	km
S_e =	5.71	m/km
P =	255	mm

$Q_Y = 0.278C_Y.I_{tc,Y}.A$ .... **(1.1)**

$t_c = 0.76A^{0.38}$ .... **(1.29)**

t_c = 1.215 hours

$C_{10} = 3.46x10^{-1}L^{-0.42}$ .... **(1.30)**

C_{10} = 0.259

Frequency Factors (C_Y/C_{10})

	ARI (years)					
	2	5	10	20	50	*100*
C_Y/C_{10}	0.34	0.70	1.00	1.28	1.62	*1.91*

100 year ARI extroplated using the power trendline

Therefore:

	ARI (years)					
	2	5	10	20	50	100
C_Y	0.088	0.181	0.259	0.331	0.419	0.494

AUSTRALIAN RAINFALL AND RUNOFF VOLUME 1 & 2 (1987)
RATIONAL AND INDEX METHODS - WESTERN AUSTRALIA

REGION: **ARID INTERIOR**

LOCATION: Mulga Rock Project Area

CATCHMENT: Catchment SD3

RATIONAL METHOD:
CONTINUES

DETERMINE AVERAGE RAINFALL INTENSITY FOR DESIGN DURATION

t_c = 1.215 hours

P_D = 0.085 .... **A(3.8)**
P_L = 0.000
P_U = 1.126
N = 0.076

Intensity upper and lower bound parameters

	ARI (Years)					
	2	5	10	20	50	100
I_L	13.683	19.677	23.730	28.955	36.384	42.482
I_U	2.495	3.655	4.453	5.481	6.956	8.176

Use Equation A(3.9)

Duration	ARI (Years) [mm/hr]					
(hours)	2	5	10	20	50	100
1.215	12.026	17.318	20.901	25.520	32.092	37.489

Calculate peak discharge using equation (1.1)

Discharge	ARI (Years)					
(m^3/s)	2	5	10	20	50	100
Q	1.01	3.00	5.17	8.08	12.86	17.72

AUSTRALIAN RAINFALL AND RUNOFF VOLUME 1 & 2 (1987)
RATIONAL AND INDEX METHODS - WESTERN AUSTRALIA

REGION: **ARID INTERIOR**

LOCATION: Mulga Rock Project Area

CATCHMENT: Catchment AWD1

i. Wandoo Woodland (75-100% cleared) - Loamy Soils

Catchment	A (km^2)	L (km)	S_e (m/km)	P (mm)	C_L %
Characteristics	2.66	2.5	[redacted]		

RATIONAL METHOD:

Care needs to be taken when catchment characteristics fall outside the following:

A =	59	km^2
L =	11.5	km
S_e =	5.71	m/km
P =	255	mm

Q_Y = $0.278C_Y.I_{tc,Y}.A$ .... **(1.1)**

t_c = $0.76A^{0.38}$ .... **(1.29)**

t_c = 1.102 hours

C_{10} = $3.46 \times 10^{-1} L^{-0.42}$ .... **(1.30)**

C_{10} = 0.235

Frequency Factors (C_Y/C_{10})

	ARI (years)					
	2	5	10	20	50	*100*
C_Y/C_{10}	0.34	0.70	1.00	1.28	1.62	*1.91*

100 year ARI extroplated using the power trendline

Therefore:

	ARI (years)					
	2	5	10	20	50	100
C_Y	0.080	0.165	0.235	0.301	0.381	0.450

AUSTRALIAN RAINFALL AND RUNOFF VOLUME 1 & 2 (1987)
RATIONAL AND INDEX METHODS - WESTERN AUSTRALIA

REGION: **ARID INTERIOR**

LOCATION: Mulga Rock Project Area

CATCHMENT: Catchment AWD1

RATIONAL METHOD:
CONTINUES

DETERMINE AVERAGE RAINFALL INTENSITY FOR DESIGN DURATION

t_c = 1.102 hours

P_D = 0.042 .... **A(3.8)**
P_L = 0.000
P_U = 1.126
N = 0.038

Intensity upper and lower bound parameters

	ARI (Years)					
	2	5	10	20	50	100
I_L	13.683	19.677	23.730	28.955	36.384	42.482
I_U	2.495	3.655	4.453	5.481	6.956	8.176

Use Equation A(3.9)

Duration	ARI (Years) [mm/hr]					
(hours)	2	5	10	20	50	100
1.102	12.833	18.467	22.279	27.193	34.183	39.922

Calculate peak discharge using equation (1.1)

Discharge	ARI (Years)					
(m^3/s)	2	5	10	20	50	100
Q	0.76	2.25	3.88	6.06	9.64	13.29

AUSTRALIAN RAINFALL AND RUNOFF VOLUME 1 & 2 (1987)
RATIONAL AND INDEX METHODS - WESTERN AUSTRALIA

REGION: **ARID INTERIOR**

LOCATION: Mulga Rock Project Area

CATCHMENT: Catchment AWD2

i. Wandoo Woodland (75-100% cleared) - Loamy Soils

Catchment	A (km^2)	L (km)	S_e (m/km)	P (mm)	C_L %
Characteristics	1.85	2.03	[redacted]		

RATIONAL METHOD:

Care needs to be taken when catchment characteristics fall outside the following:

A =	59	km^2
L =	11.5	km
S_e =	5.71	m/km
P =	255	mm

$Q_Y = 0.278 C_Y . I_{tc,Y} . A$ .... **(1.1)**

$t_c = 0.76A^{0.38}$ .... **(1.29)**

$t_c =$ 0.960 hours

$C_{10} = 3.46 \times 10^{-1} L^{-0.42}$ .... **(1.30)**

$C_{10} =$ 0.257

Frequency Factors (C_Y/C_{10})

	ARI (years)					
	2	5	10	20	50	*100*
C_Y/C_{10}	0.34	0.70	1.00	1.28	1.62	*1.91*

100 year ARI extroplated using the power trendline

Therefore:

	ARI (years)					
	2	5	10	20	50	100
C_Y	0.087	0.180	0.257	0.329	0.416	0.491

AUSTRALIAN RAINFALL AND RUNOFF VOLUME 1 & 2 (1987)
RATIONAL AND INDEX METHODS - WESTERN AUSTRALIA

REGION: **ARID INTERIOR**

LOCATION: Mulga Rock Project Area

CATCHMENT: Catchment AWD2

RATIONAL METHOD:
CONTINUES

DETERMINE AVERAGE RAINFALL INTENSITY FOR DESIGN DURATION

t_c = 0.960 hours

P_D = -0.018 .... **A(3.8)**
P_L = -0.837
P_U = 0.000
N = 0.979

Intensity upper and lower bound parameters

	ARI (Years)					
	2	5	10	20	50	100
I_L	46.676	68.516	83.554	102.914	130.720	153.749
I_U	13.683	19.677	23.730	28.955	36.384	42.482

Use Equation A(3.9)

Duration	ARI (Years) [mm/hr]					
(hours)	2	5	10	20	50	100
0.960	14.042	20.201	24.367	29.739	37.377	43.649

Calculate peak discharge using equation (1.1)

Discharge	ARI (Years)					
(m^3/s)	2	5	10	20	50	100
Q	0.63	1.87	3.22	5.03	8.00	11.03

AUSTRALIAN RAINFALL AND RUNOFF VOLUME 1 & 2 (1987)
RATIONAL AND INDEX METHODS - WESTERN AUSTRALIA

REGION: **ARID INTERIOR**

LOCATION: Mulga Rock Project Area

CATCHMENT: Catchment AWD3

i. Wandoo Woodland (75-100% cleared) - Loamy Soils

Catchment	A (km^2)	L (km)	S_e (m/km)	P (mm)	C_L %
Characteristics	0.97	1.48	[redacted]		

RATIONAL METHOD:

Care needs to be taken when catchment characteristics fall outside the following:

A =	59	km^2
L =	11.5	km
S_e =	5.71	m/km
P =	255	mm

$Q_Y = 0.278 C_Y . I_{tc,Y} . A$ .... **(1.1)**

$t_c = 0.76 A^{0.38}$ .... **(1.29)**

t_c = 0.751 hours

$C_{10} = 3.46 \times 10^{-1} L^{-0.42}$ .... **(1.30)**

C_{10} = 0.293

Frequency Factors (C_Y/C_{10})

	ARI (years)					
	2	5	10	20	50	*100*
C_Y/C_{10}	0.34	0.70	1.00	1.28	1.62	*1.91*

100 year ARI extroplated using the power trendline

Therefore:

	ARI (years)					
	2	5	10	20	50	100
C_Y	0.100	0.205	0.293	0.376	0.475	0.561

AUSTRALIAN RAINFALL AND RUNOFF VOLUME 1 & 2 (1987)
RATIONAL AND INDEX METHODS - WESTERN AUSTRALIA

REGION: **ARID INTERIOR**

LOCATION: Mulga Rock Project Area

CATCHMENT: Catchment AWD3

RATIONAL METHOD:
CONTINUES

DETERMINE AVERAGE RAINFALL INTENSITY FOR DESIGN DURATION

t_c = 0.751 hours

P_D = -0.122 .... **A(3.8)**
P_L = -0.837
P_U = 0.000
N = 0.854

Intensity upper and lower bound parameters

	ARI (Years)					
	2	5	10	20	50	100
I_L	46.676	68.516	83.554	102.914	130.720	153.749
I_U	13.683	19.677	23.730	28.955	36.384	42.482

Use Equation A(3.9)

Duration	ARI (Years) [mm/hr]					
(hours)	2	5	10	20	50	100
0.751	16.376	23.619	28.531	34.861	43.874	51.283

Calculate peak discharge using equation (1.1)

Discharge	ARI (Years)					
(m^3/s)	2	5	10	20	50	100
Q	0.44	1.31	2.26	3.53	5.62	7.76

AUSTRALIAN RAINFALL AND RUNOFF VOLUME 1 & 2 (1987)
RATIONAL AND INDEX METHODS - WESTERN AUSTRALIA

REGION: **ARID INTERIOR**

LOCATION: Mulga Rock Project Area

CATCHMENT: Catchment AWD4

i. Wandoo Woodland (75-100% cleared) - Loamy Soils

Catchment	A (km^2)	L (km)	S_e (m/km)	P (mm)	C_L %
Characteristics	0.4	0.82	[redacted]		

RATIONAL METHOD:

Care needs to be taken when catchment characteristics fall outside the following:

A =	59	km^2
L =	11.5	km
S_e =	5.71	m/km
P =	255	mm

$Q_Y = 0.278 C_Y . I_{tc,Y} . A$ .... **(1.1)**

$t_c = 0.76 A^{0.38}$ .... **(1.29)**

t_c = 0.537 hours

$C_{10} = 3.46 \times 10^{-1} L^{-0.42}$ .... **(1.30)**

C_{10} = 0.376

Frequency Factors (C_Y/C_{10})

	ARI (years)					
	2	5	10	20	50	*100*
C_Y/C_{10}	0.34	0.70	1.00	1.28	1.62	*1.91*

100 year ARI extroplated using the power trendline

Therefore:

	ARI (years)					
	2	5	10	20	50	100
C_Y	0.128	0.263	0.376	0.481	0.609	0.719

AUSTRALIAN RAINFALL AND RUNOFF VOLUME 1 & 2 (1987)
RATIONAL AND INDEX METHODS - WESTERN AUSTRALIA

REGION: **ARID INTERIOR**

LOCATION: Mulga Rock Project Area

CATCHMENT: Catchment AWD4

RATIONAL METHOD:
CONTINUES

DETERMINE AVERAGE RAINFALL INTENSITY FOR DESIGN DURATION

t_c = 0.537 hours

P_D = -0.261 .... **A(3.8)**
P_L = -0.837
P_U = 0.000
N = 0.688

Intensity upper and lower bound parameters

	ARI (Years)					
	2	5	10	20	50	100
I_L	46.676	68.516	83.554	102.914	130.720	153.749
I_U	13.683	19.677	23.730	28.955	36.384	42.482

Use Equation A(3.9)

Duration	ARI (Years) [mm/hr]					
(hours)	2	5	10	20	50	100
0.537	20.078	29.058	35.165	43.035	54.259	63.498

Calculate peak discharge using equation (1.1)

Discharge	ARI (Years)					
(m^3/s)	2	5	10	20	50	100
Q	0.29	0.85	1.47	2.30	3.68	5.07

AUSTRALIAN RAINFALL AND RUNOFF VOLUME 1 & 2 (1987)
RATIONAL AND INDEX METHODS - WESTERN AUSTRALIA

REGION: **ARID INTERIOR**

LOCATION: Mulga Rock Project Area

CATCHMENT: Catchment AWD5

i. Wandoo Woodland (75-100% cleared) - Loamy Soils

Catchment	A (km^2)	L (km)	S_e (m/km)	P (mm)	C_L %
Characteristics	0.34	0.8	[redacted]		

RATIONAL METHOD:

Care needs to be taken when catchment characteristics fall outside the following:

A =	59	km^2
L =	11.5	km
S_e =	5.71	m/km
P =	255	mm

$Q_Y = 0.278 C_Y . I_{tc,Y} . A$ .... **(1.1)**

$t_c = 0.76 A^{0.38}$ .... **(1.29)**

$t_c =$ 0.504 hours

$C_{10} = 3.46 \times 10^{-1} L^{-0.42}$ .... **(1.30)**

$C_{10} =$ 0.380

Frequency Factors (C_Y/C_{10})

	ARI (years)					
	2	5	10	20	50	*100*
C_Y/C_{10}	0.34	0.70	1.00	1.28	1.62	*1.91*

100 year ARI extroplated using the power trendline

Therefore:

	ARI (years)					
	2	5	10	20	50	100
C_Y	0.129	0.266	0.380	0.486	0.616	0.726

AUSTRALIAN RAINFALL AND RUNOFF VOLUME 1 & 2 (1987)
RATIONAL AND INDEX METHODS - WESTERN AUSTRALIA

REGION: **ARID INTERIOR**

LOCATION: Mulga Rock Project Area

CATCHMENT: Catchment AWD5

RATIONAL METHOD:
CONTINUES

DETERMINE AVERAGE RAINFALL INTENSITY FOR DESIGN DURATION

t_c = 0.504 hours

P_D = -0.286 .... **A(3.8)**
P_L = -0.837
P_U = 0.000
N = 0.658

Intensity upper and lower bound parameters

	ARI (Years)					
	2	5	10	20	50	100
I_L	46.676	68.516	83.554	102.914	130.720	153.749
I_U	13.683	19.677	23.730	28.955	36.384	42.482

Use Equation A(3.9)

Duration	ARI (Years) [mm/hr]					
(hours)	2	5	10	20	50	100
0.504	20.821	30.153	36.502	44.683	56.355	65.965

Calculate peak discharge using equation (1.1)

Discharge	ARI (Years)					
(m^3/s)	2	5	10	20	50	100
Q	0.25	0.76	1.31	2.05	3.28	4.53

AUSTRALIAN RAINFALL AND RUNOFF VOLUME 1 & 2 (1987)
RATIONAL AND INDEX METHODS - WESTERN AUSTRALIA

REGION: **ARID INTERIOR**

LOCATION: Mulga Rock Project Area

CATCHMENT: Catchment AWD6

i. Wandoo Woodland (75-100% cleared) - Loamy Soils

Catchment	A	L	S_e	P	C_L
	(km^2)	(km)	(m/km)	(mm)	%
Characteristics	0.64	0.66	[redacted]		

RATIONAL METHOD:

Care needs to be taken when catchment characteristics fall outside the following:

A =	59	km^2
L =	11.5	km
S_e =	5.71	m/km
P =	255	mm

$Q_Y = 0.278C_Y.I_{tc,Y}.A$ .... **(1.1)**

$t_c = 0.76A^{0.38}$ .... **(1.29)**

t_c = 0.641 hours

$C_{10} = 3.46\times10^{-1}L^{-0.42}$ .... **(1.30)**

C_{10} = 0.412

Frequency Factors (C_Y/C_{10})

	ARI (years)					
	2	5	10	20	50	*100*
C_Y/C_{10}	0.34	0.70	1.00	1.28	1.62	*1.91*

100 year ARI extroplated using the power trendline

Therefore:

	ARI (years)					
	2	5	10	20	50	100
C_Y	0.140	0.288	0.412	0.527	0.667	0.787

AUSTRALIAN RAINFALL AND RUNOFF VOLUME 1 & 2 (1987)
RATIONAL AND INDEX METHODS - WESTERN AUSTRALIA

REGION: **ARID INTERIOR**

LOCATION: Mulga Rock Project Area

CATCHMENT: Catchment AWD6

RATIONAL METHOD:
CONTINUES

DETERMINE AVERAGE RAINFALL INTENSITY FOR DESIGN DURATION

t_c = 0.641 hours

P_D = -0.189 .... **A(3.8)**
P_L = -0.837
P_U = 0.000
N = 0.775

Intensity upper and lower bound parameters

	ARI (Years)					
	2	5	10	20	50	100
I_L	46.676	68.516	83.554	102.914	130.720	153.749
I_U	13.683	19.677	23.730	28.955	36.384	42.482

Use Equation A(3.9)

Duration	ARI (Years) [mm/hr]					
(hours)	2	5	10	20	50	100
0.641	18.040	26.062	31.509	38.529	48.532	56.759

Calculate peak discharge using equation (1.1)

Discharge	ARI (Years)					
(m^3/s)	2	5	10	20	50	100
Q	0.45	1.34	2.31	3.61	5.76	7.95

AUSTRALIAN RAINFALL AND RUNOFF VOLUME 1 & 2 (1987)
RATIONAL AND INDEX METHODS - WESTERN AUSTRALIA

REGION: **ARID INTERIOR**

LOCATION: Mulga Rock Project Area

CATCHMENT: Catchment AWD7

i. Wandoo Woodland (75-100% cleared) - Loamy Soils

Catchment	A (km^2)	L (km)	S_e (m/km)	P (mm)	C_L %
Characteristics	0.8	1.48	[redacted]		

RATIONAL METHOD:

Care needs to be taken when catchment characteristics fall outside the following:

A =	59	km^2
L =	11.5	km
S_e =	5.71	m/km
P =	255	mm

$Q_Y = 0.278 C_Y . I_{tc,Y} . A$ .... **(1.1)**

$t_c = 0.76 A^{0.38}$ .... **(1.29)**

t_c = 0.698 hours

$C_{10} = 3.46 \times 10^{-1} L^{-0.42}$ .... **(1.30)**

C_{10} = 0.293

Frequency Factors (C_Y/C_{10})

	ARI (years)					
	2	5	10	20	50	*100*
C_Y/C_{10}	0.34	0.70	1.00	1.28	1.62	*1.91*

100 year ARI extroplated using the power trendline

Therefore:

	ARI (years)					
	2	5	10	20	50	100
C_Y	0.100	0.205	0.293	0.376	0.475	0.561

AUSTRALIAN RAINFALL AND RUNOFF VOLUME 1 & 2 (1987)
RATIONAL AND INDEX METHODS - WESTERN AUSTRALIA

REGION: **ARID INTERIOR**

LOCATION: Mulga Rock Project Area

CATCHMENT: Catchment AWD7

RATIONAL METHOD:
CONTINUES

DETERMINE AVERAGE RAINFALL INTENSITY FOR DESIGN DURATION

t_c = 0.698 hours

P_D = -0.153 .... **A(3.8)**
P_L = -0.837
P_U = 0.000
N = 0.817

Intensity upper and lower bound parameters

	ARI (Years)					
	2	5	10	20	50	100
I_L	46.676	68.516	83.554	102.914	130.720	153.749
I_U	13.683	19.677	23.730	28.955	36.384	42.482

Use Equation A(3.9)

Duration	ARI (Years) [mm/hr]					
(hours)	2	5	10	20	50	100
0.698	17.131	24.727	29.881	36.524	45.985	53.765

Calculate peak discharge using equation (1.1)

Discharge	ARI (Years)					
(m^3/s)	2	5	10	20	50	100
Q	0.38	1.13	1.95	3.05	4.86	6.71

APPENDIX C

RESULTS OF HYDRAULIC CALCULATIONS

CROSS SECTION 1

slope = 0.011538 m/m

Stage (mAHD)	Q (m3/s)	A (m2)	V (m/s)
337.00	0.0	0.0	0
337.01	0.0	0.0	0.06
337.02	0.0	0.0	0.1
337.03	0.0	0.1	0.13
337.04	0.0	0.2	0.16
337.05	0.0	0.3	0.18
337.06	0.1	0.4	0.21
337.07	0.1	0.5	0.23
337.08	0.2	0.7	0.25
337.09	0.2	0.9	0.27
337.10	0.3	1.0	0.29
337.11	0.4	1.3	0.31
337.12	0.5	1.5	0.33
337.13	0.6	1.8	0.35
337.14	0.7	2.1	0.36
337.15	0.9	2.4	0.38
337.16	1.1	2.7	0.4
337.17	1.3	3.0	0.41
337.18	1.5	3.4	0.43
337.19	1.7	3.8	0.45
337.20	1.9	4.2	0.46
337.21	2.2	4.6	0.48
337.22	2.5	5.1	0.49
337.23	2.8	5.6	0.51
337.24	3.2	6.0	0.52
337.25	3.5	6.6	0.54
337.26	3.9	7.1	0.55
337.27	4.3	7.7	0.56
337.28	4.8	8.2	0.58
337.29	5.2	8.8	0.59
337.30	5.7	9.5	0.61
337.31	6.2	10.1	0.62
337.32	6.8	10.8	0.63
337.33	7.4	11.4	0.65
337.34	8.0	12.1	0.66
337.35	8.6	12.9	0.67
337.36	9.3	13.6	0.68
337.37	10.0	14.4	0.7
337.38	10.7	15.2	0.71
337.39	11.5	16.0	0.72
337.40	12.3	16.8	0.73
337.41	13.2	17.7	0.75
337.42	14.0	18.5	0.76
337.43	14.9	19.4	0.77
337.44	15.9	20.3	0.78
337.45	16.9	21.3	0.79
337.46	17.9	22.2	0.81
337.47	18.9	23.2	0.82
337.48	20.0	24.2	0.83
337.49	21.2	25.2	0.84
337.50	22.3	26.3	0.85
337.51	23.6	27.3	0.86
337.52	24.8	28.4	0.87

CROSS SECTION 1A

slope = 0.010063 m/m

Stage (mAHD)	Q (m3/s)	A (m2)	V (m/s)
316.00	0.0	0.0	0
316.01	0.0	0.0	0.06
316.02	0.0	0.0	0.09
316.03	0.0	0.0	0.12
316.04	0.0	0.0	0.15
316.05	0.0	0.0	0.17
316.06	0.0	0.1	0.19
316.07	0.0	0.1	0.21
316.08	0.0	0.1	0.23
316.09	0.0	0.1	0.25
316.10	0.0	0.2	0.27
316.11	0.1	0.2	0.29
316.12	0.1	0.3	0.31
316.13	0.1	0.3	0.32
316.14	0.1	0.3	0.34
316.15	0.1	0.4	0.36
316.16	0.2	0.5	0.37
316.17	0.2	0.5	0.39
316.18	0.2	0.6	0.4
316.19	0.3	0.6	0.42
316.20	0.3	0.7	0.43
316.21	0.3	0.8	0.44
316.22	0.4	0.9	0.46
316.23	0.4	0.9	0.47
316.24	0.5	1.0	0.49
316.25	0.6	1.1	0.5
316.26	0.6	1.2	0.51
316.27	0.7	1.3	0.53
316.28	0.8	1.4	0.54
316.29	0.8	1.5	0.55
316.30	0.9	1.6	0.56
316.31	1.0	1.7	0.58
316.32	1.1	1.8	0.59
316.33	1.2	1.9	0.6
316.34	1.3	2.1	0.61
316.35	1.4	2.2	0.62
316.36	1.5	2.3	0.64
316.37	1.6	2.4	0.65
316.38	1.7	2.6	0.66
316.39	1.8	2.7	0.67
316.40	1.9	2.8	0.68
316.41	2.1	3.0	0.69
316.42	2.2	3.1	0.71
316.43	2.4	3.3	0.72
316.44	2.5	3.4	0.73
316.45	2.7	3.6	0.74
316.46	2.8	3.8	0.75
316.47	3.0	3.9	0.76
316.48	3.2	4.1	0.77
316.49	3.3	4.3	0.78
316.50	3.5	4.4	0.79
316.51	3.7	4.6	0.8
316.52	3.9	4.8	0.81
316.53	4.1	5	0.82
316.54	4.3	5.2	0.83
316.55	4.5	5.4	0.84
316.56	4.8	5.6	0.85
316.57	5.0	5.8	0.87
316.58	5.2	6.0	0.88
316.59	5.5	6.2	0.89
316.60	5.7	6.4	0.9
316.61	6.0	6.6	0.91
316.62	6.3	6.8	0.91
316.63	6.5	7.1	0.92
316.64	6.8	7.3	0.93
316.65	7.1	7.5	0.94
316.66	7.4	7.7	0.95
316.67	7.7	8.0	0.96
316.68	8.0	8.2	0.97
316.69	8.3	8.5	0.98
316.70	8.6	8.7	0.99
316.71	9.0	9.0	1
316.72	9.3	9.2	1.01
316.73	9.7	9.5	1.02
316.74	10.0	9.7	1.03
316.75	10.4	10.0	1.04

CROSS SECTION 2

slope = 0.011538 m/m

Stage (mAHD)	Q (m3/s)	A (m2)	V (m/s)
333.00	0.0	0.0	0
333.01	0.0	0.0	0.06
333.02	0.0	0.0	0.1
333.03	0.0	0.1	0.13
333.04	0.0	0.1	0.16
333.05	0.0	0.2	0.18
333.06	0.0	0.2	0.21
333.07	0.1	0.3	0.23
333.08	0.1	0.4	0.25
333.09	0.1	0.5	0.27
333.10	0.2	0.7	0.29
333.11	0.2	0.8	0.31
333.12	0.3	0.9	0.33
333.13	0.4	1.1	0.35
333.14	0.5	1.3	0.36
333.15	0.6	1.5	0.38
333.16	0.7	1.7	0.4
333.17	0.8	1.9	0.41
333.18	0.9	2.1	0.43
333.19	1.1	2.4	0.45
333.20	1.2	2.6	0.46
333.21	1.4	2.9	0.48
333.22	1.6	3.2	0.49
333.23	1.8	3.5	0.51
333.24	2.0	3.8	0.52
333.25	2.2	4.1	0.54
333.26	2.4	4.4	0.55
333.27	2.7	4.8	0.56
333.28	3.0	5.1	0.58
333.29	3.2	5.5	0.59
333.30	3.6	5.9	0.6
333.31	3.9	6.3	0.62
333.32	4.2	6.7	0.63
333.33	4.6	7.1	0.64
333.34	5.0	7.6	0.66
333.35	5.4	8.0	0.67
333.36	5.8	8.5	0.68
333.37	6.2	8.9	0.7
333.38	6.7	9.4	0.71
333.39	7.2	9.9	0.72
333.40	7.7	10.5	0.73
333.41	8.2	11.0	0.74
333.42	8.7	11.5	0.76
333.43	9.3	12.1	0.77
333.44	9.9	12.7	0.78
333.45	10.5	13.2	0.79
333.46	11.1	13.8	0.8
333.47	11.8	14.4	0.82
333.48	12.5	15.1	0.83
333.49	13.2	15.7	0.84
333.50	13.9	16.3	0.85
333.51	14.6	17.0	0.86
333.52	15.4	17.7	0.87

CROSS SECTION 3

slope = 0.011538 m/m

Stage (mAHD)	Q (m3/s)	A (m2)	V (m/s)
331.00	0.0	0.0	0
331.05	0.0	0.2	0.17
331.06	0.1	0.3	0.19
331.07	0.1	0.4	0.21
331.08	0.1	0.5	0.23
331.09	0.2	0.6	0.25
331.10	0.2	0.8	0.27
331.11	0.3	0.9	0.29
331.12	0.3	1.1	0.31
331.13	0.4	1.3	0.32
331.14	0.5	1.5	0.34
331.15	0.6	1.7	0.36
331.16	0.7	1.9	0.37
331.17	0.8	2.2	0.39
331.18	1.0	2.4	0.4
331.19	1.1	2.7	0.42
331.20	1.3	3.0	0.43
331.21	1.5	3.3	0.45
331.22	1.7	3.6	0.46
331.23	1.9	4.0	0.47
331.24	2.1	4.3	0.49
331.25	2.3	4.7	0.5
331.26	2.6	5.1	0.51
331.27	2.9	5.5	0.53
331.28	3.2	5.9	0.54
331.29	3.5	6.3	0.55
331.30	3.8	6.8	0.56
331.31	4.2	7.2	0.58
331.32	4.5	7.7	0.59
331.33	4.9	8.2	0.6
331.34	5.3	8.7	0.61
331.35	5.7	9.2	0.63
331.36	6.2	9.7	0.64
331.37	6.7	10.3	0.65
331.38	7.2	10.8	0.66
331.39	7.7	11.4	0.67
331.40	8.2	12.0	0.68
331.41	8.8	12.6	0.7
331.42	9.3	13.2	0.71
331.43	10.0	13.9	0.72
331.44	10.6	14.5	0.73
331.45	11.2	15.2	0.74
331.46	11.9	15.9	0.75
331.47	12.6	16.6	0.76
331.48	13.3	17.3	0.77
331.49	14.1	18.0	0.78
331.50	14.9	18.8	0.79
331.51	15.7	19.5	0.8
331.52	16.5	20.3	0.81
331.53	17.4	21.1	0.83
331.54	18.3	21.9	0.84
331.55	19.2	22.7	0.85
331.56	20.1	23.5	0.86

CROSS SECTION 4

slope = 0.007924 m/m

Stage (mAHD)	Q (m3/s)	A (m2)	V (m/s)
332.50	0.0	0.0	0
332.51	0.0	0.0	0.05
332.52	0.0	0.0	0.08
332.53	0.0	0.1	0.11
332.54	0.0	0.1	0.13
332.55	0.0	0.2	0.15
332.56	0.0	0.2	0.17
332.57	0.1	0.3	0.19
332.58	0.1	0.4	0.21
332.59	0.1	0.5	0.22
332.60	0.2	0.6	0.24
332.61	0.2	0.8	0.26
332.62	0.3	0.9	0.27
332.63	0.3	1.1	0.29
332.64	0.4	1.3	0.3
332.65	0.5	1.5	0.32
332.66	0.5	1.7	0.33
332.67	0.6	1.9	0.34
332.68	0.8	2.1	0.36
332.69	0.9	2.3	0.37
332.70	1.0	2.6	0.38
332.71	1.1	2.9	0.4
332.72	1.3	3.1	0.41
332.73	1.4	3.4	0.42
332.74	1.6	3.7	0.43
332.75	1.8	4.1	0.44
332.76	2.0	4.4	0.46
332.77	2.2	4.7	0.47
332.78	2.4	5.1	0.48
332.79	2.7	5.5	0.49
332.80	2.9	5.9	0.5
332.81	3.2	6.2	0.51
332.82	3.5	6.7	0.52
332.83	3.8	7.1	0.53
332.84	4.1	7.5	0.55
332.85	4.4	8.0	0.56
332.86	4.8	8.4	0.57
332.87	5.1	8.9	0.58
332.88	5.5	9.4	0.59
332.89	5.9	9.9	0.6
332.90	6.3	10.4	0.61
332.91	6.8	10.9	0.62
332.92	7.2	11.5	0.63
332.93	7.7	12.0	0.64
332.94	8.2	12.6	0.65
332.95	8.7	13.2	0.66
332.96	9.2	13.8	0.67
332.97	9.7	14.4	0.68
332.98	10.3	15.0	0.69
332.99	10.9	15.6	0.7
333.00	11.5	16.3	0.71
333.01	12.2	16.9	0.72
333.02	13.0	17.6	0.74
333.03	13.8	18.2	0.76
333.04	14.7	18.9	0.78
333.05	15.5	19.5	0.8
333.06	16.4	20.2	0.81
333.07	17.3	20.9	0.83
333.08	18.2	21.5	0.85
333.09	19.2	22.2	0.86
333.10	20.1	22.9	0.88

CROSS SECTION 5

slope = 0.01006 m/m

Stage (mAHD)	Q (m3/s)	A (m2)	V (m/s)
331.50	0.0	0.0	0
331.51	0.0	0.0	0.06
331.52	0.0	0.0	0.09
331.53	0.0	0.1	0.12
331.54	0.0	0.2	0.15
331.55	0.0	0.3	0.17
331.56	0.1	0.4	0.19
331.57	0.1	0.5	0.22
331.58	0.2	0.7	0.24
331.59	0.2	0.9	0.25
331.60	0.3	1.0	0.27
331.61	0.4	1.3	0.29
331.62	0.5	1.5	0.31
331.63	0.6	1.8	0.32
331.64	0.7	2.1	0.34
331.65	0.8	2.4	0.36
331.66	1.0	2.7	0.37
331.67	1.2	3.0	0.39
331.68	1.4	3.4	0.4
331.69	1.6	3.8	0.42
331.70	1.8	4.2	0.43
331.71	2.1	4.6	0.45
331.72	2.3	5.1	0.46
331.73	2.6	5.6	0.48
331.74	3.0	6.0	0.49
331.75	3.3	6.6	0.5
331.76	3.7	7.1	0.52
331.77	4.0	7.7	0.53
331.78	4.5	8.2	0.54
331.79	4.9	8.8	0.55
331.80	5.4	9.5	0.57
331.81	5.9	10.1	0.58
331.82	6.4	10.8	0.59
331.83	6.9	11.4	0.6
331.84	7.5	12.1	0.62
331.85	8.1	12.9	0.63
331.86	8.7	13.6	0.64
331.87	9.4	14.4	0.65
331.88	10.1	15.2	0.66
331.89	10.8	16.0	0.68
331.90	11.5	16.8	0.69
331.91	12.3	17.7	0.7
331.92	13.2	18.5	0.71
331.93	14.0	19.4	0.72
331.94	14.9	20.3	0.73
331.95	15.8	21.3	0.74
331.96	16.8	22.2	0.75
331.97	17.8	23.2	0.77
331.98	18.8	24.2	0.78
331.99	19.8	25.2	0.79
332.00	20.9	26.3	0.8
332.01	22.4	27.3	0.82
332.02	23.8	28.4	0.84

CROSS SECTION 6

slope = 0.005083 m/m

Stage (mAHD)	Q (m3/s)	A (m2)	V (m/s)
326.00	0.0	0.0	0
326.01	0.0	0.0	0.04
326.02	0.0	0.1	0.07
326.03	0.0	0.1	0.09
326.04	0.0	0.2	0.11
326.05	0.0	0.4	0.12
326.06	0.1	0.6	0.14
326.07	0.1	0.8	0.15
326.08	0.2	1.0	0.17
326.09	0.2	1.3	0.18
326.10	0.3	1.5	0.19
326.11	0.4	1.9	0.21
326.12	0.5	2.2	0.22
326.13	0.6	2.6	0.23
326.14	0.7	3.0	0.24
326.15	0.9	3.5	0.25
326.16	1.1	4.0	0.27
326.17	1.2	4.5	0.28
326.18	1.4	5.0	0.29
326.19	1.7	5.6	0.3
326.20	1.9	6.2	0.31
326.21	2.2	6.8	0.32
326.22	2.5	7.5	0.33
326.23	2.8	8.2	0.34
326.24	3.1	8.9	0.35
326.25	3.5	9.7	0.36
326.26	3.8	10.5	0.37
326.27	4.2	11.3	0.38
326.28	4.7	12.2	0.39
326.29	5.1	13.0	0.39
326.30	5.6	14.0	0.4
326.31	6.1	14.9	0.41
326.32	6.7	15.9	0.42
326.33	7.3	16.9	0.43
326.34	7.9	17.9	0.44
326.35	8.5	19.0	0.45
326.36	9.1	20.1	0.46
326.37	9.8	21.2	0.46
326.38	10.6	22.4	0.47
326.39	11.3	23.6	0.48
326.40	12.1	24.8	0.49
326.41	12.9	26.1	0.5
326.42	13.8	27.3	0.5
326.43	14.7	28.7	0.51
326.44	15.6	30.0	0.52
326.45	16.6	31.4	0.53
326.46	17.6	32.8	0.54
326.47	18.6	34.2	0.54
326.48	19.7	35.7	0.55
326.49	20.8	37.2	0.56
326.50	22.0	38.8	0.57
326.51	23.2	40.3	0.57
326.52	24.4	41.9	0.58

CROSS SECTION 7

slope = 0.006977 m/m

Stage (mAHD)	Q (m3/s)	A (m2)	V (m/s)
327.00	0.0	0.0	0
327.01	0.0	0.0	0.05
327.02	0.0	0.0	0.08
327.03	0.0	0.1	0.1
327.04	0.0	0.1	0.12
327.05	0.0	0.2	0.14
327.06	0.1	0.3	0.16
327.07	0.1	0.4	0.18
327.08	0.1	0.6	0.2
327.09	0.2	0.7	0.21
327.10	0.2	0.9	0.23
327.11	0.3	1.1	0.24
327.12	0.3	1.3	0.26
327.13	0.4	1.5	0.27
327.14	0.5	1.8	0.28
327.15	0.6	2.0	0.3
327.16	0.7	2.3	0.31
327.17	0.8	2.6	0.32
327.18	1.0	2.9	0.34
327.19	1.1	3.2	0.35
327.20	1.3	3.6	0.36
327.21	1.5	4.0	0.37
327.22	1.7	4.4	0.38
327.23	1.9	4.8	0.4
327.24	2.1	5.2	0.41
327.25	2.4	5.6	0.42
327.26	2.6	6.1	0.43
327.27	2.9	6.6	0.44
327.28	3.2	7.1	0.45
327.29	3.5	7.6	0.46
327.30	3.8	8.1	0.47
327.31	4.2	8.6	0.48
327.32	4.5	9.2	0.49
327.33	4.9	9.8	0.5
327.34	5.3	10.4	0.51
327.35	5.8	11.0	0.52
327.36	6.2	11.7	0.53
327.37	6.7	12.3	0.54
327.38	7.2	13.0	0.55
327.39	7.7	13.7	0.56
327.40	8.2	14.4	0.57
327.41	8.8	15.1	0.58
327.42	9.4	15.9	0.59
327.43	10.0	16.6	0.6
327.44	10.6	17.4	0.61
327.45	11.3	18.2	0.62
327.46	12.0	19.0	0.63
327.47	12.7	19.9	0.64
327.48	13.4	20.7	0.65
327.49	14.2	21.6	0.66
327.50	14.9	22.5	0.66
327.51	15.8	23.4	0.67
327.52	16.6	24.4	0.68

CROSS SECTION 8

slope = 0.006935 m/m

Stage (mAHD)	Q (m3/s)	A (m2)	V (m/s)
324.00	0.0	0.0	0
324.01	0.0	0.0	0.05
324.02	0.0	0.1	0.08
324.03	0.0	0.2	0.1
324.04	0.0	0.3	0.12
324.05	0.1	0.4	0.14
324.06	0.1	0.6	0.16
324.07	0.1	0.8	0.18
324.08	0.2	1.1	0.19
324.09	0.3	1.4	0.21
324.10	0.4	1.7	0.23
324.11	0.5	2.1	0.24
324.12	0.6	2.4	0.25
324.13	0.8	2.9	0.27
324.14	0.9	3.3	0.28
324.15	1.1	3.8	0.3
324.16	1.3	4.4	0.31
324.17	1.6	4.9	0.32
324.18	1.8	5.5	0.33
324.19	2.1	6.1	0.35
324.20	2.4	6.8	0.36
324.21	2.8	7.5	0.37
324.22	3.1	8.2	0.38
324.23	3.5	9.0	0.39
324.24	4.0	9.8	0.4
324.25	4.4	10.6	0.42
324.26	4.9	11.5	0.43
324.27	5.4	12.4	0.44
324.28	6.0	13.3	0.45
324.29	6.6	14.3	0.46
324.30	7.2	15.3	0.47
324.31	7.8	16.3	0.48
324.32	8.5	17.4	0.49
324.33	9.3	18.5	0.5
324.34	10.0	19.7	0.51
324.35	10.8	20.8	0.52
324.36	11.7	22.0	0.53
324.37	12.6	23.3	0.54
324.38	13.5	24.5	0.55
324.39	14.4	25.9	0.56
324.40	15.5	27.2	0.57
324.41	16.5	28.6	0.58
324.42	17.6	30.0	0.59
324.43	18.7	31.4	0.6
324.44	19.9	32.9	0.61
324.45	21.2	34.4	0.61
324.46	22.4	36.0	0.62
324.47	23.8	37.6	0.63
324.48	25.1	39.2	0.64
324.49	26.6	40.8	0.65
324.50	28.0	42.5	0.66
324.51	29.5	44.2	0.67
324.52	31.1	46.0	0.68

CROSS SECTION 9

slope = 0.006935 m/m

Stage (mAHD)	Q (m3/s)	A (m2)	V (m/s)
323.00	0.0	0.0	0
323.01	0.0	0.0	0.05
323.02	0.0	0.0	0.08
323.03	0.0	0.0	0.1
323.04	0.0	0.1	0.12
323.05	0.0	0.1	0.14
323.06	0.0	0.2	0.16
323.07	0.0	0.2	0.18
323.08	0.1	0.3	0.19
323.09	0.1	0.4	0.21
323.10	0.1	0.5	0.23
323.11	0.1	0.6	0.24
323.12	0.2	0.7	0.25
323.13	0.2	0.8	0.27
323.14	0.3	0.9	0.28
323.15	0.3	1.1	0.29
323.16	0.4	1.2	0.31
323.17	0.4	1.4	0.32
323.18	0.5	1.6	0.33
323.19	0.6	1.7	0.35
323.20	0.7	1.9	0.36
323.21	0.8	2.1	0.37
323.22	0.9	2.3	0.38
323.23	1.0	2.5	0.39
323.24	1.1	2.8	0.4
323.25	1.2	3.0	0.41
323.26	1.4	3.3	0.43
323.27	1.5	3.5	0.44
323.28	1.7	3.8	0.45
323.29	1.9	4.0	0.46
323.30	2.0	4.3	0.47
323.31	2.2	4.6	0.48
323.32	2.4	4.9	0.49
323.33	2.6	5.2	0.5
323.34	2.8	5.6	0.51
323.35	3.1	5.9	0.52
323.36	3.3	6.2	0.53
323.37	3.5	6.6	0.54
323.38	3.8	6.9	0.55
323.39	4.1	7.3	0.56
323.40	4.4	7.7	0.57
323.41	4.7	8.1	0.58
323.42	5.0	8.5	0.59
323.43	5.3	8.9	0.6
323.44	5.6	9.3	0.6
323.45	6.0	9.7	0.61
323.46	6.3	10.2	0.62
323.47	6.7	10.6	0.63
323.48	7.1	11.1	0.64
323.49	7.5	11.6	0.65
323.50	7.9	12.0	0.66
323.51	8.3	12.5	0.67
323.52	8.8	13.0	0.68
323.53	9.2	13.5	0.68
323.54	9.7	14	0.69
323.55	10.2	14.6	0.7
323.56	10.7	15.1	0.71
323.57	11.2	15.6	0.72
323.58	11.8	16.2	0.73
323.59	12.3	16.8	0.73
323.60	12.9	17.3	0.74
323.61	13.5	17.9	0.75
323.62	14.0	18.5	0.76
323.63	14.7	19.1	0.77
323.64	15.3	19.7	0.78
323.65	15.9	20.3	0.78
323.76	24.2	27.8	0.87
323.77	25.0	28.5	0.88
323.78	25.9	29.3	0.89
323.79	26.8	30.0	0.89
323.80	27.7	30.8	0.9
323.81	28.7	31.6	0.91
323.82	29.6	32.4	0.92
323.83	30.6	33.2	0.92
323.84	31.6	34.0	0.93
323.85	32.6	34.8	0.94

CROSS SECTION 10

slope = 0.006935 m/m

Stage (mAHD)	Q (m3/s)	A (m2)	V (m/s)
322.70	0.0	0.0	0
322.71	0.0	0.0	0.05
322.72	0.0	0.1	0.08
322.73	0.0	0.3	0.1
322.74	0.1	0.5	0.12
322.75	0.1	0.8	0.14
322.76	0.2	1.2	0.16
322.77	0.3	1.6	0.18
322.78	0.4	2.1	0.19
322.79	0.6	2.7	0.21
322.80	0.8	3.3	0.23
322.81	1.0	4.0	0.24
322.82	1.2	4.8	0.25
322.83	1.5	5.7	0.27
322.84	1.8	6.6	0.28
322.85	2.2	7.5	0.3
322.86	2.6	8.6	0.31
322.87	3.1	9.7	0.32
322.88	3.6	10.8	0.33
322.89	4.2	12.1	0.35
322.90	4.8	13.4	0.36
322.91	5.5	14.7	0.37
322.92	6.2	16.2	0.38
322.93	6.9	17.7	0.39
322.94	7.8	19.3	0.4
322.95	8.7	20.9	0.42
322.96	9.6	22.6	0.43
322.97	10.7	24.4	0.44
322.98	11.7	26.2	0.45
322.99	12.9	28.1	0.46
323.00	14.1	30.1	0.47
323.01	15.7	32.1	0.49
323.02	17.4	34.1	0.51
323.03	19.1	36.1	0.53
323.04	20.9	38.1	0.55
323.05	22.8	40.1	0.57
323.06	24.7	42.1	0.59
323.07	26.7	44.2	0.61
323.08	28.8	46.2	0.62
323.09	30.9	48.2	0.64
323.10	33.1	50.2	0.66
323.11	35.3	52.2	0.68
323.12	37.6	54.2	0.69
323.13	39.9	56.2	0.71
323.14	42.3	58.2	0.73
323.15	44.8	60.2	0.74
323.16	47.3	62.3	0.76
323.17	49.9	64.3	0.78
323.18	52.5	66.3	0.79
323.19	55.2	68.3	0.81
323.20	57.9	70.3	0.82
323.21	60.7	72.3	0.84
323.22	63.6	74.4	0.85

CROSS SECTION 11

slope = 0.007568 m/m

Stage (mAHD)	Q (m3/s)	A (m2)	V (m/s)
323.00	0.0	0.0	0
323.01	0.1	1.5	0.08
323.02	0.4	2.9	0.13
323.03	0.7	4.4	0.17
323.04	1.2	5.9	0.2
323.05	1.7	7.4	0.24
323.06	2.4	8.9	0.27
323.07	3.1	10.4	0.29
323.08	3.8	11.9	0.32
323.09	4.7	13.5	0.35
323.10	5.6	15.0	0.37
323.11	6.5	16.6	0.39
323.12	7.6	18.1	0.42
323.13	8.7	19.7	0.44
323.14	9.8	21.3	0.46
323.15	11.1	22.9	0.48
323.16	12.3	24.5	0.5
323.17	13.7	26.1	0.52
323.18	15.1	27.8	0.54
323.19	16.5	29.4	0.56
323.20	18.1	31.0	0.58
323.21	19.6	32.7	0.6
323.22	21.3	34.4	0.62
323.23	22.9	36.1	0.64
323.24	24.7	37.8	0.65
323.25	26.5	39.5	0.67
323.26	28.3	41.2	0.69
323.27	30.2	42.9	0.7
323.28	32.2	44.6	0.72
323.29	34.2	46.4	0.74
323.30	36.3	48.1	0.75
323.31	38.4	49.9	0.77
323.32	40.5	51.6	0.78
323.33	42.8	53.4	0.8
323.34	45.0	55.2	0.82
323.35	47.4	57.0	0.83
323.36	49.7	58.8	0.85
323.37	52.2	60.7	0.86
323.38	54.7	62.5	0.87
323.39	57.2	64.3	0.89
323.40	59.8	66.2	0.9
323.41	62.4	68.1	0.92
323.42	65.1	69.9	0.93
323.43	67.9	71.8	0.94
323.44	70.6	73.7	0.96
323.45	73.5	75.6	0.97
323.46	76.4	77.5	0.99
323.47	79.3	79.5	1
323.48	82.3	81.4	1.01
323.49	85.4	83.4	1.02
323.50	88.5	85.3	1.04
323.51	91.6	87.3	1.05
323.52	94.8	89.3	1.06

CROSS SECTION 11A

slope = 0.007568 m/m

Stage (mAHD)	Q (m3/s)	A (m2)	V (m/s)
317.90	0.0	0.0	0
317.91	0.0	0.0	0.05
317.92	0.0	0.0	0.08
317.93	0.0	0.1	0.11
317.94	0.0	0.1	0.13
317.95	0.0	0.2	0.15
317.96	0.1	0.3	0.17
317.97	0.1	0.4	0.19
317.98	0.1	0.6	0.2
317.99	0.2	0.7	0.22
318.00	0.2	0.9	0.24
318.01	0.3	1.1	0.25
318.02	0.3	1.3	0.27
318.03	0.4	1.5	0.28
318.04	0.5	1.8	0.3
318.05	0.6	2.0	0.31
318.06	0.7	2.3	0.32
318.07	0.9	2.6	0.34
318.08	1.0	2.9	0.35
318.09	1.2	3.2	0.36
318.10	1.3	3.6	0.38
318.11	1.5	3.9	0.39
318.12	1.7	4.3	0.4
318.13	1.9	4.7	0.41
318.14	2.2	5.2	0.42
318.15	2.4	5.6	0.44
318.16	2.7	6.0	0.45
318.17	3.0	6.5	0.46
318.18	3.3	7.0	0.47
318.19	3.6	7.5	0.48
318.20	4.0	8.0	0.49
318.21	4.3	8.6	0.5
318.22	4.7	9.2	0.51
318.23	5.1	9.7	0.52
318.24	5.5	10.3	0.53
318.25	6.0	11.0	0.54
318.26	6.4	11.6	0.56
318.27	6.9	12.2	0.57
318.28	7.4	12.9	0.58
318.29	8.0	13.6	0.59
318.30	8.5	14.3	0.6
318.31	9.1	15.0	0.61
318.32	9.7	15.8	0.62
318.33	10.3	16.5	0.63
318.34	11.0	17.3	0.63
318.35	11.7	18.1	0.64
318.36	12.4	18.9	0.65
318.37	13.1	19.8	0.66
318.38	13.9	20.6	0.67
318.39	14.6	21.5	0.68
318.40	15.5	22.4	0.69
318.41	16.3	23.3	0.7
318.42	17.2	24.2	0.71
318.43	18.1	25.1	0.72
318.44	19	26.1	0.73
318.45	19.9	27.1	0.74
318.46	20.9	28.0	0.75
318.47	21.9	29.1	0.75
318.48	23.0	30.1	0.76
318.49	24.0	31.1	0.77
318.50	25.1	32.2	0.78
318.51	26.3	33.3	0.79
318.52	27.4	34.4	0.8
318.53	28.6	35.5	0.81
318.54	29.9	36.6	0.81
318.55	31.1	37.8	0.82
318.56	32.4	39.0	0.83
318.57	33.7	40.2	0.84
318.58	35.1	41.4	0.85
318.59	36.5	42.6	0.86
318.60	37.9	43.8	0.87

CROSS SECTION 12

slope = 0.002707 m/m

Stage (mAHD)	Q (m3/s)	A (m2)	V (m/s)
316.00	0.0	0.0	0
316.01	0.0	0.0	0.06
316.02	0.0	0.0	0.09
316.03	0.0	0.0	0.12
316.04	0.0	0.0	0.15
316.05	0.0	0.0	0.17
316.06	0.0	0.1	0.19
316.07	0.0	0.1	0.21
316.08	0.0	0.1	0.23
316.09	0.0	0.1	0.25
316.10	0.0	0.2	0.27
316.11	0.1	0.2	0.29
316.12	0.1	0.3	0.31
316.13	0.1	0.3	0.32
316.14	0.1	0.3	0.34
316.15	0.1	0.4	0.36
316.16	0.2	0.5	0.37
316.17	0.2	0.5	0.39
316.18	0.2	0.6	0.4
316.19	0.3	0.6	0.42
316.20	0.3	0.7	0.43
316.21	0.3	0.8	0.44
316.22	0.4	0.9	0.46
316.23	0.4	0.9	0.47
316.24	0.5	1.0	0.49
316.25	0.6	1.1	0.5
316.26	0.6	1.2	0.51
316.27	0.7	1.3	0.53
316.28	0.8	1.4	0.54
316.29	0.8	1.5	0.55
316.30	0.9	1.6	0.56
316.31	1.0	1.7	0.58
316.32	1.1	1.8	0.59
316.33	1.2	1.9	0.6
316.34	1.3	2.1	0.61
316.35	1.4	2.2	0.62
316.36	1.5	2.3	0.64
316.37	1.6	2.4	0.65
316.38	1.7	2.6	0.66
316.39	1.8	2.7	0.67
316.40	1.9	2.8	0.68
316.41	2.1	3.0	0.69
316.42	2.2	3.1	0.71
316.43	2.4	3.3	0.72
316.44	2.5	3.4	0.73
316.45	2.7	3.6	0.74
316.46	2.8	3.8	0.75
316.47	3.0	3.9	0.76
316.48	3.2	4.1	0.77
316.49	3.3	4.3	0.78
316.50	3.5	4.4	0.79
316.51	3.7	4.6	0.8
316.52	3.9	4.8	0.81
316.53	4.1	5	0.82
316.54	4.3	5.2	0.83
316.55	4.5	5.4	0.84
316.56	4.8	5.6	0.85
316.57	5.0	5.8	0.87
316.58	5.2	6.0	0.88
316.59	5.5	6.2	0.89
316.60	5.7	6.4	0.9
316.61	6.0	6.6	0.91
316.62	6.3	6.8	0.91
316.63	6.5	7.1	0.92
316.64	6.8	7.3	0.93
316.65	7.1	7.5	0.94
316.66	7.4	7.7	0.95
316.67	7.7	8.0	0.96
316.68	8.0	8.2	0.97
316.69	8.3	8.5	0.98
316.70	8.6	8.7	0.99
316.71	9.0	9.0	1
316.72	9.3	9.2	1.01
316.73	9.7	9.5	1.02
316.74	10.0	9.7	1.03
316.75	10.4	10.0	1.04

CROSS SECTION 13

slope = 0.006369 m/m

Stage (mAHD)	Q (m3/s)	A (m2)	V (m/s)
319.00	0.0	0.0	0
319.01	0.1	1.0	0.07
319.02	0.2	1.9	0.12
319.03	0.4	2.9	0.15
319.04	0.7	3.8	0.19
319.05	1.0	4.8	0.22
319.06	1.4	5.8	0.24
319.07	1.8	6.8	0.27
319.08	2.3	7.8	0.29
319.09	2.8	8.8	0.32
319.10	3.3	9.8	0.34
319.11	3.9	10.8	0.36
319.12	4.5	11.8	0.38
319.13	5.2	12.8	0.41
319.14	5.9	13.8	0.43
319.15	6.6	14.9	0.44
319.16	7.4	15.9	0.46
319.17	8.2	16.9	0.48
319.18	9.0	18.0	0.5
319.19	9.9	19.0	0.52
319.20	10.8	20.1	0.54
319.21	11.7	21.2	0.55
319.22	12.7	22.2	0.57
319.23	13.7	23.3	0.59
319.24	14.7	24.4	0.6
319.25	15.8	25.5	0.62
319.26	16.9	26.6	0.63
319.27	18.0	27.7	0.65
319.28	19.1	28.8	0.67
319.29	20.3	29.9	0.68
319.30	21.6	31.0	0.7
319.31	22.8	32.1	0.71
319.32	24.1	33.2	0.73
319.33	25.4	34.3	0.74
319.34	26.7	35.5	0.75
319.35	28.1	36.6	0.77
319.36	29.5	37.8	0.78
319.37	30.9	38.9	0.8
319.38	32.4	40.1	0.81
319.39	33.9	41.2	0.82
319.40	35.4	42.4	0.84
319.41	37.0	43.6	0.85
319.42	38.5	44.8	0.86
319.43	40.2	45.9	0.87
319.44	41.8	47.1	0.89
319.45	43.5	48.3	0.9
319.46	45.2	49.5	0.91
319.47	46.9	50.7	0.92
319.48	48.6	51.9	0.94
319.49	50.4	53.2	0.95
319.50	52.2	54.4	0.96
319.51	54.1	55.6	0.97
319.52	56.0	56.8	0.98

CROSS SECTION 14

slope = 0.006431 m/m

Stage (mAHD)	Q (m3/s)	A (m2)	V (m/s)
324.00	0.0	0.0	0
324.01	0.0	0.0	0.05
324.02	0.0	0.0	0.07
324.03	0.0	0.1	0.1
324.04	0.0	0.1	0.12
324.05	0.0	0.2	0.14
324.06	0.0	0.3	0.15
324.07	0.1	0.4	0.17
324.08	0.1	0.5	0.19
324.09	0.1	0.6	0.2
324.10	0.2	0.8	0.22
324.11	0.2	1.0	0.23
324.12	0.3	1.2	0.25
324.13	0.3	1.4	0.26
324.14	0.4	1.6	0.27
324.15	0.5	1.8	0.28
324.16	0.6	2.0	0.3
324.17	0.7	2.3	0.31
324.18	0.8	2.6	0.32
324.19	1.0	2.9	0.33
324.20	1.1	3.2	0.34
324.21	1.3	3.5	0.36
324.22	1.4	3.9	0.37
324.23	1.6	4.2	0.38
324.24	1.8	4.6	0.39
324.25	2.0	5.0	0.4
324.26	2.2	5.4	0.41
324.27	2.5	5.8	0.42
324.28	2.7	6.3	0.43
324.29	3.0	6.7	0.44
324.30	3.3	7.2	0.45
324.31	3.5	7.7	0.46
324.32	3.9	8.2	0.47
324.33	4.2	8.7	0.48
324.34	4.5	9.2	0.49
324.35	4.9	9.8	0.5
324.36	5.3	10.4	0.51
324.37	5.7	11.0	0.52
324.38	6.1	11.6	0.53
324.39	6.5	12.2	0.54
324.40	7.0	12.8	0.55
324.41	7.5	13.4	0.56
324.42	8.0	14.1	0.57
324.43	8.5	14.8	0.57
324.44	9.0	15.5	0.58
324.45	9.6	16.2	0.59
324.46	10.2	16.9	0.6
324.47	10.8	17.7	0.61
324.48	11.4	18.4	0.62
324.49	12.0	19.2	0.63
324.50	12.7	20.0	0.63
324.51	13.4	20.8	0.64
324.52	14.1	21.6	0.65
324.53	14.8	22.5	0.66
324.54	15.6	23.3	0.67
324.55	16.4	24.2	0.68
324.56	17.2	25.1	0.68
324.57	18.0	26.0	0.69
324.58	18.9	26.9	0.7
324.59	19.7	27.8	0.71
324.60	20.6	28.8	0.72

CROSS SECTION 15

slope = 0.012531 m/m

Stage (mAHD)	Q (m3/s)	A (m2)	V (m/s)
328.70	0.0	0.0	0
328.71	0.0	0.0	0.07
328.72	0.0	0.0	0.1
328.73	0.0	0.1	0.14
328.74	0.0	0.1	0.16
328.75	0.0	0.1	0.19
328.76	0.0	0.2	0.22
328.77	0.1	0.3	0.24
328.78	0.1	0.4	0.26
328.79	0.1	0.5	0.28
328.80	0.2	0.6	0.3
328.81	0.2	0.7	0.32
328.82	0.3	0.8	0.34
328.83	0.4	1.0	0.36
328.84	0.4	1.1	0.38
328.85	0.5	1.3	0.4
328.86	0.6	1.5	0.42
328.87	0.7	1.7	0.43
328.88	0.8	1.9	0.45
328.89	1.0	2.1	0.47
328.90	1.1	2.3	0.48
328.91	1.3	2.6	0.5
328.92	1.4	2.8	0.51
328.93	1.6	3.1	0.53
328.94	1.8	3.4	0.54
328.95	2.0	3.6	0.56
328.96	2.3	3.9	0.57
328.97	2.5	4.3	0.59
328.98	2.8	4.6	0.6
328.99	3.0	4.9	0.62
329.00	3.3	5.3	0.63
329.01	3.7	5.6	0.66
329.02	4.1	6.0	0.69
329.03	4.5	6.3	0.71
329.04	4.9	6.7	0.74
329.05	5.4	7.1	0.76
329.06	5.8	7.4	0.78
329.07	6.3	7.8	0.81
329.08	6.8	8.2	0.83
329.09	7.3	8.6	0.85
329.10	7.8	9.0	0.87
329.11	8.4	9.4	0.89
329.12	8.9	9.8	0.91
329.13	9.5	10.2	0.93
329.14	10.1	10.6	0.95
329.15	10.7	11.0	0.97
329.16	11.4	11.4	0.99
329.17	12.0	11.9	1.01
329.18	12.7	12.3	1.03
329.19	13.3	12.7	1.05
329.20	14.0	13.1	1.07
329.21	14.8	13.6	1.09
329.22	15.5	14.0	1.1
329.23	16.2	14.5	1.12
329.24	17	14.9	1.14
329.25	17.8	15.4	1.15
329.26	18.6	15.9	1.17
329.27	19.4	16.3	1.19
329.28	20.2	16.8	1.2
329.29	21.1	17.3	1.22
329.30	22.0	17.8	1.24

CROSS SECTION 16

slope = 0.005149 m/m

Stage (mAHD)	Q (m3/s)	A (m2)	V (m/s)
334.90	0.0	0.0	0
334.91	0.0	0.1	0.04
334.92	0.0	0.3	0.07
334.93	0.0	0.6	0.09
334.94	0.1	1.0	0.11
334.95	0.2	1.6	0.12
334.96	0.3	2.3	0.14
334.97	0.5	3.1	0.15
334.98	0.7	4.0	0.17
334.99	0.9	5.1	0.18
335.00	1.2	6.3	0.19
335.01	1.6	7.5	0.22
335.02	2.1	8.8	0.24
335.03	2.7	10.1	0.26
335.04	3.2	11.4	0.28
335.05	3.9	12.7	0.3
335.06	4.5	14.0	0.32
335.07	5.3	15.4	0.34
335.08	6.0	16.7	0.36
335.09	6.8	18.1	0.38
335.10	7.7	19.5	0.4
335.11	8.6	20.9	0.41
335.12	9.6	22.3	0.43
335.13	10.5	23.8	0.44
335.14	11.6	25.2	0.46
335.15	12.6	26.7	0.47
335.16	13.8	28.2	0.49
335.17	14.9	29.7	0.5
335.18	16.1	31.2	0.52
335.19	17.4	32.7	0.53
335.20	18.6	34.3	0.54
335.21	20.0	35.8	0.56
335.22	21.3	37.4	0.57
335.23	22.7	39.0	0.58
335.24	24.2	40.6	0.6
335.25	25.7	42.2	0.61
335.26	27.2	43.8	0.62
335.27	28.8	45.5	0.63
335.28	30.4	47.1	0.65
335.29	32.1	48.8	0.66
335.30	33.8	50.5	0.67
335.31	35.5	52.2	0.68
335.32	37.3	53.9	0.69
335.33	39.1	55.7	0.7
335.34	41.0	57.4	0.71
335.35	42.9	59.2	0.72
335.36	44.8	61.0	0.74
335.37	46.8	62.8	0.75
335.38	48.8	64.6	0.76
335.39	50.9	66.4	0.77
335.40	53.0	68.3	0.78
335.41	55.2	70.1	0.79
335.42	57.4	72.0	0.8

CROSS SECTION 17

slope = 0.011643 m/m

Stage (mAHD)	Q (m3/s)	A (m2)	V (m/s)
337.00	0.0	0.0	0
337.01	0.0	0.0	0.06
337.02	0.0	0.0	0.1
337.03	0.0	0.1	0.13
337.04	0.0	0.1	0.16
337.05	0.0	0.2	0.18
337.06	0.1	0.3	0.21
337.07	0.1	0.4	0.23
337.08	0.1	0.5	0.25
337.09	0.2	0.6	0.27
337.10	0.2	0.8	0.29
337.11	0.3	0.9	0.31
337.12	0.4	1.1	0.33
337.13	0.5	1.3	0.35
337.14	0.6	1.5	0.37
337.15	0.7	1.7	0.38
337.16	0.8	2.0	0.4
337.17	0.9	2.2	0.42
337.18	1.1	2.5	0.43
337.19	1.3	2.8	0.45
337.20	1.4	3.1	0.46
337.21	1.6	3.4	0.48
337.22	1.9	3.8	0.49
337.23	2.1	4.1	0.51
337.24	2.3	4.5	0.52
337.25	2.6	4.8	0.54
337.26	2.9	5.2	0.55
337.27	3.2	5.6	0.57
337.28	3.5	6.1	0.58
337.29	3.9	6.5	0.59
337.30	4.2	7.0	0.61
337.31	4.6	7.4	0.62
337.32	5.0	7.9	0.63
337.33	5.5	8.4	0.65
337.34	5.9	9.0	0.66
337.35	6.4	9.5	0.67
337.36	6.9	10.0	0.69
337.37	7.4	10.6	0.7
337.38	8.0	11.2	0.71
337.39	8.5	11.8	0.72
337.40	9.1	12.4	0.74
337.41	9.8	13.0	0.75
337.42	10.4	13.7	0.76
337.43	11.1	14.3	0.77
337.44	11.8	15.0	0.78
337.45	12.5	15.7	0.8
337.46	13.3	16.4	0.81
337.47	14.0	17.1	0.82
337.48	14.9	17.9	0.83
337.49	15.7	18.6	0.84
337.50	16.6	19.4	0.85
337.51	17.5	20.2	0.87
337.52	18.4	21.0	0.88

CROSS SECTION 18

slope = 0.011643 m/m

Stage (mAHD)	Q (m3/s)	A (m2)	V (m/s)
330.90	0.0	0.0	0
330.91	0.0	0.1	0.06
330.92	0.0	0.3	0.1
330.93	0.1	0.6	0.13
330.94	0.2	1.1	0.16
330.95	0.3	1.8	0.18
330.96	0.5	2.5	0.21
330.97	0.8	3.4	0.23
330.98	1.1	4.5	0.25
330.99	1.5	5.7	0.27
331.00	2.0	7.0	0.29
331.01	2.8	8.4	0.33
331.02	3.6	9.8	0.37
331.03	4.5	11.2	0.4
331.04	5.5	12.7	0.43
331.05	6.5	14.1	0.46
331.06	7.7	15.6	0.49
331.07	8.9	17.1	0.52
331.08	10.1	18.5	0.55
331.09	11.5	20.0	0.57
331.10	12.9	21.5	0.6
331.11	14.4	23.0	0.63
331.12	16.0	24.6	0.65
331.13	17.6	26.1	0.68
331.14	19.3	27.6	0.7
331.15	21.1	29.2	0.72
331.16	22.9	30.7	0.75
331.17	24.8	32.3	0.77
331.18	26.8	33.9	0.79
331.19	28.8	35.5	0.81
331.20	30.9	37.1	0.83
331.21	33.1	38.7	0.85
331.22	35.3	40.3	0.87
331.23	37.6	42.0	0.89
331.24	39.9	43.6	0.91
331.25	42.3	45.3	0.93
331.26	44.8	46.9	0.95
331.27	47.3	48.6	0.97
331.28	49.9	50.3	0.99
331.29	52.6	52.0	1.01
331.30	55.3	53.7	1.03
331.31	58.1	55.4	1.05
331.32	60.9	57.2	1.07
331.33	63.8	58.9	1.08
331.34	66.8	60.7	1.1
331.35	69.8	62.4	1.12
331.36	72.9	64.2	1.14
331.37	76.1	66.0	1.15
331.38	79.3	67.8	1.17
331.39	82.5	69.6	1.19
331.40	85.9	71.4	1.2
331.41	89.3	73.2	1.22
331.42	92.7	75.1	1.24

CROSS SECTION 19

slope = 0.014599 m/m

Stage (mAHD)	Q (m3/s)	A (m2)	V (m/s)
337.50	0.0	0.0	0
337.51	0.0	0.0	0.07
337.52	0.0	0.0	0.11
337.53	0.0	0.1	0.15
337.54	0.0	0.2	0.18
337.55	0.1	0.3	0.21
337.56	0.1	0.4	0.23
337.57	0.2	0.6	0.26
337.58	0.2	0.8	0.28
337.59	0.3	1.0	0.31
337.60	0.4	1.2	0.33
337.61	0.5	1.5	0.35
337.62	0.6	1.7	0.37
337.63	0.8	2.0	0.39
337.64	1.0	2.4	0.41
337.65	1.2	2.7	0.43
337.66	1.4	3.1	0.45
337.67	1.6	3.5	0.47
337.68	1.9	3.9	0.49
337.69	2.2	4.3	0.5
337.70	2.5	4.8	0.52
337.71	2.8	5.3	0.54
337.72	3.2	5.8	0.55
337.73	3.6	6.3	0.57
337.74	4.1	6.9	0.59
337.75	4.5	7.5	0.6
337.76	5.0	8.1	0.62
337.77	5.6	8.7	0.64
337.78	6.1	9.4	0.65
337.79	6.7	10.1	0.67
337.80	7.4	10.8	0.68
337.81	8.0	11.5	0.7
337.82	8.8	12.3	0.71
337.83	9.5	13.1	0.73
337.84	10.3	13.9	0.74
337.85	11.1	14.7	0.76
337.86	12.0	15.6	0.77
337.87	12.9	16.4	0.78
337.88	13.8	17.3	0.8
337.89	14.8	18.3	0.81
337.90	15.9	19.2	0.83
337.91	16.9	20.2	0.84
337.92	18.1	21.2	0.85
337.93	19.2	22.2	0.87
337.94	20.5	23.2	0.88
337.95	21.7	24.3	0.89
337.96	23.0	25.4	0.91
337.97	24.4	26.5	0.92
337.98	25.8	27.6	0.93
337.99	27.3	28.8	0.95
338.00	28.8	30.0	0.96
338.01	30.7	31.2	0.98
338.02	32.7	32.4	1.01

CROSS SECTION 20

slope = 0.003994 m/m

Stage (mAHD)	Q (m3/s)	A (m2)	V (m/s)
327.90	0.0	0.0	0
327.91	0.0	0.1	0.04
327.92	0.0	0.2	0.06
327.93	0.0	0.5	0.08
327.94	0.1	0.9	0.09
327.95	0.1	1.4	0.11
327.96	0.2	2.0	0.12
327.97	0.4	2.7	0.14
327.98	0.5	3.5	0.15
327.99	0.7	4.5	0.16
328.00	0.9	5.5	0.17
328.01	1.3	6.6	0.19
328.02	1.7	7.7	0.21
328.03	2.1	8.8	0.23
328.04	2.5	9.9	0.25
328.05	3.0	11.1	0.27
328.06	3.5	12.2	0.29
328.07	4.1	13.3	0.31
328.08	4.7	14.5	0.32
328.09	5.3	15.6	0.34
328.10	5.9	16.8	0.35
328.11	6.6	17.9	0.37
328.12	7.3	19.1	0.38
328.13	8.1	20.3	0.4
328.14	8.9	21.5	0.41
328.15	9.7	22.6	0.43
328.16	10.5	23.8	0.44
328.17	11.4	25.0	0.45
328.18	12.2	26.2	0.47
328.19	13.2	27.4	0.48
328.20	14.1	28.7	0.49
328.21	15.1	29.9	0.51
328.22	16.1	31.1	0.52
328.23	17.1	32.3	0.53
328.24	18.2	33.6	0.54
328.25	19.3	34.8	0.55
328.26	20.4	36.0	0.57
328.27	21.5	37.3	0.58
328.28	22.7	38.6	0.59
328.29	23.9	39.8	0.6
328.30	25.1	41.1	0.61
328.31	26.4	42.4	0.62
328.32	27.6	43.6	0.63
328.33	28.9	44.9	0.64
328.34	30.3	46.2	0.65
328.35	31.6	47.5	0.67
328.36	33.0	48.8	0.68
328.37	34.4	50.1	0.69
328.38	35.8	51.5	0.7
328.39	37.3	52.8	0.71
328.40	38.8	54.1	0.72
328.41	40.3	55.4	0.73
328.42	41.8	56.8	0.74