

# MEMO

To: Michael Laurent

From: EHS Support

CC: Ash Fertch

Date: 16 March 2026

Re: Water Balance Evaluation for Bennett Resources Valhalla Gas Exploration and Appraisal Program

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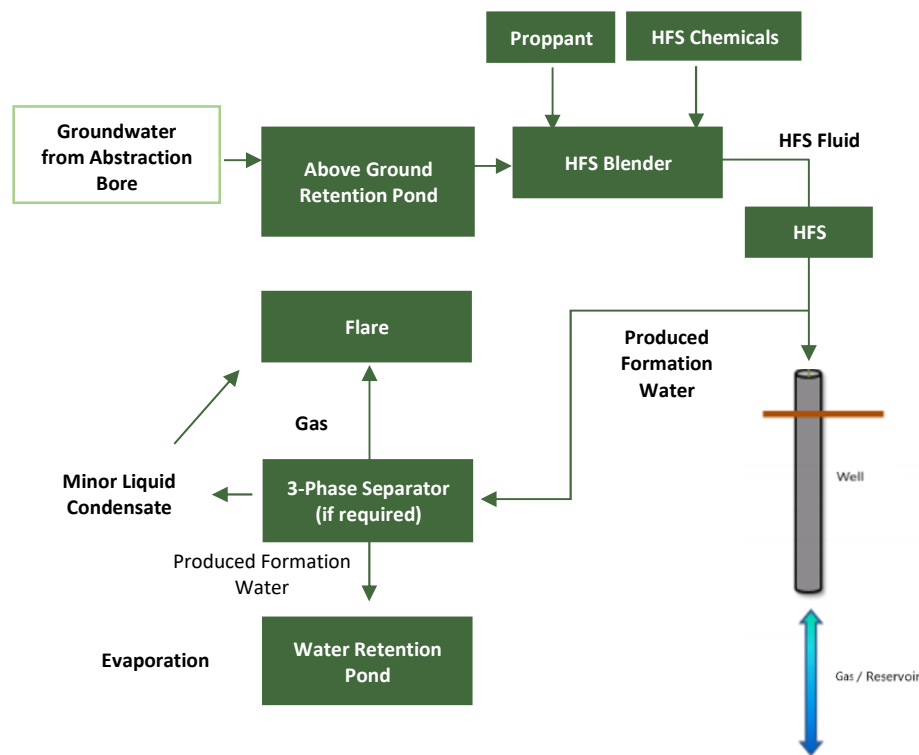
Prepared by Amit Meskar, Project Engineer and reviewed by Kevin Simpson, Principal Engineer of EHS Support.

This document is intended to provide additional support to arguments relating to climate change and extreme rainfall events in relation to proposed produced water storage in the document 'Valhalla Gas Exploration and Appraisal Program EPBC Act Preliminary Documentation 2024-10006, V3'.

## Context and Scope

This memorandum describes the modelling undertaken to evaluate the water balance for the Bennett Resources (BNR) Proposed Action and summarises the findings.

**Figure 1** illustrates the proposed liquids and gas cycle process (the process) for each well site. Each well site will typically include two exploration wells. The process is the same for each well site and consequently the water balance is undertaken for one well site with the assumption the process and modelling can be replicated at each well site.



**FIGURE 1 LIQUIDS AND GAS CYCLE PROCESS FLOW SCHEMATIC**

Water for drilling and hydraulic fracture stimulation (HFS) is sourced from groundwater. Abstracted groundwater is stored in an above groundwater retention pond. Water is then drawn from this pond for drilling and HFS. Flowback water from the wells during HFS is separated in a 3-phase separator and transferred to a produced formation water retention pond. The two wells on each well site share this pond.

The focus of this evaluation is water levels in the produced formation water retention pond, which is influenced by:

- Flowback water from the process.
- Rainwater, including increased rain forecast due to climate change impacts.
- Evaporation.

## Model and Water Balance Calculation

An Excel-based water balance model owned by EHS Support (“the Model”) was used for the evaluation. The Model calculates a monthly water balance based on monthly inputs (produced formation water and rainfall) and outputs (evaporation). The changes in water level in the produced formation water retention pond are calculated using the inputs and outputs and geometry of the pond for each month. The Model calculates monthly water balances for the Proposed Action duration and charts the results.



## Produced Formation Water

For this evaluation, produced formation water to the produced formation water retention pond is flowback water after HFS events. The flowback water is a proportion of the HFS water and based on results of previous HFS events in the Canning Basin<sup>1</sup> and analogues from similar fields globally, the proportion (recovery) is around 50%. To add conservatism, recovery proportions of 60% and 70% are modelled in Case 1 and 2 described below. The higher the recovery, the higher the volume of water going to the produced formation water retention pond. The assumed volume for each flowback condition is shown in **Table 1**.

**TABLE 1** PRODUCED FORMATION WATER VOLUME BASED ON 50%, 60%, AND 70% FLOWBACK ASSUMPTION

Flowback condition #	Flowback Assumption	Volume of Produced Water per well per year (ML/year)
1	70%	57
2	60%	49
3	50%	41

To account for potential variation in the HFS program that would be undertaken, this evaluation models two cases.

### Case 1

Case 1 assumes:

- Produced water is stored in the produced formation water pond.
- HFS event will occur within a 12-month period.<sup>2</sup>
- Well testing, is the recovery of flowback water after an HFS event and occurs for no more than 90 days in total.
- Well testing is likely to occur in the dry season: May to October 2027.

After the 90<sup>th</sup> day the modelling assumes no further accumulation of produced water and the pond level changes in response to rainfall and evaporation only.

<sup>1</sup> Buru Energy Submission to the Scientific Inquiry into Hydraulic Fracture Stimulation in Western Australia (Buru, 2018)

<sup>2</sup> A HFS event is when water is pumped into the formation but does not include well testing.

## Case 2

Case 2 assumes:

- Two wells on the same well site and the produced formation water pond.
- Produced water from both wells is stored in the produced formation water pond
- Both wells undergo well testing consecutively over a 180 day period (90 single days testing per well<sup>3</sup> .
- Well testing is likely to occur in the dry season: May to October 2027.

After the 180 days, the modelling assumes no further accumulation of produced water and the pond level changes in response to rainfall and evaporation only.

## Produced Formation Water Retention Pond and Operating Limit

BNR proposes the use of an L-shaped pond. The Model does not allow for irregular shaped ponds and consequently a proxy rectangular pond is used (assumed inverted frustum of a pyramid shape). The volume is the same as for the L-shaped drain and is shown below in **Table 2**.

A 500 millimeters (mm) freeboard is assumed below the crest level and the water level at this freeboard is assumed to be the operating limit. The water height and volumes at the freeboard limit and crest level for the produced formation water retention pond walls are shown in **Table 2**.

**TABLE 2 PRODUCED FORMATION WATER RETENTION POND VOLUMES**

Item	Volume	Height above base (m)
Pond volume (crest)	114.5 ML	5.5
Operating limit (at freeboard level)	98.5 ML	5.0

## Rainfall and Evaporation

Historical mean, 90<sup>th</sup> percentile, and maximum monthly rainfall data was sourced from the Bureau of Meteorology (BoM) website<sup>4</sup>.

The Proposed Action area is referenced as co-ordinates -18.020108, 124.765323, Calwinyardah-Noonkanbah Rd, Mount Hard within the Shire of Derby / West Kimberley. These co-ordinates are used as a general location within the wider project area to provide a reference point for the selection of the weather station. Nearby weather stations include Mount Hardman (about 10 kilometers (km) from the

<sup>4</sup> [https://www.bom.gov.au/climate/averages/tables/cw\\_003093\\_All.shtml](https://www.bom.gov.au/climate/averages/tables/cw_003093_All.shtml) (accessed 25 February 2026)



Proposed Action area); Derby (about 120 km from the Proposed Action area); and Fitzroy Crossing Aero (about 85 km from the Proposed Action area). While the Mount Hardman station is only 10 km from the Proposed Action area, it only has data since 1997. Derby weather station is further than Fitzroy Crossing and close to the coast where the ocean may influence climate. Consequently, **Fitzroy Crossing Aero weather station** was selected as the most appropriate data source for rainfall and evaporation.

To account for uncertainty associated with rainfall over the course of the Proposed Action, the following scenarios are modelled:

1. Average rainfall (see **Table A1**).
2. Average rainfall with 1 in a 100-year (1% Annual Exceedance Probability (AEP)) storm event in year 1 of HFS<sup>5</sup>. The storm event is assumed to last for 72 hours (3 days) and to occur in May 2027.
3. Average rainfall with one in a 200-year (0.5% AEP) storm event in year 1 of HFS. The storm event is assumed to last for 72 hours (3 days) and to occur in May 2027.
4. 90<sup>th</sup> percentile rainfall during the wet season months of November through April. This represents an absolute worst case.

The probability of a 1 in 100 year (1% AEP) or 1 in 200 year (0.5% AEP) storm event occurring during the proposed action duration of 7 years is estimated at 6.8% and 3.4%, respectively. This probability is calculated using the Binomial Distribution and Complement rule in Probability (Ross, 2010):

$$P(\text{failure}) = (1 - AEP)^n$$

where

*P(failure)* is the probability of at least 1 event failure / storm not occurring,

*AEP* is the Annual Exceedance Probability as described above and used as 1% for 1 in a 100 year storm and 0.5% for 1 in a 200 year storm,

*n* is the proposed action / project duration of 7 years.

The above formula can then be used to calculate the probability of at least 1 storm event (1 in a 100 year storm / 1 in a 200 year storm) successfully occurring during the project duration of 7 years using the complement rule of Probability.

$$P(\text{at least 1 event of a 1 in a 100 or 200 year storm}) = 1 - (1 - AEP)^n$$

where

*P(at least 1 event of a 1 in a 100 or 200 year storm)* is the probability of at least 1 event / storm occurring during the proposed action / project duration,

*AEP* is the Annual Exceedance Probability as described above and used as 1% for 1 in a 100 year storm and 0.5% for 1 in a 200 year storm,

*n* is the proposed action / project duration of 7 years

<sup>5</sup><https://www.bom.gov.au/climate/current/month/wa/archive/202301.summary.shtml#:~:text=Ex%2DTropical%20Cyclone%20Ellie%20brought,Kimberley%20region%20of%20Western%20Australia.>



The mean rainfall data set is adjusted for climate impacts (see next section), but these are unlikely to be material within this timeframe / project duration. Further, it is assumed the storm events occur at the end of the wet season (November – April in the Kimberley).

The 1 in 100 storm event adds 345 mm and the 1 in 200 storm events adds 400 mm to the average rainfall for the month.

Further conservatism is added by applying an **evaporation coefficient of 0.75** to the pan evaporation to account for pond wall effects (Luke, 1987). Section 3 of the referenced document states that the general coefficients of 0.70 to 0.78 are generally adopted. Considering the location of the proposed activity with high temperatures and winds and the size of the pond (wall effects decrease with size), a value near the upper end of this range is likely representative of actual conditions.

### Accounting for Climate Impacts

The Independent Expert Scientific Committee (IESC) on Unconventional Gas Development and Large Coal Mining Development (IESC, 2025), states “the water balance calculations need to account for the occurrence of extreme rainfall intensities due to 1.3°C global warming which has already occurred”. The ‘Book 1 – Scope and Philosophy’ released under ‘A Guide To Flood Estimation’ by the Australian Rainfall & Runoff (ARR) Chapter 6 has the equation below to estimate projected rainfall for any rare, high intensity rainfall events (Wasko C, 2024):

$$I_p = I \left( 1 + \frac{\alpha}{100} \right)^{\Delta T}$$

where,

*I<sub>p</sub>* is the projected (current or future) design rainfall depth or intensity,

*I* is the historical design rainfall depth or intensity (data from BoM),

*α* is the rate of change as from **Table 3**,

*ΔT* is the most up-to-date estimate of global (land and ocean) temperature projection for the design period of interest and selected climate scenario relative to a baseline time period (see **Table 4**).

**TABLE 3 RECOMMENDED RATES OF CHANGE (A) AND ASSOCIATED UNCERTAINTY DERIVED IN WASKO ET AL (2024), PRESENTED PER DEGREE GLOBAL TEMPERATURE CHANGE (%/°C) (WASKO C, 2024)**

	≤1 hour	>1 hour and <24 hours	≥24 hours
Central (median) estimate (%/°C)	15	See Attachment C (Table A6)	8
‘Likely’ range (corresponding to ~66% <sup>6</sup> range) (%/°C)	7-28		2-15

<sup>6</sup> Consistent with terminology used by the IPCC the 66% range corresponds to an uncertainty range of +/- 33%.



**TABLE 4 GLOBAL MEAN SURFACE TEMPERATURE PROJECTIONS ( $\Delta T$ ) FOR FOUR SOCIO-ECONOMIC PATHWAYS RELATIVE TO 1961-1990. THE 90% UNCERTAINTY INTERVAL IS PROVIDED IN PARENTHESES (WASKO C, 2024)**

Climate Scenario	SSP1-2.6	SSP2-4.5	SSP3-7.0	SSP5-8.5
Current and near-term (2021-2040) ( $^{\circ}\text{C}$ )	1.2 (0.9 - 1.5)	1.2 (0.9 – 1.5)	1.2 (0.9 – 1.5)	1.3 (1.0 – 1.6)

**Table Note:**

The above is the first row of the table. Subsequent rows are for past the year 2040.

The process described above is used to adjust the mean rainfall data set and storm events to account for the recent effects of climate change. The inputs are:

- $I$  is the average rainfall and 1 in 100 and 1 in 200 storm events (from BoM website / IFD curves)<sup>7</sup>
- $\alpha$  is 8 as the storm events are assumed to occur for 3 days (consistent with the statement made by BNR in the EPBC referral Section 5.4.2.7)
- $\Delta T$  is assumed to 1.3 which is the worst case climate scenario SSP5-8.8.

The rainfall data sets are shown in **Table A1**.

## Findings

The findings for Case 1 and Case 2 are provided below.

Monthly flows of produced water, rainfall and evaporation for 50% flowback under Case 1 for average rainfall (**Table A2**), 1 in a 100-year storm (**Table A3**), 1 in a 200-year storm (**Table A4**) and 90<sup>th</sup> percentile (in wet season) (**Table A5**) rainfall scenarios is provided in **Attachment B**. The tables provide a worked example of the water balance calculations to illustrate how the modelling process is applied across different scenarios. Monthly flows for 50% flowback under Case 1 only are provided as no overflows are observed. However, graphs of the results for each flowback rate modelled are provided in the tables below.

### Case 1 Findings

**Table 5** summarises the results of the modelling based on the inputs and assumptions described above for **50% flowback**, **Table 6** for **60% flowback** and **Table 7** for **70% flowback**. In the charts the dashed blue line is the water level in the pond showing flowback water entering the pond for 2 years (Feb 2027 – March 2029) and a further 3 years (March 2029 – December 2032). After year 2, the modelling assumes no further accumulation of produced water and the pond level changes in response to rainfall and evaporation only. The orange line is the operating limit (500 mm freeboard); and the red line is the crest.

<sup>7</sup> [https://www.bom.gov.au/water/designRainfalls/revised-ifd/?design=rare&sdmin=true&sdhr=true&sdday=true&nsd%5B%5D=&nsdunit%5B%5D=m&coordinate\\_type=dd&latitude=-18.193&longitude=125.567&user\\_label=&values=depths&update=](https://www.bom.gov.au/water/designRainfalls/revised-ifd/?design=rare&sdmin=true&sdhr=true&sdday=true&nsd%5B%5D=&nsdunit%5B%5D=m&coordinate_type=dd&latitude=-18.193&longitude=125.567&user_label=&values=depths&update=)



**TABLE 5 WATER BALANCE FINDINGS FOR 50% FLOWBACK UNDER CASE 1**

Scenario #	Produced water pond size	Rainfall Scenario (data from BoM <sup>8</sup> )	Outcome												
1	~114.4 ML	Average	Level in produced water pond does not exceed the 500 mm freeboard limit.												
			<table border="1"> <thead> <tr> <th>Item</th> <th>Input (ML over 7 years)</th> <th>Output (ML over 7 years)</th> </tr> </thead> <tbody> <tr> <td>Produced water</td> <td>82</td> <td></td> </tr> <tr> <td>Rainfall</td> <td>134</td> <td></td> </tr> <tr> <td>Evaporation</td> <td></td> <td>209</td> </tr> <tr> <td><b>Total</b></td> <td><b>215</b></td> <td><b>209</b></td> </tr> </tbody> </table>	Item	Input (ML over 7 years)	Output (ML over 7 years)	Produced water	82		Rainfall	134		Evaporation		209
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<sup>8</sup> [https://www.bom.gov.au/climate/averages/tables/cw\\_003093\\_All.shtml](https://www.bom.gov.au/climate/averages/tables/cw_003093_All.shtml) (accessed 25 February 2026)

<sup>9</sup> [https://www.bom.gov.au/water/designRainfalls/revise-ifd/?year=2016&coordinate\\_type=dd&latitude=-18.193&longitude=125.567&sdmin=true&sdhr=true&sdday=true&user\\_label=](https://www.bom.gov.au/water/designRainfalls/revise-ifd/?year=2016&coordinate_type=dd&latitude=-18.193&longitude=125.567&sdmin=true&sdhr=true&sdday=true&user_label=)



Scenario #	Produced water pond size	Rainfall Scenario (data from BoM <sup>8</sup> )	Outcome												
3	~114.4 ML	One in a 200-year storm (data from BoM) <sup>10</sup>	Level in produced water pond does not exceed the 500 mm freeboard limit.												
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4	~114.4 ML	90 <sup>th</sup> percentile rainfall in wet season only (data from BoM)	Level in produced water pond does not exceed the 500 mm freeboard limit.												
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**Table 6** summarises the results of the modelling based on the inputs and assumptions described above for **60% flowback**.

**TABLE 6 WATER BALANCE FINDINGS FOR 60% FLOWBACK UNDER CASE 1**

Scenario #	Produced water pond size	Rainfall Scenario (data from BoM <sup>11</sup> )	Outcome												
1	~114.4 ML	Average	Level in produced water pond does not exceed the 500 mm freeboard limit.												
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2	~114.4 ML	One in a 100-year storm (data from BoM <sup>12</sup> )	Level in produced water pond does not exceed the 500 mm freeboard limit.												
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Scenario #	Produced water pond size	Rainfall Scenario (data from BoM <sup>11</sup> )	Outcome												
3	~114.4 ML	One in a 200-year storm (data from BoM) <sup>13</sup>	Level in produced water pond does not exceed the 500 mm freeboard limit.												
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**Table 7** summarises the results of the modelling based on the inputs and assumptions described above for **70% flowback**.

**TABLE 7 WATER BALANCE FINDINGS FOR 70% FLOWBACK UNDER CASE 1**

Scenario #	Produced water pond size	Rainfall Scenario (data from BoM <sup>14</sup> )	Outcome												
1	~114.4 ML	Average	Level in produced water pond does not exceed the 500 mm freeboard limit.												
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2	~114.4 ML	One in a 100-year storm (data from BoM <sup>15</sup> )	By October 2028, the level in the produced water pond marginally exceeds the 500 mm freeboard limit by an estimated excess volume of 0.5ML. Does not exceed the crest level.												
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Produced water	114														
Rainfall	158														
Evaporation		265													
<b>Total</b>	<b>272</b>	<b>265</b>													

<sup>14</sup> [https://www.bom.gov.au/climate/averages/tables/cw\\_003093\\_All.shtml](https://www.bom.gov.au/climate/averages/tables/cw_003093_All.shtml) (accessed 25 February 2026)

<sup>15</sup> [https://www.bom.gov.au/water/designRainfalls/revise-ifd/?year=2016&coordinate\\_type=dd&latitude=-18.193&longitude=125.567&sdmin=true&sdhr=true&sdday=true&user\\_label=](https://www.bom.gov.au/water/designRainfalls/revise-ifd/?year=2016&coordinate_type=dd&latitude=-18.193&longitude=125.567&sdmin=true&sdhr=true&sdday=true&user_label=)



Scenario #	Produced water pond size	Rainfall Scenario (data from BoM <sup>14</sup> )	Outcome															
3	~114.4 ML	One in a 200-year storm (data from BoM) <sup>16</sup>	<p>By October 2028, the level in the produced water pond marginally exceeds the 500 mm freeboard limit by an estimated excess volume of 1.5ML. Does not exceed the crest limit.</p> <table border="1"> <thead> <tr> <th>Item</th> <th>Input (ML over 7 years)</th> <th>Output (ML over 7 years)</th> </tr> </thead> <tbody> <tr> <td>Produced water</td> <td>114</td> <td></td> </tr> <tr> <td>Rainfall</td> <td>160</td> <td></td> </tr> <tr> <td>Evaporation</td> <td></td> <td>267</td> </tr> <tr> <td><b>Total</b></td> <td><b>274</b></td> <td><b>267</b></td> </tr> </tbody> </table>	Item	Input (ML over 7 years)	Output (ML over 7 years)	Produced water	114		Rainfall	160		Evaporation		267	<b>Total</b>	<b>274</b>	<b>267</b>
			Item	Input (ML over 7 years)	Output (ML over 7 years)													
Produced water	114																	
Rainfall	160																	
Evaporation		267																
<b>Total</b>	<b>274</b>	<b>267</b>																
4	~114.4 ML	90th percentile rainfall in wet season only (data from BoM) (data from BoM / see Table A1)	<p>By October 2028, the level in the produced water pond exceeds the 500 mm freeboard limit by an estimated volume of 16.5 ML and marginally overflows the crest limit.</p> <table border="1"> <thead> <tr> <th>Item</th> <th>Input (ML over 7 years)</th> <th>Output (ML over 7 years)</th> </tr> </thead> <tbody> <tr> <td>Produced water</td> <td>114</td> <td></td> </tr> <tr> <td>Rainfall</td> <td>242</td> <td></td> </tr> <tr> <td>Evaporation</td> <td></td> <td>296</td> </tr> <tr> <td><b>Total</b></td> <td><b>356</b></td> <td><b>296</b></td> </tr> </tbody> </table>	Item	Input (ML over 7 years)	Output (ML over 7 years)	Produced water	114		Rainfall	242		Evaporation		296	<b>Total</b>	<b>356</b>	<b>296</b>
			Item	Input (ML over 7 years)	Output (ML over 7 years)													
Produced water	114																	
Rainfall	242																	
Evaporation		296																
<b>Total</b>	<b>356</b>	<b>296</b>																

<sup>16</sup> [https://www.bom.gov.au/water/designRainfalls/revise-ifd/?year=2016&coordinate\\_type=dd&latitude=-18.193&longitude=125.567&sdmin=true&sdhr=true&sdday=true&user\\_label=](https://www.bom.gov.au/water/designRainfalls/revise-ifd/?year=2016&coordinate_type=dd&latitude=-18.193&longitude=125.567&sdmin=true&sdhr=true&sdday=true&user_label=)



Case 2 Findings

**Table 8** summarises the results of the modelling based on the inputs and assumptions described above for **50% flowback** under Case 2.

**TABLE 8 WATER BALANCE FINDINGS FOR 50% FLOWBACK UNDER CASE 2**

Scenario #	Produced water pond size	Rainfall Scenario (data from BoM <sup>17</sup> )	Outcome												
1	~114.4 ML	Average	Level in produced water pond does not exceed the 500 mm freeboard limit.												
			<table border="1"> <thead> <tr> <th>Item</th> <th>Input (ML over 7 years)</th> <th>Output (ML over 7 years)</th> </tr> </thead> <tbody> <tr> <td>Produced water</td> <td>82</td> <td></td> </tr> <tr> <td>Rainfall</td> <td>134</td> <td></td> </tr> <tr> <td>Evaporation</td> <td></td> <td>209</td> </tr> <tr> <td><b>Total</b></td> <td><b>215</b></td> <td><b>209</b></td> </tr> </tbody> </table>	Item	Input (ML over 7 years)	Output (ML over 7 years)	Produced water	82		Rainfall	134		Evaporation		209
Item	Input (ML over 7 years)	Output (ML over 7 years)													
Produced water	82														
Rainfall	134														
Evaporation		209													
<b>Total</b>	<b>215</b>	<b>209</b>													
2	~114.4 ML	One in a 100-year storm (data from BoM <sup>18</sup> )	Level in produced water pond does not exceed the 500 mm freeboard limit.												
			<table border="1"> <thead> <tr> <th>Item</th> <th>Input (ML over 7 years)</th> <th>Output (ML over 7 years)</th> </tr> </thead> <tbody> <tr> <td>Produced water</td> <td>82</td> <td></td> </tr> <tr> <td>Rainfall</td> <td>158</td> <td></td> </tr> <tr> <td>Evaporation</td> <td></td> <td>233</td> </tr> <tr> <td><b>Total</b></td> <td><b>240</b></td> <td><b>233</b></td> </tr> </tbody> </table>	Item	Input (ML over 7 years)	Output (ML over 7 years)	Produced water	82		Rainfall	158		Evaporation		233
Item	Input (ML over 7 years)	Output (ML over 7 years)													
Produced water	82														
Rainfall	158														
Evaporation		233													
<b>Total</b>	<b>240</b>	<b>233</b>													

<sup>17</sup> [https://www.bom.gov.au/climate/averages/tables/cw\\_003093\\_All.shtml](https://www.bom.gov.au/climate/averages/tables/cw_003093_All.shtml) (accessed 25 February 2026)

<sup>18</sup> [https://www.bom.gov.au/water/designRainfalls/revise-ifd/?year=2016&coordinate\\_type=dd&latitude=-18.193&longitude=125.567&sdmin=true&sdhr=true&sdday=true&user\\_label=](https://www.bom.gov.au/water/designRainfalls/revise-ifd/?year=2016&coordinate_type=dd&latitude=-18.193&longitude=125.567&sdmin=true&sdhr=true&sdday=true&user_label=)



Scenario #	Produced water pond size	Rainfall Scenario (data from BoM <sup>17</sup> )	Outcome												
3	~114.4 ML	One in a 200-year storm (data from BoM) <sup>19</sup>	Level in produced water pond does not exceed the 500 mm freeboard limit.												
			<table border="1"> <thead> <tr> <th>Item</th> <th>Input (ML over 7 years)</th> <th>Output (ML over 7 years)</th> </tr> </thead> <tbody> <tr> <td>Produced water</td> <td>82</td> <td></td> </tr> <tr> <td>Rainfall</td> <td>160</td> <td></td> </tr> <tr> <td>Evaporation</td> <td></td> <td>235</td> </tr> <tr> <td><b>Total</b></td> <td><b>242</b></td> <td><b>235</b></td> </tr> </tbody> </table>	Item	Input (ML over 7 years)	Output (ML over 7 years)	Produced water	82		Rainfall	160		Evaporation		235
Item	Input (ML over 7 years)	Output (ML over 7 years)													
Produced water	82														
Rainfall	160														
Evaporation		235													
<b>Total</b>	<b>242</b>	<b>235</b>													
4	~114.4 ML	90 <sup>th</sup> percentile rainfall in wet season only (data from BoM / see <b>Table A1</b> )	Level in produced water pond does not exceed the 500 mm freeboard limit.												
			<table border="1"> <thead> <tr> <th>Item</th> <th>Input (ML over 7 years)</th> <th>Output (ML over 7 years)</th> </tr> </thead> <tbody> <tr> <td>Produced water</td> <td>82</td> <td></td> </tr> <tr> <td>Rainfall</td> <td>242</td> <td></td> </tr> <tr> <td>Evaporation</td> <td></td> <td>279</td> </tr> <tr> <td><b>Total</b></td> <td><b>324</b></td> <td><b>279</b></td> </tr> </tbody> </table>	Item	Input (ML over 7 years)	Output (ML over 7 years)	Produced water	82		Rainfall	242		Evaporation		279
Item	Input (ML over 7 years)	Output (ML over 7 years)													
Produced water	82														
Rainfall	242														
Evaporation		279													
<b>Total</b>	<b>324</b>	<b>279</b>													

<sup>19</sup> [https://www.bom.gov.au/water/designRainfalls/revise-ifd/?year=2016&coordinate\\_type=dd&latitude=-18.193&longitude=125.567&sdmin=true&sdhr=true&sdday=true&user\\_label=](https://www.bom.gov.au/water/designRainfalls/revise-ifd/?year=2016&coordinate_type=dd&latitude=-18.193&longitude=125.567&sdmin=true&sdhr=true&sdday=true&user_label=)



**Table 9** summarises the results of the modelling based on the inputs and assumptions described above for **60% flowback** under Case 2.

**TABLE 9 WATER BALANCE FINDINGS FOR 60% FLOWBACK UNDER CASE 2**

Scenario #	Produced water pond size	Rainfall Scenario (data from BoM <sup>20</sup> )	Outcome												
1	~114.4 ML	Average	Level in produced water pond does not exceed the 500 mm freeboard limit.												
			<table border="1"> <thead> <tr> <th>Item</th> <th>Input (ML over 7 years)</th> <th>Output (ML over 7 years)</th> </tr> </thead> <tbody> <tr> <td>Produced water</td> <td>98</td> <td></td> </tr> <tr> <td>Rainfall</td> <td>134</td> <td></td> </tr> <tr> <td>Evaporation</td> <td></td> <td>225</td> </tr> <tr> <td><b>Total</b></td> <td><b>232</b></td> <td><b>225</b></td> </tr> </tbody> </table>	Item	Input (ML over 7 years)	Output (ML over 7 years)	Produced water	98		Rainfall	134		Evaporation		225
Item	Input (ML over 7 years)	Output (ML over 7 years)													
Produced water	98														
Rainfall	134														
Evaporation		225													
<b>Total</b>	<b>232</b>	<b>225</b>													
2	~114.4 ML	One in a 100-year storm (data from BoM <sup>21</sup> )	By January 2028 the level in the produced water pond marginally exceeds the 500 mm freeboard limit by an estimated volume of 0.5ML. Does not exceed the crest level.												
			<table border="1"> <thead> <tr> <th>Item</th> <th>Input (ML over 7 years)</th> <th>Output (ML over 7 years)</th> </tr> </thead> <tbody> <tr> <td>Produced water</td> <td>98</td> <td></td> </tr> <tr> <td>Rainfall</td> <td>158</td> <td></td> </tr> <tr> <td>Evaporation</td> <td></td> <td>249</td> </tr> <tr> <td><b>Total</b></td> <td><b>256</b></td> <td><b>249</b></td> </tr> </tbody> </table>	Item	Input (ML over 7 years)	Output (ML over 7 years)	Produced water	98		Rainfall	158		Evaporation		249
Item	Input (ML over 7 years)	Output (ML over 7 years)													
Produced water	98														
Rainfall	158														
Evaporation		249													
<b>Total</b>	<b>256</b>	<b>249</b>													

<sup>20</sup> [https://www.bom.gov.au/climate/averages/tables/cw\\_003093\\_All.shtml](https://www.bom.gov.au/climate/averages/tables/cw_003093_All.shtml) (accessed 25 February 2026)

<sup>21</sup> [https://www.bom.gov.au/water/designRainfalls/revise-ifd/?year=2016&coordinate\\_type=dd&latitude=-18.193&longitude=125.567&sdmin=true&sdhr=true&sdday=true&user\\_label=](https://www.bom.gov.au/water/designRainfalls/revise-ifd/?year=2016&coordinate_type=dd&latitude=-18.193&longitude=125.567&sdmin=true&sdhr=true&sdday=true&user_label=)



Scenario #	Produced water pond size	Rainfall Scenario (data from BoM <sup>20</sup> )	Outcome												
3	~114.4 ML	One in a 200-year storm (data from BoM) <sup>22</sup>	By November 2027 the level in the produced water pond marginally exceeds the 500 mm freeboard limit by an estimated volume of 1.5ML. Does not exceed the crest level.												
			<table border="1"> <thead> <tr> <th>Item</th> <th>Input (ML over 7 years)</th> <th>Output (ML over 7 years)</th> </tr> </thead> <tbody> <tr> <td>Produced water</td> <td>98</td> <td></td> </tr> <tr> <td>Rainfall</td> <td>160</td> <td></td> </tr> <tr> <td>Evaporation</td> <td></td> <td>251</td> </tr> <tr> <td><b>Total</b></td> <td><b>258</b></td> <td><b>251</b></td> </tr> </tbody> </table>	Item	Input (ML over 7 years)	Output (ML over 7 years)	Produced water	98		Rainfall	160		Evaporation		251
Item	Input (ML over 7 years)	Output (ML over 7 years)													
Produced water	98														
Rainfall	160														
Evaporation		251													
<b>Total</b>	<b>258</b>	<b>251</b>													
4	~114.4 ML	90 <sup>th</sup> percentile rainfall in wet season only (data from BoM / see <b>Table A1</b> )	By January 2028 the level in the produced water pond marginally exceeds the 500 mm freeboard limit by an estimated volume of 7.5ML. Does not exceed the crest level.												
			<table border="1"> <thead> <tr> <th>Item</th> <th>Input (ML over 7 years)</th> <th>Output (ML over 7 years)</th> </tr> </thead> <tbody> <tr> <td>Produced water</td> <td>98</td> <td></td> </tr> <tr> <td>Rainfall</td> <td>242</td> <td></td> </tr> <tr> <td>Evaporation</td> <td></td> <td>289</td> </tr> <tr> <td><b>Total</b></td> <td><b>356</b></td> <td><b>289</b></td> </tr> </tbody> </table>	Item	Input (ML over 7 years)	Output (ML over 7 years)	Produced water	98		Rainfall	242		Evaporation		289
Item	Input (ML over 7 years)	Output (ML over 7 years)													
Produced water	98														
Rainfall	242														
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<b>Total</b>	<b>356</b>	<b>289</b>													

<sup>22</sup> [https://www.bom.gov.au/water/designRainfalls/revised-ifd/?year=2016&coordinate\\_type=dd&latitude=-18.193&longitude=125.567&sdmin=true&sdhr=true&sdday=true&user\\_label=](https://www.bom.gov.au/water/designRainfalls/revised-ifd/?year=2016&coordinate_type=dd&latitude=-18.193&longitude=125.567&sdmin=true&sdhr=true&sdday=true&user_label=)



**Table 10** summarises the results of the modelling based on the inputs and assumptions described above for **70% flowback** under Case 2.

**TABLE 10 WATER BALANCE FINDINGS FOR 70% FLOWBACK UNDER CASE 2**

Scenario #	Produced water pond size	Rainfall Scenario (data from BoM <sup>23</sup> )	Outcome												
1	~114.4 ML	Average	By November 2027 the level in the produced water pond marginally exceeds the 500 mm freeboard limit by an estimated volume of 4.5ML. Does not exceed the crest level.												
			<table border="1"> <thead> <tr> <th>Item</th> <th>Input (ML over 7 years)</th> <th>Output (ML over 7 years)</th> </tr> </thead> <tbody> <tr> <td>Produced water</td> <td>114</td> <td></td> </tr> <tr> <td>Rainfall</td> <td>134</td> <td></td> </tr> <tr> <td>Evaporation</td> <td></td> <td>242</td> </tr> <tr> <td><b>Total</b></td> <td><b>248</b></td> <td><b>242</b></td> </tr> </tbody> </table>	Item	Input (ML over 7 years)	Output (ML over 7 years)	Produced water	114		Rainfall	134		Evaporation		242
Item	Input (ML over 7 years)	Output (ML over 7 years)													
Produced water	114														
Rainfall	134														
Evaporation		242													
<b>Total</b>	<b>248</b>	<b>242</b>													
2	~114.4 ML	One in a 100-year storm (data from BoM <sup>24</sup> )	By November 2027 the level in the produced water pond marginally exceeds the 500 mm freeboard limit by an estimated volume of 15.5ML. The water level reaches the crest level.												
			<table border="1"> <thead> <tr> <th>Item</th> <th>Input (ML over 7 years)</th> <th>Output (ML over 7 years)</th> </tr> </thead> <tbody> <tr> <td>Produced water</td> <td>114</td> <td></td> </tr> <tr> <td>Rainfall</td> <td>158</td> <td></td> </tr> <tr> <td>Evaporation</td> <td></td> <td>266</td> </tr> <tr> <td><b>Total</b></td> <td><b>272</b></td> <td><b>266</b></td> </tr> </tbody> </table>	Item	Input (ML over 7 years)	Output (ML over 7 years)	Produced water	114		Rainfall	158		Evaporation		266
Item	Input (ML over 7 years)	Output (ML over 7 years)													
Produced water	114														
Rainfall	158														
Evaporation		266													
<b>Total</b>	<b>272</b>	<b>266</b>													

<sup>23</sup> [https://www.bom.gov.au/climate/averages/tables/cw\\_003093\\_All.shtml](https://www.bom.gov.au/climate/averages/tables/cw_003093_All.shtml) (accessed 25 February 2026)

<sup>24</sup> [https://www.bom.gov.au/water/designRainfalls/revise-ifd/?year=2016&coordinate\\_type=dd&latitude=-18.193&longitude=125.567&sdmin=true&sdhr=true&sdday=true&user\\_label=](https://www.bom.gov.au/water/designRainfalls/revise-ifd/?year=2016&coordinate_type=dd&latitude=-18.193&longitude=125.567&sdmin=true&sdhr=true&sdday=true&user_label=)



Scenario #	Produced water pond size	Rainfall Scenario (data from BoM <sup>25</sup> )	Outcome												
3	~114.4 ML	One in a 200-year storm (data from BoM) <sup>25</sup>	By November 2027 the level in the produced water pond marginally exceeds the 500 mm freeboard limit by an estimated volume of 17.5ML. The water level reaches the crest level.												
			<table border="1"> <thead> <tr> <th>Item</th> <th>Input (ML over 7 years)</th> <th>Output (ML over 7 years)</th> </tr> </thead> <tbody> <tr> <td>Produced water</td> <td>114</td> <td></td> </tr> <tr> <td>Rainfall</td> <td>160</td> <td></td> </tr> <tr> <td>Evaporation</td> <td></td> <td>267</td> </tr> <tr> <td><b>Total</b></td> <td><b>274</b></td> <td><b>267</b></td> </tr> </tbody> </table>	Item	Input (ML over 7 years)	Output (ML over 7 years)	Produced water	114		Rainfall	160		Evaporation		267
Item	Input (ML over 7 years)	Output (ML over 7 years)													
Produced water	114														
Rainfall	160														
Evaporation		267													
<b>Total</b>	<b>274</b>	<b>267</b>													
4	~114.4 ML	90 <sup>th</sup> percentile rainfall in wet season only (data from BoM / see <b>Table A1</b> )	By November 2027, the water level in the produced water pond exceeds the 500 mm freeboard limit by an estimated volume of 22.5 ML. The crest level is breached.												
			<table border="1"> <thead> <tr> <th>Item</th> <th>Input (ML over 7 years)</th> <th>Output (ML over 7 years)</th> </tr> </thead> <tbody> <tr> <td>Produced water</td> <td>114</td> <td></td> </tr> <tr> <td>Rainfall</td> <td>242</td> <td></td> </tr> <tr> <td>Evaporation</td> <td></td> <td>296</td> </tr> <tr> <td><b>Total</b></td> <td><b>356</b></td> <td><b>296</b></td> </tr> </tbody> </table>	Item	Input (ML over 7 years)	Output (ML over 7 years)	Produced water	114		Rainfall	242		Evaporation		296
Item	Input (ML over 7 years)	Output (ML over 7 years)													
Produced water	114														
Rainfall	242														
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<b>Total</b>	<b>356</b>	<b>296</b>													

<sup>25</sup> [https://www.bom.gov.au/water/designRainfalls/revised-ifd/?year=2016&coordinate\\_type=dd&latitude=-18.193&longitude=125.567&sdmin=true&sdhr=true&sdday=true&user\\_label=](https://www.bom.gov.au/water/designRainfalls/revised-ifd/?year=2016&coordinate_type=dd&latitude=-18.193&longitude=125.567&sdmin=true&sdhr=true&sdday=true&user_label=)



## Conclusions

The water balance for two cases for HFS execution at three water recovery scenarios and four rainfall scenarios for each case were modelled. The results are shown in **Table 11**.

Case 1: HFS water from two wells distributed over two years, the pond freeboard limit is not exceeded under any scenario except the worst case rainfall conditions at 60% HFS recovery, as well as the -storm event and -worst-case rainfall scenarios at 70% recovery. The crest level is not exceeded for any Case 1 scenario except the worst-case rainfall scenario at 70% HFS recovery.

Case 2: HFS water from two wells into the pond over 180 days, the freeboard limit is exceeded for the 60% and 70% HFS recovery scenarios, with the exception of the mean-rainfall scenario at 60% recovery. The crest level is exceeded in all scenarios except mean rainfall at 70% recovery. At 50% HFS recovery, neither the freeboard nor the crest limit is exceeded under any rainfall scenario.

The 90th-percentile rainfall scenario is considered conservative, as it reflects conditions approaching the historical maximum rainfall for the wet season. Climate-change-related increases in rainfall are not expected to reach this magnitude.

**TABLE 11 SUMMARY OF MODELLING**

Case	HFS Recovery	Rainfall	Breach Freeboard	Breach Crest
1	50%	Mean	No	No
1	50%	1 in 100	No	No
1	50%	1 in 200	No	No
1	50%	90 <sup>th</sup> P wet	No	No
1	60%	Mean	No	No
1	60%	1 in 100	No	No
1	60%	1 in 200	No	No
1	60%	90 <sup>th</sup> P wet	Yes	No
1	70%	Mean	No	No
1	70%	1 in 100	Yes	No
1	70%	1 in 200	Yes	No
1	70%	90 <sup>th</sup> P wet	Yes	Yes
2	50%	Mean	No	No
2	50%	1 in 100	No	No
2	50%	1 in 200	No	No
2	50%	90 <sup>th</sup> P wet	No	No
2	60%	Mean	No	No
2	60%	1 in 100	Yes	No
2	60%	1 in 200	Yes	No
2	60%	90 <sup>th</sup> P wet	Yes	No
2	70%	Mean	Yes	No
2	70%	1 in 100	Yes	Yes



Case	HFS Recovery	Rainfall	Breach Freeboard	Breach Crest
2	70%	1 in 200	Yes	Yes
2	70%	90 <sup>th</sup> P wet	Yes	Yes

## Limitations

The following limitations apply to the modelling undertaken for this evaluation:

- The Model relies on input data provided by BNR expected engineering design, scientific evidence, and public datasets. Any inaccuracies or uncertainties in produced water volumes including changes due to design alterations and rainfall data and evaporation rates may influence model outputs.
1. Water-level predictions for large, infrequent storm events (e.g., 1% AEP / 1-in-100-year) carry uncertainty due to limited empirical data and the sensitivity of peak levels to rainfall intensity, temporal pattern, and spatial distribution.
  2. The Model represents physical behaviour using mathematical approximations. Simplifications of geometry (of the pond) are necessary as the project is not at the design stage and as-built construction drawings are not available. Actual on-site conditions may alter the modelling.
  3. The overall dimensions and shape of the pond (length, width, and height) may be altered, provided the required volumetric capacity is maintained. Pond dimensions may vary in size to meet design and operational requirements. The Model assumes the pond operate as designed and remains free of debris and vegetation that may reduce evaporation.

Model outputs are intended for planning and design guidance only. They should not be used as the sole basis for operational decision-making, emergency response, or safety-critical applications without further validation and review.



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## Attachment A

**TABLE A1      RAINFALL DATA - FITZROY CROSSING (1997-2025 BoM WEBSITE)**

#	Month	Average (mm)	Climate Adjusted Mean (mm)	Climate Adjusted Mean with 1 in 100 storm in May (mm)	Climate Adjusted Mean with 1 in 200 storm in May (mm)	90 <sup>th</sup> Percentile in wet season only	PAN evaporation (mm)
1	January	193	213	213	213	298	300
2	February	136	151	151	151	274	200
3	March	106	117	117	117	227	250
4	April	22	24	24	24	85	200
5	May	15	17	398	459	15	200
6	June	7	8	8	8	7	175
7	July	5	5	5	5	5	175
8	August	2	3	3	3	2	200
9	September	2	2	2	2	2	250
10	October	14	16	16	16	14	300
11	November	38	42	42	42	67	300
12	December	133	146	146	146	225	300



## Attachment B

TABLE A2 SCENARIO 1 – AVERAGE RAINFALL

Month	Date	Produced Water Input (ML)	Rain Input (ML)	Evaporation output (ML)	Change (ML)	Volume in Pond (ML)
1	01-Jan-27	0.0	0.0	0.0	0.0	0.0
2	01-Feb-27	0.0	3.9	0.0	3.9	3.9
3	01-Mar-27	0.0	3.0	0.0	3.0	6.9
4	01-Apr-27	0.0	0.6	2.3	-1.6	5.2
5	01-May-27	0.0	0.4	2.9	-2.4	2.8
6	01-Jun-27	0.0	0.2	2.3	-2.1	0.7
7	01-Jul-27	0.0	0.1	0.7	-0.6	0.1
8	01-Aug-27	13.7	0.1	0.1	13.7	13.8
9	01-Sep-27	13.7	0.1	1.9	11.8	25.6
10	01-Oct-27	13.3	0.4	2.4	11.3	37.0
11	01-Nov-27	0.0	1.1	3.1	-2.1	34.9
12	01-Dec-27	0.0	3.8	3.9	-0.2	34.7
13	01-Jan-28	0.0	5.5	3.9	1.6	36.3
14	01-Feb-28	0.0	3.9	3.9	0.0	36.2
15	01-Mar-28	0.0	3.0	3.9	-0.9	35.3
16	01-Apr-28	0.0	0.6	2.6	-2.0	33.3
17	01-May-28	0.0	0.4	3.3	-2.8	30.5
18	01-Jun-28	0.0	0.2	2.6	-2.4	28.1
19	01-Jul-28	0.0	0.1	2.6	-2.4	25.7
20	01-Aug-28	13.7	0.1	2.2	11.6	37.3
21	01-Sep-28	13.7	0.1	2.2	11.6	48.9
22	01-Oct-28	13.3	0.4	2.6	11.1	60.0
23	01-Nov-28	0.0	1.1	3.4	-2.4	57.6
24	01-Dec-28	0.0	3.8	4.3	-0.6	57.0
25	01-Jan-29	0.0	5.5	4.3	1.2	58.2
26	01-Feb-29	0.0	3.9	4.3	-0.4	57.8
27	01-Mar-29	0.0	3.0	4.3	-1.3	56.5
28	01-Apr-29	0.0	0.6	2.9	-2.2	54.2
29	01-May-29	0.0	0.4	3.6	-3.1	51.1
30	01-Jun-29	0.0	0.2	2.8	-2.6	48.5
31	01-Jul-29	0.0	0.1	2.8	-2.6	45.8
32	01-Aug-29	0.0	0.1	2.4	-2.3	43.5
33	01-Sep-29	0.0	0.1	2.4	-2.3	41.2
34	01-Oct-29	0.0	0.4	2.7	-2.3	38.9
35	01-Nov-29	0.0	1.1	3.3	-2.3	36.6
36	01-Dec-29	0.0	3.8	4.0	-0.2	36.4
37	01-Jan-30	0.0	5.5	3.9	1.5	37.9
38	01-Feb-30	0.0	3.9	3.9	-0.1	37.8
39	01-Mar-30	0.0	3.0	4.0	-1.0	36.9
40	01-Apr-30	0.0	0.6	2.6	-2.0	34.9
41	01-May-30	0.0	0.4	3.3	-2.8	32.0
42	01-Jun-30	0.0	0.2	2.6	-2.4	29.6
43	01-Jul-30	0.0	0.1	2.6	-2.4	27.2



Month	Date	Produced Water Input (ML)	Rain Input (ML)	Evaporation output (ML)	Change (ML)	Volume in Pond (ML)
44	01-Aug-30	0.0	0.1	2.2	-2.2	25.0
45	01-Sep-30	0.0	0.1	2.2	-2.1	22.9
46	01-Oct-30	0.0	0.4	2.5	-2.1	20.8
47	01-Nov-30	0.0	1.1	3.1	-2.0	18.8
48	01-Dec-30	0.0	3.8	3.7	0.1	18.9
49	01-Jan-31	0.0	5.5	3.6	1.8	20.7
50	01-Feb-31	0.0	3.9	3.6	0.2	20.9
51	01-Mar-31	0.0	3.0	3.7	-0.7	20.2
52	01-Apr-31	0.0	0.6	2.4	-1.8	18.4
53	01-May-31	0.0	0.4	3.0	-2.6	15.8
54	01-Jun-31	0.0	0.2	2.4	-2.2	13.6
55	01-Jul-31	0.0	0.1	2.4	-2.3	11.3
56	01-Aug-31	0.0	0.1	2.1	-2.0	9.3
57	01-Sep-31	0.0	0.1	2.0	-2.0	7.3
58	01-Oct-31	0.0	0.4	2.3	-1.9	5.4
59	01-Nov-31	0.0	1.1	2.9	-1.8	3.6
60	01-Dec-31	0.0	3.8	3.4	0.3	4.0
61	01-Jan-32	0.0	5.5	3.4	2.1	6.0
62	01-Feb-32	0.0	3.9	3.4	0.5	6.5
63	01-Mar-32	0.0	3.0	3.4	-0.4	6.1
64	01-Apr-32	0.0	0.6	2.3	-1.7	4.4
65	01-May-32	0.0	0.4	2.9	-2.4	2.0
66	01-Jun-32	0.0	0.2	2.0	-1.8	0.2
67	01-Jul-32	0.0	0.1	0.2	-0.1	0.1
68	01-Aug-32	0.0	0.1	0.1	-0.1	0.1
69	01-Sep-32	0.0	0.1	0.1	0.0	0.1
70	01-Oct-32	0.0	0.4	0.1	0.4	0.4
71	01-Nov-32	0.0	1.1	0.4	0.7	1.1
72	01-Dec-32	0.0	3.8	1.1	2.7	3.8
73	01-Jan-33	0.0	5.5	3.3	2.1	5.9
74	01-Feb-33	0.0	3.9	3.4	0.5	6.4
75	01-Mar-33	0.0	3.0	3.4	-0.4	5.9
76	01-Apr-33	0.0	0.6	2.3	-1.7	4.3
77	01-May-33	0.0	0.4	2.8	-2.4	1.9
78	01-Jun-33	0.0	0.2	1.9	-1.7	0.2
79	01-Jul-33	0.0	0.1	0.2	-0.1	0.1
80	01-Aug-33	0.0	0.1	0.1	-0.1	0.1
81	01-Sep-33	0.0	0.1	0.1	0.0	0.1
82	01-Oct-33	0.0	0.4	0.1	0.4	0.4
83	01-Nov-33	0.0	1.1	0.4	0.7	1.1
84	01-Dec-33	0.0	3.8	1.1	2.7	3.8
85	01-Jan-34	0.0	5.5	3.3	2.1	5.9

**TABLE A3 SCENARIO 2 – CHANGE IN VOLUME FOR 1 IN A 100-YEAR STORM**

Month	Date	Produced Water Input (ML)	Rain Input (ML)	Evaporation output (ML)	Change (ML)	Volume in Pond (ML)
1	01-Jan-27	0.0	0.0	0.0	0.0	0.0
2	01-Feb-27	0.0	4.3	0.0	4.3	4.3
3	01-Mar-27	0.0	3.3	0.0	3.3	7.6
4	01-Apr-27	0.0	0.7	2.3	-1.6	6.0
5	01-May-27	0.0	11.3	2.9	8.4	14.4
6	01-Jun-27	0.0	0.2	2.3	-2.1	12.4
7	01-Jul-27	0.0	0.2	2.4	-2.2	10.1
8	01-Aug-27	13.7	0.1	2.1	11.7	21.9
9	01-Sep-27	13.7	0.1	2.0	11.8	33.6
10	01-Oct-27	13.3	0.5	2.5	11.3	44.9
11	01-Nov-27	0.0	1.2	3.2	-2.1	42.9
12	01-Dec-27	0.0	4.1	4.1	0.1	43.0
13	01-Jan-28	0.0	6.0	4.0	2.0	44.9
14	01-Feb-28	0.0	4.3	4.0	0.2	45.2
15	01-Mar-28	0.0	3.3	4.1	-0.8	44.4
16	01-Apr-28	0.0	0.7	2.7	-2.0	42.4
17	01-May-28	0.0	0.5	3.4	-2.9	39.5
18	01-Jun-28	0.0	0.2	2.7	-2.5	37.0
19	01-Jul-28	0.0	0.2	2.7	-2.5	34.5
20	01-Aug-28	13.7	0.1	2.3	11.5	46.0
21	01-Sep-28	13.7	0.1	2.3	11.5	57.5
22	01-Oct-28	13.3	0.5	2.7	11.0	68.6
23	01-Nov-28	0.0	1.2	3.6	-2.4	66.2
24	01-Dec-28	0.0	4.1	4.5	-0.3	65.8
25	01-Jan-29	0.0	6.0	4.4	1.6	67.4
26	01-Feb-29	0.0	4.3	4.4	-0.2	67.3
27	01-Mar-29	0.0	3.3	4.5	-1.1	66.1
28	01-Apr-29	0.0	0.7	3.0	-2.3	63.9
29	01-May-29	0.0	0.5	3.7	-3.2	60.7
30	01-Jun-29	0.0	0.2	2.9	-2.7	58.0
31	01-Jul-29	0.0	0.2	2.9	-2.7	55.2
32	01-Aug-29	0.0	0.1	2.5	-2.4	52.8
33	01-Sep-29	0.0	0.1	2.5	-2.4	50.4
34	01-Oct-29	0.0	0.5	2.8	-2.4	48.0
35	01-Nov-29	0.0	1.2	3.5	-2.3	45.7
36	01-Dec-29	0.0	4.1	4.1	0.0	45.8
37	01-Jan-30	0.0	6.0	4.1	1.9	47.7
38	01-Feb-30	0.0	4.3	4.1	0.2	47.9
39	01-Mar-30	0.0	3.3	4.1	-0.8	47.1
40	01-Apr-30	0.0	0.7	2.7	-2.1	45.0
41	01-May-30	0.0	0.5	3.4	-2.9	42.1
42	01-Jun-30	0.0	0.2	2.7	-2.5	39.6
43	01-Jul-30	0.0	0.2	2.7	-2.5	37.0
44	01-Aug-30	0.0	0.1	2.3	-2.3	34.8
45	01-Sep-30	0.0	0.1	2.3	-2.2	32.6



Month	Date	Produced Water Input (ML)	Rain Input (ML)	Evaporation output (ML)	Change (ML)	Volume in Pond (ML)
46	01-Oct-30	0.0	0.5	2.6	-2.2	30.4
47	01-Nov-30	0.0	1.2	3.2	-2.0	28.4
48	01-Dec-30	0.0	4.1	3.8	0.3	28.7
49	01-Jan-31	0.0	6.0	3.8	2.2	30.9
50	01-Feb-31	0.0	4.3	3.8	0.5	31.4
51	01-Mar-31	0.0	3.3	3.8	-0.5	30.9
52	01-Apr-31	0.0	0.7	2.6	-1.9	29.0
53	01-May-31	0.0	0.5	3.2	-2.7	26.3
54	01-Jun-31	0.0	0.2	2.5	-2.3	24.0
55	01-Jul-31	0.0	0.2	2.5	-2.4	21.6
56	01-Aug-31	0.0	0.1	2.2	-2.1	19.5
57	01-Sep-31	0.0	0.1	2.1	-2.1	17.4
58	01-Oct-31	0.0	0.5	2.4	-2.0	15.4
59	01-Nov-31	0.0	1.2	3.0	-1.8	13.6
60	01-Dec-31	0.0	4.1	3.6	0.6	14.2
61	01-Jan-32	0.0	6.0	3.5	2.5	16.7
62	01-Feb-32	0.0	4.3	3.6	0.7	17.4
63	01-Mar-32	0.0	3.3	3.6	-0.3	17.1
64	01-Apr-32	0.0	0.7	2.4	-1.7	15.4
65	01-May-32	0.0	0.5	3.0	-2.5	12.8
66	01-Jun-32	0.0	0.2	2.4	-2.2	10.7
67	01-Jul-32	0.0	0.2	2.4	-2.2	8.5
68	01-Aug-32	0.0	0.1	2.0	-2.0	6.5
69	01-Sep-32	0.0	0.1	2.0	-2.0	4.6
70	01-Oct-32	0.0	0.5	2.3	-1.8	2.7
71	01-Nov-32	0.0	1.2	2.7	-1.5	1.2
72	01-Dec-32	0.0	4.1	1.2	3.0	4.1
73	01-Jan-33	0.0	6.0	3.3	2.7	6.8
74	01-Feb-33	0.0	4.3	3.4	0.9	7.7
75	01-Mar-33	0.0	3.3	3.4	-0.1	7.6
76	01-Apr-33	0.0	0.7	2.3	-1.6	6.0
77	01-May-33	0.0	0.5	2.9	-2.4	3.6
78	01-Jun-33	0.0	0.2	2.3	-2.1	1.5
79	01-Jul-33	0.0	0.2	1.5	-1.4	0.2
80	01-Aug-33	0.0	0.1	0.2	-0.1	0.1
81	01-Sep-33	0.0	0.1	0.1	0.0	0.1
82	01-Oct-33	0.0	0.5	0.1	0.4	0.5
83	01-Nov-33	0.0	1.2	0.5	0.7	1.2
84	01-Dec-33	0.0	4.1	1.2	3.0	4.1
85	01-Jan-34	0.0	6.0	3.3	2.7	6.8

**TABLE A4 SCENARIO 3 – CLIMATE ADJUSTED RAINFALL WITH 1 IN 200 YEAR STORM EVENT IN MAY 2027**

Month	Date	Produced Water Input (ML)	Rain Input (ML)	Evaporation output (ML)	Change (ML)	Volume in Pond (ML)
1	01-Jan-27	0.0	0.0	0.0	0.0	0.0
2	01-Feb-27	0.0	4.3	0.0	4.3	4.3
3	01-Mar-27	0.0	3.3	0.0	3.3	7.6
4	01-Apr-27	0.0	0.7	2.3	-1.6	6.0
5	01-May-27	0.0	13.0	2.9	10.1	16.1
6	01-Jun-27	0.0	0.2	2.3	-2.1	14.1
7	01-Jul-27	0.0	0.2	2.4	-2.2	11.8
8	01-Aug-27	13.7	0.1	2.1	11.7	23.6
9	01-Sep-27	13.7	0.1	2.1	11.7	35.3
10	01-Oct-27	13.3	0.5	2.5	11.3	46.6
11	01-Nov-27	0.0	1.2	3.3	-2.1	44.5
12	01-Dec-27	0.0	4.1	4.1	0.0	44.6
13	01-Jan-28	0.0	6.0	4.1	2.0	46.5
14	01-Feb-28	0.0	4.3	4.1	0.2	46.7
15	01-Mar-28	0.0	3.3	4.1	-0.8	45.9
16	01-Apr-28	0.0	0.7	2.7	-2.0	43.9
17	01-May-28	0.0	0.5	3.4	-2.9	41.0
18	01-Jun-28	0.0	0.2	2.7	-2.5	38.5
19	01-Jul-28	0.0	0.2	2.7	-2.5	36.0
20	01-Aug-28	13.7	0.1	2.3	11.5	47.5
21	01-Sep-28	13.7	0.1	2.3	11.5	59.0
22	01-Oct-28	13.3	0.5	2.7	11.0	70.0
23	01-Nov-28	0.0	1.2	3.6	-2.4	67.5
24	01-Dec-28	0.0	4.1	4.5	-0.3	67.2
25	01-Jan-29	0.0	6.0	4.5	1.6	68.8
26	01-Feb-29	0.0	4.3	4.4	-0.2	68.6
27	01-Mar-29	0.0	3.3	4.5	-1.2	67.4
28	01-Apr-29	0.0	0.7	3.0	-2.3	65.2
29	01-May-29	0.0	0.5	3.7	-3.2	61.9
30	01-Jun-29	0.0	0.2	2.9	-2.7	59.2
31	01-Jul-29	0.0	0.2	2.9	-2.8	56.4
32	01-Aug-29	0.0	0.1	2.5	-2.4	54.0
33	01-Sep-29	0.0	0.1	2.5	-2.4	51.6
34	01-Oct-29	0.0	0.5	2.8	-2.4	49.2
35	01-Nov-29	0.0	1.2	3.5	-2.3	46.9
36	01-Dec-29	0.0	4.1	4.1	0.0	46.9
37	01-Jan-30	0.0	6.0	4.1	1.9	48.8
38	01-Feb-30	0.0	4.3	4.1	0.2	49.0
39	01-Mar-30	0.0	3.3	4.1	-0.8	48.2
40	01-Apr-30	0.0	0.7	2.8	-2.1	46.1
41	01-May-30	0.0	0.5	3.4	-3.0	43.1
42	01-Jun-30	0.0	0.2	2.7	-2.5	40.6
43	01-Jul-30	0.0	0.2	2.7	-2.5	38.1
44	01-Aug-30	0.0	0.1	2.3	-2.3	35.8
45	01-Sep-30	0.0	0.1	2.3	-2.2	33.6



Month	Date	Produced Water Input (ML)	Rain Input (ML)	Evaporation output (ML)	Change (ML)	Volume in Pond (ML)
46	01-Oct-30	0.0	0.5	2.6	-2.2	31.4
47	01-Nov-30	0.0	1.2	3.2	-2.1	29.4
48	01-Dec-30	0.0	4.1	3.8	0.3	29.7
49	01-Jan-31	0.0	6.0	3.8	2.2	31.9
50	01-Feb-31	0.0	4.3	3.8	0.5	32.3
51	01-Mar-31	0.0	3.3	3.9	-0.5	31.8
52	01-Apr-31	0.0	0.7	2.6	-1.9	29.9
53	01-May-31	0.0	0.5	3.2	-2.7	27.2
54	01-Jun-31	0.0	0.2	2.5	-2.3	24.9
55	01-Jul-31	0.0	0.2	2.5	-2.4	22.5
56	01-Aug-31	0.0	0.1	2.2	-2.1	20.4
57	01-Sep-31	0.0	0.1	2.2	-2.1	18.3
58	01-Oct-31	0.0	0.5	2.4	-2.0	16.3
59	01-Nov-31	0.0	1.2	3.0	-1.8	14.5
60	01-Dec-31	0.0	4.1	3.6	0.6	15.0
61	01-Jan-32	0.0	6.0	3.6	2.5	17.5
62	01-Feb-32	0.0	4.3	3.6	0.7	18.2
63	01-Mar-32	0.0	3.3	3.6	-0.3	17.9
64	01-Apr-32	0.0	0.7	2.4	-1.7	16.2
65	01-May-32	0.0	0.5	3.0	-2.5	13.6
66	01-Jun-32	0.0	0.2	2.4	-2.2	11.4
67	01-Jul-32	0.0	0.2	2.4	-2.2	9.2
68	01-Aug-32	0.0	0.1	2.0	-2.0	7.3
69	01-Sep-32	0.0	0.1	2.0	-2.0	5.3
70	01-Oct-32	0.0	0.5	2.3	-1.8	3.4
71	01-Nov-32	0.0	1.2	2.8	-1.7	1.8
72	01-Dec-32	0.0	4.1	1.8	2.4	4.1
73	01-Jan-33	0.0	6.0	3.3	2.7	6.8
74	01-Feb-33	0.0	4.3	3.4	0.9	7.7
75	01-Mar-33	0.0	3.3	3.4	-0.1	7.6
76	01-Apr-33	0.0	0.7	2.3	-1.6	6.0
77	01-May-33	0.0	0.5	2.9	-2.4	3.6
78	01-Jun-33	0.0	0.2	2.3	-2.1	1.5
79	01-Jul-33	0.0	0.2	1.5	-1.4	0.2
80	01-Aug-33	0.0	0.1	0.2	-0.1	0.1
81	01-Sep-33	0.0	0.1	0.1	0.0	0.1
82	01-Oct-33	0.0	0.5	0.1	0.4	0.5
83	01-Nov-33	0.0	1.2	0.5	0.7	1.2
84	01-Dec-33	0.0	4.1	1.2	3.0	4.1
85	01-Jan-34	0.0	6.0	3.3	2.7	6.8

**TABLE A5**      **SCENARIO 4 – 90<sup>TH</sup> PERCENTILE RAINFALL**

Month	Date	Produced Water Input (ML)	Rain Input (ML)	Evaporation output (ML)	Change (ML)	Volume in Pond (ML)
1	01-Jan-27	0.0	0.0	0.0	0.0	0.0
2	01-Feb-27	0.0	7.8	0.0	7.8	7.8
3	01-Mar-27	0.0	6.4	0.0	6.4	14.2
4	01-Apr-27	0.0	2.4	2.3	0.1	14.3
5	01-May-27	0.0	0.4	3.0	-2.5	11.8
6	01-Jun-27	0.0	0.2	2.4	-2.2	9.6
7	01-Jul-27	0.0	0.1	2.3	-2.2	7.4
8	01-Aug-27	13.7	0.1	2.0	11.8	19.2
9	01-Sep-27	13.7	0.1	2.0	11.8	30.9
10	01-Oct-27	13.3	0.4	2.4	11.3	42.2
11	01-Nov-27	0.0	1.9	3.2	-1.3	40.9
12	01-Dec-27	0.0	6.4	4.0	2.3	43.3
13	01-Jan-28	0.0	8.4	4.0	4.4	47.7
14	01-Feb-28	0.0	7.8	4.0	3.7	51.4
15	01-Mar-28	0.0	6.4	4.1	2.3	53.7
16	01-Apr-28	0.0	2.4	2.8	-0.4	53.3
17	01-May-28	0.0	0.4	3.5	-3.1	50.3
18	01-Jun-28	0.0	0.2	2.8	-2.6	47.6
19	01-Jul-28	0.0	0.1	2.8	-2.6	45.0
20	01-Aug-28	13.7	0.1	2.4	11.4	56.4
21	01-Sep-28	13.7	0.1	2.4	11.4	67.8
22	01-Oct-28	13.3	0.4	2.8	10.9	78.7
23	01-Nov-28	0.0	1.9	3.7	-1.8	76.9
24	01-Dec-28	0.0	6.4	4.6	1.7	78.6
25	01-Jan-29	0.0	8.4	4.6	3.8	82.4
26	01-Feb-29	0.0	7.8	4.6	3.1	85.5
27	01-Mar-29	0.0	6.4	4.7	1.7	87.3
28	01-Apr-29	0.0	2.4	3.2	-0.8	86.5
29	01-May-29	0.0	0.4	4.0	-3.6	83.0
30	01-Jun-29	0.0	0.2	3.2	-3.0	80.0
31	01-Jul-29	0.0	0.1	3.1	-3.0	77.0
32	01-Aug-29	0.0	0.1	2.7	-2.7	74.3
33	01-Sep-29	0.0	0.1	2.7	-2.6	71.7
34	01-Oct-29	0.0	0.4	3.0	-2.6	69.1
35	01-Nov-29	0.0	1.9	3.8	-1.9	67.2
36	01-Dec-29	0.0	6.4	4.5	1.9	69.1
37	01-Jan-30	0.0	8.4	4.4	4.0	73.1
38	01-Feb-30	0.0	7.8	4.5	3.3	76.4
39	01-Mar-30	0.0	6.4	4.5	1.9	78.2
40	01-Apr-30	0.0	2.4	3.1	-0.7	77.6
41	01-May-30	0.0	0.4	3.9	-3.4	74.2
42	01-Jun-30	0.0	0.2	3.1	-2.9	71.3
43	01-Jul-30	0.0	0.1	3.0	-2.9	68.4
44	01-Aug-30	0.0	0.1	2.6	-2.6	65.8
45	01-Sep-30	0.0	0.1	2.6	-2.6	63.3



Month	Date	Produced Water Input (ML)	Rain Input (ML)	Evaporation output (ML)	Change (ML)	Volume in Pond (ML)
46	01-Oct-30	0.0	0.4	2.9	-2.5	60.7
47	01-Nov-30	0.0	1.9	3.7	-1.8	59.0
48	01-Dec-30	0.0	6.4	4.3	2.0	61.0
49	01-Jan-31	0.0	8.4	4.3	4.1	65.1
50	01-Feb-31	0.0	7.8	4.3	3.4	68.5
51	01-Mar-31	0.0	6.4	4.4	2.0	70.6
52	01-Apr-31	0.0	2.4	3.0	-0.6	70.0
53	01-May-31	0.0	0.4	3.8	-3.3	66.7
54	01-Jun-31	0.0	0.2	3.0	-2.8	63.9
55	01-Jul-31	0.0	0.1	3.0	-2.8	61.1
56	01-Aug-31	0.0	0.1	2.6	-2.5	58.6
57	01-Sep-31	0.0	0.1	2.5	-2.5	56.1
58	01-Oct-31	0.0	0.4	2.9	-2.5	53.6
59	01-Nov-31	0.0	1.9	3.6	-1.7	52.0
60	01-Dec-31	0.0	6.4	4.2	2.2	54.1
61	01-Jan-32	0.0	8.4	4.2	4.3	58.4
62	01-Feb-32	0.0	7.8	4.2	3.5	61.9
63	01-Mar-32	0.0	6.4	4.3	2.1	64.0
64	01-Apr-32	0.0	2.4	2.9	-0.5	63.5
65	01-May-32	0.0	0.4	3.7	-3.2	60.3
66	01-Jun-32	0.0	0.2	2.9	-2.7	57.6
67	01-Jul-32	0.0	0.1	2.9	-2.7	54.8
68	01-Aug-32	0.0	0.1	2.5	-2.4	52.4
69	01-Sep-32	0.0	0.1	2.5	-2.4	50.0
70	01-Oct-32	0.0	0.4	2.8	-2.4	47.6
71	01-Nov-32	0.0	1.9	3.5	-1.6	46.0
72	01-Dec-32	0.0	6.4	4.1	2.3	48.3
73	01-Jan-33	0.0	8.4	4.1	4.4	52.6
74	01-Feb-33	0.0	7.8	4.1	3.6	56.3
75	01-Mar-33	0.0	6.4	4.2	2.2	58.5
76	01-Apr-33	0.0	2.4	2.8	-0.4	58.1
77	01-May-33	0.0	0.4	3.6	-3.1	54.9
78	01-Jun-33	0.0	0.2	2.9	-2.7	52.3
79	01-Jul-33	0.0	0.1	2.8	-2.7	49.6
80	01-Aug-33	0.0	0.1	2.4	-2.4	47.2
81	01-Sep-33	0.0	0.1	2.4	-2.4	44.8
82	01-Oct-33	0.0	0.4	2.7	-2.3	42.5
83	01-Nov-33	0.0	1.9	3.4	-1.5	41.0
84	01-Dec-33	0.0	6.4	4.0	2.3	43.3
85	01-Jan-34	0.0	8.4	4.0	4.4	47.8



## Attachment C

**TABLE A6** INTERPOLATED RATE OF CHANGE FOR RAINFALL DEPTH WITH ASSOCIATED UNCERTAINTY RANGE  
(WASKO C, 2024)

Duration	Rate of change (%/°C) and estimates of 'likely' range (corresponding to ~66% range) in parentheses
1.5 hour	13.7 (6.1 – 25.6)
2 hours	12.8 (5.5 – 24.0)
3 hours	11.8 (4.7 – 22.0)
4.5 hours	10.8 (4.0 – 20.3)
6 hours	10.2 (3.6 – 19.2)
9 hours	9.5 (3.1 – 17.8)
12 hours	9.0 (2.7 – 16.9)
18 hours	8.4 (2.3 – 15.7)