MEMORANDUM

COMPANY: Toro Energy

ATTENTION: Alan Tandy

CC:

FROM: Rob Swift

DATE: 4 November 2014 JOB NO: 1134J DOC NO: 017a

SUBJECT: Summary of West Creek Borefield Modelling Results

1. **Background**

Toro Energy’s (Toro) Lake Way and Centipede-Millipede uranium deposits are located along the edge of the Lake Way playa, south of the town of Wiluna, in the Murchison region of Western Australia’s Mid-west. Toro also owns a further uranium deposit at Lake Maitland located some 105km south-east of Wiluna. The proposed mining of these deposits is referred to as the Wiluna Uranium Project.

Toro propose to process approximately 2Mt of ore per annum over a project life of 25 years. It is estimated that the Wiluna Uranium Project will require up to 2.5GL/a of moderate salinity water (Total Dissolved Solids or TDS < 3,000mg/L), mainly for operation of the ore processing plant to be located at the Centipede-Millipede mine.

Groundwater modelling was completed in 2010 for the West Creek water supply area by RPS (formerly Aquaterra). The groundwater model developed covered the proposed West Creek borefield, as well as the surrounding groundwater catchment. Groundwater modelling results showed that the proposed borefield would be sufficient to supply the then required water demand of 0.7GL/a for the proposed project life of 10 years. This was based on modelling that included a maximum water level drawdown constraint that maintained the predicted saturated thickness of the calcrete aquifer at between 60% and 75% of its original saturated thickness.

Subsequent to this modelling work, the required operational life of the West Creek Borefield has been increased from 10 years to 25 years. The existing numerical model (Aquaterra 2010) has been re-run based on this requirement to assess the ‘sustainable’ yield of the Borefield over this extended period.

2. **Model Runs and Results**

The numerical model developed in 2010 was rerun to assess the maximum supply potential of the West Creek Borefield over a period of 25 years. All the model runs use the so-called “expanded” West Creek Borefield configuration (as per Scenario 9 in the 2010 Aquaterra report), which includes pumping from the Apex Southern Borefield (production bores XP 1 to 5). Three borefield abstraction scenarios were run, as summarised in Table 1, comprising:

- **Scenario 1**: West Creek Borefield at 0.7GL/a, Apex Southern Borefield at 0.64GL/a.
- **Scenario 2**: West Creek Borefield at 0.7GL/a, Apex Southern Borefield at 2.36GL/a
- **Scenario 3**: West Creek Borefield at 0.4GL/a, Apex Southern Borefield at 2.36GL/a

The expanded West Creek Borefield used in the model comprises nine production bores as summarised in Table 1 and presented on Figure 4.
The general parameters, including recharge, evapotranspiration and fixed head boundary conditions, used in the original 2010 model (Aquaterra 2010) have been maintained for the current modelling study.

The 40% aquifer drawdown constraint used in the previous model (Aquaterra 2010), is also applied in all modelling Scenarios and is presented in Table 1 as the minimum allowable water level elevation. This is associated with the protection of groundwater dependent ecosystems, including stygofauna which have been identified in the calccrete aquifer.

Table 1: Production Bore Setup for Individual Model Scenarios

<table>
<thead>
<tr>
<th>Borefield</th>
<th>Production Bore ID</th>
<th>Minimum Allowable Water Level Elevation (m)</th>
<th>Initial Abstraction Rates (m$^3$/d)</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Scenario 1</td>
</tr>
<tr>
<td>West Creek</td>
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<td>495.38</td>
<td>163</td>
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<tr>
<td></td>
<td>P62</td>
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<td></td>
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</tr>
<tr>
<td></td>
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<td>204</td>
</tr>
<tr>
<td>Apex Southern</td>
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<td>Apex Southern</td>
<td>TOTAL</td>
<td></td>
<td>1,918</td>
</tr>
</tbody>
</table>

Table 1: Production Bore Setup for Individual Model Scenarios

2.1 Scenario 1

Pumping from the West Creek Borefield was modelled at a rate of 0.7GL/a, the sustainable rate predicted for the borefield over the original project life of 10 years. The Apex Southern Borefield was pumped at a rate of 0.64GL/a, as per the estimate from the 2010 report of historical “average” abstraction rates.

The predicted abstraction rates from the West Creek and Apex Southern Borefields over the 25 year period are shown on Figure 1. The yield of the West Creek Borefield starts to decline after approximately seven years, and after 25 years reduces to approximately 0.35GL/a. The Apex Southern Borefield cannot sustain the proposed abstraction rate (0.64GL/a) and collapses rapidly to approximately 0.2GL/a.

2.2 Scenario 2

The West Creek Borefield is pumped as per Scenario 1 (0.7GL/a), whilst the Southern Apex Borefield is operated at its licensed limit of 2.36GL/a (the Department of Water 5C allocation). The predicted abstraction rates from the West Creek and Southern Apex Borefields are shown in Figure 2. The yield profile of the West Creek Borefield over time is similar to Scenario 1, collapsing to approximately 0.35GL/a after 25 years. The Southern Apex Borefield cannot sustain the 5C Licensed maximum abstraction rate.
The predicted water level drawdown contours after 25 years for Scenario 2 are shown in Figure 4. For comparison purposes, the predicted drawdown contours from the previous modelling work (Aquaterra 2010) for Scenario 9 after 10 years of pumping are also shown on Figure 4. It should be noted that the initial pumping rates for the Apex Southern Borefield in the original model was 0.64GL/a, whereas the current model uses 2.64GL/a. The drawdown contours after 25 years have extended slightly further from the West Creek production bores, notably extending a further 0.5km west, 1.3km south-west and 2.0km south-east from the footprint of the previous (10 year) modelling study. In the south-east the extent of the drawdown contours are also impacted by the high initial drawdown rates from the Apex Southern Borefield.

2.3 Scenario 3

The West Creek and Apex Southern Borefields are operated at a rate of 0.44GL/a and 2.36GL/a, respectively, for a period of 25 years. The predicted abstraction rates from both Borefields are shown on Figure 3.

The model predicts that the West Creek Borefield can sustain a production rate of approximately 0.4GL/a for 25 years. The predicted water level drawdown contours after 25 years are shown on Figure 5. The drawdown extent is slightly less than that of Scenario 2, extending 0.4km west, 1.2km south-west and 2km south-east of the footprint of the previous (10 year) modelling phase. In the south-east the extent of the drawdown contours are also impacted by the high initial drawdown rates from the Apex Southern Borefield.

3. Summary

The modelling work undertaken highlights the limited extent of the West Creek aquifer system, with only a limited volume of groundwater available in aquifer storage for abstraction and predicts that the West Creek Borefield is capable of supplying approximately 0.4GL/a over a period of 25 years noting that this is in part limited by the constraints necessary to protect GDEs and also by the nearby pumping activity associated with the Apex Southern Borefield. The modelling predicts that the Apex Southern Borefield declines to approximately 0.2GL/a, well below the licensed limit of 2.36GL/a.

Yours sincerely,

RPS Water Management

Rob Swift
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4. References

Scenario 1: West Creek (initial Rate 0.7GL/a) and Apex Southern (initial rate 0.64GL/a) Borefields over 25 years

FIGURE 1

West Creek Borefield  Apex Southern Borefield
Scenario 2 West Creek (initial Rate 0.7GL/a) and Apex Southern (initial rate 2.64GL/a) Borefields over 25 years

FIGURE 2
Scenario 3 West Creek (initial Rate 0.44GL/a) and Apex Southern (initial rate 2.64GL/a) Borefields over 25 years FIGURE 3