Affidavit of Christopher Ian Leonard Oppenheim

WAD 37 of 2022

Federal Court of Australia

District Registry: Western Australia

Division: General

YINDJIBARNDI NGURRA ABORIGINAL CORPORATION RNTBC

Applicant

STATE OF WESTERN AUSTRALIA & ORS

Respondents

Affidavit of:	**Christopher Ian Leonard Oppenheim**
Address:	c/- Fortescue Metals Group, Level 2, 87 Adelaide Terrace, East Perth WA 6004
Occupation:	Hydrogeologist
Date:	4 ~~X~~ August 2023 CO HR

Filed on behalf of (name & role of party)	FMG Pilbara Pty Ltd, Pilbara Energy (Generation) Pty Ltd, Pilbara Energy Company Pty Ltd, Pilbara Gas Pipeline Pty Ltd and The Pilbara Infrastructure Pty Ltd
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Chr Oppenheim

Contents

I, Christopher Ian Leonard Oppenheim, c/- Fortescue Metals Group, Level 2, 87 Adelaide Terrace, East Perth WA 6004, General Manager – Resource Definition, make oath and say as follows:

1. I am employed by FMG Personnel Services Pty Ltd, a subsidiary of Fortescue Metals Group Limited (**FMGL**), as a General Manager – Resource Definition. I have been in this role since March 2023. Prior to being employed in this role, I have been employed by FMG Personnel Services Pty Ltd in various roles since March 2011.

2. I am authorised to make this affidavit on behalf of the 2nd to 6th respondents (**FMG Respondents**). In this affidavit, I refer to FMGL, the FMG Respondents, and other entities related to them collectively as "**FMG**".

3. Unless otherwise stated, the facts contained in this affidavit are within my own knowledge and are true.

BACKGROUND

4. In this section of my affidavit, I set out:

    (a) my qualifications, and a history of my involvement with FMG;

    (b) an explanation of the hydrology of the area on which FMG's Solomon mining operations occur (**Solomon Hub**). Hydrology refers to the distribution and movement of surface water in an area;

Chr Oppenheim

(c) an explanation of the hydrogeology of the Solomon Hub. Hydrogeology refers to the distribution and movement of groundwater (as opposed to surface water) in an area.

My qualifications and employment with FMG

5. I am a qualified geologist and have the following tertiary qualifications:

    (a) Bachelor of Science (double major in geology and geography) awarded by the Otago University of New Zealand; and

    (b) Post Graduate Certificate - Ground Water Science awarded by Flinders University of South Australia.

6. I first became involved with the Solomon mining operations (**Solomon Hub**) when I joined FMG in March 2011 as a Senior Hydrogeologist. At this time, project approvals for the Solomon Hub were in the process of being granted and there was considerable planning taking place for construction of the mining infrastructure and the commencement of mining. In my role, I worked exclusively on matters relating to hydrogeology at the Solomon Hub. In particular, a large part of my work in this role involved coordinating with local traditional owners and other FMG teams to design and implement the programs I outline below.

7. In July 2012, I was promoted to the role of Specialist Hydrogeologist at FMG. In that role, I continued to work on matters relating to hydrogeology at the Solomon Hub, but I was also involved in regional work unrelated to the Solomon Hub. This work included responsibility for dewatering, water supply and approvals compliance in respect of groundwater obligations under FMG's environmental approvals.

8. In November 2015, I was promoted to the role of Principal Hydrogeologist at FMG. In that role, I was responsible for supervision of all matters relating to hydrogeology at all FMG-owned mines except for the Chichester Hub.

9. In April 2018, I moved into FMG's Drilling team as a Manager – Drilling. In this team, I have been responsible for matters involving resource definition and hydrogeological drilling. I was promoted to Senior Manager – Drilling in November 2021, and to General Manager – Resource Definition in March 2023. In these roles, I have not had day-to-day management of matters concerning the management of hydrogeology of the Solomon Hub, but I have been kept aware of the nature of FMG's activities in the management of hydrogeology due to the nature of my work. This is because my work continues to be related to hydrogeology, and so it is inter-related with what is done by other teams in in the management of hydrogeology.

Summary of hydrology at Solomon Hub

10. When I joined FMG in March 2011, work had already been done to identify the surface water catchments and groundwater aquifers that could, or may be, affected by the Solomon Hub mine. This work was done by FMG with the assistance of external contractors.

11. Solomon Hub sits across three surface water catchments. These catchments are Zalamea, Kangeenarina and Weelumurra.

12. I have been shown a map of the Solomon Hub, the compensation application area, and FMG's operations within that area, with these three catchments overlaid over the top of it. I believe that map is accurate. Attached to this affidavit and marked "**CILO-1**" is a copy of that map.

13. The *Zalamea catchment* sits in the south-eastern corner of the Solomon Hub, partly within the compensation application area. In October 2017, FMG's environmental approvals were updated to remove any requirement to protect the Zalamea catchment. Before that, FMG was required to monitor groundwater in a similar fashion to the Kangeenarina catchment.

14. The *Kangeenarina catchment* runs through the approximate centre of the Solomon Hub. This catchment supports both the Kangeenarina Creek itself as well as associated permanent and semi-permanent groundwater-fed pools on local reaches of that creek. Kangeenarina Creek runs from south to north through Trinity and the Valley of the Kings, and then north-east for approximately 14 km before discharging into the Lower Fortescue River.

15. Pursuant to its environmental approvals, FMG is permitted to dewater mining pits located within this catchment, but is required to protect the Kangeenarina Creek and associated pool system outside the area of the Solomon Hub. I outline the steps FMG takes to do so at paragraphs 44 to 60 below.

16. The *Weelumurra catchment* is located to the west of the Queens deposit in the Solomon Hub, and is located partially within the compensation application area and partially within the lands of the Eastern Guruma people. This catchment supports the Weelumurra Creek and associated permanent and semi-permanent pools. Weelumurra Creek begins outside the south-west boundary of the compensation application area and runs in an approximately south to north-west direction. It later intersects with the western part of the compensation area and eventually joins the Fortescue River.

17. Pursuant to its environmental approvals, FMG is permitted to dewater the Queens mining pit, which is located outside the compensation application area and within the Weelumurra catchment. Although FMG conducted some minor abstraction at Queens between 2013 and 2017 for the purpose of supplementing Kangeenarina Creek, material dewatering of the Queens mining area began in 2018. FMG is also required to take steps to protect Weelumurra Creek and the associated pools under its environmental approvals. I outline these steps at paragraphs 61 to 76 below.

18. Although the Queens mining area, and the area of the Weelumurra Creek which is near to it, are located outside the compensation application area, I have included an explanation of FMG's activities in relation to these areas because the Weelumurra Creek flows north into the compensation application area.

19. One site that I understand to be of particular significance to the Yindjibarndi people is *Satellite Spring*, which I understand the Yindjibarndi people refer to as *Bangkangarra*. *Bangkangarra* is a naturally occurring spring which is located directly to the north of mining lease M47/1475 and to the west of mining lease M47/1473. It is not covered by any FMG mining lease or miscellaneous licence, but is covered by an FMG exploration licence. As I explain at paragraphs 77 to 81 below, *Bangkangarra*'s geological position means that it is unlikely that FMG's operations can affect, have affected, or will affect *Bangkangarra*.

Summary of hydrogeology at Solomon Hub

[redacted] [redacted]

[redacted] [redacted]

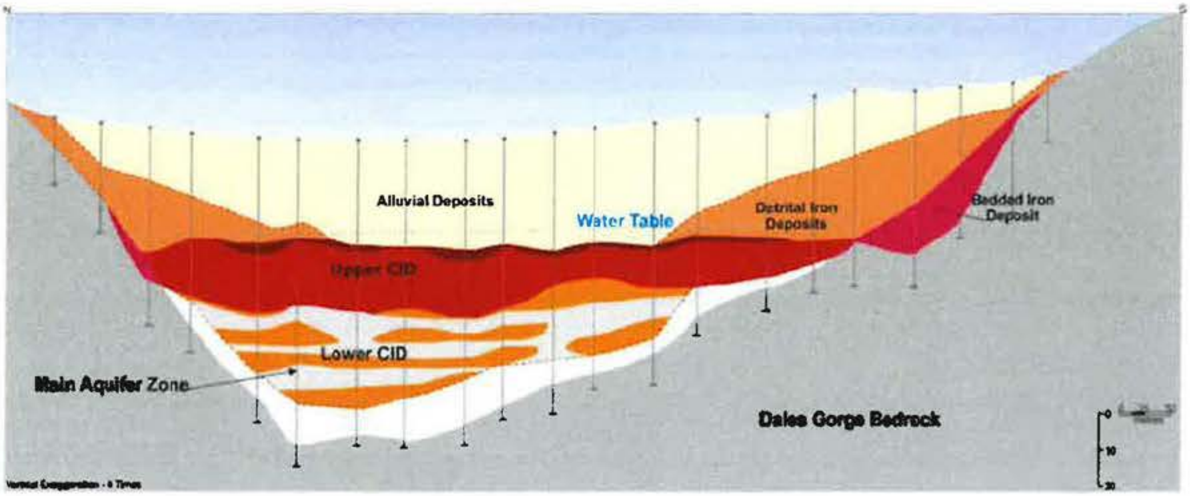
[redacted] [redacted]

[redacted] [redacted]

[redacted] [redacted]

[redacted] [redacted]

26. These layers can be seen in the below graph, which has been extracted from page 21 of the *Solomon Mining Area: Updated H3 Hydrogeological Assessment* dated 4 August 2021 (**H3 Assessment**). Attached to this affidavit and marked "**CILO-2**" is a copy of the H3 Assessment, without its appendices (which are voluminous). The H3 Assessment was prepared to assess and outline the impact of FMG's dewatering and injection activities on nearby environmental receptors, present management strategies to manage those impacts, and present the output of FMG's modelling of the current mine plan taking into account those strategies.



27. FMG has, since the development of the Solomon Hub, used numerical modelling to assess the potential groundwater impacts of its dewatering and injection activities. This modelling has been refined and calibrated over time as the Solomon Hub has expanded and FMG has obtained more data from its dewatering and drilling operations. From my experience, FMG refines and recalibrates this data every quarter. FMG has, among other things, used this modelling to assess the shape and permeability of the three aquifer levels underlying the Solomon Hub.

28. As part of this modelling process, FMG calculates the size of the three aquifer levels and the amount of water that it anticipates will be held in those levels and, based on these figures, models the anticipated rate of flow of groundwater to its bores. It then compares the modelled rate of flow against the actual results it records from its bores in a process called "transient flow calibration", in order to assess the accuracy of the modelling. If the actual flow of groundwater were to be greater than the modelled flow, then it would indicate that FMG's data was incomplete (for example, it may indicate that groundwater may be flowing through conduits in the bedrock and contributing to the groundwater in the Solomon Hub area). [redacted]

[redacted]

[redacted] [redacted]

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FMG'S ENVIRONMENTAL OBLIGATIONS

36. In this section, I set out the key environmental obligations that underpin FMG's management of the hydrology and hydrogeology of the Solomon Hub.

37. As part of the Solomon Hub's environmental commitments, FMG was required to obtain approval from:

(a) the Western Australian Government under the *Environmental Protection Act 1986* (WA); and

(b) the Commonwealth Government under the *Environmental Protection and Biodiversity Conservation Act 1999* (Cth).

38. On 20 April 2011, the Western Australian Minister for the Environment issued Ministerial Statement 862 (**MS 862**), which contained the environmental approval for the Solomon Hub. Attached to this affidavit and marked **"CILO-3"** is a copy of MS 862.

39. As outlined in Schedule 1 to MS 862, FMG was authorised, among other things, to dewater (that is, to lower the groundwater level within a certain area) up to 10 gigalitres per annum from the Kings mine, subject to the conditions set out in that approval.

40. Relevantly, condition 11 of MS 862 related to the management of groundwater. In particular, FMG was required:

(a) prior to dewatering, to submit a report providing details of a supplementation program designed to support water levels of groundwater fed pools within the project area (Condition 11-2);

(b) to ensure that water levels in groundwater fed pools within, and adjacent to, the project area are maintained consistent with pre-mining levels (Condition 11-1);

(c) to implement the supplementation program identified in the report, monitor groundwater and surface water levels, and monitor the health and cover of riparian vegetation (Condition 11-3);

(d) to submit the results of its monitoring to the Environmental Protection Authority (Condition 11-4); and

(e) if its monitoring indicates a decline in water levels, to report its finding to the Environmental Protection Authority and take steps to halt the decline (Condition 11-5).

41. On 3 October 2017, the Minister issued Ministerial Statement 1062 (**MS 1062**). MS 1062 contained updated environmental approvals relating to FMG's proposed expansion of the Solomon Hub. Attached to this affidavit and marked **"CILO-4"** is a copy of MS 1062.

42. As outlined in Schedule 1 to MS 1062, MS 1062 authorised FMG to dewater a total of 26 gigalitres per annum from within the mine development envelope, subject to the conditions set out in that approval. Relevantly, FMG was required to:

(a) prepare and submit Condition Environmental Management Plans identifying the steps that it would take to achieve specific environmental objectives, including the protection of groundwater (Conditions 7-1 and 7-2);

(b) maintain water levels in permanent pools in Kangeenarina Creek consistently with pre-mining surveys, except where authorised to be removed (i.e. dewatered) (Condition 10-1(3));

(c) maintain water levels in permanent and semi-permanent pools associated with Weelumurra Creek consistently with natural seasonal levels (Condition 10-1(5));

(d) maintain the health of vegetation associated with the three groundwater catchments I have identified above (Conditions 10-1(1), 10-1(2), 10-1(4), and 10-1(6)); and

(e) prevent contamination of groundwater and surface water with metals from the Queens mining area (Condition 11-1).

43. Below, I set out my understanding of the steps that FMG has taken to ensure it complies with these obligations.

PROTECTION OF KANGEENARINA CREEK CATCHMENT

44. In this section of my affidavit, I set out the steps FMG takes to protect the Kangeenarina Creek and its associated pools.

45. As mentioned, FMG's environmental approvals permit it to dewater within the area of the mine development envelope, and use a certain amount of that water for its operational requirements. However, FMG is required to ensure that, outside that envelope, water levels at Kangeenarina Creek and associated pools are maintained consistent with pre-mining levels.

46. In order to comply with this requirement, FMG has designed and implemented a Kangeenarina Pools Supplementation Plan. I was involved in the preparation of this document. The Kangeenarina Pools Supplementation Plan was first issued on 10 May 2012. Since that date, the plan has been subject to multiple revisions. Attached to this affidavit and marked "**CILO-5**" is a copy of the latest revision of the Kangeenarina Pools Supplementation Plan, revision 5, dated 21 February 2020.

47. [redacted] FMG prepared the Kangeenarina Pools Supplementation Plan in consultation with members of the Wirlu-Murra Yindjibarndi Aboriginal Corporation (**WMYAC**). I was personally involved in liaising with WMYAC during the development of the Kangeenarina Pools Supplementation Plan.

48. FMG's consultation with WMYAC involved regular meetings with members of WMYAC. As part of these meetings, the WMYAC members talked about the importance of Kangeenarina Creek and its associated pools to the Yindjibarndi people, and identified those areas which they considered

critical to protect. In turn, FMG employees travelled to Roebourne, Karratha and Port Hedland to explain the steps FMG was taking to protect the creek, and to explain the data it had gathered.

49. As explained in greater detail in the Kangeenarina Pools Supplementation Plan, FMG takes the following steps to protect and monitor the Kangeenarina groundwater catchment, and in particular the downstream area of Kangeenarina Creek. The precise locations of the infrastructure I describe below are identified at Figure 2 to the Kangeenarina Pools Supplementation Plan.

50. First, in May 2014, FMG implemented a surface water supplementation programme to protect Kangeenarina Creek specifically. In short, this involves pumping water from FMG's dewatering operations directly into downstream Kangeenarina Creek.

51. Currently, FMG is dewatering the Kings and Trinity mining pits. Water is sourced from FMG's dewatering operations in these mining pits (and, from time to time, from its other operations within the Solomon Hub) and pumped north. A certain amount of this water is used for FMG's operational requirements, such as for the Kings Ore Processing Facility. The balance of the water is used for the surface water supplementation programme and for the groundwater reinjection programme I explain below.

52. This water is pumped directly to four spigots at various locations along the trunk of Kangeenarina Creek, at the northern end of the Solomon Hub mine envelope, in order to specifically maintain groundwater levels at the permanent pools. I understand that since my involvement with the supplementation programme, FMG no longer relies on this surface water supplementation programme, and instead relies on the sub-surface groundwater reinjection programme below.

53. Secondly, in June 2016 FMG implemented a sub-surface groundwater reinjection programme to ensure that it maintains groundwater levels in the Kangeenarina Creek catchment. In short, this involves the pumping of water from FMG's dewatering operations through a perforated underground pipe, so that the water is added back into the surrounding water table.

54. As with the surface water supplementation programme, water is sourced from FMG's dewatering operations and pumped north. This water is pumped through injection pipelines (also known as "diffuser lines") located approximately 1.5m underground, which are located north-east of the surface water supplementation spigots. The injection pipeline is perforated at regular intervals, in order to allow water to escape the pipe. The water then flows back down into the groundwater table.

55. The scope of this programme has increased over time. When the groundwater injection programme was introduced, FMG operated one system, which has operated at up to 120 litres per second during peak periods. FMG introduced a second system further downstream in April 2020, which operates in preference to the original system and has operated at up to 40 litres per second.

56. Thirdly, FMG has installed three groundwater monitoring bores along Kangeenarina Creek, downstream of its mining operations, and one surface water level monitoring bore within

Kangeenarina Creek. FMG uses these bores to measure groundwater levels and quality along the Kangeenarina Creek, to ensure that the programmes I outline above are operating as intended and to ensure that the quality of the water remains compliant.

57. The results from these bores are reviewed on a monthly basis, and compared against three tiers of trigger levels, as follows:

(a) A Tier 1 trigger occurs when the water table falls to the bottom of a measured "baseline range". The baseline range reflects the pre-mining water table level, taking into account historical seasonal trends. In other words, a Tier 1 trigger occurs when groundwater falls below the level it would probably have been if the Solomon Hub mine did not exist. A Tier 1 trigger would result in FMG increasing re-injection rates until the trigger was addressed.

(b) A Tier 2 trigger occurs when the water table falls at least 0.5m below the Tier 1 trigger level. This would indicate to FMG that its supplementation and reinjection programmes are not performing as required. A Tier 2 trigger would result in FMG taking contingency actions to identify and address the root cause of the issue, and to re-establish the required groundwater level.

(c) A Tier 3 trigger occurs when the water table falls at least 0.5m below the Tier 2 trigger level. This would indicate to FMG that its supplementation and reinjection programmes are failing to meet its objectives. It would require that FMG issue a report to the Department of Environment under condition 7-4 of MS 1062. FMG also conducts this monitoring to ensure that its activities do not result in the injection of excess groundwater, which would result in groundwater mounding.

[redacted]

[redacted]

[redacted]

[redacted]

60. [redacted] Although FMG does not include the results of these bores in its Annual Environmental Reports (as it is not required to do so by its regulatory approval), FMG maintains records of the data from those two bores.

PROTECTION OF WEELUMURRA CREEK CATCHMENT

61. In this section of my affidavit, I set out the steps FMG takes to protect the Weelumurra Creek and its associated pools.

62. FMG's environmental approvals also require it to maintain water levels in permanent and semi-permanent pools associated with Weelumurra Creek consistently with natural seasonal levels, and to prevent impact to groundwater and surface water with metals from the Queens mining area. FMG has understood this as a requirement to maintain the Weelumurra Creek and pools at a level consistent with the observed natural range, without necessarily mimicking seasonal fluctuations.

63. FMG has adopted a management approach for Weelumurra Creek that is similar to its approach to Kangeenarina Creek. This approach is outlined in the Weelumurra Creek Supplementation Plan, which was first issued on 3 August 2018. Attached to this affidavit and marked **"CILO-6"** is a copy of the latest revision of the Weelumurra Creek Supplementation Plan, revision 5, dated 24 June 2021. I was not involved in the preparation or implementation of the Weelumurra Creek Supplementation Plan, but I am aware of the nature of its contents due to the nature of my work at FMG.

64. As explained in greater detail in the Weelumurra Creek Supplementation Plan, without proper management, there is the potential for the dewatering of the Queens mine pit to potentially lower the water table and impact the pools on Weelumurra Creek.

[redacted] [redacted]

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MANAGEMENT OF SATELLITE SPRING OR BANGKANGARRA

77. In this section of my affidavit, I set out my views on the interaction between FMG's operations at the Solomon Hub and the site known as Satellite Spring or Bangkangarra.

78. On 19 May 2014, I swore an affidavit in support of FMG's application for a determination by the National Native Title Tribunal in respect of tenements M47/1473 and M47/1475 (**May 2014 Affidavit**). Attached to this affidavit and marked "**CILO-7**" is a copy of my May 2014 Affidavit.

79. In my May 2014 Affidavit, I explain the following:

    [redacted]

    [redacted]

    (c) The Bangkangarra sub-catchment is elevated above the other catchments in the area. Specifically, the base of that sub-catchment sits approximately 20 metres above the highest level of the Trinity mining area. Consequently, water may only flow from Bangkangarra into the Kangeenarina Creek, and not vice versa.

(d) The Bangkangarra sub-catchment is recharged by rainfall and not by input by any other catchment system. Instead, Bangkangarra feeds into Kangeenarina Creek via a small waterfall and creek line.

(e) FMG did not intend to undertake mining operations within the Bangkangarra sub-catchment or to dewater that sub-catchment, but it was my view that in the unlikely event that any mining operation did impact Bangkangarra, remedial action could be taken by way of a sub-surface reinjection system or surface supplementation system.

80. In the course of preparing this affidavit, I have reviewed my May 2014 Affidavit. In my opinion, the contents of my May 2014 Affidavit remain true.

81. To my knowledge, FMG does not conduct monitoring of groundwater levels, dust or vibration at Bangkangarra. Due to the heritage significance of that area, FMG has not sought to [redacted] install monitoring equipment at Bangkangarra.

Sworn by Christopher Ian Leonard Oppenheim)
at Perth)
in the State of Western Australia)
on ~~1~~ August 2023)
4 CO HR)

Signature of deponent

Before me: Hamish Hamilton Robertson

Signature of witness

a legal practitioner who has held a practice certificate for at least
2 years and who holds a current practice certificate.

"CILO-1"

WAD 37 of 2022

Federal Court of Australia

District Registry: Western Australia

Division: General

YINDJIBARNDI NGURRA ABORIGINAL CORPORATION RNTBC

Applicant

STATE OF WESTERN AUSTRALIA & ORS

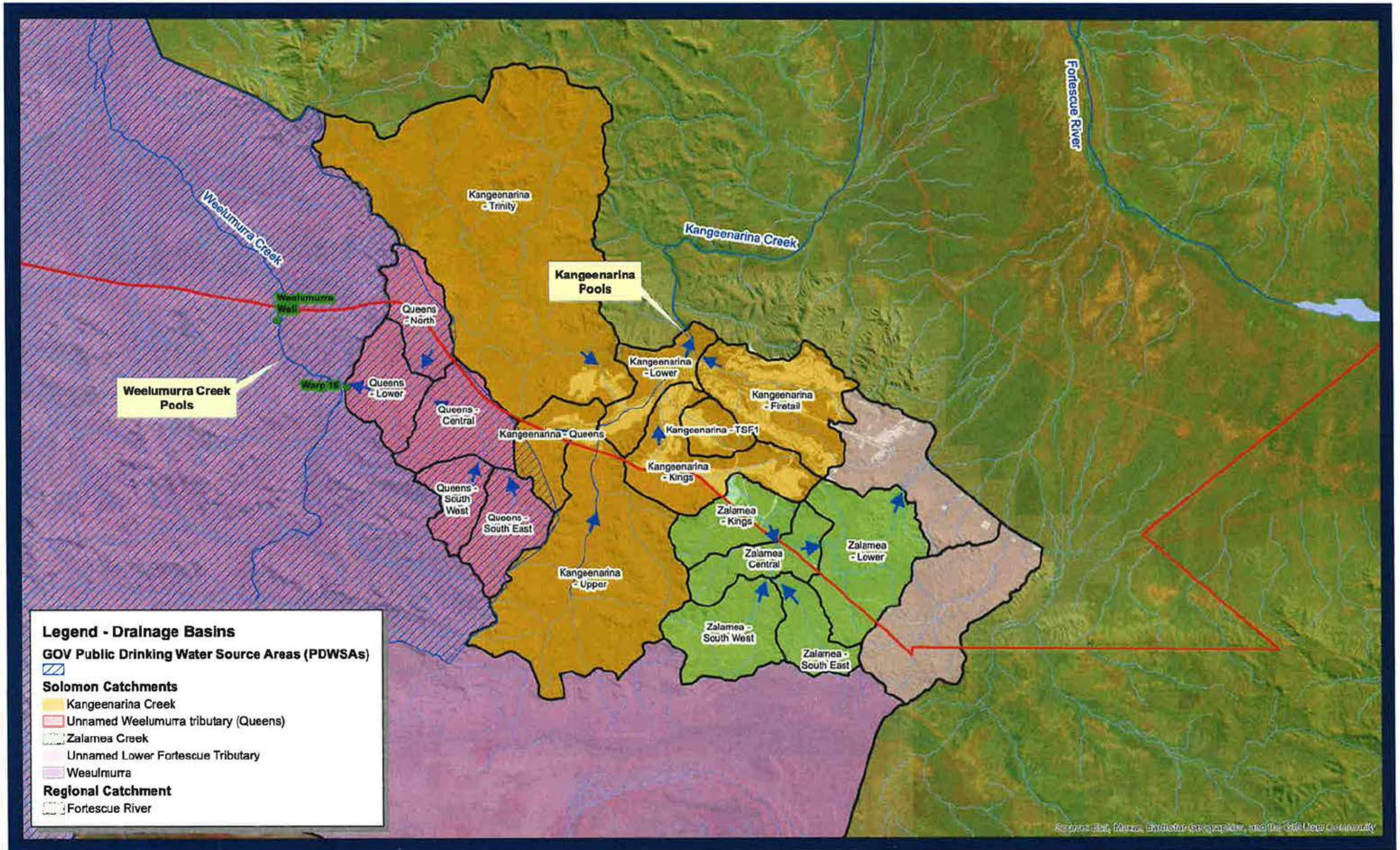
Respondents

This is the annexure marked "**CILO-1**" referred to in the affidavit of Christopher Ian Leonard Oppenheim sworn on 4 August 2023.

Signature of witness

Hamish Hamilton Robertson

a legal practitioner who has held
a practice certificate for at least
2 years and who holds a current
practice certificate.



LEGEND

- Determined Area
- Drainage
- Flow Direction
- Pools
- GOV DIWA Significant Wetlands
- Solomon Disturbed Area

Data Sources:
Public Drinking Water Source Areas (PDWSAs), DWER, 2023.
DIWA Significant Wetlands, DWER, 2023
Linear Hydrography, Geoscience Australia.
Aerial Imagery, ESRI.
All other data, FMG.

N

0 1 2 3 4 5
Kilometers

Requested By: T.Matic
Drawn By: M.Craft
Revised By: M.Craft
Approved By: A.Phu
Scale: 1:150,000
Coordinate System: GDA 1994 MGA Zone 50
Document Name: 20230705_SurfaceWaterMap

Date: 6/07/2023
Size: A3L
Revision: 0
Confidentiality: 0

Surface Water Subcatchments and Major Drainage in the Solomon Project Area

Fortescue

"CILO-2"

WAD 37 of 2022

Federal Court of Australia

District Registry: Western Australia

Division: General

YINDJIBARNDI NGURRA ABORIGINAL CORPORATION RNTBC

Applicant

STATE OF WESTERN AUSTRALIA & ORS

Respondents

This is the annexure marked "**CILO-2**" referred to in the affidavit of Christopher Ian Leonard Oppenheim sworn on 4 August 2023.

Signature of witness

Hamish Hamilton Robertson
a legal practitioner who has held
a practice certificate for at least
2 years and who holds a current
practice certificate.

Fortescue

Report

Solomon Mining Area: Updated H3 Hydrogeological Assessment

Water Management

04/08/2021

Doc # SO-RP-WM-0008 Rev0

Solomon Mining Area: Updated H3 Hydrogeological Assessment			
Document & Revision Number	**Doc # SO-RP-WM-0008**	Rev0	**4/08/2021**
Status	IFU - Issued for Use		
Summary of Changes	Update to the mining section of the 2015 Solomon Life of Mine Hydrogeological Assessment (SO-AS-EN-0060)		
Author	Zbigniew Boniecki		
Checked or Squad Review# (if applicable)	Michael Carrol		
Approved	Jordin Barclay		
Access to this document:	Public Use (Access to all)	**Next Review Date (if applicable)**	As required

Revision History ***(to be completed for each version retained by Document Control)***

Author	Checker	Approver	Rev No.	Status	Issued Date
Z Boniecki	**M Carrol**	**J Barclay**	0	IFU	4/08/2021
Initial/Surname	Initial/Surname	Initial/Surname		Choose an item.	Click here to enter a date.

EXECUTIVE SUMMARY

The Solomon Project is located in the Shire of Ashburton approximately 60 km north of Tom Price in the Pilbara region of Western Australia. It is situated between Rio Tinto's Tom Price to Dampier railway (to the west) and Karijini National Park (to the southeast). The project contains the Valley of the Kings (Kings), Firetail and Valley of the Queens (Queens) mining areas. The Kings mining area can be further subdivided into the Kings, Trinity, Zalamea, Castle Valley and Fredericks mining areas.

Construction of the Solomon Project commenced during September 2011. Groundwater abstraction for construction commenced in August 2011. Mining commenced in August 2012, with subsequent dewatering of the Kings deposit commencing in January 2014.

In the 2020 water year, groundwater abstraction totalled almost 90% of the total 18.2 GL/yr allocation of the mining area groundwater licences, GWL175139(3) and GWL176913(3), owing in part to increased dewatering requirements following heavy rainfall associated with Tropical Cyclone Damien. Recent high rainfall events and mining moving closer to areas of supplementation (thus increasing recirculation of groundwater) have led to an anticipation that the dewatering demand for the Solomon Mine licences will exceed the combined 18.2 GL/yr dewatering licence. As such, Fortescue Metals Group (FMG) intends to increase its 5C allocation for the mining area to the Part IV allowed limit of 25 GL/yr.

The primary objectives of this assessment are to:

- Assess dewatering and injection impacts to environmental receptors (Weelumurra Creek Pools, Kangeenarina Creek Pools) under the expanded groundwater abstraction volumes.
- Demonstrate the required management strategies (injection and supplementation) to prevent impacts to these receptors, paying particular attention to assessing the current trigger levels and performance to date of the current management plans.
- Present the model output for the current mine plan (10 years) with the simulated mine water balance and drawdown.

As a secondary objective, FMG intends to combine these two licences into a single licence with the increased allocation of 25 GL/yr, as has been recommended by Annual Aquifer Reviews. As the channel iron deposit (CID) aquifer is continuous and well connected, the division into two licences is purely administrative and reflects the history of licence development at the site.; An amalgamation of licences would not change groundwater abstraction operations or impacts to the aquifer but would simplify reporting.

Numerical Modelling

In support of a licence allocation increase, the existing numerical model was used to simulate multiple scenarios and assess groundwater volumes, potential impacts to environmental receptors, and the effectiveness of management strategies. The numerical model simulation output forms the basis of the groundwater impact assessment for the requested increase in groundwater abstraction licence.

Assessment of Impacts

The numerical modelling outcomes for this assessment are summarised as:

- Supplementation will be able to achieve management objectives for the Kangeenarina and Weelumurra supplementation plans and limit drawdown from the proposed increase in abstraction.

- Required abstraction rates for dewatering are anticipated to peak in the years when large recharge events occur, particularly when coincident with progression of below water table mining in new or deeper areas.

- A proportion of the increase in flows is due to mining at Queens approaching the Weelumurra injection borefield, resulting in increased recirculation. Because these volumes are re-injected back into the aquifer, this is not considered to be a net loss to the aquifer system although it is understood it would account towards total abstraction volumes.

- A grout barrier would have a beneficial impact by reducing recirculation between Weelumurra injection borefield and the Queens abstraction borefield, and thus would reduce required abstraction and supplementation rates.

- The required supplementation rates at the Weelumurra injection borefield are expected to be 5.5 GL/yr (175 L/s, 17.5 L/s per bore) without a grout barrier and 4.7 GL/yr (150 L/s, 15 L/s per bore) with a grout barrier. This latter value is dependent primarily on the final barrier permeability and extent achieved during construction

- Model simulations predict that the current management strategies will continue to be effective at limiting drawdown from increased dewatering volumes to the local CID aquifer within the mining area. No drawdown from dewatering activity is expected to extend past the Weelumurra injection borefield or Kangeenarina supplementation scheme.

Groundwater Management and Monitoring

- FMG has an adaptive approach to groundwater management. The borefield capacities will enable flexibility in abstraction from the various groundwater resources, whereby abstraction can be increased in one of the key areas and decreased in another, in order to offset possible environmental impacts from abstraction and spread the abstraction load.

- Groundwater management and monitoring will be undertaken in accordance with the following management plans relevant to the Solomon Mine Area's abstraction:
  - Solomon Groundwater Operating Strategy Rev9 (FMG, 2020d)
  - Kangeenarina Pools Supplementation Plan (FMG, 2020c)

- Weelumurra Creek Supplementation Plan (FMG, 2021, in prep)
  - Lignite Management Plan (FMG, 2021, *in prep*)
  - Vegetation Health Monitoring and Management Plan (FMG, 2019c)
- The existing network and monitoring program detailed in the operating strategy is considered sufficient to assess impacts for the mining area.
- This monitoring program will be modified on an ongoing basis to ensure operational aspects of abstraction and injection (e.g. clogging) are managed.

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1. INTRODUCTION

The Solomon Project is located in the Shire of Ashburton approximately 60 km north of Tom Price in the Pilbara region of Western Australia Plate 1. Located within the Hamersley Range, to the west of the Fortescue Valley, it is situated between Rio Tinto's Tom Price to Dampier railway (to the west) and Karijini National Park (to the southeast).

Groundwater abstraction for mine dewatering purposes occurs from the channel iron deposit (CID) aquifer under groundwater abstraction licences, GWL175139(3) and GWL176913(3), with a total allocation of 18.2 gigalitres per year (GL/yr). A combined Groundwater Operating Strategy (GWOS, *SO-00018-RP-HY-0001_Rev9*) governs the operation and management of dewatering, along with other abstraction activity occurring across the project.

In the 2020 water year, groundwater abstraction totalled almost 90% of the total allocation, owing in part to increased dewatering requirements following heavy rainfall associated with Tropical Cyclone Damien.

Recent high rainfall events and mining moving closer to areas of supplementation (thus increasing recirculation of groundwater) have led to an anticipation that the dewatering demand for the Solomon Mine licences will exceed the combined 18.2 GL/yr dewatering licence. FMG is therefore looking to increase its 5C allocation for the Mining area to the maximum referred under s38 of the *Environmental Protection Act* of 25 GL/yr (FMG, 2015) . The Part IV Ministerial Statement 1062 (MS1062) resulting from this referral is provided in Appendix 1.

In support of this licence expansion, several scenarios have been simulated using the existing numerical groundwater model to quantify dewatering requirements, dewatering impacts, effectiveness of management strategies, and water balances.

The primary objectives of this assessment are to:

- Assess dewatering and injection impacts to environmental receptors (Weelumurra Creek Pools, Kangeenarina Creek Pools) under the expanded groundwater abstraction volumes.
- Assess and present the required management strategies (injection and supplementation) to prevent impacts to these receptors, paying particular attention to the requirements of the current management plans.
- Present the model output for the current mine plan (10 years) with the simulated mine water balance and drawdown.

As a secondary objective, FMG is looking to combine these two licences into a single licence with the increase allocation of 25 GL/yr, as has been recommended by Annual Aquifer Reviews (FMG, 2019b) (FMG, 2020e). As the CID aquifer is continuous and well connected, the division into two licences is purely administrative; an amalgamation of licences would not change groundwater abstraction operations or impacts to the aquifer but would simplify reporting.

1.1 Background

Construction of the Solomon Project commenced during September 2011. Groundwater abstraction for construction commenced in August 2011. Mining commenced in August 2012, with subsequent dewatering of the Kings deposit commencing in January 2014.

The project comprises mining of a combination of channel iron deposits (CIDs), detrital iron deposits (DIDs) and bedded iron deposits (BIDs) in Kings, Firetail and Queens. The Kings deposit includes the Kings, Trinity, Zalamea and Castle Valley mining areas. These areas are all linked geologically and are collectively described as the Kings deposit. The Firetail deposit consists of the Firetail North and Firetail South mining areas. Plate 2 provides locations of the respective mining areas.

The project produces a combined total of up to 80 Mt of iron ore per annum, with the Firetail deposit contributing up to 30 Mt per annum from a blend of BIDs and DIDs. The Kings deposits produce up to 50 Mt of ore per annum comprising mostly CIDs, with some Brockman and detrital ore. Ore from the Firetail and Kings deposits is mined by conventional truck-and-shovel methods using a discrete pit mining concept of placing overburden and waste into mined-out areas (FMG, 2010). Ore from the mine is transported via a 127 km rail line to FMG's existing north–south railway for export from Port Hedland.

A tailings storage facility (TSF) has been constructed in the Kings Valley for storage of low permeability tailings generated from ore processing.

1.1.1 Groundwater Usage

As described in Section 2.4, the CID forms a palaeochannel aquifer system. Each of the CID deposits occurs beneath the water table and groundwater abstraction is required for pit dewatering to enable mining.

In addition to the dewatering of mine pits, groundwater is abstracted for mine site use that includes dust suppression, construction of infrastructure, camp supply and ore processing. Groundwater is abstracted in accordance with several 5C licences issued by the Department of Water (DoW), under the *Rights in Water and Irrigation Act 1914*.

FMG currently has approval for, and operates, six groundwater abstraction licences in support of operations at Solomon (licence areas are presented in Plate 3 and licences are provided in Appendix 2):

- Queens (GWL176913) and Dewatering (GWL1752139) – to facilitate mining through the dewatering of the CID aquifer. The GWL176913 groundwater licence covers mining tenement M47/1411 which is also incorporated in GWL1752139, meaning that water in the Queens mining area can be abstracted under GWL1752139.

- Potable (GWL177110) as a potable water supply for the Kangi, Castle and Dally Camps.

- Southern Fortescue (GWL177974 and GWL 177976) – as a supplementary mine water supply when dewatering yields are insufficient to meet water demands. Bores are screened in paleochannel/paleovalley deposits and the Wittenoom Formation in the Southern Fortescue Valley to the south of the mining area.

- Stockyards borefield (GWL174095) – located on the fringe of the Lower Fortescue Valley and screened in the Wittenoom Formation. This borefield is currently not in operation but it is anticipated that this borefield will undergo future expansion.

The current assessment update aims to amalgamate the Queens and Dewatering Borefield Licences (GWL176913 and GWL1752139) and expand the licence allocation limit to the maximum of 25 GL/yr referred under s38 of the *EP Act*. Plate 3 indicates additional tenements of water take proposed for this amendment.

The Stockyards borefield (Lower Fortescue) and Southern Fortescue borefields are within aquifers that are hydrogeologically distinct and separated from the CID aquifer of the mining area. The current assessment and this report therefore do not incorporate or discuss the Southern Fortescue, and Lower Fortescue licences and associated aquifer systems.

1.2 Other Groundwater Users

Aside from the licences operated by FMG discussed in Section 1.1.1, there are 90 groundwater licences from 14 proponents within a 50 km radius from the centre of the site (DWER, 2021). Of these, 38 are allocated to the Hamersley–Fractured Rock aquifer, with a total allocation limit of 142 GL/yr. Based on the conceptual understanding of the site (further described in Section 2.4) and modelling assessment (Section 8.3), drawdown from dewatering operations within the CID aquifer will have very limited influence on the relatively low permeability Hamersley Formation bedrock, and is anticipated to have negligible impact on groundwater resources removed from the CID aquifer.

There are no pastoral bores with the CID aquifer at the Solomon Mining area; however, there is one pastoral wells located along Weelumurra Creek (Weelumurra well, 4.7 km downstream of the Weelumurra injection borefield). As the Weelumurra Creek Supplementation Plan seeks to prevent drawdown impact at Warp 16 (located on the downstream side of the injection borefield), no significant impacts to this user will occur. This is further supported by numerical modelling as discussed in Section 8.3.

The Queens deposit is partly situated within the easternmost boundary of the Priority 2 area of the Millstream Water Resource, which is a Public Drinking Water Source Area (PDSWA).

However, the bores for the Millstream Water Resource are located more than 85 km from the Queens mining tenement.

2. REGIONAL SETTING

2.1 Climate

The Pilbara has an arid tropical climate characterised by low and variable rainfall, high daily temperatures, high diurnal temperature variability and high evaporation rates. Summer months extend from October to April, when maximum daily temperatures can exceed 35°C. The winter months extend from May to September, with temperatures ranging from approximately 7°C to 23°C.

The Pilbara region is associated with two climatic zones: semi-desert (tropical) and desert (summer rain). The semi-desert areas, located in coastal and inland high-rainfall zones are characterised by tropical climate patterns with nine to eleven months of dryer weather, with hot humid summers and warm winters. The desert areas, which occur inland, are characterised by up to twelve months of dry weather with hot, dry summers (October to April) and mild winters (May to September) (MWH, 2010).

Rainfall in the Pilbara is low and variable, and generally associated with local thunderstorms and cyclonic events that occurs between mid-December and April. Tropical storms in the area have the potential to produce significant rainfall and, in some instances, the average annual rainfall can be exceeded in a single month. Tropical storms are also capable of producing localised flooding in inland areas (URS, 2010).

Rainfall data from 1974 to 2021 and temperature data from 1996 to 2021 are sourced from the nearest open weather station Paraburdoo Aero (7185) (BOM, 2021). The monthly recorded rainfall totals since 1974 and temperature averages since 1996 are provided in Table 1. Annual evaporation is estimated to be approximately 3,000 mm/yr (Van Vreeswyk, 2004).

Table 1: Weather data 1974 - 2021 (BoM Station: Paraburdoo Aero (7185))

Month	***Paraburdoo (7185)***		
	Mean Monthly Rainfall (mm)	**Mean Minimum Temperature (°C)**	**Mean Maximum Temperature (°C)**
January	59.0	36.3	44.3
February	75.6	34.2	43.7
March	48.8	33.2	40.0
April	23.8	29.4	37.2
May	18.1	25.4	31.8
June	23.1	22.9	27.6
July	13.6	21.2	27.8
August	9.8	25.1	30.5
September	3.3	28.8	33.6
October	4.0	32.4	38.6
November	8.4	34.9	40.5
December	26.4	37.7	42.7
Annual	**321.3**	**31.9**	**35.7**

Historical daily rainfall data from regional gauges were analysed to identify historical trends. Regional gauges (BoM Station No.) at Hamersley (5005), Mt Florance (5014), Mulga Downs (5015), Wittenoom (5026), Paraburdoo Aero (5026) and Coolawanyah (5001), which encompass an area more than 2,500 square kilometres, have been reviewed over a 110-year period from 1908 to 2018. Furthermore, the available results for the five rainfall stations were averaged to attempt to remove the effect of localised spatial variability.

These gauges are all within the vicinity of the Hamersley ranges, which has a higher annual average rainfall than other areas of the Pilbara (Charles, 2013). The region of higher annual average corresponds well with elevation plots, which suggests orographic processes occur.

The average daily totals are illustrated in Figure 1 presenting daily rainfall between 1909 and 2020, as well as a rainfall excess/deficit trend for the same period. The graph was developed using available averaged daily data (BOM, 2021) from the six BoM weather stations mentioned above. A detailed assessment of rainfall excess/deficit for the period from 1995 to 2019 was also completed as part of the *Baseline Survey Technical Report* (FMG, 2020).

Rainfall excess/deficit trends present a running deviation of long-term actual rainfall against the average. This provides season-scale identification of trends (wet/dry) as well as longer term (e.g. decadal) deviation from average conditions. Because of their natural tempering of peaks, trends are often good for correlating rainfall events to aquifer responses. Observations from the more detailed rainfall/excess deficit trend in FMG (2020) include:

- The overall rainfall trend is characterised by the cyclic nature of wet and dry seasons, with annual fluctuations of about 200 mm evident across the record.
- The trend shows a period of increasing rainfall from mid-1999 to 2000 after a long dry period that started in 1920. Rainfall Period 1 is denoted in (FMG, 2020) to characterise a distinct wet period characterised by increasing rainfall and significant cyclonic rainfall events from 1995 to 2006. The average rainfall for this period was the wettest on record at 664 mm.
- From 2007 to 2013, the annual average rainfall was approximately 470 mm, above long-term averages (Rainfall Period 2), and including a series of large rainfall events.
- Since 2014, a comparatively dry period has been experienced at Solomon, characterised by a gradual return to rainfall deficit (Rainfall Period 3).

In the context of these data, FMG has operated at Solomon during a 'wetting' period in the 110-year rainfall record, with the recent stabilisation of the trend indicative of an absence of large rainfall events since 2014, resulting in a return to rainfall deficit.

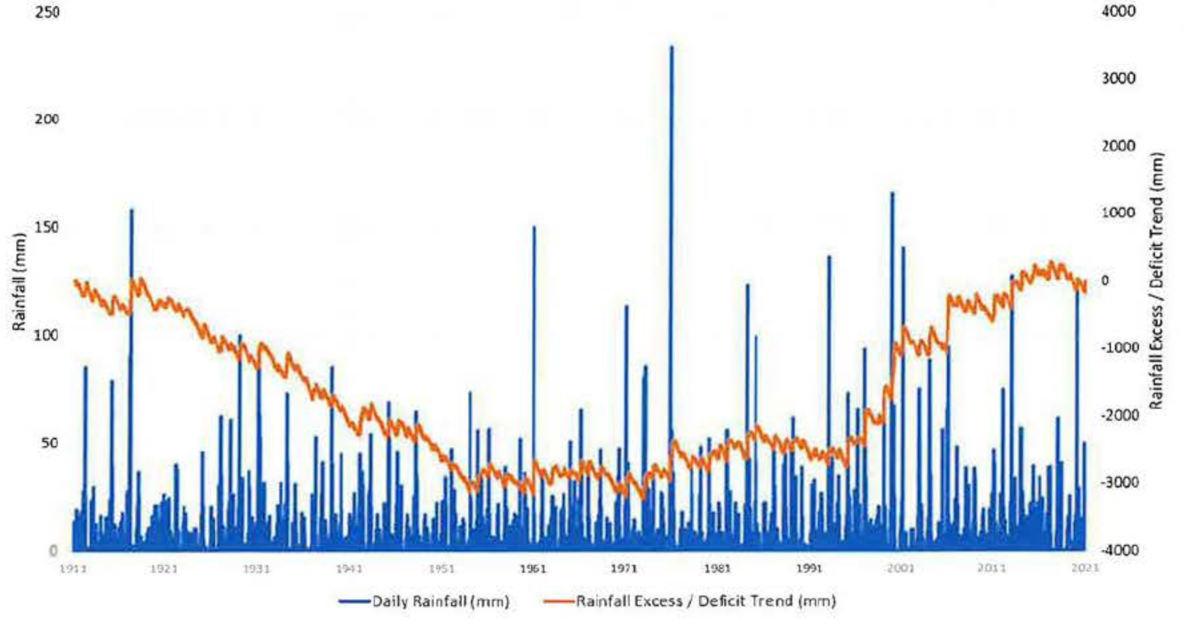


Figure 1: Historical rainfall – daily average rainfall

2.2 Hydrology

2.2.1 Regional Hydrology

The Solomon mine site is within the Hamersley Ranges within the Fortescue River catchment. The Fortescue River Basin has an area of 49,710 km^2, and it can be divided into the upper and lower Fortescue River sub-catchments. The lower catchment is relatively flat with poorly defined river channel up to Gregory's Gorge, but beyond this, river channels are better defined.

The main branch of the Fortescue River drains in a north-westerly direction and discharges into the Indian Ocean. The Solomon Project area is saturated within the lower Fortescue River sub-catchment (upstream of Gregory's Gorge).

Pilbara Catchment Response

Pilbara soils typically have high initial infiltration rates for dry catchment conditions (i.e. when the antecedent moisture content of the soils is low). Significant stream flow usually occurs when the antecedent moisture content of the soils is high, which is caused by significant rainfall in the days or weeks preceding a storm event.

There are typically two different types of climatic events which cause significant flood response in the Pilbara: cyclonic activity/tropical low-pressure systems and localised diurnal or semi-diurnal thunderstorms.

Cyclonic activity can result in severe and widespread flooding, generally on a river basin scale. This flooding activity can be forecast in advance (albeit with significant uncertainty). This type of flooding typically produces large peak flows and often results in significant damage to infrastructure due to magnitude of flows and total volume of water. However, not all cyclones will result in severe flooding.

Diurnal and semi-diurnal thunderstorms have the potential to create fast and localised flooding, referred to as flash flooding. These events are much harder to predict as they can occur in the upper reaches of catchments. These events generally have a lower potential for widespread damage as the extent and magnitude of flooding is much smaller than cyclonic events.

2.2.2 Site Hydrology

The Solomon Project area contributes to the upper watershed formed by the Lower Fortescue River catchment. The main local surface water drainage systems include the Kangeenarina Creek, Weelumurra Creek and Zalamea Gorge. The Kangeenarina and Weelumurra creeks predominantly flow from south to north towards the Fortescue River and are groundwater fed, whereas the Zalamea Gorge predominantly flows from west to east, again towards the Fortescue River.

Stream flows in the region are seasonal, typically in the period from January to March each year and are widely variable. Ephemeral flow patterns result in rivers and creeks being dry for most of the year, with occasional persistent pools where springs occur along watercourses (Coffey, 2011).

Monitoring of stream flows during Tropical Cyclone Heidi (estimated to have resulted in rainfall event of magnitude close to a 2-year average recurrence interval) showed that peak flows occurred within 2–3 hours and receded within 6 hours, confirming the rapid/flashy response to rainfall in these catchments. Timing of future storm events may not always be consistent with this as it is dependent on rainfall duration, but these data provide an indication of the speed of the catchment response.

Other observations from the 2011/2012 wet season suggest that these catchments have high initial loss rates, in the order of 50 mm after prolonged dry periods. It was also noted that even with a high antecedent moisture condition, catchments still required in the order of 20 mm of rainfall in order to generate stream flow. This is consistent with suggested values for North West soil types presented in Australian Rainfall and Runoff (Pilgrim, 1987).

Kangeenarina Creek

Kangeenarina Creek is the main drainage system within the project area and contains the Kings and Firetail mining areas (Plate 4). It flows north through the Solomon Project site and then northeast for approximately 14 km before discharging into the Lower Fortescue River through an alluvial fan. The Kangeenarina Creek catchment extends nearly to Hamersley Road in the south and to the foothills of Mount Margaret in the north.

The Solomon Project area is located in the headwaters of Kangeenarina Creek and includes Valley of the Kings, Firetail Valley and Trinity Valley. There is a soft catchment divide between Kangeenarina and Zalamea catchments, at the top of the Kings Valley. There is another similar soft catchment divide with Kangeenarina and Weelumurra catchments at the top of the Queens Valley. In these areas, flow paths are not distinct and there is no clear demarcation of flow boundaries. There is some contribution to Kangeenarina Creek from the Valley of the Queens on the area of the eastern side of the soft catchment divide.

The majority of the catchment of the Kangeenarina Creek system is located within active or pending FMG tenements; however, Trinity Valley and a tributary of the Upper Kangeenarina Creek catchment are located within tenements owned by Rio Tinto.

Weelumurra Creek

Weelumurra Creek is located to the southern and western extent of the Solomon Project area (Plate 4). It flows in a northwesterly direction around the project area to discharge into the Lower Fortescue River several kilometres downstream of the Kangeenarina Creek discharge point. The Weelumurra Creek system is significantly larger than Kangeenarina Creek and Zalamea Gorge.

The remainder of the Valley of the Queens project area west of the soft catchment divide contributes to the Weelumurra Creek system. The main flow is from east to west, with contribution from sub-catchments from the north and south. Flow from the Valley of the Queens project area enters the main branch of Weelumurra Creek through culverts under the Rio Tinto railway.

Hamersley Road, Solomon Airport and the section of Castle Road between Hamersley Road and Kanji Camp all contribute to the Weelumurra Creek catchment upstream of the Valley of the

Queens. Sub-catchment boundaries and stream channels are poorly defined in this part of the catchment.

Zalamea Gorge

Zalamea Gorge is located on the eastern extent of the project area flowing in a northeasterly direction prior to discharging via an alluvial fan into the Southern Branch of the Lower Fortescue River. The catchment divide between the Kangeenarina Creek and Zalamea Gorge is poorly defined and flow paths are not distinct.

2.3 Geology of the Mining Area (Kings, Queens and Trinity)

The outcropping geology in the Solomon mining area includes the Dales Gorge, Whaleback Shale and Joffre members of the Brockman Iron Formation, which are known to host large iron ore deposits within other parts of the Hamersley Ranges. Incised into this bedrock geology are large palaeochannel systems, predominantly 1–2 km in width, and stretching for tens of kilometres (Golder, 2012).

During the Tertiary period, weathering and erosion of the Brockman Iron Formation deposited iron-rich materials into these incised channels. These iron-rich channels are known as channel iron deposits (CIDs).

Through FMG's interpretation of drill hole results, the CIDs can be subdivided into an upper 'hard ore CID' and a lower 'ochreous CID'. Clay lenses are observed as semi-discrete bands often several metres thick, sometimes of a poddy nature although often traceable between drill holes (Golder, 2012).

The material overlying the CID has been eroded from iron-rich material. This clastic material is concentrated into horizons of elevated iron grade termed detrital iron deposits (DIDs), which form part of the sequence of overlying Tertiary aged alluvials (Golder, 2012).

The general palaeochannel CID stratigraphy within the Solomon mining area is shown in Figure 2 and described below:

- Tertiary Alluvium comprising mostly gravelly clays from ground surface.
- Alluvial/colluvial and detrital deposits: Valley-fill sequence consisting of an approximate 10–60 m thick unit of clay, silt and gravel including iron-rich detritals derived from BIDs.
- Oakover Formation: A calcrete and silcrete horizon typically overlies the CID and varies in thickness up to several metres.
- Upper CID: A hard, brown goethite dominant CID which has been overprinted in places by a hard cap zone of hydrated goethite up to 15 m in thickness.
- Lower CID: A vuggy, clay-rich ochreous goethite dominant CID.

- Basal conglomerate: A basal conglomerate and clay unit is present at the base of the CID, typically within the deepest parts of the palaeochannel system. In the western part of Queens, a lignitic facies of this basal unit has formed. This is not shown in Figure 2 but is described in detail in the *Lignite Study Report* (FMG, 2021).
- Brockman Iron Formation: Relatively flat-lying, predominately barren, but with local mineralisation occurring on the adjacent valley slopes and margins to the palaeochannels. The Mount McRae Shale commonly occurs adjacent to the outcrops of the Brockman Iron Formation. Meta-dolerite sills and dolerite dykes are known to cut the Brockman Iron Formation within the regional Solomon Project area. Integral to the Brockman Iron Deposit are banded iron formations that form the source material for the BID and DID valley-fill successions.

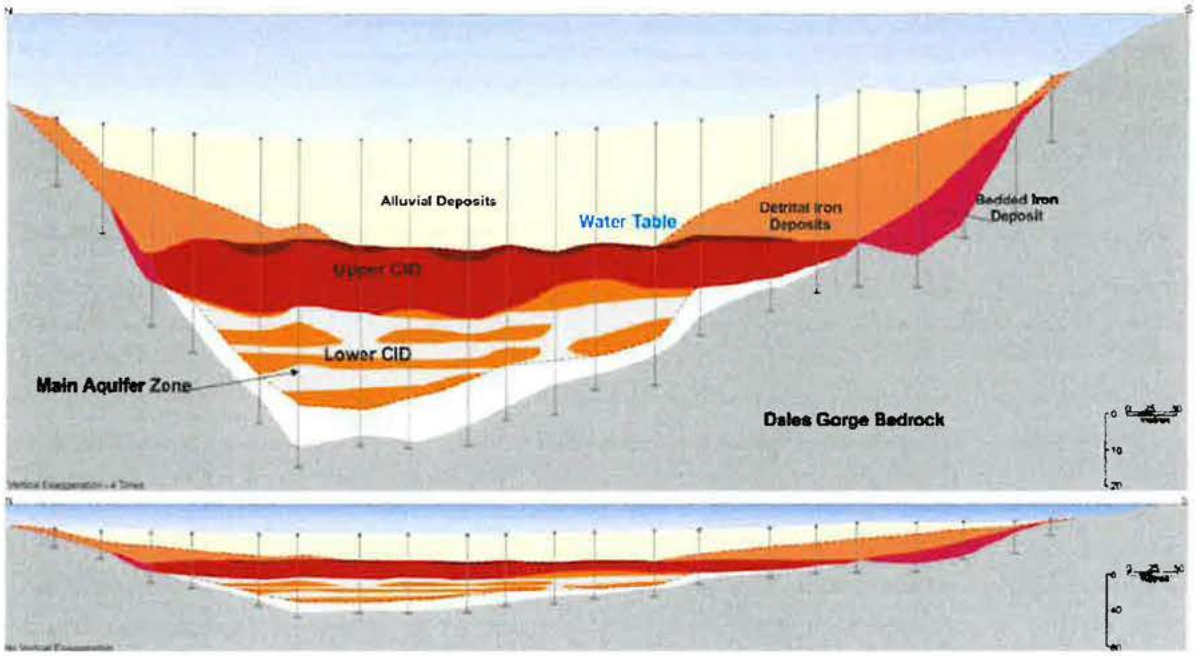


Figure 2: CID geology cross section

2.4 Hydrogeology of the Mining Area (Kings, Queens and Trinity)

As described by MWH (2010), the Solomon Project is situated on CID which occurs within palaeochannels incised into relatively flat lying Brockman Iron Formation. The primary aquifer in the Solomon area is interpreted to be associated with secondary porosity and transmissivity of the ochreous goethite Lower CID.

Groundwater in the Solomon mining area is also associated with:

I. Alluvium, colluvium, and detrital deposits including the BID and DID sequence within Tertiary palaeochannel sediments which overlie the CID. Commonly the BID and DID sediments occur above the water table.

II. Deposits of calcrete in historical and current water table settings within the Tertiary palaeochannel sediments. The occurrence, extent and thickness of calcrete deposits are widely variable.

III. Upper CID which overlies the Lower CID and is characterised by comparatively low transmissivity. There may be increased transmissivity and groundwater flow at the contact between the Upper and Lower CID.

The Lower CID is partially connected to the underlying, variably weathered and fractured bedrock unit. Operational dewatering to date has not demonstrated any notable groundwater contribution from bedrock units; however local structures may contribute to groundwater flow and connection in other areas throughout the palaeochannel (FMG, 2020).

3. ENVIRONMENTAL RECEPTORS, RISKS AND EXISTING MANAGEMENT

The two main surface water drainage systems in the Solomon mining area (Kangeenarina and Weelumurra creeks) feature permanent, semi-permanent, and/or transient groundwater or surface water supported pools. The shallow water table at these drainage systems and associated pools may also support phreatophytic (groundwater dependent) vegetation (URS, 2012). Locations of these receptors are show in Plate 4. There is a risk that dewatering activities may reduce water availability to these locations, leading to a loss of permanent and semi-permanent pools, or a decline in vegetation health.

Further to the risks posed by dewatering to these receptors, additional environmental risk has been acknowledged associated with a lignitic body in the western part of the Queens deposit. Oxidation of this material may result in an unwanted water quality outcome for Weelumurra Creek and downstream thereof.

Ministerial Statement 1062 includes conditions associated with the management of these risks, including developing study plans and management plans. Some of these plans are "in force" already as part of existing operations, whilst others are being updated or submitted at the time of this assessment.

3.1 Pools (from FMG (2020))

The Department of Water (DoW; now the Department of Water and Environmental Regulation) completed a survey of Pilbara pools in 2012, as a part of the Pilbara Groundwater Allocation Plan. The classification of permanent/semi-permanent pools employed by DoW in this database is as follows:

- permanent: 100% of the years assessed
- semi-permanent: 60 – 99% of the years assessed
- intermittent: <60% of the years assessed (FMG, 2015c).

In recent years, as additional baseline surveys have been carried out and Fortescue's understanding of the pools has progressed, this classification has been further developed into a characterisation system, reported in the *Baseline Survey Technical Report* (FMG, 2020) . Key characteristics and hydrographs of each permanent, semi-permanent and intermittent pools are summarised Table 2 and have been used for the baseline assessments of Weelumurra and Kangeenarina Creek pools.

The baseline assessment indicates there has been an overall decline in the areal extent of pools between 2003 and 2019, although evidence from significant wet years suggests an up to 60% increase in area, is possible as a reversal of this trend. As regional groundwater levels have declined since 2014, in line with the current drying period (Section 2.1), what are now understood to be semi-permanent and intermittent pools have migrated further downstream, with permanent pools located solely within the groundwater discharge zones. Observations used in the original PER submission in 2014 would have reflected the outcome of 11 years of almost double the long term average annual rainfall, followed by a another 6 years of above average rainfall (Rainfall Period 1 and 2). Since 2014, there has been a gradual return to a cumulative rainfall deficit, with discharge exceeding recharge (Rainfall Period 3).

3.1.1 Kangeenarina Creek

The pools of Kangeenarina Creek are groundwater supported, with groundwater recharge occurring primarily via stream flow along the main channel/low terrace and where CID and basement outcrop (e.g. Trinity valley). Data indicates a 50 mm magnitude storm event is required to initiate surface water flow and direct recharge. Diffuse recharge to lower CID and basement units occurs via vertical drainage from temporary surface water pools and saturated alluvial detrital material.

Permanent groundwater fed pools are typically located in two parallel north to northeast trending creek channels within the groundwater discharge zone (Plate 4). The pools are not observed to be continuous in nature (i.e. occur in discrete scour locations in the creek channel).

Semi-permanent pools are located in a transitional throughflow zone that extends upstream. Following significant rainfall events and the noticeable wetting period from 1995 to 2014, groundwater levels were naturally elevated in this zone temporarily sustaining groundwater fed semi-permanent pools from 514 to 523 mAHD (e.g. CG04 and CG02). Overtime, these pools lost their connection with the water table as groundwater levels declined during the dry period, exacerbated by the onset of dewatering activity in Trinity.

Additional semi-permanent and intermittent pools occur in secondary flow channels along the low and high terrace geomorphic zones following significant rainfall and surface water flow events. These pools are present in wetter years and dry up as they lose their connection (semi-permanent) with the underlying water table. Intermittent pools are typically disconnected from the water table and may provide localised recharge to the alluvial detritals sequence for several months.

3.1.2 Weelumurra Creek

The pools of Weelumurra Creek are groundwater supported, with groundwater recharge occurring primarily via stream flow along the main channel, and groundwater throughflow from the Queens and Weelumurra palaeochannels and overlying alluvium.

Permanent groundwater pools occur only in the discharge zone (Plate 4), which is at the downstream extent of where pools have been observed. The pool locations are primarily within the main creek channel and may migrate as the creek morphology changes. The depths of the pools vary for the same reason, forming in scour points in the main channel.

Semi-permanent pools are typically located in the throughflow zone (Plate 4); upstream from the permanent pools, also within the main creek channel. These pools are recharged with surface water and supported by elevated groundwater levels following significant rainfall events (>50 mm). Over time (six to twelve months) these pools lose their connection with the water table as groundwater levels decline due to evapotranspiration and discharge downstream. Additional semi-permanent pools are located within the main groundwater discharge zone in secondary flow channels generally located at slightly higher elevations within the creek low terrace.

Intermittent pools occur in recharge zones further upstream (Plate 4) and in secondary flow channels along the low and high terrace geomorphic zones following significant rainfall and surface water flow events. These pools are present in wetter years and dry out as their connection with the underlying water table is lost. These include the pools in the area termed Weelumurra South, in which pools were observed only in a 2004 aerial photograph.

3.2 Groundwater Dependent Vegetation (from FMG (2020))

Baseline investigations to characterise and monitor keystone riparian species and overall community health were undertaken to define appropriate baseline riparian conditions and key parameters for future monitoring. Monitoring was aligned with Fortescue's *Vegetation Health Monitoring and Management Plan (100-PL-EN-1020).* Work was completed for riparian systems including those relevant to Weelumurra and Kangeenarina creek systems, shown in Plate 4.

Typically, the riparian vegetation in each creek system includes forest and woodland dominated by phreatophytic (groundwater dependent) Eucalyptus camaldulensis subsp. refulgens and Melaleuca argentea. Tree density, population structure, species composition and groundwater dependence vary in accordance with broad geomorphic units that are relatively consistent across all systems.

The vegetation at each of the riparian ecosystems uses a combination of water sources including:

- Vadose-zone water replenished by surface inputs (likely on an annual basis under long-term average conditions);

- Water released from specific yield as groundwater levels decline following a recharge event. Groundwater recharge typically occurs every second year or when a 50 mm or greater magnitude rainfall event occurs;

- Sustained capillary rise from the water table into the vadose zone, where it is accessed by plant roots (i.e. groundwater).

For reasons of energetic and ecologically efficiency, plants preferentially use shallow soil water when it is available. As vadose zone storage increases as depth to groundwater increases, the relative importance of groundwater diminishes with increasing depth to water table, up to approximately 10 – 12 m, whereafter it is deemed negligible. Unless the water table is very close to the surface and groundwater constitutes the primary plant water source, maintaining access to groundwater typically becomes most important during prolonged dry phases when the overlying vadose zone dries out.

An integrated ecohydrogeological model was developed to simulate past, present and potential future water regimes and assess the outcomes for groundwater dependent ecosystems. The results, summarised in Table 3, indicate again that current vegetation community composition reflects a period of above average water availability. Self-thinning is likely as the system adjusts to average rainfall conditions,

Table 2: Solomon Permanent, Semi-Permanent and Intermittent Pool Characteristics

Pool	Typical Groundwater Location	Geomorphic Location	Main Water Source	Groundwater Connection	Groundwater temperature	Creek Morphology	Years Assessed (DoW Classification)
Permanent	Discharge Zone	Main Channel(s)	Groundwater	Continuous	Subdued diurnal temperature, due to ingress of cooler groundwater	Stable lateral channels, potentially infilled during significant events	100%
Semi-Permanent	Throughflow Zone	Secondary channels/low Terrace Main Channel (Throughflow Zones)	Initially surface water. Groundwater sustained	Med-long term connection (4 to 12 months)	Initial subdued temperature range followed by strong diurnal range in line with changes in air temperature	Semi-stable channels, at times shaded with high suspended sediments and fines	60-99%
Intermittent	Largely Throughflow and Recharge Zones	Typically, within overflow channels on low and high terrace. But also, upstream main channels	Surface Water	Short Term (days to 3 months)	Strong diurnal temperature range in line with atmospheric air temperature	Varies – as above but also non-stable, transient and mobile creek beds	<60%

Table 3: Ecological Water Balance – Predicted and Observed Mature Tree SBA

Area	Mature Tree Sustainable SBA (under long term average rainfall)	Above average rainfall mature tree SBA (wet period)	Recent Measured Mature Tree SBA
Zalamea Creek	22 m^2/ha (Channel and Low Terrace)	23 m^2/ha	33 m^2/ha (due to creek supplementation and increased water availability. Not sustainable.
Kangeenarina Creek	22 m^2/ha (Channel and Low Terrace)	27 m^2/ha (channel)	Channel: 25-45 m^2/ha Low Terrace: 10-18 m^2/ha High Terrace: 8-12 m^2/ha High Spillway: 10-20 m^2/ha
Weelumurra Creek (main pools)	22 m^2/ha (Channel and Low Terrace) and 8 m^2/ha (High Terrace)	23 m^2/ha (channel) 9 m^2/ha (high channel)	Channel/Low Terrace: 25-30 m^2/ha High Terrace: 8-12 m^2/ha High Spillway: 8-12 m^2/ha
Weelumurra West	22 m^2/ha (Channel and Low Terrace) and 8 m^2/ha (High Terrace)	23 m^2/ha (channel) 9 m^2/ha (high channel)	Channel: 8-18 m^2/ha Low Terrace: 22-28 m^2/ha High Terrace: 7-13 m^2/ha
Hamersley Gorge	Not completed due to access constraints for field data collection		

3.3 Inland Water Quality (from FMG (2021))

The conditions of MS 1062 require further study and subsequent management of the potential risk to inland water quality related specifically to the Lignitic Body identified in the western extent of Queens (Plate 4).

A range of studies were outlined within the *Lignite Study Plan, SO-00000-PL-EN-0002* (FMG, 2020f) with findings and further analysis reported in the *Lignite Study Report, SO-00000-RP-EN-0013* (FMG, 2021). The *Lignite Management Plan* is yet to be submitted for approval, with submission planned for September 2021.

Risks to inland water quality relate to the potential for oxidation of the lignitic body owing to mining or dewatering activity. Oxidation may release potential contaminants including metals and metalloids and alter the groundwater pH. Fortescue will reduce the risk of oxidation by implementing a buffer for dewatering and mining, as well as planning contingency actions in the event oxidation does occur.

Beyond the lignitic body, no additional specific groundwater quality risks have been identified in hydrogeological assessments to date.

3.4 Existing Management of Impacts

Supplementation is undertaken at Solomon as a primary management measure to limit drawdown propagation towards the environmental receptors outlined in Section 3 in accordance with Ministerial Statement 1062. Approval to supplement is also governed under Part V of the *Environmental Protection Act 1986*. FMG holds licence L8464/2010/2, which includes a 'dewatering' prescribed premises category and contains details of point source emissions to groundwater and surface water for Kangeenarina and Weelumurra creeks.

Conditions 10-1(3), 10-1(5) and 13-1(1) of Ministerial Statement 1062 (Appendix 1) require the development of groundwater trigger levels to enable adaptive management of groundwater/pool levels at the Kangeenarina Creek and Weelumurra Creek pools. The trigger levels have been continually reviewed, as additional information on historical variations, hydrogeological behaviour and ecosystem dependency is established. The trigger levels that are currently assigned to bores relevant to the mining area are presented in Table 4.

Table 4: Kangeenarina (Rev 5) and Weelumurra* (Rev 2) groundwater triggers, thresholds and limit criteria. Rev 5 of the Weelumurra was submitted in July 2021, proposed values from this revision in grey italics

Bore ID	Tier 1 – Trigger (mAHD)	Tier 2 – Threshold (mAHD)	Tier 3 – Limit (mAHD)
KMB12S	510.0	509.5	509.0
Warp 16*	504.8 *(505.03)*	504.3 *(504.62)*	503.8 *(504.22)*
Weelumurra Well*	480.0 *(479.94)*	479.5 *(479.84)*	479.0 *(479.74)*

Tier 1 and 2 triggers are internal trigger levels and inform supplementation and abstraction management around pools to limit dewatering impacts. They do not constitute a Conditional Management Target and therefore do not require communication with the Environmental Protection Authority (EPA) under Condition 7-4 of Ministerial Statement 1062.

Tier 3 triggers are specified lower-bound limit criteria and may indicate that the management system is failing to meet its objective. Tier 3 triggers are considered a Conditional Management Target and breaching these limit criteria would require initiation of actions under Condition 7-4 of Ministerial Statement 1062, with associated communication to the Department of Water and Environmental Regulation (DWER).

Revision 9 of the Solomon Groundwater Operating Strategy (FMG, 2020d) includes additional management measures (Table 8 of the Strategy) to meet the stated objectives:

- Groundwater abstraction is compliant with conditions of licence
- Impacts from operations are within expected range
- Water Use Efficiency

With contingency actions including additional monitoring and reduction in abstraction if no specific contingency measures are relevant from any of receptor specific management plans

3.4.1.1 Kangeenarina Creek Supplementation/Infiltration

Monitoring, assessment of impacts and adaptive management of water levels at Kangeenarina Creek Pools is managed in accordance with the *Kangeenarina Pools Supplementation Plan, Rev 5* (FMG, 2020c).The Kangeenarina Creek Supplementation/Infiltration supply system comprises two different systems:

- Direct pool supplementation occurs via four spigots at various locations along Kangeenarina Creek. Currently only the northernmost spigot is operational. This system has a maximum capacity of approximately 70 L/s. Water for this system is sourced from the Kings and Trinity dewatering borefields.
- Buried supplementation occurs in two locations further north of the spigots adjacent to the Kings Ore Processing Facility (OPF). The first system, commissioned in June 2016, has operated at up to 120 L/s during peak periods of stress. A second system was commissioned further downstream in April 2020 and currently operates in preference to the original system, with flows of up to 40 L/s recorded to date. The original line is periodically used to ensure it remains operable.

A copy of the Kangeenarina Creek Supplementation plan is provided in Appendix 3.

3.4.1.2 Weelumurra Supplementation

The Weelumurra Supplementation System is used exclusively to manage the protection of phreatophytic vegetation and seasonal pools from dewatering activities at the Queens mining area upstream of Weelumurra Creek. Monitoring, assessment of impacts, and adaptive management of water levels at Weelumurra Pools is managed in accordance with the *Weelumurra Creek Supplementation Plan, Rev 2* (FMG, 2021, in prep).

Dewatering drawdown from mining is managed through supplementation, involving re-injection of groundwater (sourced from a water supply system in Queens) via a series of re-injection bores. During operation of the Weelumurra supplementation system, the alignment of the re-injection bores facilitates the mitigation of potential drawdown impacts along the western tenement boundary of the Solomon mine site from early dewatering at Queens.

To further mitigate impacts to Weelumurra Creek and reduce the recirculation of groundwater, FMG has commenced a project to construct the Queens Hydraulic Barrier Wall. The Barrier Wall is a grout barrier constructed across the Queens Valley over the entire thickness of the Solomon paleochannel. It will act to reduce permeability in the alluvium and CID, reducing the volumes of supplementation required on the downstream side of the wall, and the dewatering volumes required on the upstream side of the wall. Construction of the Barrier Wall is scheduled for completion in approximately 2023/2024.

A copy of Rev 2 of the Weelumurra Creek Supplementation Plan is provided in Appendix 4. An updated Plan (Rev 5) was submitted to DWER in July 2021.

4. LOCAL CONCEPTUAL HYDROGEOLOGICAL MODEL

The baseline conceptual hydrogeological model was first developed following initial field investigations (MWH, 2010) and formally updated in the *Life of Mine Hydrogeological Assessment* (FMG, 2015d). Model suitability and relevance is assessed in the Triennial Aquifer Review, with local adjustments to the model made on an ongoing basis. The most recent Triennial Aquifer Review (FMG, 2019b) concluded the model remains suitable to assess impacts from dewatering within the Mine Area (Section 7.1.2.3).

The below sections summarize the conceptual model as it is adopted in the current numerical model, and presented in the *Groundwater Modelling Assessment of the Solomon LoM R120ii* (FMG, 2015b), a copy of this report is available in Appendix 8.

4.1.1 Hydrostratigraphy

Groundwater in the Solomon mining area is associated with three major aquifer units. In descending stratigraphic order these units are:

- Alluvial, colluvial and detrital deposits within the palaeochannels which overlie the CIDs. The alluvial deposits can also include calcrete and silcrete deposits at palaeo water tables.
- An Upper CID unit which generally has low permeability.
- An ochreous goethite rich Lower CID unit which generally has high permeability from secondary porosity and is considered to be the primary aquifer in the project area.
- Beneath the Lower CID, weathered bedrock at the base and walls of the palaeochannel valley may have limited groundwater storage and/or permeability. However, in some discrete areas, likely associated with structural influences, the bedrock may have elevated permeability. It is likely that the bedrock will be in direct hydraulic connection with the overlying channel.

The top three units are primary aquifers that are significant to Solomon mine water management. Since the weathered bedrock has low permeability, it is not likely to have significant effects on the palaeochannel aquifer system. Any local contribution is likely to be associated with connection to the overlying Lower CID; therefore bedrock contribution has been considered with the Lower CID. This approach has been successful through existing dewatering and model reviews in Kings and Trinity to date.

The base of the conceptual model is comprised of bedrock, with relatively low hydraulic parameters.

Based on drilling data, it is believed that the Alluvial and Upper CID unit have relatively homogeneous hydraulic properties, but the Lower CID may have a large spatial variability in permeability due to the heterogeneity of secondary permeability.

The vertical distributions of these units are well defined by drilling bore logs within the resource area of the Solomon Project area, but are unknown within branches of CID outside of the resource area and to the West of the project area along the CID palaeochannel associated with

Weelumurra Creek. In the model construction, it was assumed that the hydrostratigraphy in areas without drilling data would extend horizontally from the nearest available data points.

4.1.2 Aquifer Parameters

Based on aquifer test results and literature reported values of similar hydrogeological layers, the likely ranges of aquifer hydraulic parameters are presented in Table 5. These hydraulic parameter ranges have been used in the numerical model for this assessment; the ranges have remained largely unchanged since the 2015 *Life of Mine Hydrogeological Assessment* (FMG, 2015d), however the zoning and distributions of parameters have been adjusted during ongoing calibration of the model.

Table 5: Range of hydraulic parameters for the Solomon Mine Area Model

Unit	Hydraulic conductivity (K) [m/day]	Specific yield (Sy) [-]	Specific storage (Ss) [1/m]
Alluvial	2–350	0.05–0.25	$10^{-4} - 10^{-5}$
Upper CID	1–50	0.05–0.25	$10^{-4} - 10^{-5}$
Lower CID	5–600	0.05–0.25	$10^{-4} - 10^{-5}$
Bedrock	0.1–0.001	-	$10^{-4} - 10^{-5}$

4.1.3 Groundwater Flow and Levels

Baseline groundwater elevation contours across the Solomon mining area are presented in Plate 5. These contours incorporate data captured by (MWH, 2010) throughout the majority of the mining area, supplemented by data from (URS, 2011) for the reaches of Kangeenarina Creek.

Plate 5 shows groundwater elevations range from 580 m AHD in the southern (upstream) reaches of Kangeenarina Creek to 510 m AHD in both the northern portion of Kangeenarina Creek (where discharge to the surface pools occurs) and the western outlet to Weelumurra Creek. Groundwater flow in the superficial aquifer is sympathetic with topography, with flows running from ridge crests to valley floors. The hydraulic gradient decreases towards the north and the Kangeenarina Creek pools, indicating relatively higher transmissivity of the aquifer system towards the north. The hydraulic gradient shown in Plate 5 indicates that groundwater discharges from the Kings and Queens groundwater system at three locations, coincident with 'pools' in present-day surface water drainages. A groundwater divide in Trinity results in groundwater flow both west through Queens, discharging into Weelumurra Creek, and northeast through Trinity, following the Kangeenarina Creek outlet and supports the

Kangeenarina Creek Pools. Groundwater monitoring data indicate that these groundwater divides are dynamic, in that they respond significantly to the amount of recharge and abstraction occurring.

Vertical flow dynamics are minor. Data from (URS, 2011) indicate that groundwater levels are similar in all aquifers, with slight downward heads generally evident from the alluvial to upper and lower CID aquifers. Head differences are generally within 0.1 m. During operation, observed head differences are exacerbated by dewatering at Trinity and supplementation at Kangeenarina Creek, with greater drawdown rates observed in the CID aquifer than the Alluvial aquifer close to active dewatering, with the head differences lessening toward areas of active supplementation.

4.1.4 Recharge and Evapotranspiration

As discussed in MWH's report (MWH, 2010), the Solomon aquifer system is recharged through direct rainfall infiltration or intercepted surface runoff over areas where the alluvial or CID layer is exposed to the surface. Recharge to the alluvial aquifer also occurs from localised infiltration from the creeks and their tributaries during infrequent flow events.

Rainfall data from the Wittenoom BOM site have been used to calculate the historical recharge sequence for the model as they are the most complete rainfall records. The largest rainfall events recorded during the groundwater monitoring period 2008-2010 were in January and February of 2009 when 162 mm and 171 mm were recorded at Wittenoom, respectively. However, there was no apparent groundwater recharge response from these events observed in the groundwater monitoring bores. A review of baseline data by FMG (2020) indicates that events of over 50 mm in magnitude (i.e. intense storms) are required to initiate both surface water flow and direct recharge, particularly through drainage systems. However, groundwater recharge may change depending on the antecedent soil moisture conditions and after transformations of the land surface. For simplicity, we assume that the recharge coefficient (the ratio of recharge rate to rainfall rate) is a constant over the whole aquifer system.

In the Pilbara region the recharge coefficient is likely in the range of 2-10% of rainfall. The potential average regional evaporation rate is about 3 m/year.

Additional recharge is also evident in monitoring data through seepage from the Solomon Tailings Storage Facility (TSF). Calibration of the model to this data indicates approximately 60 L/s can be considered to report back to the CID from the TSF.

4.1.5 Groundwater Discharge

The groundwater system is driven by large infrequent recharge events associated with tropical thunderstorms and cyclones and as such the system does not reach a steady state. The area has experienced higher than average rainfall over Rainfall Period 1 and 2 (Section 2.1), resulting in elevated groundwater levels around the time abstraction commenced at Solomon. Regional groundwater levels, not impacted by abstraction, show a steady decline over the Rainfall Period 3, amounting to 3 – 4m since records commenced (FMG, 2020). Fortescue's abstraction drawdown in the Mining Area is overprinted on this decline.

The contours of the groundwater levels indicate three groundwater discharge zones from the Solomon palaeochannel system:

- Weelumurra Creek (Evapotranspiration and discharge to pools)
- Kangeenarina Creek (Evapotranspiration and discharge to pools)
- Zalamea Creek (Evapotranspiration)

4.1.6 Water Balance

The current water balance for the CID aquifer in the mining area has been developed as an output from the steady-state calibration of the 2015 LOM R120ii (FMG, 2015b) update of the numerical model and is presented in Table 6. The corresponding boundary conditions presented in this table are outlined in Plate 6.

Table 6: Mine area water balance (from steady-state calibration)

	Component	Long-term average flow rate (GL/yr)	Proportion of rainfall over the relevant catchment (%)
Inflow	**Recharge**	3.71	N/A
	Inflow at External BC 1	0.70	0.11
	Inflow at External BC 2	0.52	8.42
	Inflow at External BC 4	0.46	0.91
	Inflow at External BC 7	0.30	2.60
	Subtotal	**5.69**	N/A
Outflow	**Throughflow at External BC 3**	0.70	N/A
	Throughflow at External BC 5	0.04	N/A
	Throughflow at External BC 6	0.05	N/A
	EVT (Weelumurra)	2.42	N/A
	EVT (Zalamea)	0.28	N/A
	EVT(Kangeenarina)	1.58	N/A
	EVT (Kings/Queens/Trinity)	0.64	N/A
	Subtotal	**5.71**	N/A

The estimated pre-mining groundwater storage for the LOM R120ii assessment is about 71.5 GL (FMG, 2015b).

5. PREVIOUS INVESTIGATIONS

Several initial site investigations were conducted at the Solomon site to define baseline hydrogeological conditions, most notably by Golder (Golder, 2008) and MWH (2010). A preliminary numerical hydrogeological model of the project area was prepared by NTEC (2010) . Further studies were undertaken at Kangeenarina Creek (URS, 2012), while a site-wide dewatering assessment was completed by Golder (2012). These studies were consolidated into the *Solomon Life of Mine Hydrogeological Assessment* (FMG, 2015d).

Additional studies have since been carried out to address conditions of MS 1062; the most notable of which are the *Baseline Survey Technical Report* (FMG, 2020) and *Lignite Study Report* (FMG, 2021).

The following sections provide a brief summary of these investigations.

5.1.1 Solomon and Investigator Project Tenements: Factual Report – Field Programme

A drilling and bore installation programme was undertaken within the Queens, Trinity and Kings mining areas. The programme was terminated prematurely due to the impending economic downturn at the end of 2008.

Lithology, groundwater levels (GWLs) and airlift yields were obtained during the programme.

Full details of this programme are contained in *Solomon and Investigator Project Tenements: Factual Report – Field Programme* (Golder, 2008).

5.1.2 Hydrogeological Assessment of the Solomon Project

A detailed hydrogeological investigation was undertaken between May and November 2010, predominantly covering the Kings, Trinity and Queens areas. The investigation included a detailed drilling and testing programme.

The site programme primarily targeted the CID aquifer in the Solomon mining area and was used to determine a conceptual hydrogeological model of the Solomon mining area.

Full details and findings of the study are contained in *Final Report – Hydrogeological Assessment of the Solomon Project* (MWH, 2010).

5.1.3 Solomon Project Groundwater Modelling

NTEC (2010) produced a preliminary groundwater flow model of the Solomon mining area based on the conceptual model and hydrostratigraphy developed by MWH (2010).The model was produced to enable preliminary assessments of mine water, and to undertake future mining scenarios.

The base of the model was assumed to be impermeable bedrock. Three model layers were constructed, representing the Alluvials, Upper CID and the Lower CID units. The weathered bedrock was not included as a model layer as it was assumed to be an impermeable base. Furthermore, the pool systems of Kangeenarina Creek were not captured within the model layers.

Full details and findings of the study are captured in *Solomon Project Groundwater Modelling* (NTEC, 2010).

NTEC updated the model in 2012 (NTEC, 2012) to incorporate the Trinity Valley catchment into the active model domain and provide revised dewatering volumes.

Predicted dewatering rates, with the inclusion of the Trinity Valley catchment, ranged from 2.3 to 17.6 GL/yr, but were generally less than 10 GL/yr (average of 6.4 GL/yr).

5.1.4 H3 Hydrogeological Assessment Report – FMG Solomon Dewatering 2012

Golder (2012) prepared an H3 hydrogeological assessment for the Solomon Project, which supported FMG's application to the DoW for a 5C licence to take water for mine pit dewatering and proposed aquifer re-injection at Solomon. The assessment included a site programme of drilling, bore construction and aquifer testing, from which the results were used to update the conceptual and numerical hydrogeological model prepared by NTEC (2010) and provide updated predictive assessments of dewatering requirements and groundwater drawdown impacts. The updated model incorporated an updated mining plan with a 21-year mining life, plus changes to the model configuration.

It should be noted the model did not include the Trinity Valley extension incorporated by NTEC (2012), instead representing this area as bedrock. Hence the model did not capture the additional flows from this catchment.

5.1.5 Solomon Life of Mine Hydrogeological Assessment 2015

The 2012 H3 hydrogeological assessment was updated in 2015 to support the Solomon Part IV referral, which in turn was submitted to expand the existing Solomon mine by up to 11,715 hectares, with some additional expansion of areas and borefields outside the mine area (rail, Southern Fortescue and Lower Fortescue). The assessment consisted of numerical model updates to assess impacts, management strategies and predicted water balances of the expansion. The assessment projected the total average water usage for mine dewatering at 6.1 GL/yr, with a maximum projection of 16.2 GL/yr.

This current H3 hydrogeological assessment represents an update to the Solomon mining area component of the *2015 Solomon Life of Mine Hydrogeological Assessment*.

5.1.6 Baseline Survey Technical Report

The *Baseline Survey Technical Report* was prepared to support the completion of the *Baseline Survey Report (in prep)* and inform development or revision of Fortescue's management of environmental receptors. Table 7 below outlines studies completed following the 2015

Assessment, that have been incorporated into an updated baseline understanding of the main receptors around the broader Solomon Project, including those identified in Section 3

Table 7: Recent Baseline Survey Plan Studies and Surveys (from FMG (2020))

Flora, Vegetation & Geomorphology Studies/Surveys	Hydrological Studies/Surveys
• AQ2 Pty Ltd, Apr 2019. Solomon Ecohydrology. • AQ2 Pty Ltd, Feb 2020. Solomon Ecohydrology Stage 2 Overview Assessment of Analogue Sites. Version B Final. • Ecoscape Pty Ltd, Mar 2020. Solomon Groundwater and Surface Water Dependent Vegetation and Permanent Pools: Baseline Monitoring. Document SO-RP-EN-0144. Draft Rev0 • Equinox Environmental, Apr 2019. Weelumurra South Riparian Vegetation Assessment. • Geowater Consulting, Dec 2019. Lower Fortescue Conceptual Hydrogeology Model Review. • Hydrobiology, Apr 2020. Baseline Geomorphology Assessment – FMG Sheila Valley and Raven, April 2020. Document B19096. V1-1 Draft • Tetra Tech Proteus, May 2016. Solomon Project Pit Backfill Evaluation	• Advisian, Oct 2017. Hamersley Gorge Hydrochemical Study: Field Investigation Memo. Document 201012-00632. • Advisian, Jan 2018. Hamersley Gorge Hydrochemical Investigation. Document 201012-00632-0001. • AQ2 Pty Ltd, Oct 2019. Hydrogeological Conceptualisation – Weelumurra Creek Groundwater System. • AQ2 Pty Ltd, Oct 2019. Solomon Ecohydrology: Kangeenarina Creek Supplementation Options. Rev A • Fortescue, Feb 2019, Weelumurra Creek Supplementation Plan, (SO-PL-EN-0023: Rev 2). • Fortescue, May 2019. Weelumurra Pool Monitoring – March 2019. • Fortescue, Feb 2020, Kangeenarina Pools Supplementation Plan, (SO-00000-PL-EN-0003: Rev 5). • Fortescue, May 2020. Non-invasive monitoring of Hamersley Gorge Memo

5.1.7 Lignite Study Report

The *Lignite Study Report* summarised the findings of studies and assessments undertaken to support the development of the *Lignite Management Plan (in prep)*, as guided by the *Lignite Study Plan* and *Hydraulic Barrier Study Plan*. Whilst the report itself is a standalone study, Table 8 outlines additional reports that have been considered and incorporated into the work.

Table 8: Studies Relevant to the Lignite Study Report and Surveys (from FMG (2020))

Lignite Study Plan Studies	Hydraulic Barrier Study Plan Studies
• FMG (2019) Lignite Background Studies Report – Phase I	• Golder. (2019). *Interpretive Report: Queens Grout Trial, FMG Solomon.* Perth: Golder Associates Pty Ltd. • Golder. (2019). *Solomon Queens Lignite Assessment Technical Memorandum.* Perth: Golder Associates. • Golder. (2021). *Lignite Study Phase 1 Report: Queens Hydraulic Barrier Wall Project.* Perth: Golder Associates Pty Ltd.

5.1.8 Kangeenarina Creek Supplementation Options and Optimisation 2020 and 2021

In 2020, AQ2 completed an assessment (*Kangeenarina Creek Supplementation Options*) of groundwater dependent vegetation around Kangeenarina Creek under historical conditions and the supplementation regime (AQ2, 2020). A follow-up of this assessment *Kangeenarina Creek Optimisation of Supplementation* was completed in 2021 (AQ2, 2021).

The main conclusions of these assessments that are relevant to management objectives are:

- The supplementation regime has resulted in an increase in pool water levels and reduced the seasonal range of water levels, particularly in the dry season. This may be leading to some alteration of the natural system (species ratios, density, and root depths) and may be at risk of increasing vegetation stress.
- An adjustment to the trigger level management system to focus more on surface water pools as opposed to groundwater, may be required to better optimise supplementation for vegetation health.
- An adjustment of management approach may result in a correction in vegetation density, particularly in individual trees where an ability to respond to natural fluctuation is now limited.

5.1.9 Operational Drilling, Monitoring, Trials, Test Pumping and Mine Plan Assessments

Fortescue continues to develop its dewatering borefield to meet the requirements of the Solomon mine plan. While formal bore completion reports are not completed, updated bore details are included in revisions to the Groundwater Operating Strategy and in every Annual Aquifer Review. These drilling programs include test pumping which usually constitutes a step rate test to determine well efficiency and guide pump design; constant rate tests are utilised in new dewatering areas to assist in model calibration.

Furthermore, mine plan assessments are completed every three months. Once again, no formal report is completed, but each assessment involves:

a. Incorporation of all monitoring (recharge, levels, abstraction and injection/supplementation) data since the previous assessment;

b. Recalibration of the model (adjustment to zonal parameters or inclusion of additional zones) against this recent data;

c. Incorporation of newly drilled bores and development of skin factors for use in the model; and

d. Execution of between 3 and 5 predictive scenarios in order to inform dewatering, abstraction and supplementation flow rates for the period of the plan.

Additionally, field trials and modelling assessments will be completed for internal planning purposes. An example of this includes a review of drawdown resulting from operation of the horizontal dewatering bore in Queens, and confirmation that the model could indeed simulate the resulting drawdown.

6. PRODUCTION AND MONITORING BORES

There are currently 79 production bores that form the Queens (14 bores) and Dewatering (65 bores) borefields within the CID aquifer in the Solomon mining area. A groundwater monitoring network is established in the mining area and is monitored in accordance with the *Groundwater Operating Strategy* Rev9 (FMG, 2020d). Dewatering borefield details are provided in Appendix 6 and locations are presented in Plate 7. Monitoring bore details including the screened aquifer are provided in appendix 7 and locations (referencing monitoring compliance driver) are presented in Plates 8a to 8j.

7. AQUIFER IMPACT ASSESSMENT

Since 2015 there have been three annual aquifer reviews and two triennial aquifer reviews (2017 and 2019) that assessed the observed impacts against what was predicted in the 2015 H3 hydrogeological assessment. The below sections summarise the findings from these aquifer reviews.

7.1.1 Current and Historical Groundwater Abstraction Volumes

Groundwater abstraction from the Solomon mining area commenced in 2007, with water taken for exploration purposes in the Trinity area. Abstraction increased in May 2010 when exploration moved into Kings, and then again in late 2011 when abstraction for construction purposes commenced. In June 2013, abstraction commenced from Queens for injection into the Kangeenarina Creek pools system, while dewatering commenced in Kings and abstraction commenced from the Southern Fortescue Borefield in late 2013/early 2014. Dewatering abstraction in advance of mining has been ramping up in the Queens mining area since 2019.

Table 9 provides a breakdown of abstraction over the life of the Solomon Project for the mining areas (i.e. Kings, Queens and Trinity), while Figure 3 presents a summary of annual abstraction volumes over this period..

Table 9: Groundwater abstraction from the Solomon mining area 2007 to 2020

Year	Abstraction (kL)			
	Kings	Queens	Trinity	Total
2007-2008	0	0	38,804	**38,804**
2008-2009	0	0	16,686	**16,686**
2009-2010	16,715	0	28,989	**45,704**
2010-2011	65,453	0	21,733	**87,186**
2011-2012	1,068,439	0	287,891	**1,356,330**
2012-2013	1,772,477	62,209	437,082	**2,271,768**
2013-2014	3,593,485	809,944	501,867	**4,905,296**
2014-2015	5,059,983	738,529	2,808,556	**8,607,068**
2015-2016	5,748,244	0	6,525,447	**12,273,691**
2016-2017	6,959,669	38,476	4,981,726	**11,979,871**
Aug – Dec 2017*	2,439,973	121,017	447,845	**3,008,835**
2018	4,460,271	1,008,764	5,313,490	**10,782,525**
2019	4,153,777	2,406,700	4,982,940	**11,543,417**
2020	2,715,135	2,150,720	11,129,958	**15,995,813**
Total	***38,089,921***	***7,336,359***	***37,523,014***	***82,912,994***
% of Total	***46%***	***9%***	***45%***	***100%***

* Change in reporting period to Calendar year

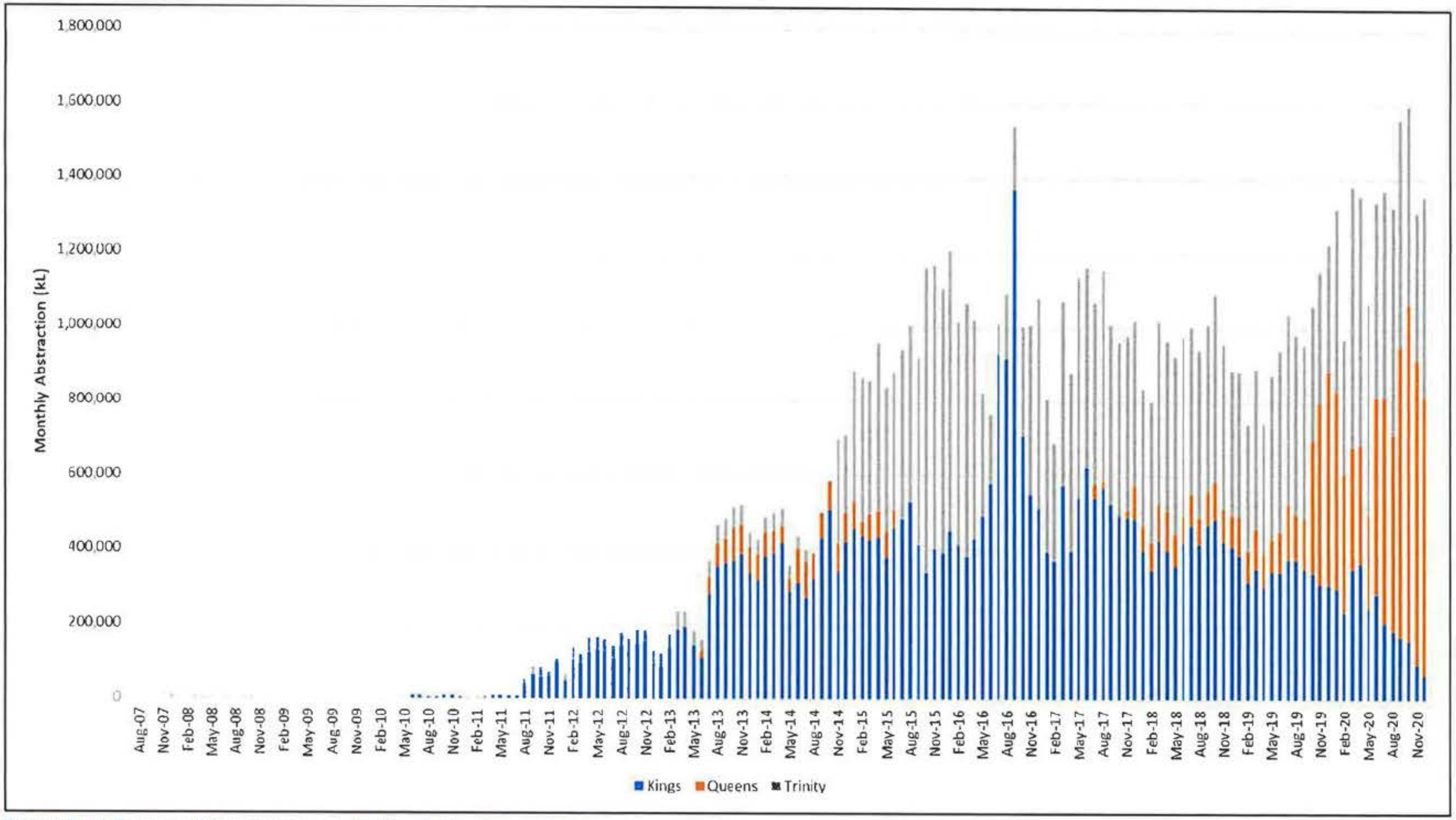


Figure 3: Solomon mining area groundwater abstraction volumes

Abstraction volumes from the mining area increased significantly in 2014. Abstraction in the 2020 water year has increased up to 15,995,813 kL. As shown in Figure 3, the bulk of the increase was derived from dewatering of Kings and Trinity for progression of mining in 2014 and Queens in 2019 as Kings abstraction progressively reduced.

Of the total abstraction of 15,995,813 kL during the 2020 water year, 2,150,720 kL was sourced from the borefield in Queens. Direct supplementation to the pools at Kangeenarina Creek, commenced in May 2014. In 2020, approximately 1,814,605 kL was supplemented, but annual volumes have ranged between 840,000 kL and 3,043,000 kL depending on operational and environmental requirements. Supplementation to Weelumurra Creek via injection commenced in 2019. In 2020, approximately 664,013 kL was supplemented into this system.

7.1.2 Assessment of Impacts to date

Monitoring has been ongoing at Solomon in accordance with operating strategy conditions and to meet the defined management objectives. This section synthesises the most recent analysis of the monitoring data from the 2019 Triennial (FMG, 2019b) and the 2020 Annual (FMG, 2020e) Aquifer Reviews. Analysis was conducted with regard to:

- The effect of activities on the management objectives
- Aquifer capacity to sustain ongoing dewatering and/or supply activities
- Significant changes to the aquifer system highlighted by monitoring results.

Vegetation monitoring was conducted as part of separate operational approval requirements at the Kangeenarina Creek, Zalamea Gorge, Weelumurra Creek and Hamersley Gorge in late November 2020 (FMG, Ecoscape, 2020b).

7.1.2.1 Impact on Management Objectives

Kangeenarina Creek

Monitoring of water levels at bore KMB12S and pool levels at CG05 indicate that water levels in the upstream reaches of Kangeenarina Creek have been successfully maintained by the Kangeenarina supplementation scheme. While Tier 1 trigger level breaches have been observed, these were short lived and successfully managed by increased supplementation. An extensive period of below average rainfall and the resulting absence of streamflow is a major contributing factor to declining water levels.

Vegetation monitoring indicated that 'there were no results indicating that the riparian vegetation of Kangeenarina Creek monitoring sites had been adversely impacted in 2020' (FMG, Ecoscape, 2020b).

Based on the management objectives outlined in the *Kangeenarina Creek Supplementation Plan* (FMG, 2020c) (Appendix 3), all objectives have been met to date. However, Fortescue is now intends to optimise supplementation such that the robustness of the downstream vegetation communities can be maintained. A revision to the *Kangeenarina Creek Supplementation Plan* is required in order to address the findings of AQ2 (2021), as outlined in Section 5.1.8.

Weelumurra Creek

From the historical monitoring of Warp 16, groundwater levels have reduced by 1.5–2 m between 2009 and 2017 (Figure 4). Abstraction at Queens was minimal during this time, and the reduction continued when there was no abstraction at Queens in 2016 and 2017. As outlined in FMG (2020) it is likely that the reduction is largely a reflection of naturally declining water levels associated with Rainfall Period 3 (Section 2.1), overprinted by the impacts of water supply abstraction in Queens.

Groundwater levels between the Queens abstraction borefield and Weelumurra Creek (as observed at Warp 16) have since been successfully managed by supplementation via injection at the Weelumurra injection borefield. While some short-lived Tier 1 trigger levels have been observed during nearby test pumping, these were managed successfully by increasing injection volumes. Owing to the low volumes of water injected compared to the system capacity, there is a strong indication FMG will be able to continue to meet the management objective of the *Weelumurra Creek Supplementation Plan* (Appendix 4). The apparent trigger level breaches in Figure 4 are associated with either use of Warp 16 by RTIO (during which time the trigger level does not apply), or the result of injection trials undertaken to further understanding of the groundwater response to injection rates.

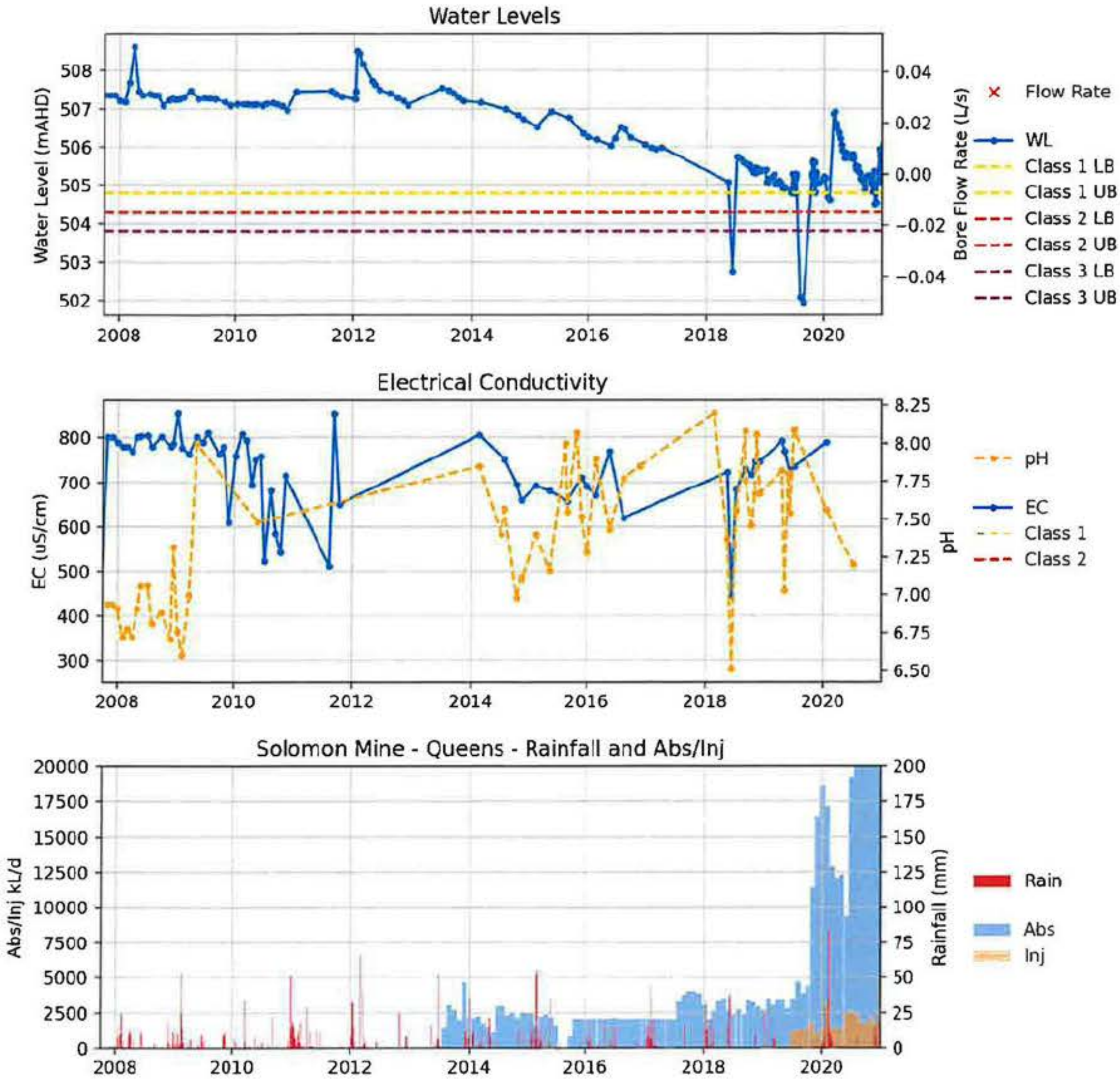


Figure 4: Warp 16 hydrograph

7.1.2.2 Aquifer Capacity for Ongoing Abstraction

The Kings and Trinity areas have historically seen drawdowns as high as 35 m from pre-mining water levels as mining progressed. However, as mining to base of pit is gradually achieved through these areas, and backfill commences, abstraction volumes have been able to reduce. As a result there has been either minimal recent additional groundwater drawdown or even recovery (up to 10 m through areas in Kings). Additionally, higher than average rainfall in 2020 contributed to recovering water levels through recharge, and required increased abstraction Trinity to maintain groundwater levels.

There has also been recovery of water levels in Castle Valley between the Trinity mining area and Castle Camp, associated with the Castle Valley infiltration. As such, it is considered that the Castle Valley infiltration scheme is preserving some of the groundwater resources that are a surplus of dewatering activities.

Drawdown of up to 14 m has been observed within the Queens area in 2020, with an increase in abstraction. These reductions in aquifer levels are a direct outcome, and the objective, of dewatering abstraction in advance of mining in this area.

7.1.2.3 Comparison of Monitoring Data with Modelled Predictions

To assess if there are any unexpected impacts to the groundwater system and aquifer capacity, observed drawdowns within the mine region are compared against drawdowns simulated by the Solomon groundwater model used to assess impacts of mining for the 2015 Public Environmental Review submission (*Public Environmental Review – Solomon Iron Ore Project Sustaining Production 2015)*.

Drawdown for the CID aquifer was simulated by a numerical model between late 2015 and 2020 and contours are provided in Plate 9. Actual drawdown contours from observed data between December 2015 and December 2019 are presented in Plate 10. From a comparison of the modelled drawdowns and actual drawdowns within the CID aquifer the following points are made:

- Drawdown within the Trinity mining area is similar to modelled predictions, with some variations, such as less drawdown in the west and a larger gradient in the east, mostly due to changes in mine plan.
- Drawdowns within the Kings mining area are similar to those modelled. However, there is greater observed drawdown at the southeast of the Kings mining area due to changes in the mine plan accelerating mining and abstraction to the east earlier than used in the model.
- The extent of observed drawdown from Kings towards the Zalamea pools is greater than modelled; observed drawdown is 10 m drawdown at SMB1055 and 4.2 m at SMB1052 as opposed to the model which did not predict drawdown to extend to SMB1055. These differences are the result of the above-mentioned changes in mine plan, abstraction from KIP081 (not modelled), and cessation of supplementation at Zalamea in January 2019 after the removal of the licence condition. Reduced rainfall in 2018 and 2019 may also have made a small contribution to the difference between the modelled and observed drawdowns.
- Drawdowns within the Queens mining area are greater than the model predicted. This is largely due to changes in the mine plan from that used in the numerical model, resulting in greater abstraction earlier than scheduled.
- Despite differences in drawdowns at Queens, and to a lesser degree, Trinity, the drawdowns, or lack thereof, at the Kangeenarina and Weelumurra creeks are similar or

less than those predicted in the model. This is largely due to the adaptively managed supplementation systems in these areas.

- Supplementation at Kangeenarina has been significantly more than the model originally predicted, averaging 83 L/s as opposed to the 10 L/s predicted, suggesting a greater hydraulic conductivity in the area between Kangeenarina Creek and the abstraction borefields than was assumed by the model.

- Supplementation at Weelumurra has been implemented two years ahead of that scheduled in the model (2021) to counter earlier abstraction at Queens. Supplementation rates are currently half (14 L/s) of the 30 L/s that was modelled.

As differences between the numerical model predictions and observed water levels are largely due to changes to the mine plan and the dewatering/supplementation schedule, FMG does not consider that there have been any significant unexpected impacts to aquifer capacity and groundwater system. Furthermore, the dewatering model has been effective at simulating groundwater levels, and planning dewatering and supplementation requirements.

7.1.2.4 Water quality and hydrochemistry

From analysis of historical electrical conductivity (EC) readings and piper plots in the 2019 triennial aquifer review (FMG, 2019b) there has generally been no observed degradation in water quality. Some fluctuations in anion rations were observed in piper plots (Appendix 5); however, long-term trends were not evident. Similarly, EC readings fluctuated in monitored bores but increasing trends were rare.

7.1.2.5 Significant Changes to the Aquifer System

There have been no unexpected changes to the groundwater system indicated by the water level, field water quality and hydrochemical data, beyond those expected from the approved dewatering, injection/supplementation and abstraction activities as predicted by numerical model simulations.

8. UPDATED NUMERICAL MODEL AND GROUNDWATER IMPACT ASSESSMENT

As outlined in Section 5, a numerical model for the Solomon Project was initially developed in 2010 for a number of environmental impact assessments. FMG took ownership of the numerical model in 2012 and extended the domain for the 2015 Life of Mine (LoM) assessment. While the general structure (grid discretisation, layer elevations, and boundary conditions) have remained largely unchanged since the LoM assessment in 2015 (FMG, 2015d), the model parameters and conceptual model have undergone several phases of calibration based on an expanded understanding of the hydrogeology from a growing amount of drilling and testing data, and collection of ongoing operational data.

For the current assessment the numerical model was used to simulate multiple scenarios based on an updated mine plan to assess for groundwater demands, potential impacts to environmental receptors, and effectiveness of management strategies. The numerical model simulation output forms the basis of the groundwater impact assessment for the requested increase in groundwater abstraction licence.

The current model presents:

- A linear relationship to estimate the amount and distribution of recharge
- A gamma distribution model to simulate the temporal distribution of recharge to groundwater systems with relatively deep groundwater levels
- A steady-state calibration of the numerical model using average measured water table elevations to approximate the long-term average groundwater levels
- Transient flow calibration of the numerical model.

8.1 Groundwater Flow Model Details

MODFLOW-SURFACT version 3.0 was used as the numerical engine for the updated groundwater model, and Groundwater Vistas v6 as the model pre- and post-processing graphical user interface.

The model domain was selected to cover the mine resource areas and the hydrogeologically associated environmentally sensitive areas (including the pools) with sufficient offset to mitigate the effect of the uncertainties at the external boundaries. The extent of the model domain is 25 km × 12 km. The domain has been divided uniformly into 40 m × 40 m numerical cells.

The model includes four layers aligned with the conceptual hydrostratigraphy (as described in section 4) that represent:

- Alluvial deposits
- Upper CID
- Lower CID
- Weathered bedrock.

The model features numerous zones defined by various hydraulic properties, including hydraulic conductivity, storage, recharge and evapotranspiration. The use of multiple hydraulic property zones in the model, accommodates the potential need to fine-tune the modelled spatial variations in hydraulic properties to better fit observed groundwater levels. The determination of zone values stems from pumping test analyses, abstraction responses and known literature.

The long-term annual average of the distributed recharge over the entire model domain is about 3.0% of the long-term average of the annual rainfall at the Wittenoom station, which is near the lower end of the generally expected range of 2–10% in the Pilbara region. The evaporation extinction depth in the Weelumurra Creek is set at 5 m below ground level.

Constant head boundary conditions are applied to the inflow boundary segments. A constant head boundary is also applied to outflow at the northwest corner of the model domain. Fresh bedrock enveloping the palaeochannel hydrostratigraphy is set as a no-flow boundary. Groundwater discharge through pool settings are defined by drains, while fracture wells were set up in the model to simulate pit dewatering.

Comprehensive detail on the formulation of model construction, properties, initial zoning, calibration and water balance is provided in the FMG Report *Groundwater Flow Modelling Assessment of the Solomon LoM R120ii* (FMG, 2015b) (Appendix 8). The current zoning and assigned hydraulic conductivities that are derived from the most recent calibration and used in the numerical model assessments are represented in Figure 5 to Figure 7.

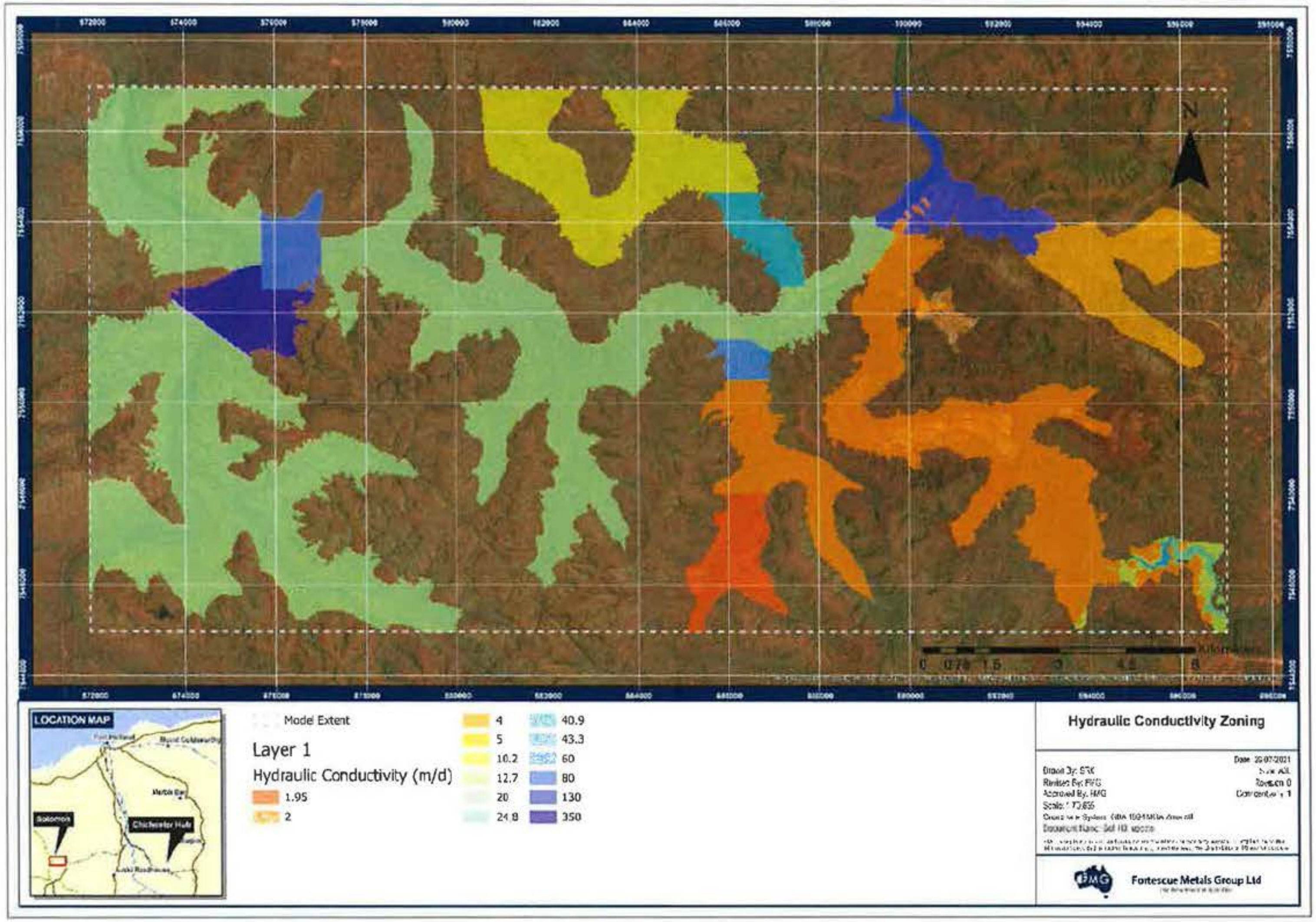


Figure 5: Alluvial (layer 1) hydraulic conductivities

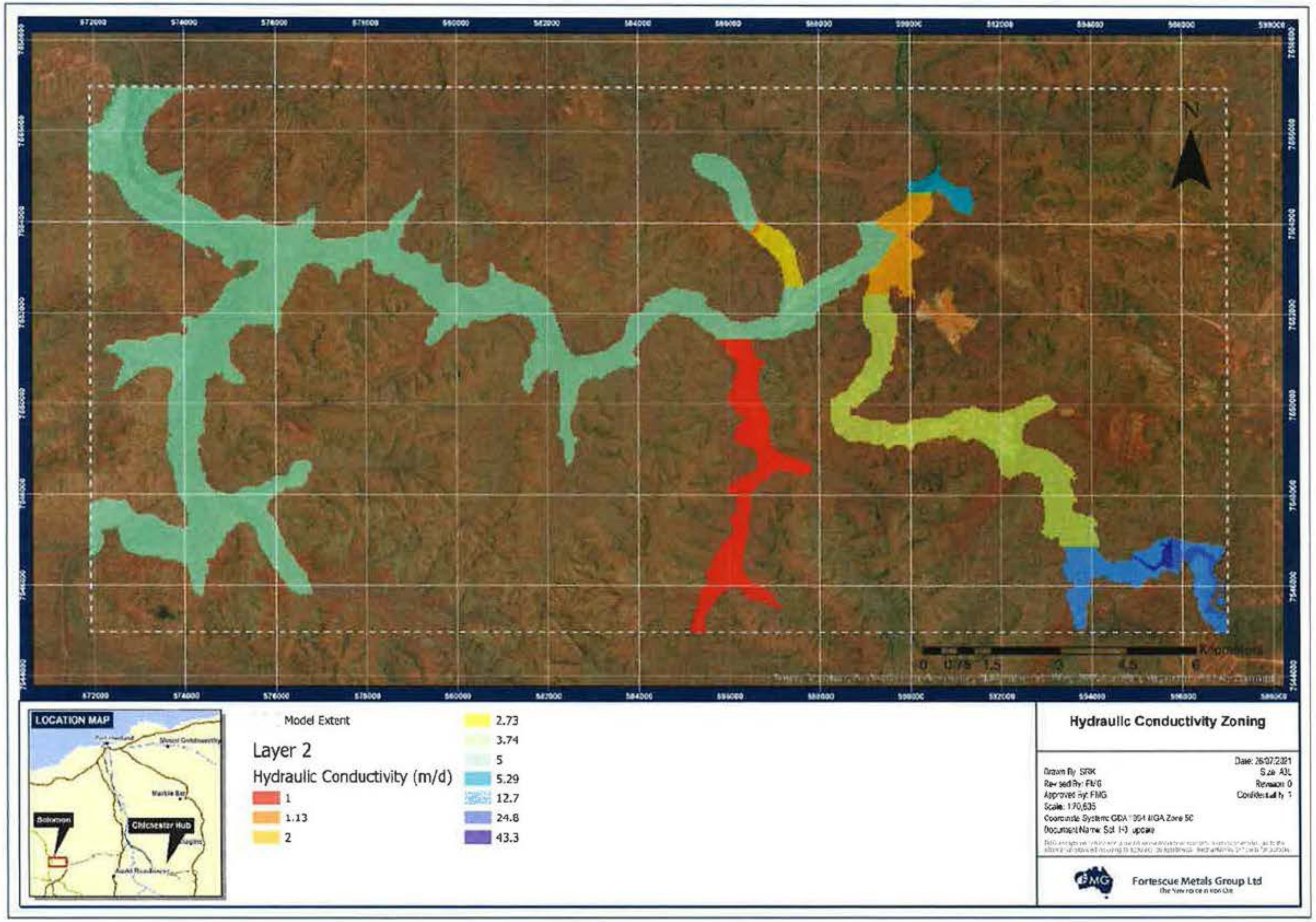


Figure 6: Upper CID (layer 2) hydraulic conductivities

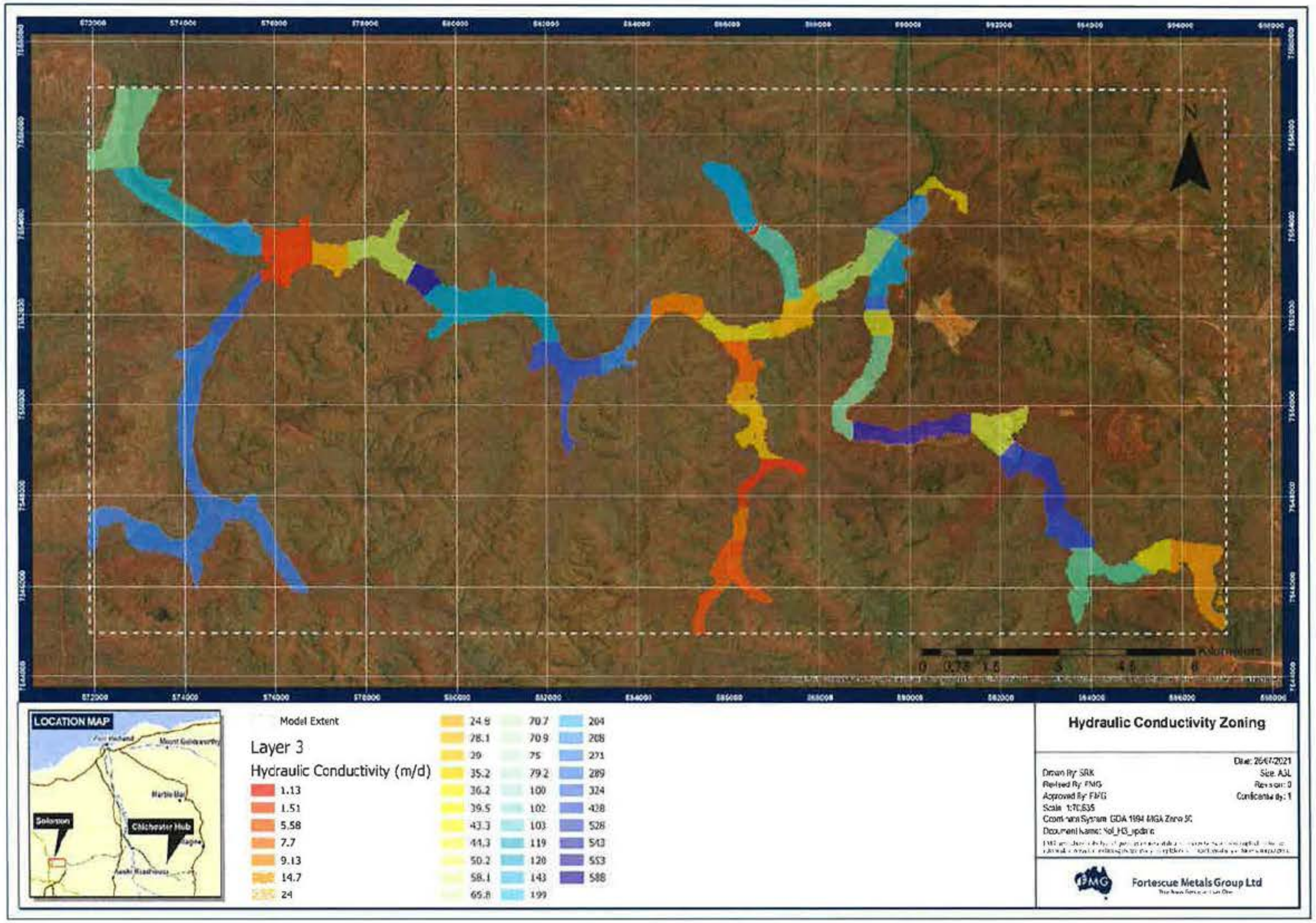


Figure 7: Lower CID (layer 3) hydraulic conductivities

8.2 Simulation Scenarios

To assess the dewatering requirements and efficacy of management strategies, five scenarios were simulated in the numerical model. The scenarios varied with the degree of management, and in the case of Scenario 5, the frequency of high rainfall events that was applied. However, simulation of pit dewatering requirements and some boundary conditions remained consistent throughout each scenario, and the common elements included:

- Mine progression, pit levels and the associated drain boundary condition – drain outflow rates (representing sumps) would vary between scenarios as a model output.
- Well target water levels to achieve mine progression – well flow rates would vary between scenarios as a model output.
- Boundary conditions at the edges of the model (as described in the model *Groundwater Flow Modelling Assessment of the Solomon LoM R120ii* (FMG, 2015b), Appendix 8, Plate 6.
- TSF infiltration and Castle infiltration modelled as a constant flux boundary condition.
- Supplementation at Kangeenarina Creek is simulated for all scenarios as a reflection of current operations.
- Recharge applied in the transient simulation was the same for Scenarios 2 to 4, recharge in Scenario 5 was adjusted to simulate wetter conditions (described further below). No large recharge events were applied for Scenario 1, while large rainfall/recharge events in 2022 and 2025 were applied for Scenarios 2 to 4 to simulate cyclone-controlled rainfall typical of the region.
- Hydraulic parameters remain constant for the model domain across all scenarios. The only exception is where time variant permeability is adopted to simulate the development of the hydraulic grout barrier along a discrete column of cells in the western part of Queens in Scenarios 2, 4, and 5.

The objective and model methodology of each scenario is described below and the simulated outcomes are discussed in Section 8.3.

8.2.1 Scenario 1 – No management

For this scenario the base model is run with abstraction and dewatering assigned to achieve the appropriate pit progression with no mitigation measures simulated for Weelumurra Creek and Kangeenarina Creek.

The purpose of this scenario is to provide a baseline against which to measure the effectiveness of management strategies at Weelumurra Creek and Kangeenarina Creek.

8.2.2 Scenario 2 – Grout barrier

The base model is run with a simulated grout barrier between the Queens mining area and Weelumurra injection borefield. The grout barrier is simulated numerically by reducing hydraulic conductivities within the Alluvial to 0.0009 m/d, and reducing the hydraulic conductivities of the Upper CID and Lower CID by a factor of 100 and 10 to 0.05 m/d and 0.056 m/d respectively. These values have been determined in consultation with the grouting consultant (Golder Associates) through both expert opinion and the results of an initial trial completed in the Queens area (Golder, 2019); however the final parameters will only be known upon completion of construction. The grout barrier is applied in the model at the estimated completion date of June 2023.

The purpose of this scenario is to assess the effectiveness of the barrier at reducing dewatering impacts on Weelumurra Creek without any supplementation.

8.2.3 Scenario 3 – Supplementation at Weelumurra injection borefield

The base model is run with supplementation set at the Weelumurra injection borefield by applying a well boundary condition at each injection site. The injection borefield is located upgradient of the Weelumurra Creek pools, a distance of 200 m from the western boundary of FMG's mining tenement M47/1410. The bores are screened through the upper and lower CID to allow maximum recharge to the main aquifers feeding the pools.

Injection rates are adjusted such that the drawdown does not extend past the injection borefield.

The purpose of this scenario is to simulate the required injection flow rates to prevent drawdown at the Weelumurra Creek pools and to test that an injection borefield alone will be effective at preventing drawdown within an acceptable injection rate per bore.

8.2.4 Scenario 4 – Supplementation and grout barrier at Weelumurra Creek

The base model is run with both the grout barrier from Scenario 2 and supplementation from Scenario 3.

The purpose of this scenario was to assess the combined effectiveness of the grout barrier and supplementation on management of water levels at Weelumurra Creek during dewatering at Queens, and the effect of the grout barrier on the required supplementation rates.

8.2.5 Scenario 5 – Supplementation, grout barrier and frequent large rainfall events

This scenario modifies Scenario 4 (grout barrier and supplementation) to include consecutive large rainfall events in 2024 and 2025 in addition to the large event in 2022 (as opposed to only large rainfall events in 2022 and 2024 in all other scenarios). As an analogous precedent, the large rainfall from Cyclone Heidi (January 2012) and Tropical Low Peta (January 2013) as recorded at Wittenoom were used for the 2024 and 2025 recharge events in the simulation.

All other variables were left the same as Scenario 4 as the objective was to demonstrate the increased abstraction volumes required to meet mine progression as a result of the increased rainfall.

8.3 Assessment of impacts

To assess the water level impacts of each scenario, the maximum drawdown from pre-mining conditions was calculated from the minimum water level simulated in the model at any given period; plots of maximum simulated drawdown are presented in Plates 12 to 16. The drawdown from pre-mining water level at the initial time step of the model is presented in Plate 11. It should be noted that a natural groundwater decline of between 2 – 4 m is already recorded regionally as discussed in Section 7.1.2 and reported in detail in FMG (2020). For the purpose of this assessment, a groundwater level decline of 2-3 m from steady state conditions is therefore considered to be the result of natural recession and not associated with dewatering impacts unless environmental management objectives (trigger levels) are breached.

8.3.1 Drawdown at Weelumurra Creek

The model scenarios indicate that supplementation at the injection borefield will adequately limit drawdown from dewatering reaching Weelumurra and should prevent any sustained breaches of Tier 1, 2, and 3 triggers at Warp 16, as represented by scenarios 3, 4, and 5 (Figure 10 to Figure 12) when compared to the base case without supplementation (Scenario 1 included on each graph). Scenario 5 shows that this should be valid even if large recharge events in consecutive years prompt dewatering volumes to exceed 25 GL/yr. Spatially, as represented by maximum drawdown contours (Plates 14 to 16), groundwater decline would be limited to no more than expected under natural decline at Warp 16 and Weelumurra Pools by virtue of injection borefield supplementation.

Conversely, Scenario 1 suggests that without mitigation measures, drawdown at Warp 16 would exceed 25 m. Scenario 2 shows that the grout barrier on its own would not be sufficient to prevent drawdown at Weelumurra Creek Pools both terms of impacts at Warp 16 (Figure 9) and extension of drawdown to pools as seen in the drawdown contours in Plates 12 and 13. The maximum drawdown contours show unmanaged drawdown would extend well into the Weelumurra Creek Pools and the grout barrier alone (no supplementation) would have little impact on the drawdown extent.

8.3.2 Drawdown at Kangeenarina Creek

The baseline scenario simulated unmitigated impacts of up to 14 m of drawdown at KMB12S from dewatering (shown by Scenario 1 in Figure 13) with over 10 m of drawdown extending more than 1 km past KMB12S as seen in Plate 12.

During all model scenarios with supplementation (scenarios 2 to 5), however, water levels at KMB12S were maintained above the Tier 3 trigger level. While simulated water levels decrease throughout the first half of simulation and drop below the Tier 1 internal trigger level when no large recharge events are applied, simulated water levels plateau above the Tier 2 trigger level from 2028 and fluctuate seasonally thereafter. Spatially, as can be seen in Plates 13 to 16, drawdown from dewatering activities is not simulated to extend past KMB12S in any scenario where supplementation is active.

An example of simulated drawdown is provided in Figure 13, this hydrograph represents scenario 5 with a comparison to scenario 1, however, for impacts at Kangeenarina all scenario (other than Scenario 1 - baseline) outputs are almost identical, with only minor variations in water levels, and consequently increased abstraction from Trinity, immediately following large rainfall events.

8.3.3 Effectiveness of Grout barrier

The effectiveness of the grout barrier was tested in the model by itself (Scenario 2) and in combination with supplementation (scenarios 4 and 5), assuming the target permeability reduction is achieved.

Outputs from Scenario 2 indicate that the grout barrier alone would have a marginal effect on water levels away from the Queens mining area and will not be sufficient in preventing drawdown from reaching unacceptable levels at Weelumurra Pools, as represented by water levels in Warp 16 (Figure 9). When combined with supplementation (Scenario 4, Figure 11) impacts on water levels at Warp 16 are only slightly less (0.25 m at end of simulation) than with supplementation alone (Figure 10), and within baseline levels.

While the grout barrier does not improve management outcomes explicitly, when combined with supplementation (supplementation alone is sufficient for managing water levels at Weelumurra Creek) the grout barrier is simulated to reduce the recirculation and thus, the required total abstraction volumes required, evident when Scenario 3 and Scenario 4 are compared (Table 10 and Figure 8). While there is uncertainty in the final barrier parameters, the target of reduced recirculation is itself a notable outcome, with lower supplementation rates reducing operational and environmental risk.

8.3.4 Dewatering and Supplementation volumes

Abstraction and supplementation volumes varied considerably between the modelled scenarios. Figure 8 shows dewatering requirements are highest in 2022 and 2025 in all scenarios, coincident with the applied recharge. Abstraction volumes decrease gradually following the peak in 2025, as the aquifer is dewatered, and no large recharge events are applied Table 10.

The base case (Scenario 1), with no large-scale rainfall events or recirculation from supplementation, would require the lowest dewatering volumes, with peaks of 19.9 GL/yr in 2022 and 18 GL/yr in 2025. A grout barrier (Scenario 2) has no appreciable benefits in terms of dewatering volumes when supplementation is not active and any reduction in flows are overprinted by large recharge applied in 2025, with only a slight (~0.15 GL/yr) reduction from base case volumes later in the simulation period starting in 2029. Dewatering volumes for Scenario 2 would peak at 23.5 GL/yr. Dewatering impacts are not adequately managed in either scenario and would result in unacceptable drawdown at Weelumurra Pools (as indicated by Warp 16 simulated levels).

Where dewatering impacts are managed with supplementation, barring any large-scale consecutive rainfall events, dewatering flows are anticipated to peak in 2025 between 23.8 GL/yr with a grout barrier (Scenario 4) and 25.2 GL/yr without a grout barrier (Scenario 3). As the exact impact of the grout barrier is untested (currently under construction), the total abstraction volume under these recharge conditions is expected to be between these two figures.

From Scenario 5 outputs, sequential large-scale rainfall events are anticipated to significantly increase the dewatering requirement to achieve the required dewatering of pits and supplementation of pools. This increase has already been recorded in the Trinity area in recent years (Section 7.1.2.2), coincident with an increase in the Queens area as part of the mine progression. While the grout barrier does have an influence on required volumes in the simulations several years following major rainfall events (from 2027 onwards), it reduces peak dewatering volumes in 2025 when there is a second large-scale rain event just as dewatering ramps up, and dewatering requirements would exceed the 25 GL/yr limit in this event. Two consecutive large-scale events in 2024 and 2025, coincident with a required increase in dewatering, is expected to result in peak dewatering rates of 28.7 GL/yr.

Required supplementation volumes at the Weelumurra injection borefield are simulated to rise to a maximum of 175 L/s (5.5 GL/yr) in April 2025 to maintain water levels at Warp 16 above all trigger levels; the grout barrier is simulated to reduce this requirement to 150 L/s (4.7 GL/yr). Under the current assessment, the maximum rate, once reached, is maintained until the end of the model time period (July 2031). It should be noted that a proportion of this is recirculated to dewatering volumes at the Queens abstraction borefield; therefore, not all the abstraction at Queens represents a net loss to the aquifer system.

Table 10: Simulated abstraction volumes

Year	Scenario 1 (GL)	Scenario 2 (GL)	Scenario 3 (GL)	Scenario 4 (GL)	Scenario 5 (GL)
2021	16.30	16.30	16.31	16.31	16.31
2022	19.91	22.53	22.59	22.61	22.61
2023	13.47	15.66	15.96	15.81	15.81
2024	12.46	13.24	13.69	13.44	18.50
2025	18.01	23.55	25.24	23.79	28.74
2026	13.43	14.35	18.00	15.73	18.62
2027	10.01	10.63	14.46	12.22	14.16
2028	8.91	8.84	12.60	10.62	11.89
2029	8.44	8.30	12.02	10.13	10.80
2030	8.19	7.98	11.67	9.82	10.32
2031	4.00	3.83	5.65	4.75	5.00
Total	**133.13**	**145.20**	**168.19**	**155.24**	**172.75**

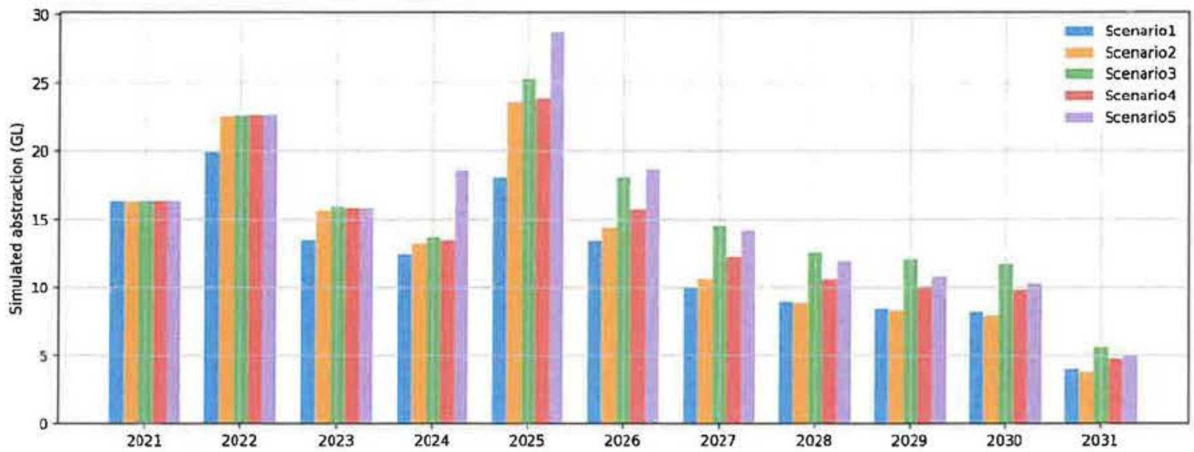


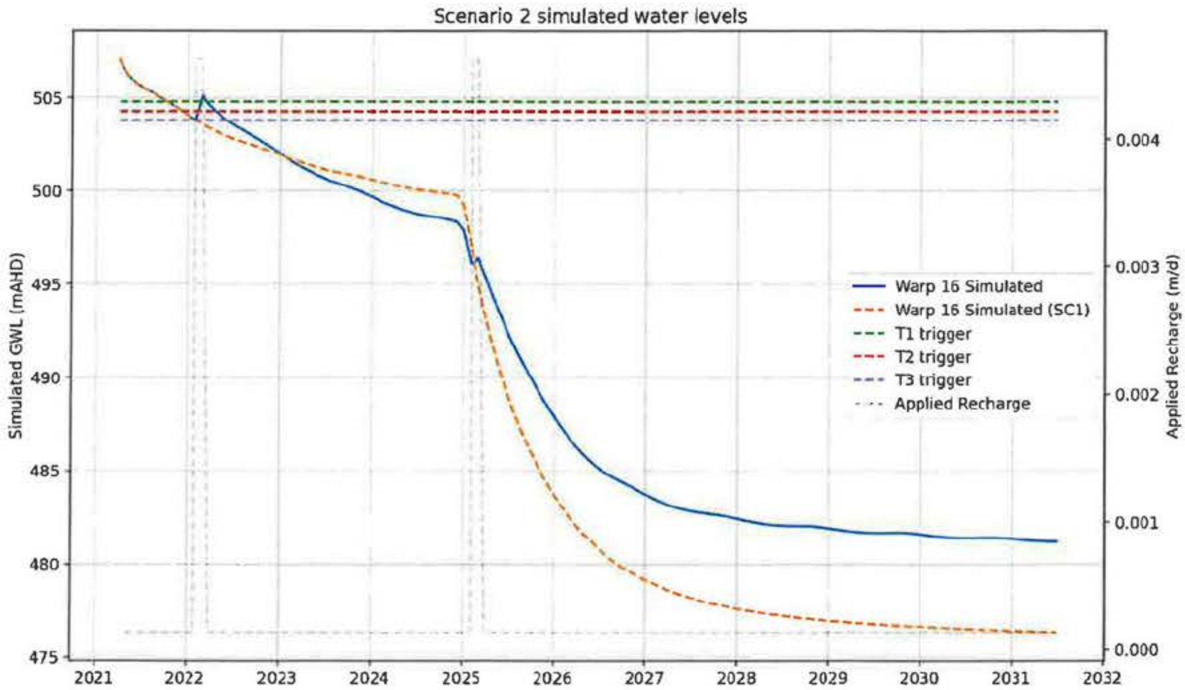
Figure 8: Simulated abstraction volumes for each scenario

8.3.5 Predicted Impacts on Groundwater Quality

Groundwater is fresh through the CID and alluvial aquifers, with no known occurrence of saline water within the mining area. Water of a similar quality will be drawn as abstraction continues. As such there is predicted to be low risk of impacts to groundwater or surface water quality as a result of the increased abstraction. As suggested by annual aquifer review reporting (Section 0), monitoring performed to date supports this assessment, with no degradation in water quality and/or appreciable changes in hydrochemistry evident to 2020.

There are currently no anticipated impacts to water quality from supplementation; this will continue to be managed through the Part V licence L8464/2010/2.

As discussed in Section 3.3, dewatering progress towards western Queens increases the risk to water quality owing to the presence of a Lignitic Body at the base of the palaeochannel. The *Lignite Management Plan* will dictate management requirements to address this risk and prevent water quality degradation.



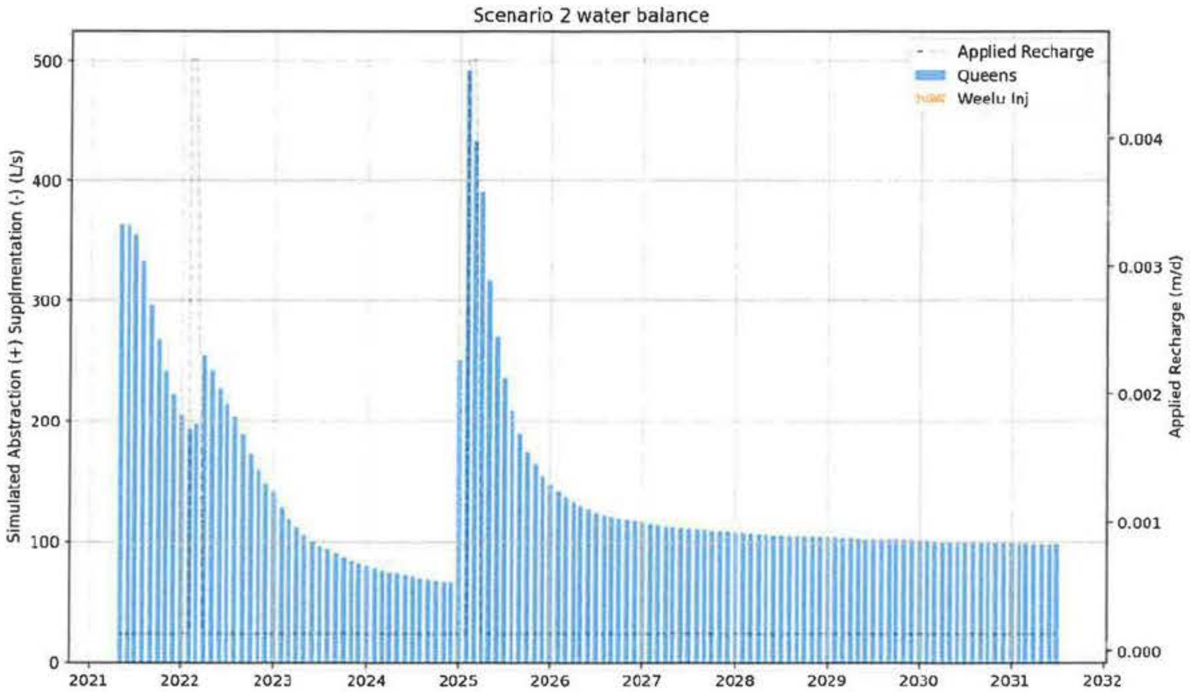


Figure 9 Simulated Weelumurra Management outcomes for scenario 2

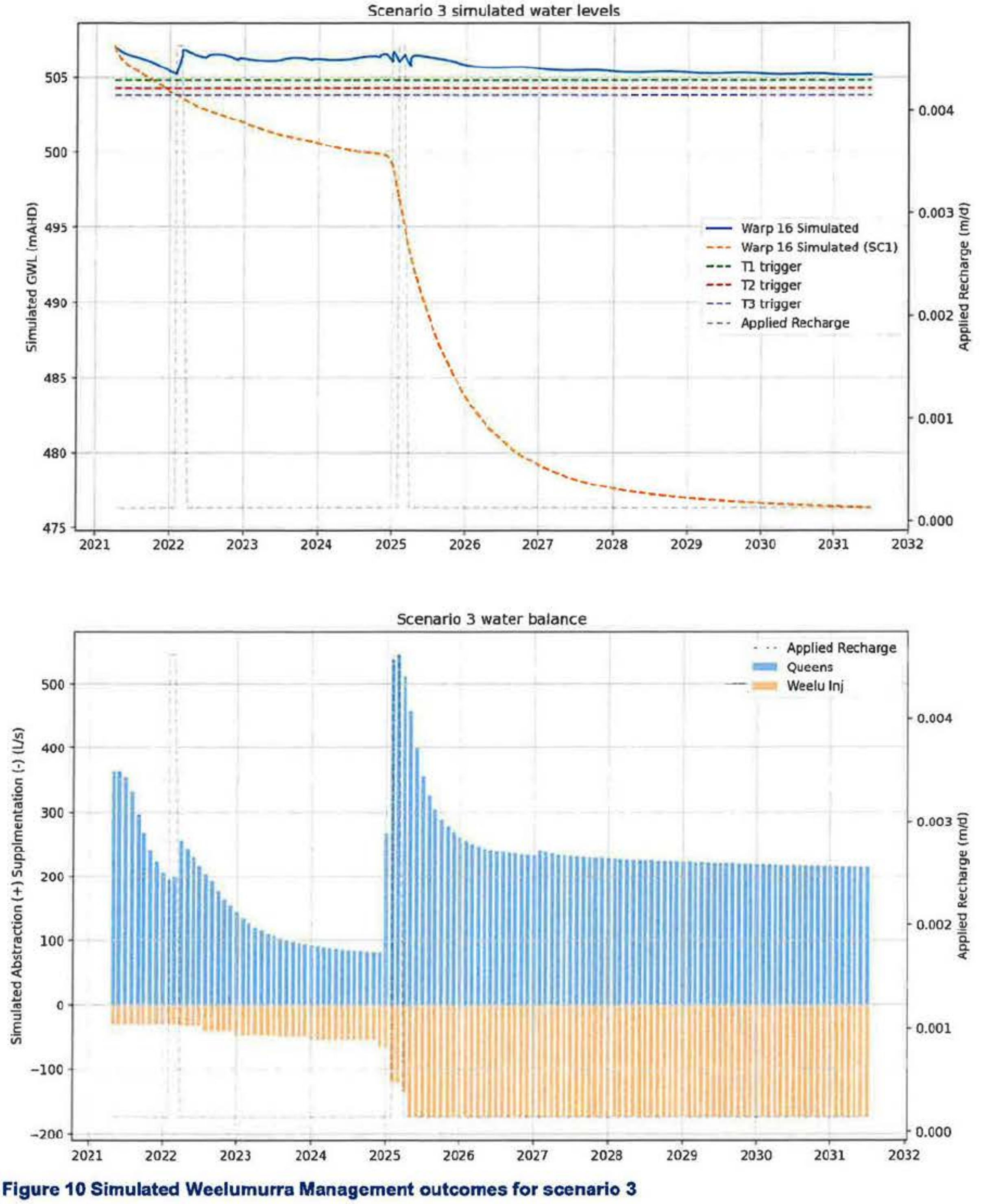
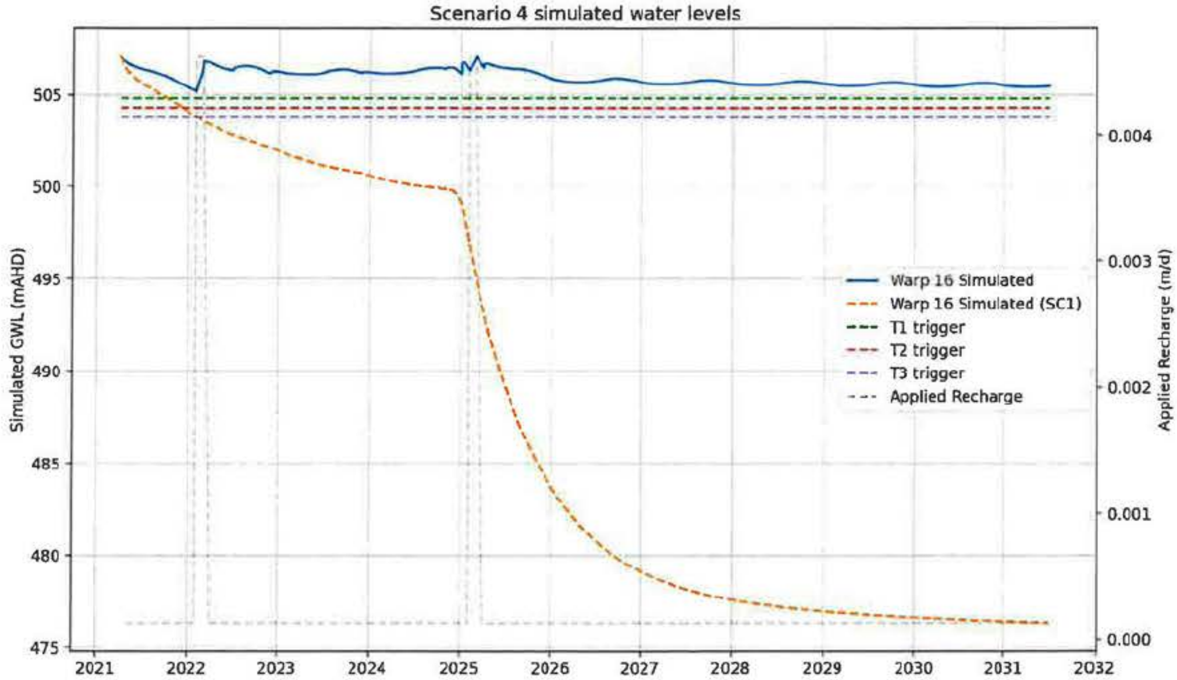


Figure 10 Simulated Weelumurra Management outcomes for scenario 3



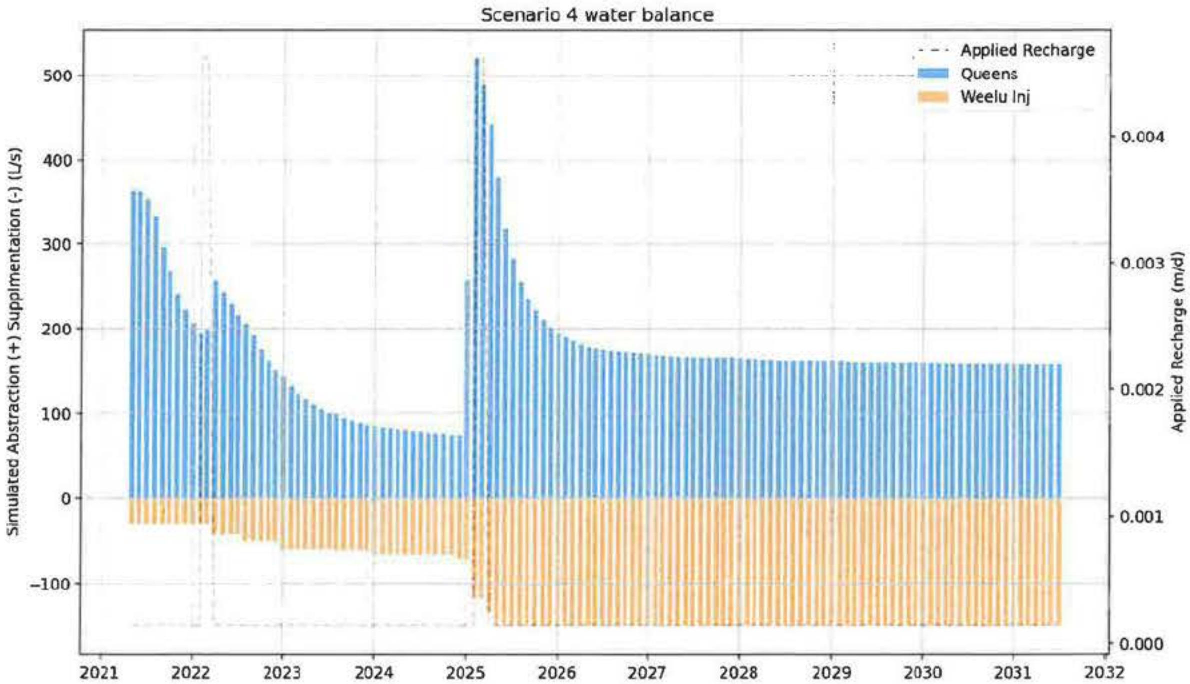
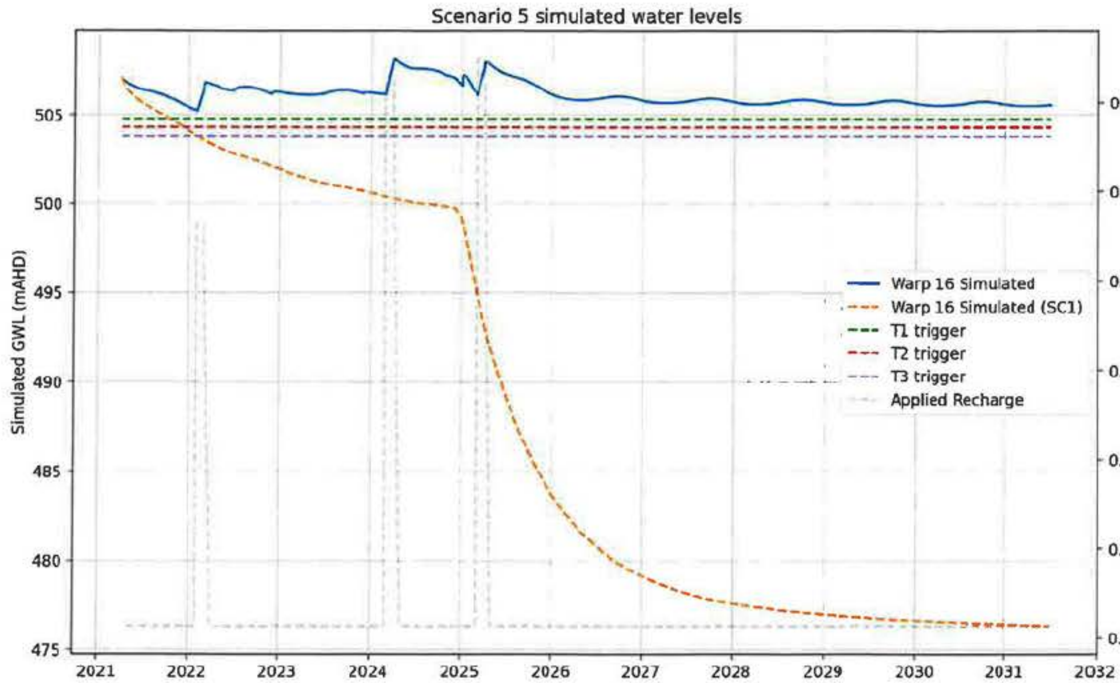


Figure 11 Simulated Weelumurra Management outcomes for scenario 4



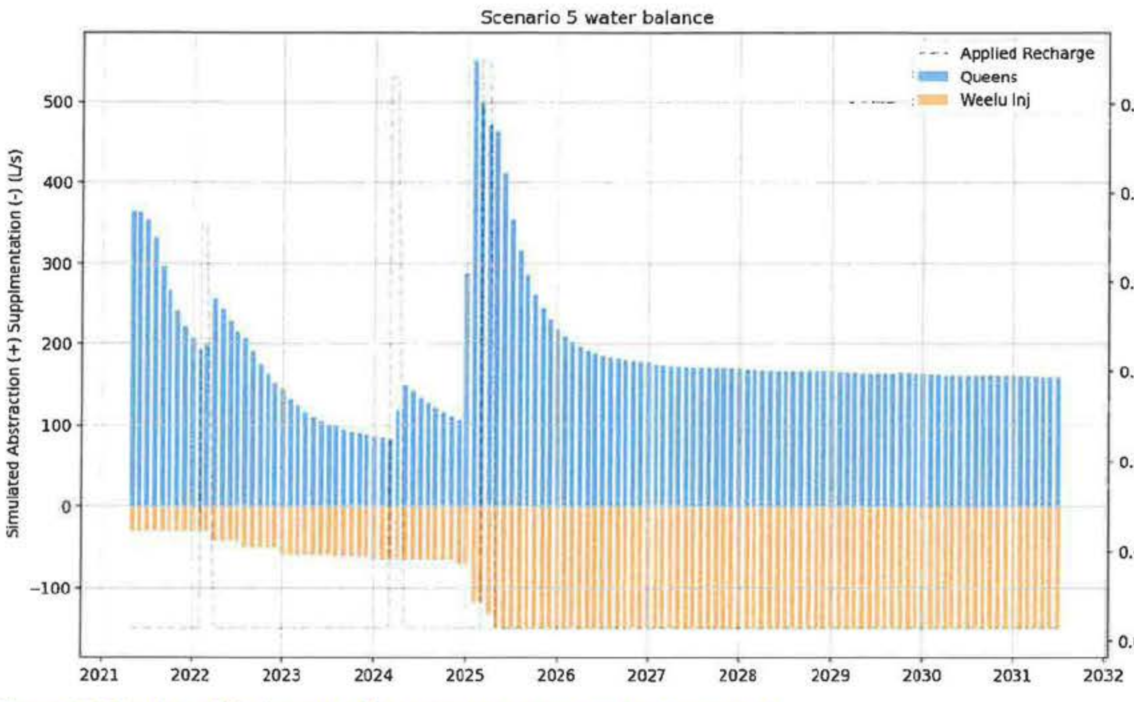


Figure 12 Simulated Weelumurra Management outcomes for scenario 5

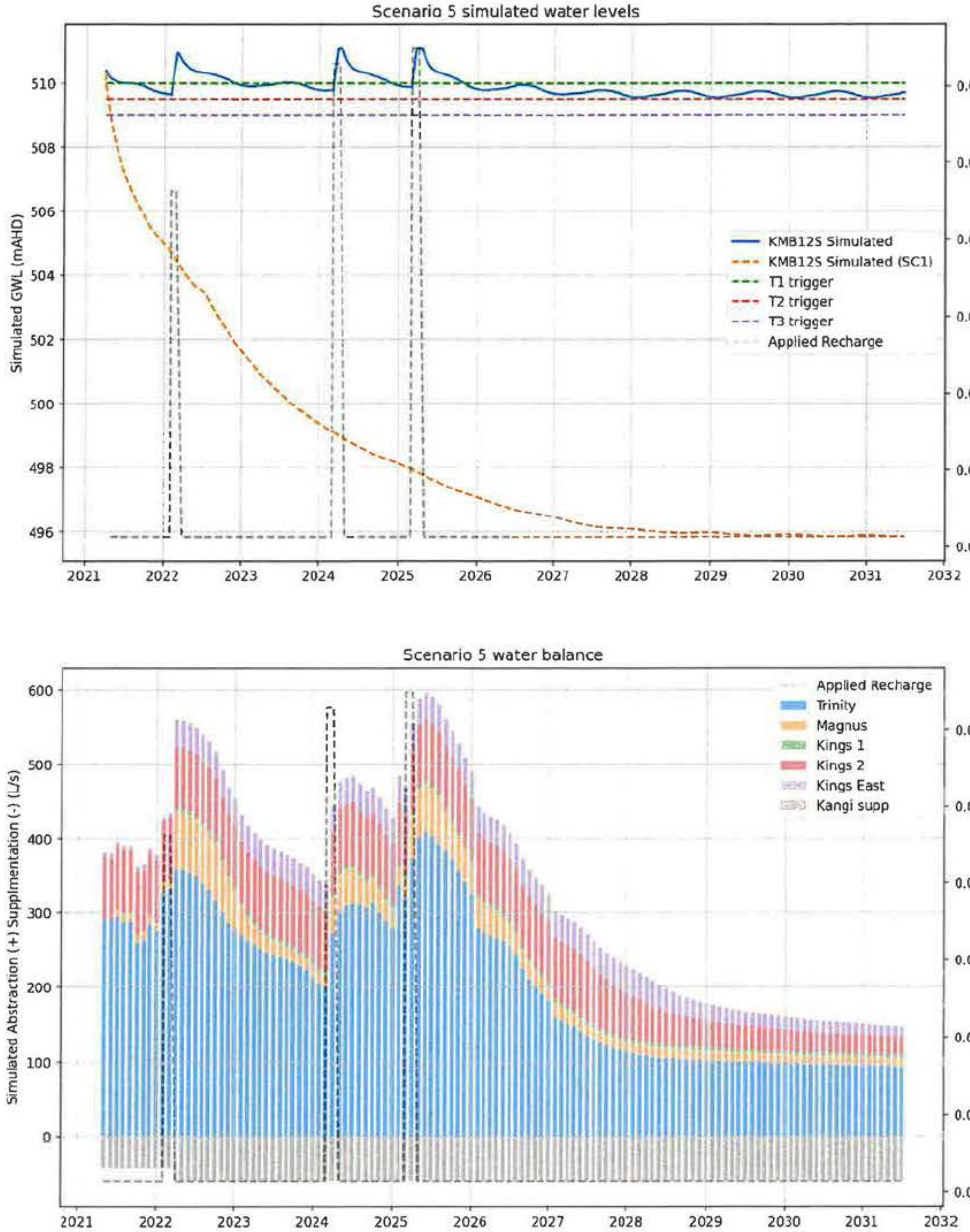


Figure 13 Simulated Kangeenarina Management outcomes for Scenario 5

9. GROUNDWATER MANAGEMENT AND MONITORING

An adaptive approach to groundwater management will be undertaken throughout the LoM at Solomon. Borefield capacities will be sufficiently large to enable flexibility in abstraction from the various resources, whereby abstraction can be increased in one of the key areas and decreased in another, in order to offset possible environmental impacts from abstraction in this area. Abstraction volumes are expected to vary in each area throughout the LoM, in order to manage potential impacts and align with dewatering requirements, whilst still achieving site water requirements.

Groundwater management and monitoring will be undertaken in accordance with the approved Solomon Groundwater Operating Strategy (currently Rev9 (FMG, 2020d)), and any related Management Plans pursuant to Conditions of Ministerial Statement 1062.

From the outputs of the modelling assessment the current monitoring outlined in the Operating Strategy (including those in conditional Management Plans) is considered sufficient for managing impacts on environmental receptors and aquifer capacity. Additional monitoring is likely to be implemented through works associated with the *Lignite Management Plan.*

For the purposes of assessing the validity of model output, particularly the anticipated impact and effectiveness of the grout barrier and the effectiveness of the Weelumurra injection borefield at higher capacities, it is recommended that regular monitoring be conducted either side of the grout barrier once complete, particularly once dewatering and injection rates increase. Monitoring of water levels throughout operation would assist in calibrating the model and the changes in hydraulic properties caused by the installation of the grout barrier.

Operational monitoring of the Weelumurra injection bores and associated monitoring bores should be conducted to assess clogging of injection bores during operation and act as an early warning of reducing injection bore efficiency and potential loss in capacity. As the Groundwater Operating Strategy does not list specific operational monitoring bores, but rather minimum monitoring objectives for each area, updates to the monitoring schedule can be incorporated into the current framework without any update to the operating strategy.

The current site operational monitoring schedule, provided in Appendix 9, already includes weekly monitoring of Weelumurra injection monitoring bores which is considered sufficient for monitoring injection performance and capacity. Three (3) additional monitoring bores locations (yet to be drilled, exact locations to be confirmed) have been included to assess the effectiveness of the grout barrier once it is completed. The locations of all existing site monitoring bores are provided in Plate 8a to 8j.

10. CONCLUSIONS

FMG intends to combine GWL176913 and GWL1752139 and increase the combined allocation of 18.2 GL/yr to the Part IV approved 25 GL/yr licence to continue operations at the Solomon Project.

Key findings of this assessment in relation to the impacts to this licence increase include:

- Peak dewatering volumes are simulated to exceed the current 18.2 GL/yr allocation in 2022 and 2025. These peak dewatering volumes are based on large rainfall/recharge events coinciding with a ramp-up of dewatering volumes as required by the current mine plan. Climate variability therefore presents a large source of uncertainty in the future water balance.

- As the Queens licence (GWL176913) overlaps the dewatering licence (GWL1752139) and increases in dewatering will be from the Queens area, a combination of these licences would not require changes to the operational philosophy of abstraction borefields. The amalgamation of these licences is purely an administrative change and would simplify annual reporting.

- Further to the above, the model simulates high recharge events, particularly when coinciding with a ramp-up of dewatering requirements, risks abstraction occurring at over the 25 GL/yr limit set by the current Part IV approval.

- The grout barrier as simulated is effective in reducing the supplementation requirement and thus total water demand through reduction of recirculation between the Weelumurra injection borefield and Queens abstraction. The effectiveness of the grout barrier on flows will be re-assessed once construction of the grout barrier is completed.

- The grout barrier by itself will be insufficient as a management strategy for limiting dewatering impacts at Weelumurra Creek.

- Supplementation at Weelumurra Creek is simulated to sufficiently manage dewatering impact for Queens at Warp 16 and Weelumurra Creek in accordance with the *Weelumurra Supplementation Plan* (FMG, 2021, in prep). From numerical model scenarios supplementation via injection will effectively manage environmental objectives at peak rates of 5.5 GL/yr (175 L/s, 17.5 L/s per bore) with a grout barrier and 4.7 GL/yr (150 L/s, 15 L/s per bore) without a grout barrier. While this is within the maximum predicted capacity of individual bores (~20 L/s), the operational capacity of the injection borefield and effectiveness of the grout barrier will need to be regularly assessed to ensure that required supplementation rates are attainable with the injection infrastructure and to flag any infrastructure maintenance and upgrades in advance of the system approaching capacity.

- A proportion of the increase in flows is due to mining at Queens approaching the Weelumurra injection borefield, resulting in increased recirculation. Because these volumes are re-injected into the aquifer this is not considered a net loss to the aquifer system.

- All environmental management objectives of the *Kangeenarina Creek Supplementation Plan* (FMG, 2020c) are simulated to be sufficiently met by the current management strategies. Further to this, recent assessments of the Vegetation and Pools at Kangeenarina in *Solomon Ecohydrology: Kangeenarina Creek Supplementation Options* (AQ2, 2021), and *Kangeenarina Creek Ecohydrological optimization of Supplementation* (AQ2, 2020) suggest that basing supplementation on the trigger level at KMB12S may be inefficient and causing some vegetation stress. While further monitoring and investigation is recommended by these assessments, there is the recommendation to conduct management through supplementation based on surface water monitoring at pools, rather than groundwater triggers in monitoring bores. FMG intends to further investigate and update its management plans where appropriate.

- Model simulations predict that the current management strategies will continue to be effective at limiting drawdown from increased dewatering volumes to the local CID aquifer within the mining area. No drawdown from ongoing dewatering is expected to extend past the Weelumurra injection borefield or Kangeenarina Creek Pools.

- Model simulations predict that active management strategies (injection alone, or a combination of injection and grout barrier) will prevent breaches in all trigger levels at Warp 16.

Water Quality

Water quality risks associated with implementation of the proposed abstraction are associated with the Queens Lignitic Body. Assessment and management of this risk is addressed in the *Lignite Study Report* and future *Lignite Management Plan* respectively.

Groundwater Management and Monitoring

- FMG has an adaptive approach to groundwater management. The borefield capacities will enable flexibility in abstraction from the various groundwater resources, whereby abstraction can be increased in one of the key areas and decreased in another, in order to offset possible environmental impacts from abstraction and spread abstraction load.

- Groundwater management and monitoring will be undertaken in accordance with the Solomon Groundwater Operating Strategy Rev9 (FMG, 2020d) and associated conditional Management Plans associated with Ministerial Statement 1062.

- The existing network and monitoring programme detailed in the operating strategy is considered sufficient for assessment of impacts for the mining area.

- A monitoring programme will be designed and implemented for assessing the effectiveness of the grout barrier once its construction is completed and to monitor the ongoing capacity of the injection borefield to flag any reduction in capacity from clogging.

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Plate 1: Regional Map

Plate 2: Mining Areas

Plate 3: Groundwater Licences

Plate 4: Groundwater Related Receptors and Risk

Plate 5: Baseline CID Groundwater Contours

Plate 6: CID model extent and boundary conditions

Plate 7: Solomon Borefields

Plate 8: Solomon Monitoring Bore Network

Plate 9: Modelled CID Drawdown 2015 to 2020

Plate 10: Measured CID Drawdown 2015 to 2020

Plate 11: Drawdown contours at model initial time step

Plate 12: Scenario 1 maximum drawdown contours

Plate 13: Scenario 2 maximum drawdown contours

Plate 14: Scenario 3 maximum drawdown contours

Plate 15: Scenario 4 maximum drawdown contours

Plate 16: Scenario 5 maximum drawdown contours

Appendix 1: Ministerial Statement 1062

Appendix 2: 5C Abstraction Licences

Appendix 3: Kangeenarina Supplementation Plan

Appendix 4: Weelumurra Supplementation Plan

Appendix 5: Piper Diagrams

Appendix 6: Production Bore Details

Appendix 7: Monitoring Bore Details

Appendix 8: 2015 LoMR120ii Modelling Report

Appendix 9: Suggested Monitoring Schedule

"CILO-3"

WAD 37 of 2022

Federal Court of Australia

District Registry: Western Australia

Division: General

YINDJIBARNDI NGURRA ABORIGINAL CORPORATION RNTBC

Applicant

STATE OF WESTERN AUSTRALIA & ORS

Respondents

This is the annexure marked "**CILO-3**" referred to in the affidavit of Christopher Ian Leonard Oppenheim sworn on 4 August 2023.

Signature of witness

Hamish Hamilton Robertson
a legal practitioner who has held a practice certificate for at least 2 years and who holds a current practice certificate.

Published on: 20 April 2011 Statement No.: 862

STATEMENT THAT A PROPOSAL MAY BE IMPLEMENTED (PURSUANT TO THE PROVISIONS OF THE *ENVIRONMENTAL PROTECTION ACT 1986)*

SOLOMON IRON ORE PROJECT

Proposal:	The proposal is to develop and operate two new mines at a greenfield site approximately 60 kilometres north of Tom Price, and to construct and operate a railway up to 130 kilometres in length from the mine site to the existing FMG railway. The proposal is further documented in schedule 1 of this statement.
Proponent:	Fortescue Metals Group Limited
Proponent Address:	Level 2, 87 Adelaide Terrace, EAST PERTH WA 6004
Assessment Number:	1841

Report of the Environmental Protection Authority: Report 1386

The proposal referred to in the above report of the Environmental Protection Authority may be implemented. The implementation of that proposal is subject to the following conditions and procedures:

1 Proposal Implementation

1-1 The proponent shall implement the proposal as documented and described in schedule 1 of this statement subject to the conditions and procedures of this statement.

2 Proponent Nomination and Contact Details

2-1 The proponent for the time being nominated by the Minister for Environment under sections 38(6) or 38(7) of the *Environmental Protection Act 1986* is responsible for the implementation of the proposal.

2-2 The proponent shall notify the Chief Executive Officer of the Office of the Environmental Protection Authority of any change of the name and address of the proponent for the serving of notices or other correspondence within 30 days of such change.

3 Time Limit of Authorisation

3-1 The authorisation to implement the proposal provided for in this statement shall lapse and be void five years after the date of this statement if the proposal to which this statement relates is not substantially commenced.

3-2 The proponent shall provide the Chief Executive Officer of the Office of the Environmental Protection Authority with written evidence which demonstrates that the proposal has substantially commenced on or before the expiration of five years from the date of this statement.

4 Compliance Reporting

4-1 The proponent shall prepare and maintain a compliance assessment plan to the satisfaction of the Chief Executive Officer of the Office of the Environmental Protection Authority.

4-2 The proponent shall submit to the Chief Executive Officer of the Office of the Environmental Protection Authority the compliance assessment plan required by condition 4-1 at least six months prior to the first compliance report required by condition 4-6, or prior to implementation, whichever is sooner.

The compliance assessment plan shall indicate:

1 the frequency of compliance reporting;

2 the approach and timing of compliance assessments;

3 the retention of compliance assessments;

4 the method of reporting of potential non-compliances and corrective actions taken;

5 the table of contents of compliance assessment reports; and

6 public availability of compliance assessment reports.

4-3 The proponent shall assess compliance with conditions in accordance with the compliance assessment plan required by condition 4-1.

4-4 The proponent shall retain reports of all compliance assessments described in the compliance assessment plan required by condition 4-1 and shall make those reports available when requested by the Chief Executive Officer of the Office of the Environmental Protection Authority.

4-5 The proponent shall advise the Chief Executive Officer of the Office of the Environmental Protection Authority of any potential non-compliance within seven days of that non-compliance being known.

4-6 The proponent shall submit to the Chief Executive Officer of the Office of the Environmental Protection Authority the first compliance assessment report fifteen months from the date of issue of this Statement addressing the twelve month period from the date of issue of this Statement and then annually from the date of submission of the first compliance assessment report.

The compliance assessment report shall:

1 be endorsed by the proponent's Chief Executive Officer or a person delegated to sign on the Chief Executive Officer's behalf;

2 include a statement as to whether the proponent has complied with the conditions;

3 identify all potential non-compliances and describe corrective and preventative actions taken;

4 be made publicly available in accordance with the approved compliance assessment plan; and

5 indicate any proposed changes to the compliance assessment plan required by condition 4-1.

5 Public Availability of Data

5-1 Within three months of the issue of this Statement, and for the remainder of the life of the proposal, the proponent shall make all environmental data (including sampling design and sampling methodology) used in the assessment of this proposal publicly available in a manner approved by the Chief Executive Officer of the Office of the Environmental Protection Authority.

6 Priority Species and Significant Vegetation – Mine Site

6-1 Prior to ground disturbing activities, excluding establishment of access roads or any other preliminary works as approved by the Chief Executive Officer of the Office of the Environmental Protection Authority, and within 12 months of the commencement of all other ground disturbing activities the proponent shall conduct and submit to the Chief Executive Officer of the Office of the Environmental Protection Authority a survey of the Robe Pisolite vegetation unit and the priority species *Gompholobium karijini* within the project area to the satisfaction of the Chief Executive Officer of the Office of the Environmental Protection Authority on advice from the Department of Environment and Conservation.

6-2 At least three months prior to ground disturbing activities associated with the Zion deposit, the proponent shall demonstrate that mining of the deposit will not result in a significant adverse impact on the conservation of *Gompholobium karijini* (ref. voucher M.E Trudgen & S.M Maley MET 10580 (PERTH 06090508) or any Robe Pisolite vegetation units that may be restricted in distribution to the satisfaction of the Chief Executive Officer of the Office of the Environmental Protection Authority.

6-3 The proponent shall make the results of the survey required by condition 6-1 publicly available in a manner approved by the Chief Executive Officer of the Office of the Environmental Protection Authority.

7 Priority Species – Rail Corridor

7-1 Prior to the commencement of ground disturbing activities associated with the railway, (other than minor and preliminary works previously approved by the Chief Executive Officer of the Office of the Environmental Protection Authority) the proponent shall conduct targeted surveys for Priority Flora species within the rail corridor, including *Aristida jerichoensis* variety *subspinulifera*, *Paspalidium retiglume, and Goodenia nuda* to the satisfaction the Chief Executive Officer of the Office of the Environmental Protection Authority on advice from the Department of Environment and Conservation.

7-2 Prior to commencement of ground disturbing activities associated with the railway, the proponent shall demonstrate that all rail infrastructure including access roads, construction camps and borrow pits will be located to avoid impacts to Priority Flora identified through condition 7-1 as far as practicable to the satisfaction of the Chief Executive Officer of the Office of the Environmental Protection Authority.

7-3 Prior to the commencement of ground disturbing activities associated with the railway, the proponent shall provide a final rail alignment which demonstrates that Wall Creek Waterhole will not be impacted.

7-4 The proponent shall make the results of the surveys required by condition 7-1 publicly available in a manner approved by the Chief Executive Officer of the Office of the Environmental Protection Authority.

8 Weeds

8-1 The proponent shall ensure that:

1. Prior to commencement of ground disturbing activities reference sites on nearby land which will not be impacted during implementation of the proposal are chosen in consultation with the Office of the Environmental Protection Authority, on advice from the Department of Environment and Conservation and a baseline survey undertaken;

2. Prior to commencement of ground disturbing activities, impact sites within the proposal area are chosen in consultation with the Office of the Environmental Protection Authority, on advice from the Department of Environment and Conservation, and a baseline survey undertaken;

3. No new species of weeds (including both declared weeds and environmental weeds) are introduced into the proposal area as a result of the implementation of the proposal;

4. The cover of weeds (including both declared weeds and environmental weeds) within the proposal area does not exceed that existing on reference sites determined in accordance with condition 8-1(1); and

5. The reference sites and impact sites are to be monitored every two years after commencement of ground disturbing activities to determine whether changes in weed cover and type are as a result of project implementation or broader regional changes.

9 Rehabilitation

9-1 The proponent shall undertake progressive rehabilitation, beginning within 12 months of the commencement of ground-disturbing activities and continuing until the following outcomes are achieved to the satisfaction of the CEO:

1. The waste material landforms and tailings storage facility shall be non-polluting and shall be constructed so that their stability, surface drainage, resistance to erosion and ability to support local native vegetation are similar to undisturbed natural analogue landforms as demonstrated by Ecosystem Function Analysis or other methodology acceptable to the Chief Executive Officer of the Office of the Environmental Protection Authority on advice from the Department of Environment and Conservation and the Department of Mines and Petroleum.

2. The waste material landforms, tailings storage facility and other areas disturbed through implementation of the proposal, shall be progressively rehabilitated with vegetation composed of native plant species of local provenance (defined as seed material collected within a suitable maximum distance of the proposal area as agreed by the

Chief Executive Officer of the Office of the Environmental Protection Authority on advice from the Department of Environment).

3. The percentage cover and species diversity of living self sustaining native vegetation in all rehabilitation areas shall be comparable to that of undisturbed natural analogue sites as demonstrated by Ecosystem Function Analysis or other methodology acceptable to the Chief Executive Officer of the Office of the Environmental Protection Authority.

9-2 Rehabilitation activities shall continue until such time as the requirements of condition 9-1 are met, and are shown to be met by inspections and reports, for a minimum of five years following mine completion to the satisfaction of the Chief Executive Officer of the Office of the Environmental Protection Authority, on advice of the Department of Mines and Petroleum.

Note: The methodology for Ecosystem Function Analysis is set out in Tongway DJ and Hindley 2004 *Landscape Function Analysis – Procedures for Monitoring and Assessing Landscapes*, Commonwealth Scientific and Industrial Research Organisation Sustainable Ecosystems, Canberra.

10 Surface Water

10-1 The proponent shall ensure that changes to surface water flows related to the construction of the railway do not adversely affect any significant vegetation community, including Mulga.

10-2 To verify that the requirements of condition 10-1 are met the proponent shall:

1. identify any areas of significant vegetation potentially impacted by changes to surface water flows related to the proposal in consultation with the Department of Environment and Conservation;

2. undertake baseline monitoring of areas of significant vegetation;

3. determine trigger levels for surface water flows, vegetation community health and vegetation cover in consultation with the Department of Environment and Conservation;

4. design and locate environmental culverts and other surface water control features in consultation with the Department of Environment and Conservation;

5. monitor surface water flows, including in the vicinity of significant vegetation; and
6. monitor the health and cover of significant vegetation to be retained in the proposal area and in adjacent areas.

Monitoring is to be carried out according to a method and schedule determined to the satisfaction of the Chief Executive Officer of the Office of the Environmental Protection Authority prior to the commencement of construction of the railway, and is to be carried out until such time as the Chief Executive Officer of the Office of the Environmental Protection Authority determines on advice from the Department of Environment and Conservation that monitoring actions may cease.

10-3 In the event that monitoring required by condition 10-2 indicates an exceedance of trigger levels determined by condition 10-2 (3) as a result of railway construction:

1. the proponent shall report such findings to the Chief Executive Officer of the Office of the Environmental Protection Authority within 21 days of the exceedance being identified;

2. in the report required by condition 10-3 (1) the proponent shall provide evidence which allows determination of the cause of the exceedance;

3. if determined by the Chief Executive Officer of the Office of the Environmental Protection Authority to be a result of activities undertaken in implementing the proposal, the proponent shall submit actions to be taken to remediate the exceedance within 21 days of the determination being made by the Chief Executive Officer of the Office of the Environmental Protection Authority; and

4. the proponent shall implement actions to remediate the exceedance upon approval of proposed actions by the Chief Executive Officer of the Office of the Environmental Protection Authority and shall continue these actions until such time as the Chief Executive Officer of the Office of the Environmental Protection Authority determines that the remedial actions may cease.

10-4 The proponent shall submit annually the results of monitoring required by condition 10-2 to the Chief Executive Officer of the Office of the Environmental Protection Authority.

10-5 The proponent shall make the monitoring reports required by condition 10-4 publicly available in a manner approved by the Chief Executive Officer of the Office of the Environmental Protection Authority.

11 Groundwater

11-1 The proponent shall ensure that water levels in groundwater fed pools within and adjacent to the project area are maintained consistent with pre-mining levels as defined in the report required by condition 11-2.

11-2 Prior to the commencement of dewatering, the proponent shall submit a report developed in consultation with Department of Environment and Conservation and the Department of Water, to the satisfaction of the Chief Executive Officer of the Office of the Environmental Protection Authority.

The report shall provide details including the timing, methodology, infrastructure design, trigger levels and monitoring strategies of a supplementation program designed to support water levels of groundwater fed pools within the project area.

11-3 In order to verify that the requirements of condition 11-1 are met, the proponent shall:

1. identify all sites and parameters to be monitored to the satisfaction of the Chief Executive Officer of the Office of the Environmental Protection Authority on advice from the Department of Environment and Conservation prior to the commencement of dewatering;

2. provide the results of baseline monitoring of water levels and native vegetation health and abundance at all sites identified by condition 11-3 (1) prior to the commencement of dewatering;

3. implement the supplementation program described in the report required by 11-2, or revisions approved by the Chief Executive Officer of the Office of the Environmental Protection Authority;

4. monitor groundwater and/or surface water levels at each of the agreed sites; and

5. monitor the health and cover of riparian vegetation at each of the agreed sites.

Monitoring is to be carried out to the satisfaction of the Chief Executive Officer of the Office of the Environmental Protection Authority, and is to continue until such time as the Chief Executive Officer of the Office of the Environmental Protection Authority determines that monitoring and management actions may cease.

11-4 The proponent shall submit annually the results of monitoring required by condition 11-3 to the Chief Executive Officer of the Office of the Environmental Protection Authority.

11-5 In the event that monitoring required by condition 11-3 indicates a decline in water levels at any spring, pool or creek, or in the health and condition of the riparian vegetation:

1. the proponent shall report such findings to the Chief Executive Officer of the Office of the Environmental Protection Authority within seven (7) days of the decline being identified;

2. in the report required by condition 11-5 (1) the proponent shall provide evidence which allows determination of the cause of the decline;

3. if determined by the Chief Executive Officer of the Office of the Environmental Protection Authority to be a result of activities

undertaken in implementing the proposal, the proponent shall determine actions to be taken to remediate the decline in consultation with the Department of Environment and Conservation;

4. the proponent shall submit proposed actions to the Chief Executive Officer of the Office of the Environmental Protection Authority within 21 days of the determination being made by the Chief Executive Officer of the Office of the Environmental Protection Authority; and

5. the proponent shall implement the actions determined under condition 11-5 (4) to halt the decline and remediate the impact to riparian and groundwater dependent vegetation upon approval of the Chief Executive Officer of the Office of the Environmental Protection Authority and shall continue until such time the Chief Executive Officer of the Office of the Environmental Protection Authority determines that the remedial actions may cease.

11-6 The proponent shall ensure that water is supplied for supplementation of natural features in preference to water required for mining operations.

11-7 The proponent shall make the monitoring reports required by conditions 11-3 and 11-4 publicly available in a manner approved by the Chief Executive Officer of the Office of the Environmental Protection Authority.

12 Vertebrate Fauna

12-1 Prior to the commencement of blasting activities, and prior to clearing in any areas likely to contain habitat suitable for Northern Quoll, Pilbara Leaf-nosed Bat or Mulgara species, whichever is sooner, the proponent shall develop a Fauna Management Plan to the satisfaction of the Chief Executive Officer of the Office of the Environmental Protection Authority on advice from the Department of Environment and Conservation.

12-2 The Fauna Management Plan shall include, but is not limited to, the following:

- management strategies to minimise impacts to the Pilbara Leaf-nosed Bat;
- management strategies for minimisation of impacts to Northern Quoll and Mulgara, developed in consultation with the Department of Environment and Conservation;
- management strategies for minimisation of impacts to habitat associated with the Northern Quoll;
- measures to protect a range of fauna habitat types, including creek bed and rocky habitats; and
- detailed monitoring procedures to determine the effectiveness of management strategies.

12-3 The proponent shall implement for the life of the project the Fauna Management Plan required by condition 12-1, or any subsequent approved revisions.

12-4 The proponent shall make the Fauna management Plan required by condition 12-1 publicly available in a manner approved by the Chief Executive Officer of the Office of the Environmental Protection Authority

13 Troglofauna

13-1 The proponent shall undertake troglofauna surveys biannually at a minimum in geological formations similar to the project area to validate predictions of habitat connectivity and improve knowledge of troglofauna populations in the region to inform future management of mining and associated operations, until such time as the Chief Executive Officer of the Office of the Environmental Protection Authority determines that sufficient knowledge of troglofauna populations has been acquired.

13-2 The troglofauna surveys shall be undertaken in accordance with the draft Environmental Protection Authority Guidance Statement 54a - *Sampling Methods and Survey Considerations for Subterranean Fauna in Western Australia* (August 2007) or its revisions and to the satisfaction of the Chief Executive Officer of the Office of the Environmental Protection Authority.

13-3 Within 30 months of ground disturbing activities the proponent shall prepare and submit a technical report based on the results of the surveys required by condition 13-1 to the requirements of the Chief Executive Officer of the Office of the Environmental Protection Authority on advice of the Department of Environment and Conservation.

13-4 Three months prior to commencement of ground disturbing activities associated with the Zion deposit, the proponent shall demonstrate that similar and connected troglofauna habitat exists outside of areas that have been or are likely to be impacted by mining to the satisfaction of the Chief Executive Officer of the Office of the Environmental Protection Authority on advice of the Department of Environment and Conservation.

13-5 The proponent shall prepare and submit annually further technical reports based on the results of the surveys required by condition 13-1 to the requirements of the Chief Executive Officer of the Office of the Environmental Protection Authority on advice of the Department of Environment and Conservation.

13-6 The proponent shall make the reports required by conditions 13-3, 13-4 and 13-5 publicly available in a manner approved by the Chief Executive Officer of the Office of the Environmental Protection Authority.

14 Mine Plan and Conceptual Closure Strategy

14-1 Prior to construction of the mine waste rock dumps and the tailings storage facilities for both the Early Ore and Full Production stages respectively, the proponent shall submit a detailed, staged and project-specific Mine Plan and Preliminary Closure Strategy to the requirements of the Chief Executive Officer of the Office of the Environmental Protection Authority on advice of the Department of Mines and Petroleum and the Department of Environment and Conservation.

Note: The Mine Plan and Preliminary Closure Strategy shall be staged in accordance with the development of the project, including Early Ore and Full Production stages.

14-2 The Mine Plan and Preliminary Closure Strategy shall include detailed results of geochemical and geophysical characterisation of materials, including tailings, in particular the potential for acid drainage, metalliferous drainage, and of the occurrence of dispersive materials and asbestiform minerals. Testing for materials with potential to cause acid and/or metalliferous drainage shall include static and kinetic testing carried out using techniques and timeframes consistent with national and international standards (*Leading Practice Sustainable Development Program for the Mining Industry – Managing Acid and Metalliferous Drainage 2009* – Department of Industry, Tourism and Resources; The Global Acid Rock Drainage Guide 2009 – International Network for Acid Prevention).

14-3 The Mine Plan and Preliminary Closure Strategy shall include detailed technical information on proposed design of tailings storage facilities including tailings characterisation studies, seepage controls and monitoring proposed.

14-4 The Mine Plan and Preliminary Closure Strategy shall provide detailed technical information on proposed management measures to prevent pollution, environmental harm or human health impacts during implementation of the proposal and after mine completion and closure.

14-5 The Mine Plan and Preliminary Closure Strategy shall include maps and diagrams showing the proposed placement, dimensions, design and proposed methods of construction and closure of waste disposal facilities, mine pits and tailings storage facilities.

14-6 The Mine Plan and Preliminary Closure Strategy shall demonstrate that waste disposal facilities will be located, designed and constructed to ensure that they are non-polluting and so that their final shape, height, stability and ability to support native vegetation are comparable to natural landforms in the area.

14-7 The Mine Plan and Closure Strategy shall demonstrate that the amount of backfill material available will be sufficient to allow backfilling to an extent that will preclude the formation of pit lakes after mine completion and closure, and to ensure there is capillary break between the surface and groundwater to maintain groundwater quality.

14-8 The Mine Plan and Preliminary Closure Strategy shall provide information on the placement and design of surface water control features as required by condition 10, and demonstrate that surface water control features will be constructed and rehabilitated to ensure that natural drainage lines are maintained as far as practicable during mine operations and re-established after mine completion and closure.

14-9 The Mine Plan and Preliminary Closure Strategy shall demonstrate that groundwater barriers installed during operation of the mine can be maintained after mine completion and closure.

14-10 The proponent shall implement the Mine Plan referred to in conditions 14-1 to 14-9.

14-11 The proponent shall make the Mine Plan and Preliminary Closure Strategy required by condition 14-1 publicly available in a manner approved by the Chief Executive Officer of the Office of the Environmental Protection.

15 Final Closure and Decommissioning Plan

15-1 At least three (3) years prior to mine completion, the proponent shall prepare and submit a Final Closure and Decommissioning Plan to the requirements of the Chief Executive Officer of the Office of the Environmental Protection, on advice of the Department of Environment and Conservation and Department of Mines and Petroleum.

15-2 The Final Closure and Decommissioning Plan shall be prepared consistent with:

1. ANZMEC/MCA 2000, *Strategic Framework for Mine Closure Planning*;

   and

2. Department of Industry Tourism and Resources 2006 *Mine Closure and Completion* (Leading Practice Sustainable Development Program for the Mining Industry), Commonwealth Government, Canberra;

15-3 The Final Closure and Decommissioning Plan shall provide detailed technical information on the following:

1. Final closure of all areas disturbed through implementation of the proposal so that they are safe, stable and non-polluting.

2. Decommissioning of all plant infrastructure and equipment.

3. Disposal of waste materials;

4. Final rehabilitation of:
   - the minesite including waste material landforms and other areas outside the mine pit;

- the haul roads, processing areas and accommodation facilities; and
- the mine pit area, including details of the final landform, and demonstrating that groundwater quality will not be negatively impacted in the long term.

5. Management and monitoring following mine completion.

6. Inventory of all contaminated sites and proposed management.

15-4 The proponent shall implement the Final Closure and Decommissioning Plan, or subsequent approved revisions.

15-5 The proponent shall make the Final Closure and Decommissioning Plan required by Condition 15-1 publicly available in a manner approved by the Chief Executive Officer of the Office of the Environmental Protection

Notes

1. The Minister for Environment will determine any dispute between the proponent and the Office of the Environmental Protection Authority over the fulfilment of the requirements of the conditions.

2. The proponent is required to apply for a Works Approval and Licence for this project under the provisions of Part V of the *Environmental Protection Act 1986*.

HON BILL MARMION MLA
MINISTER FOR ENVIRONMENT; WATER

Schedule 1

Fortescue Metals Group Limited (Fortescue) proposes to develop new mines within the Solomon Project, a greenfield site approximately 60 kilometres (km) north of Tom Price and adjacent to the North Eastern boundary of the Karijini National Park, and to construct and operate a railway up to 130 kilometres in length from the new mines eastwards to the existing FMG railway.

The deposits would produce a combined total of up to 80 million tonnes of iron ore per annum for a minimum 20 years. The Solomon Iron Ore Project includes three components. These are the Kings Mine, the Firetail Mine, and the Railway development. (Figures 1 and 2)

Mining would be standard open cut methods, with overburden and waste initially stored in external waste dumps and backfilled to the mined out pit. Tailings storage would be in constructed valley pits.

Infrastructure required for the proposal includes ore processing facilities, water and wastewater treatment plants, an airport located to the south of the project area, power station and overhead transmission lines, maintenance workshops, administration and storage areas, and construction and accommodation villages.

The main characteristics of the proposal are summarised in Table 1 below. A detailed description of the proposal is provided in Section 4 of the PER (FMG 2010)

Table 1: Summary of key proposal characteristics

Element	Description
General	
Mine Life	Firetail – 20 years Kings – 20 years
Clearing (Total disturbance)	Firetail – up to 1100 hectares Kings – up to 3300 hectares Railway – up to 1100 hectares
Mine pit area	Firetail – up to 880 hectares Kings – up to 2750 hectares
Length of railway	• Up to 130 kilometre Railway extending from Fortescue's existing Port Hedland to Cloudbreak rail line to the Firetail mining area; and • Rail spur from the main Solomon rail to a loading siding south of the Valley of the Kings
Dewatering	Up to 10 gigalitres per annum from the Kings mine.
Waste rock disposal	Firetail – up to 128 million tonnes disposal to external waste dumps, remainder to in-pit backfilling.

Element	Description
	Kings - up to 245 million tonnes disposal to external waste dumps, remainder to in-pit backfilling.
Final Landform	Backfilling to an extent that precludes the formation of pit lakes.
Tailings storage facilities	Tailings disposal in constructed valley pits located near the Kings and Firetail processing facilities.
Dewater disposal	• Processing and operational water supply requirements; and • Managed aquifer recharge.
Infrastructure	
Ore processing	Separate facilities required to process Channel Iron Deposit and Banded Iron Deposit/Detrital Iron Deposit Processing using tertiary and secondary crushing, and gravity concentration of the ore combined with separation of sand and clay waste materials.
Airport	Airport facility including small shelter, maintenance workshop, refueling facilities and ablution block to be used for mining and conservation related purposes.
Power supply	85MW (production capacity) dual fuel power station capable of running on diesel or gas supply.
Wastewater treatment	Wastewater treatment plants
Accommodation	• Temporary construction camps for rail and minesite; and • Permanent accommodation village and supporting infrastructure for a workforce of up to 1800.

Figures

Figure 1 – Location of the Kings and Firetail deposits

Figure 2 – Location of the Rail corridor

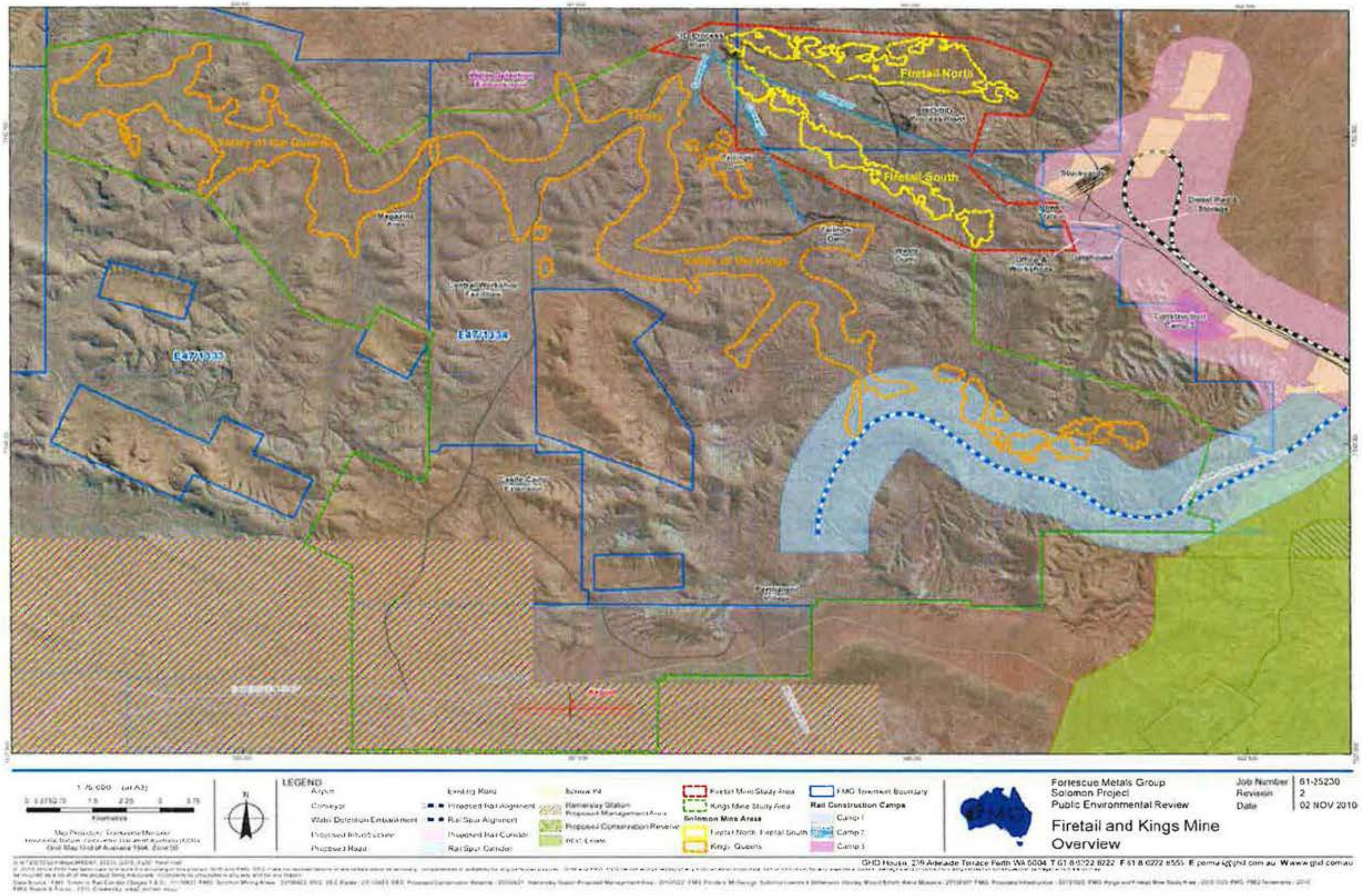

Figure 1 – Location of the Kings and Firetail deposits

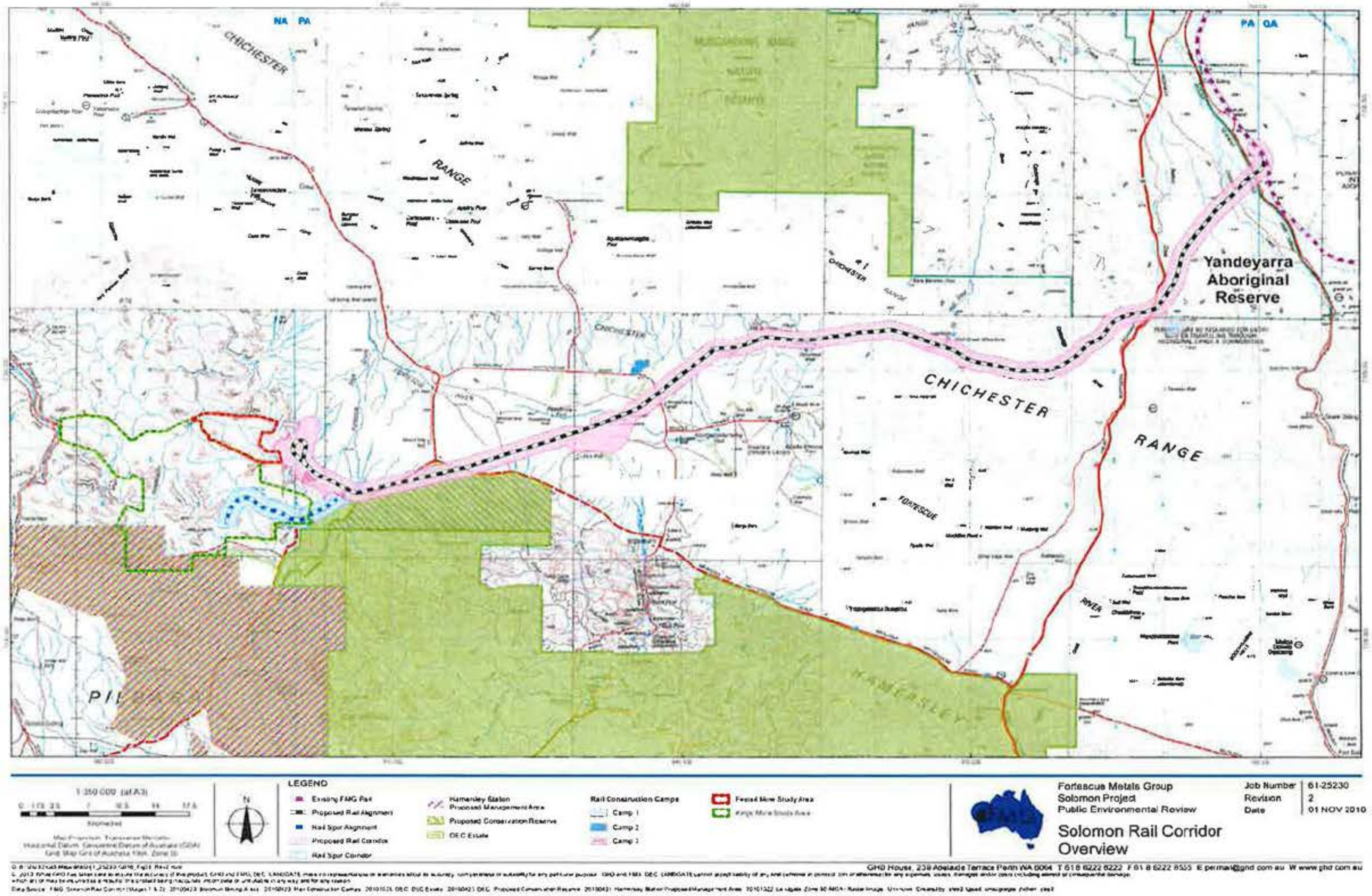

Figure 2 – Location of the Rail corridor

Attachment 1 to Ministerial Statement 862

Change to Proposal

Proposal: Solomon Iron Ore Project

Proponent: Fortescue Metals Group Limited

Change: Change to Schedule 1, Key Proposal Characteristics Table

Key Characteristics Table:

Element	Description of proposal	Description of approved change to proposal
General		
Mine Life	Firetail – 20 years Kings – 20 years	Firetail – 20 years Kings – 20 years
Clearing (Total disturbance)	Firetail – up to 1100 hectares Kings – up to 3300 hectares Railway – up to 1100 hectares	Firetail – up to 1100 hectares Kings – up to 3300 hectares **Railway – up to 1897 hectares with permanent disturbance of 764 ha and 1,133 ha rehabilitated**
Mine pit area	Firetail – up to 880 hectares Kings – up to 2750 hectares	Firetail – up to 880 hectares Kings – up to 2750 hectare
Length of railway	• Up to 130 kilometre Railway extending from Fortescue's existing Port Hedland to Cloudbreak rail line to the Firetail mining area; and • Rail spur from the main Solomon rail to a loading siding south of the Valley of the Kings	• Up to 130 kilometre Railway extending from Fortescue's existing Port Hedland to Cloudbreak rail line to the Firetail mining area; and • Rail spur from the main Solomon rail to a loading siding south of the Valley of the Kings
Dewatering	Up to 10 gigalitres per annum from the Kings mine.	Up to 10 gigalitres per annum from the Kings mine.
Waste rock disposal	Firetail – up to 128 million tonnes disposal to external waste dumps, remainder to in-pit backfilling. Kings - up to 245 million tonnes disposal to external waste dumps, remainder to in-pit backfilling.	Firetail – up to 128 million tonnes disposal to external waste dumps, remainder to in-pit backfilling. Kings - up to 245 million tonnes disposal to external waste dumps, remainder to in-pit backfilling.

Final Landform	Backfilling to an extent that precludes the formation of pit lakes.	Backfilling to an extent that precludes the formation of pit lakes.
Tailings storage facilities	Tailings disposal in constructed valley pits located near the Kings and Firetail processing facilities.	Tailings disposal in constructed valley pits located near the Kings and Firetail processing facilities.
Dewater disposal	• Processing and operational water supply requirements; and • Managed aquifer recharge.	• Processing and operational water supply requirements; and • Managed aquifer recharge.
Infrastructure		
Ore processing	Separate facilities required to process Channel Iron Deposit and Banded Iron Deposit / Detrital Iron Deposit. Processing using tertiary and secondary crushing, and gravity concentration of the ore combined with separation of sand and clay waste materials.	Separate facilities required to process Channel Iron Deposit and Banded Iron Deposit / Detrital Iron Deposit. Processing using tertiary and secondary crushing, and gravity concentration of the ore combined with separation of sand and clay waste materials.
Airport	Airport facility including small shelter, maintenance workshop, refuelling facilities and ablution block to be used for mining and conservation related purposes.	Airport facility including small shelter, maintenance workshop, refuelling facilities and ablution block to be used for mining and conservation related purposes.
Power Supply	85MW (production capacity) dual fuel power station capable of running on diesel or gas supply.	**Removed as not relevant to this Statement**
Wastewater Treatment	Wastewater treatment plants	**Removed as not relevant to this Statement**
Accommodation	• Temporary construction camps for rail and minesite; and • Permanent accommodation village and supporting infrastructure for a workforce of up to 1800.	• Temporary construction camps for rail and minesite; and • Permanent accommodation village and supporting infrastructure for a workforce of up to 1800.

Note: Text in **bold** in the Key Characteristics Table, indicates change/s to the proposal.

Dr Paul Vogel
CHAIRMAN
Environmental Protection Authority
under delegated authority

Approval date: 13 December 2011

Attachment 2 to Ministerial Statement 862

Change to proposal under s45C of the *Environmental Protection Act 1986*

This Attachment replaces Schedule 1 and Attachment 1 of Ministerial Statement 862

Proposal: Solomon Iron Ore Project

Proponent: Fortescue Metals Group Limited

Changes:

- Up to 5 hectares of disturbance of the Priority Ecological Community 'Brockman Iron Cracking Clay Communities of the Hamersley Range';
- Increase in peak dewatering rate to 25 gigalitres per annum; and
- Changes to Schedule 1 to remove elements not environmentally relevant and to contemporise this Statement.

Table 1: Summary of the Proposal

Proposal Title	Solomon Iron Ore Project
Short Description	The proposal is to develop the Firetail and Kings mines at a greenfield site approximately 60 km north of Tom Price and adjacent to the north-eastern boundary of the Karijini National Park, and to construct and operate a railway between the new mines and an existing railway.

Table 2: Location and authorised extent of physical and operational elements

Element	Location	Previously Authorised Extent	Authorised Extent
Mine life	-	Firetail – 20 years Kings – 20 years	**Removed as not a key element for environmental protection.**
Clearing (Total Disturbance)	-	Firetail – up to 1100 ha Kings – up to 3300 ha Railway – up to 1897 ha with permanent disturbance of 764 and 1133 ha rehabilitated.	**Element replaced with 'Total Disturbance – Mines', and 'Total Disturbance – Railway' elements.**
Total Disturbance - Mines	Figure 1, Figure 3	Firetail – up to 1100 ha Kings – up to 3300 ha	**Up to 4400 ha within the 29818 ha Project Development Area 1, including not more than 5 ha disturbance of the PEC 'Brockman Iron Cracking Clay Communities' within the 153 ha Project Development Area 2.**

Element	Location	Previously Authorised Extent	Authorised Extent
Mine pit area	Figure 1	Firetail - up to 880 ha. Kings – up to 2750 ha.	**Firetail and Kings - not more than 3630 ha within the 29818 ha Project Development Area 1.**
Total Disturbance - Railway	**Figure 2**	**Up to 1897 ha with permanent disturbance of 764 ha and 1133 ha rehabilitated.**	**Not more than 1897 ha total disturbance within the 26945 ha (combined) Railway Corridor and Rail Spur Corridor. Of the total disturbance area for the railway, not more than 764 ha is to be permanent disturbance and all other disturbed areas are to be rehabilitated.**
Length of Railway	-	• Up to 130 km Railway extending from Fortescue's existing Port Hedland to Cloudbreak rail line to the Firetail mining area; and • Rail spur from the main Solomon rail to a loading siding south of the Valley of the Kings.	**Removed as addressed by 'Total Disturbance – Railway' element.**
Dewatering	Kings Mine	Up to 10 GL per annum.	**Up to 25 GL per annum.**
Waste rock disposal	-	Firetail – up to 128 million tonnes disposed to external waste dumps, remainder to in-pit backfilling. Kings – up to 245 million tonnes disposed to external waste dumps, remainder to in-pit backfilling.	Firetail – up to 128 million tonnes disposed to external waste dumps, remainder to in-pit backfilling. Kings – up to 245 million tonnes disposed to external waste dumps, remainder to in-pit backfilling..
Backfilling of mine pits	-	Pits backfilled to an extent that precludes the formation of pit lakes.	Pits backfilled to an extent that precludes the formation of pit lakes.
Tailings storage facilities	-	Tailings disposal in constructed valley pits.	Tailings disposal in constructed valley pits.

Element	Location	Previously Authorised Extent	Authorised Extent
Dewater disposal	-	• Processing and operational water supply requirements; and • Managed aquifer recharge.	• Processing and operational water supply requirements; and • Managed aquifer recharge.
Ore processing	-	Separate facilities required to process Channel Iron Deposit and Banded Iron Deposit / Detrital Iron Deposit. Processing using tertiary and secondary crushing, and gravity concentration of the ore combined with separation of sand and clay waste materials.	**Removed as regulated under other legislation.**
Airport	-	Airport facility including small shelter, maintenance workshop, refueling facilities and ablution block to be used for mining and conservation related purposes.	**Removed as not a key element for environmental protection.**
Accommodation	-	• Temporary construction camps for rail and minesite; and • Permanent accommodation village and supporting infrastructure for a workforce of up to 1800.	**Removed as not a key element for environmental protection.**

Note: Text in **bold** in Table 2 indicates a change to the proposal.

Table 3: Abbreviations

Abbreviation	Term
ha	hectare
km	kilometre
GL	gigalitre

Figures (attached)

Figure 1 Solomon Mine Overview;
Figure 2 Solomon Rail Corridor Overview; and
Figure 3 Disturbance within the Priority Ecological Community 'Brockman Iron Cracking Clay Communities of the Hamersley Range'.

[Signed 21 November 2013]

Dr Paul Vogel
CHAIRMAN
Environmental Protection Authority
under delegated authority

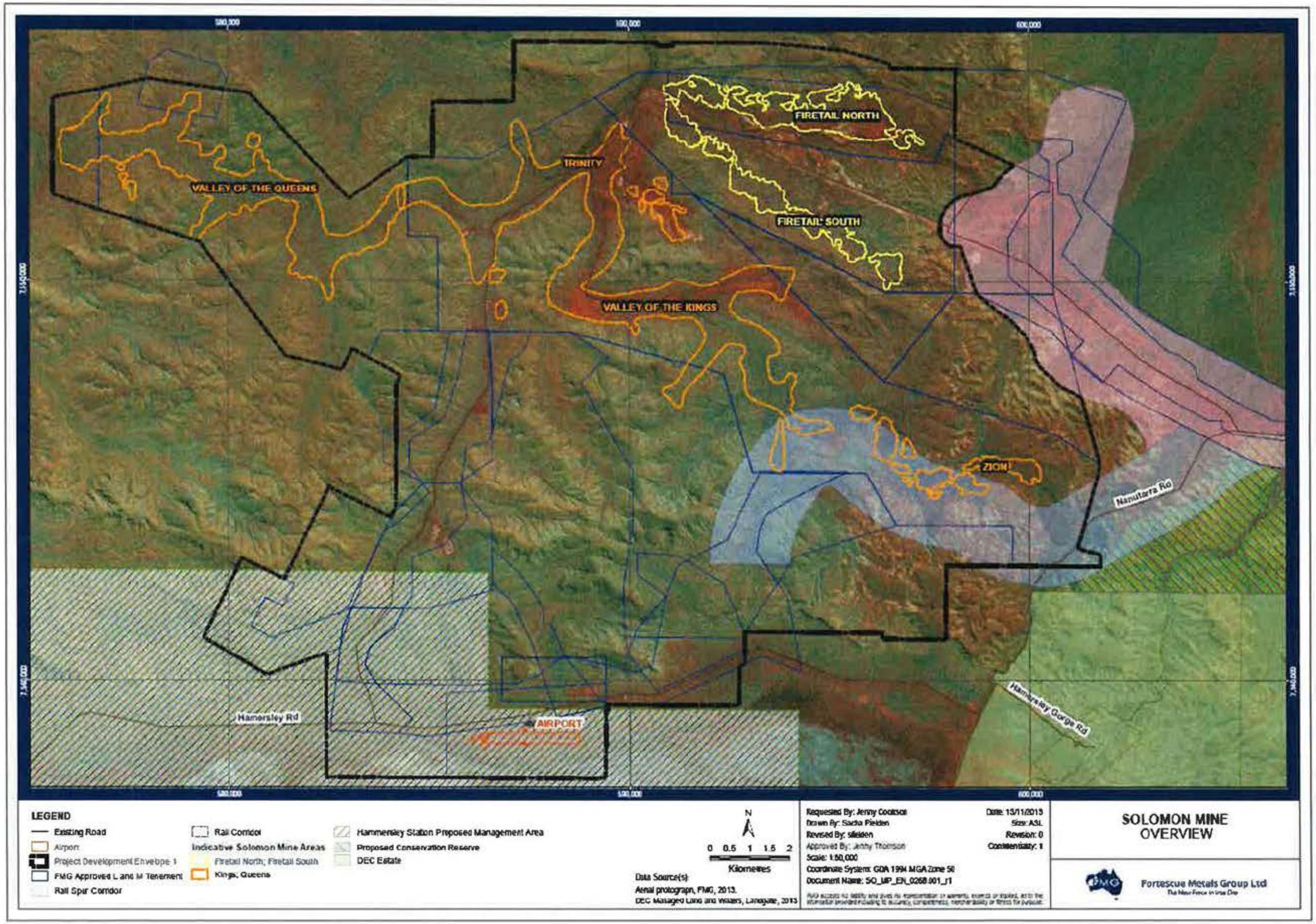

Figure 1. Solomon Mine Overview

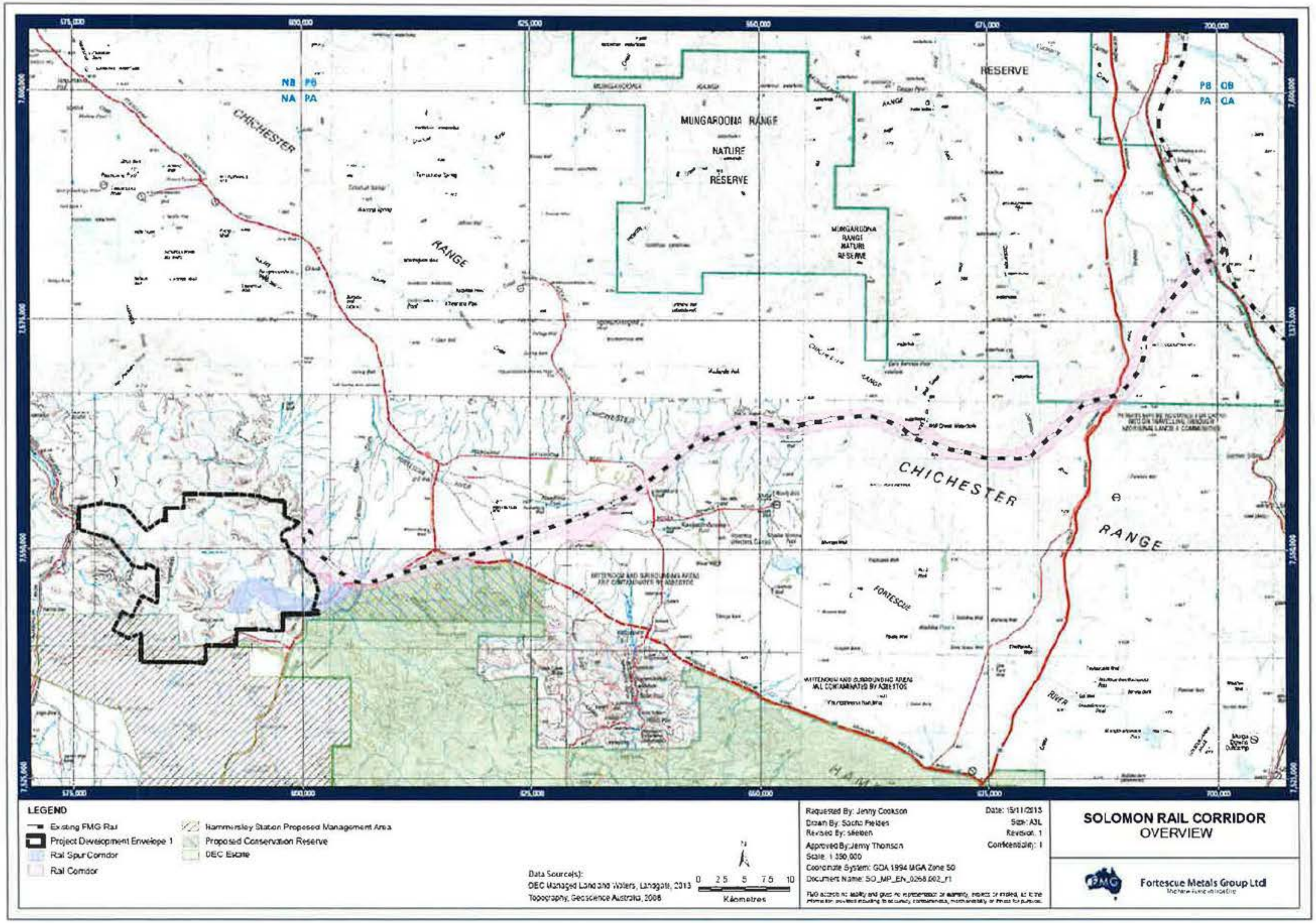

Figure 2. Solomon Rail Corridor Overview

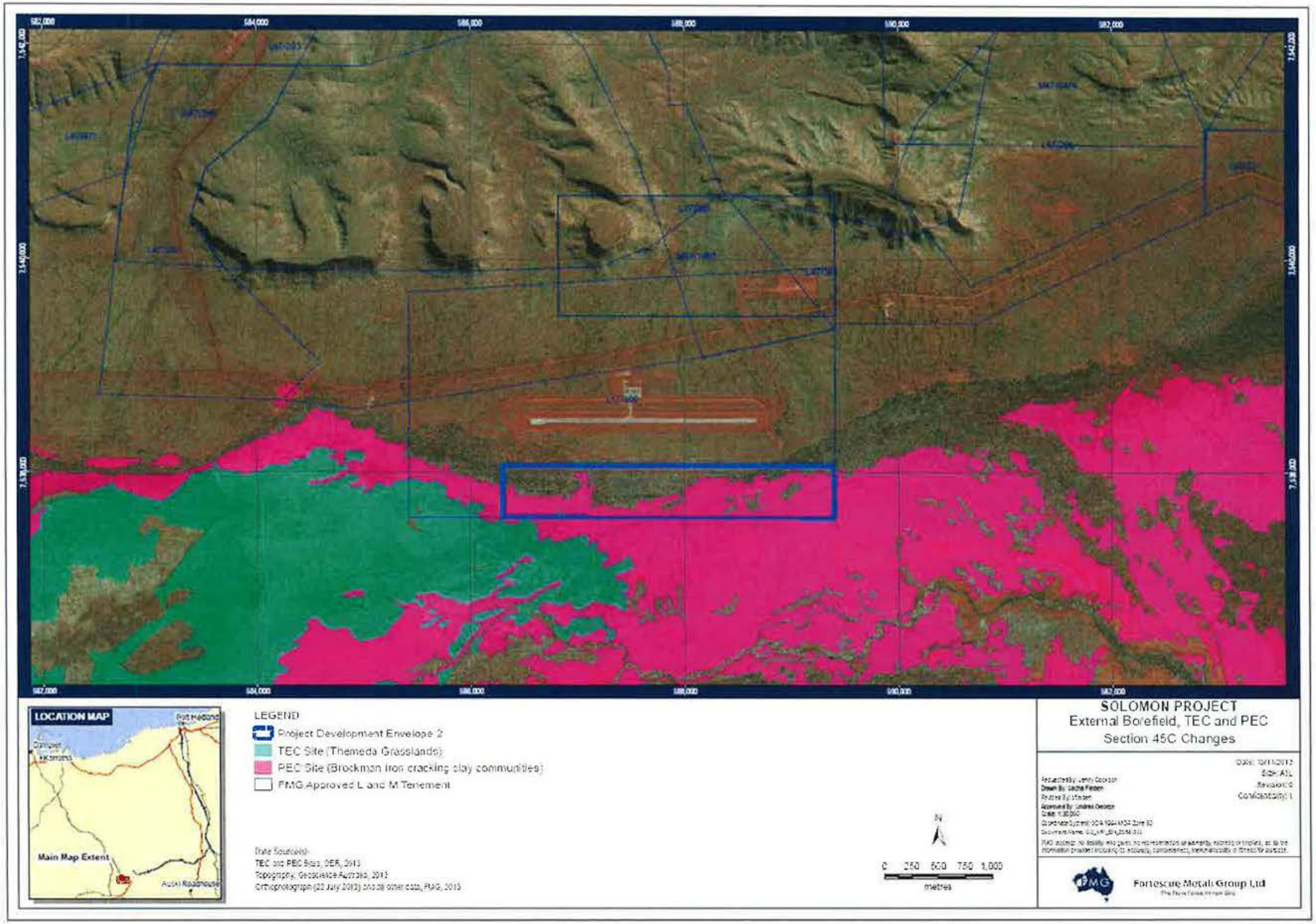

Figure 3. Disturbance within the Priority Ecological Community 'Brockman Iron Cracking Clay Communities of the Hamersley Range'

Attachment 3 to Ministerial Statement 862

Change to proposal approved under section 45C of the *Environmental Protection Act 1986*

This Attachment replaces Schedule 1, Attachment 1 and Attachment 2 to Ministerial Statement 862

Proposal: Solomon Iron Ore Project

Proponent: Fortescue Metals Group Limited

Changes:

- Increase in Total Disturbance (Mines) of 16 ha;
- 'Project Development Area 1' and 'Project Development Area 2' changed to 'Project Development Envelope 1' and 'Project Development Envelope 2'; and
- Amendments to the Project Development Envelope 1 and Rail Corridor and Rail Spur Corridor boundaries, and corresponding adjustment of area values.

Table 1: Summary of the Proposal

Proposal Title	Solomon Iron Ore Project
Short Description	The proposal is to develop the Firetail and Kings mines at a greenfield site approximately 60 kilometres north of Tom Price and adjacent to the north-eastern boundary of the Karijini National Park, and to construct and operate a railway between the new mines and an existing railway.

Table 2: Location and authorised extent of physical and operational elements

Element	Location	Previously Authorised Extent	Authorised Extent
Total Disturbance – Mines	Figure 1, Figure 3.	Up to 4400 ha within the 29818 ha Project Development Area 1, including not more than 5 ha disturbance of the PEC 'Brockman Iron Cracking Clay Communities' within the 153 ha Project Development Area 2.	**Up to 4416 ha within the 31333 ha Project Development Envelope 1,** including not more than 5 ha disturbance of the PEC 'Brockman Iron Cracking Clay Communities' within the 153 ha Project Development **Envelope** 2.
Mine Pit Area	Figure 1	Firetail and Kings – not more than 3630 ha within the 29818 ha Project Development Area 1.	Firetail and Kings – not more than 3630 ha within the **31333 ha Project Development Envelope 1.**

Element	Location	Previously Authorised Extent	Authorised Extent
Total Disturbance – Railway	Figure 2	Not more than 1897 ha total disturbance within the 26945 ha (combined) Railway Corridor and Rail Spur Corridor. Of the total disturbance area for the railway, not more than 764 ha is to be permanent disturbance and all other disturbed areas are to be rehabilitated.	Not more than 1897 ha total disturbance within the **29257 ha (combined) Railway Corridor and Rail Spur Corridor.** Of the total disturbance area for the railway, not more than 764 ha is to be permanent disturbance and all other disturbed areas are to be rehabilitated.
Dewatering	Kings Mine	Up to 25 GL per annum.	Up to 25 GL per annum.
Waste Rock Disposal	-	Firetail – up to 128 million tonnes disposed to external waste dumps, remainder to in-pit backfilling. Kings – up to 245 million tonnes disposed of to external waste dumps, remainder to in-pit backfilling.	Firetail – up to 128 million tonnes disposed to external waste dumps, remainder to in-pit backfilling. Kings – up to 245 million tonnes disposed of to external waste dumps, remainder to in-pit backfilling.
Backfilling of mine pits	-	Pits backfilled to an extent that precludes the formation of pit lakes.	Pits backfilled to an extent that precludes the formation of pit lakes.
Tailings storage facilities	-	Tailings disposal in constructed valley pits.	Tailings disposal in constructed valley pits.
Dewater disposal	-	• Processing and operational water supply requirements; and • Managed aquifer recharge.	• Processing and operational water supply requirements; and • Managed aquifer recharge.

Note: Text in **bold** in Table 2 indicates a change to the proposal.

Table 3: Abbreviations

Abbreviation	Term
ha	hectare
km	kilometre
GL	gigalitre
PEC	Priority Ecological Community

Figures (attached)

Figure 1 Solomon Mine Overview;

Figure 2 Solomon Rail Corridor Overview; and

Figure 3 Disturbance within the Priority Ecological Community 'Brockman Iron Cracking Clay Communities of the Hamersley Range'.

P Vogel

Dr Paul Vogel
CHAIRMAN
Environmental Protection Authority
under delegated authority

Approval date: 15.10.14

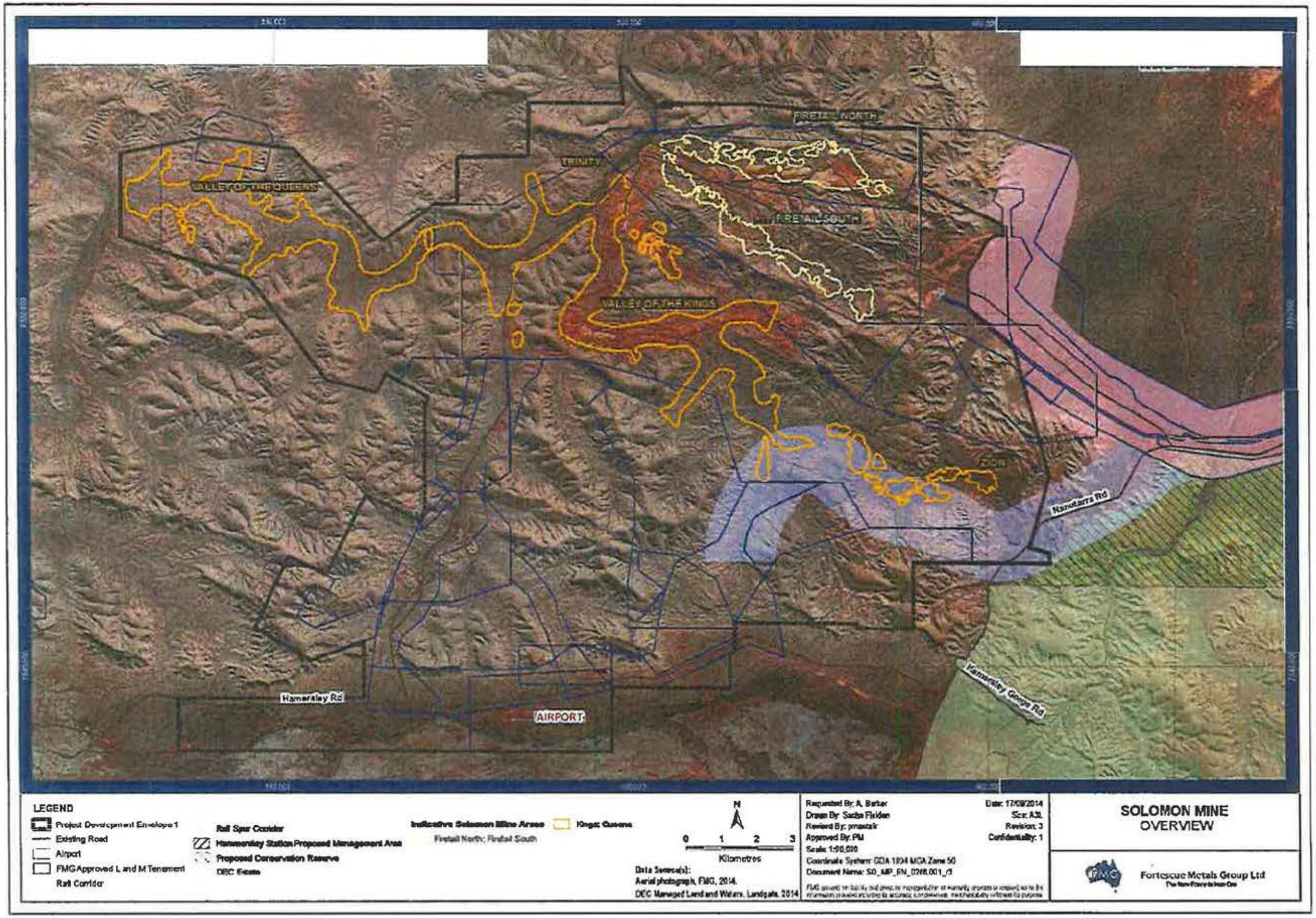

Figure 1. Solomon Mine Overview

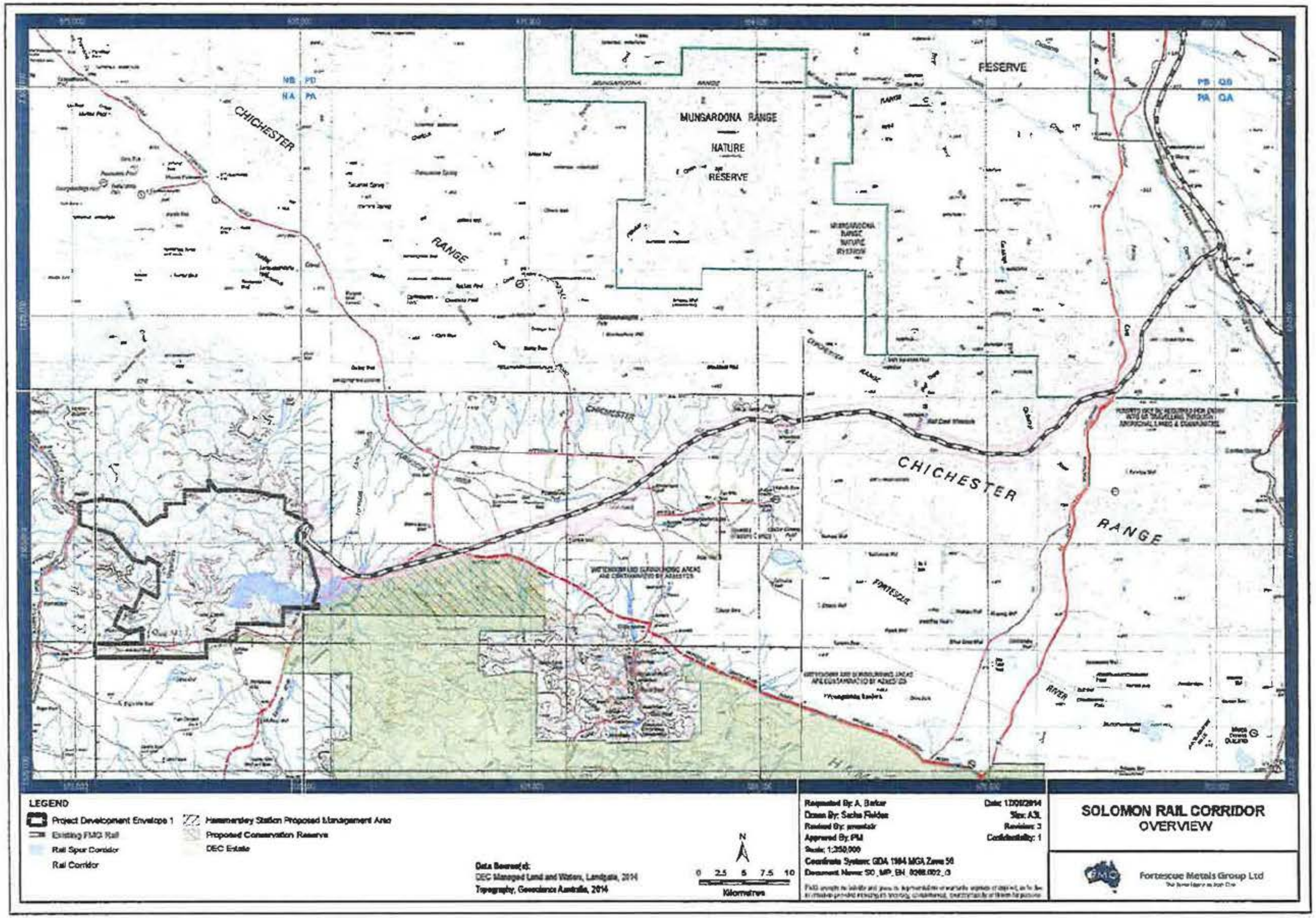

Figure 2. Solomon Rail Corridor Overview

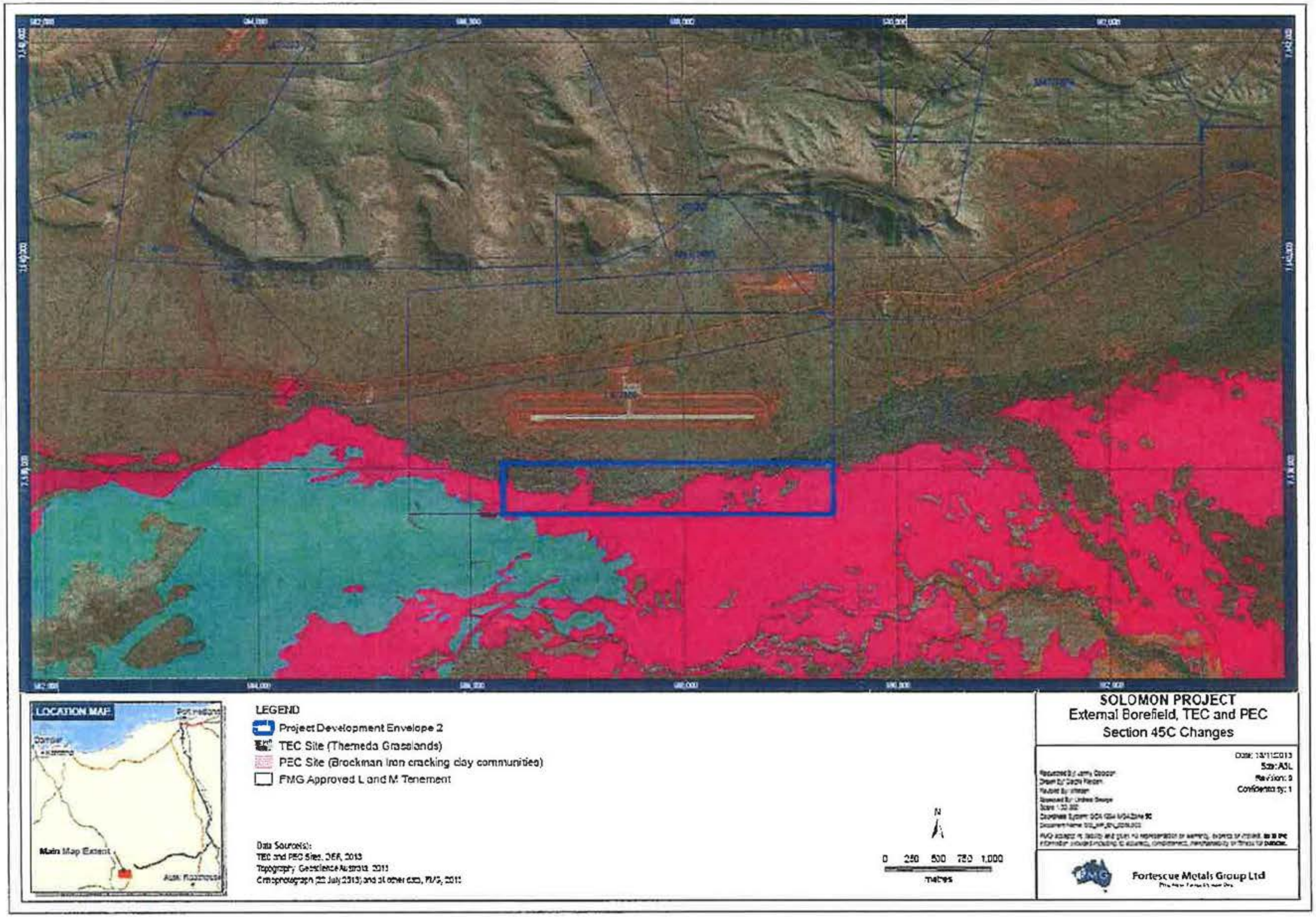

Figure 3. Disturbance within the Priority Ecological Community 'Brockman Iron Cracking Clay Communities of the Hamersley Range'

"CILO-4"

WAD 37 of 2022

Federal Court of Australia

District Registry: Western Australia

Division: General

YINDJIBARNDI NGURRA ABORIGINAL CORPORATION RNTBC

Applicant

STATE OF WESTERN AUSTRALIA & ORS

Respondents

This is the annexure marked "**CILO-4**" referred to in the affidavit of Christopher Ian Leonard Oppenheim sworn on 4 August 2023.

Signature of witness

Hamish Hamilton Robertson
a legal practitioner who has held
a practice certificate for at least
2 years and who holds a current
practice certificate.

Published on: 3 October 2017 Statement No. 1062

STATEMENT THAT A REVISED PROPOSAL MAY BE IMPLEMENTED
(*Environmental Protection Act 1986*)

SOLOMON IRON ORE PROJECT – SUSTAINING PRODUCTION

Proposal: Proposal to develop and operate the Solomon Iron Ore Mine, located approximately 60 kilometres north of Tom Price, including the Southern Borefield and Lower Fortescue Borefield, and operate the existing Hamersley Rail line.

The proposal is a revision of the Solomon Iron Ore Project, the subject of Statement No. 862 dated 20 April 2011.

Proponent: Fortescue Metals Group Limited
Australian Company Number 002 594 872

Proponent Address: Level 2, 87 Adelaide Terrace
EAST PERTH WA 6004

Assessment Number: 2019

Report of the Environmental Protection Authority: 1588

Previous Report of the Environmental Protection Authority: 1386

Previous Statement Number: 862

Pursuant to section 45, read with section 45B of the *Environmental Protection Act 1986,* it has been agreed that:

1. the revised proposal described and documented in Schedule 1 may be implemented;

2. the implementation of the revised proposal, being the *Solomon Iron Ore Project* as amended, is subject to the following implementation conditions: and

3. from the date of this Statement, each of the implementation conditions in Statement 862 no longer apply in relation to the revised proposal.

1 Proposal Implementation

1-1 When implementing the Revised Proposal, the proponent shall not exceed the authorised extent of the Revised Proposal as defined in Table 2 in Schedule 1, unless amendments to the Revised Proposal and the authorised extent of the Revised Proposal have been approved under the EP Act.

2 Contact Details

2-1 The proponent shall notify the CEO of any change of its name, physical address or postal address for the serving of notices or other correspondence within twenty-eight (28) days of such change. Where the proponent is a corporation or an association of persons, whether incorporated or not, the postal address is that of the principal place of business or of the principal office in the State.

3 Compliance Reporting

3-1 The proponent shall prepare, submit and maintain a Compliance Assessment Plan to the CEO at least six (6) months prior to the first Compliance Assessment Report required by condition 3-6.

3-2 The Compliance Assessment Plan shall indicate:

(1) the frequency of compliance reporting;

(2) the approach and timing of compliance assessments;

(3) the retention of compliance assessments;

(4) the method of reporting of potential non-compliances and corrective actions taken;

(5) the table of contents of Compliance Assessment Reports; and

(6) public availability of Compliance Assessment Reports.

3-3 After receiving notice in writing from the CEO that the Compliance Assessment Plan satisfies the requirements of condition 3-2 the proponent shall assess compliance with conditions in accordance with the Compliance Assessment Plan required by condition 3-1.

3-4 The proponent shall retain reports of all compliance assessments described in the Compliance Assessment Plan required by condition 3-1 and shall make those reports available when requested by the CEO.

3-5 The proponent shall advise the CEO of any potential non-compliance within seven (7) days of that non-compliance being known.

3-6 The proponent shall submit to the CEO Compliance Assessment Reports addressing compliance in the previous calendar year. Compliance Assessment Reports shall be submitted by the submission date defined in the Compliance Assessment Plan required by condition 3-2, or as otherwise agreed in writing by the CEO.

The Compliance Assessment Report shall:

(1) be endorsed by the proponent's CEO or a person delegated to sign on the CEO's behalf;

(2) include a statement as to whether the proponent has complied with the conditions;

(3) identify all potential non-compliances and describe corrective and preventative actions taken;

(4) be made publicly available in accordance with the approved Compliance Assessment Plan; and

(5) indicate any proposed changes to the Compliance Assessment Plan required by condition 3-1.

4 Public Availability of Plans and Reports

4-1 Subject to condition 4-2, within a reasonable time period approved by the CEO of the issue of this Statement and for the remainder of the life of the proposal the proponent shall make publicly available, in a manner approved in writing by the CEO, all environmental plans and reports required under this Statement.

4-2 If any parts of the plans and reports referred to in condition 4-1 contains particulars of:

(1) a secret formula or process; or

(2) confidential commercially sensitive information;

the proponent may submit a request for approval from the CEO to not make those parts of the plans and reports publicly available. In making such a request the proponent shall provide the CEO with an explanation and reasons why the data should not be made publicly available.

5 Baseline surveys - Groundwater and surface water dependent vegetation and permanent pools

5-1 Within six months of the issue of this Statement, or as otherwise agreed in writing by the CEO, the proponent shall prepare and submit a Baseline Survey Plan to the satisfaction of the CEO.

5-2 The Baseline Survey Plan shall:

(1) identify areas where further surveys are required to meet the requirements of conditions 10-1, noting that information collected during pre-mining surveys should be identified and used in wherever available;

(2) detail the proposed methodology for further baseline surveys and monitoring;

(3) detail the proposed criteria for identification of analogue sites to inform monitoring and management of groundwater levels in permanent pools, with particular regard to Weelumurra Creek pools; and

(4) detail the proposed frequency and timing of the proposed surveys and monitoring.

5-3 After receiving notice in writing from the CEO that the Baseline Survey Plan satisfies the requirements of condition 10-1, the proponent shall undertake additional baseline surveys and confirm the suitability of proposed analogue sites in accordance with the baseline survey review and plan.

5-4 On completion of the baseline surveys and monitoring the proponent shall report to the CEO on the following:

(1) completion of the baseline surveys and monitoring in accordance with the plan;

(2) the results of the baseline surveys and monitoring;

(3) the location of suitable analogue sites for monitoring and management of groundwater levels in permanent pools; and

(4) a consolidated document detailing the pre-mining baseline condition of groundwater levels and vegetation health, and analogue sites suitable to inform monitoring required to demonstrate that conditions 10-1 will be met.

6 Inland waters environmental quality – lignite studies

6-1 Within 12 months of the issue of this Statement, or as otherwise agreed in writing by the CEO, the proponent shall prepare and submit a Lignite Study Plan and a Hydraulic Barrier Study Plan to the CEO to demonstrate that condition 11-1 can be met.

6-2 The Lignite Study Plan shall:

(1) provide a clear description of the extent and nature of the lignite body identified in the Western end of the Queens area;

(2) describe the methodology and timing of proposed investigations designed to select and justify appropriate vertical and horizontal buffer distances between the lignite body and the mining surface;

(3) describe the methodology and timing of proposed investigations to identify and quantify contaminants that will be generated should the lignite oxidise in the Queens area. Investigations should define the chemical and physical processes relevant to the transport and interaction of identified contaminants within the subsurface and surface-water environments; and

(4) describe the methodology and timing of proposed investigations to determine the net acid producing potential of lignite in the Queens area.

6-3 The Hydraulic Barrier Study Plan shall:

(1) identify the process for selection of the proposed material to be used in construction of the hydraulic barrier including testing to confirm that no reaction to lignitic material would occur;

(2) describe the methodology and timing of investigations to determine the likely performance of the hydraulic barrier in the event of lignite oxidation, and consequent contaminant production (acid, sulphate metals and metalloids), including contaminant migration pathways and travel times; and

(3) describe the methodology and timing of investigations to confirm that the proposed construction method for the hydraulic barrier would not result in oxidisation of lignitic material intersected by the barrier.

6-4 After receiving notice that the Lignite Study Plan and the Hydraulic Barrier Study Plan satisfy the requirements of conditions 6-2 and 6-3, the proponent shall undertake the studies in accordance with the plan.

6-5 Within three months of completion of the background studies described conditions 6-2 and 6-3, the proponent shall report to the CEO on the results of the background studies.

7 Management-based Condition Environmental Management Plans

7-1 The proponent shall prepare and submit Condition Environmental Management Plans:

(1) within 12 months of issue of this Statement or as otherwise agreed in writing by the CEO, to demonstrate that the environmental objectives in conditions 8-1, 9-1, 12-1 and 14-1 will be met; and

(2) within 24 months of the issue of this Statement or as otherwise agreed in writing by the CEO, to demonstrate that the environmental objectives in conditions 10-1, 11-1, 17-1 and 18-1 will be met.

7-2 The Condition Environmental Management Plans shall:

(1) specify the environmental objectives to be achieved, as specified in conditions 8-1, 9-1, 10-1, 11-1, 12-1, 14-1, 17-1 and 18-1;

(2) specify risk-based management actions that will be implemented to demonstrate compliance with the environmental objectives specified in conditions 8-1, 9-1, 10-1, 11-1, 12-1, 14-1, 17-1 and 18-1. Failure to implement one or more of the management actions represents non-compliance with these conditions;

(3) specify measurable management target(s) to determine the effectiveness of the risk-based management actions;

(4) specify monitoring and analysis to measure the effectiveness of management actions against management targets, including but not limited to, parameters to be measured, baseline data, monitoring locations, and frequency and timing of monitoring;

(5) specify a process for revision of management actions and changes to proposed activities that could be undertaken, in the event that the management targets are not achieved;

(6) provide the format and timing to demonstrate that conditions 8-1, 9-1, 10-1, 11-1 12-1, 14-1, 17-1 and 18-1 have been met for the reporting period in the Compliance Assessment Report required by condition 3-1 including, but not limited to:

(a) verification of the implementation of management actions; and

(b) reporting on the effectiveness of management actions against management target(s).

7-3 After receiving notice in writing from the CEO that the Condition Environmental Management Plan(s) satisfies the requirements of condition 7-2 for conditions 8-1, 9-1, 10-1, 11-1 12-1, 14-1, 17-1 and 18-1, the proponent shall:

(1) implement the provisions of the Condition Environmental Management Plan(s); and

(2) continue to implement the Condition Environmental Management Plan(s) until the CEO has confirmed by notice in writing that the proponent has demonstrated the objectives specified in conditions 8-1, 9-1, 10-1, 11-1, 12-1, 14-1, 17-1 and 18-1 have been met.

7-4 In the event that monitoring, tests, surveys or investigations indicate exceedance of management target(s) specified in the Condition Environmental Management Plan(s), the proponent shall:

(1) report the exceedance in writing to the CEO within 21 days of the exceedance being identified;

(2) investigate to determine the cause of the management targets being exceeded;

(3) provide a report to the CEO within 90 days of the exceedance being reported as required by condition 7-4(1). The report shall include:

(a) cause of management targets being exceeded;

(b) the findings of the investigation required by conditions 7-4(2);

(c) details of revised and/or additional management actions to be implemented to prevent exceedance of the management target(s);

(d) relevant changes to proposal activities.

7-5 In the event that one or more of the management actions specified in the Condition Environmental Management Plan have not been implemented, the proponent shall:

(1) report the failure to implement management action/s in writing to the CEO within 7 days of identification;

(2) investigate to determine the cause of the management action(s) not being implemented;

(3) investigate to provide information for the CEO to determine potential environmental harm or alteration of the environment that occurred due to the failure to implement management actions;

(4) provide a report to the CEO within 21 days of the reporting required by condition 7-5(1). The report shall include:

(a) cause for failure to implement management actions;

(b) the findings of the investigation required by conditions 7-5(2) and 7-5(3);

(c) relevant changes to proposal activities; and

(d) measures to prevent, control or abate the environmental harm which may have occurred.

7-6 The proponent:

(1) may review and revise the Condition Environmental Management Plan(s); or

(2) shall review and revise the Condition Environmental Management Plan(s) as and when directed by the CEO.

7-7 The proponent shall implement the latest revision of the Condition Environmental Management Plan(s), which the CEO has confirmed by notice in writing, satisfies the requirements of condition 7-2.

Mine and Borefield

8 Flora and Vegetation – conservation significant flora species and vegetation

8-1 The proponent shall manage the implementation of the proposal to meet the following environmental objectives:

(1) maintain the health of populations of *Gompholobium karijini* within the Mine Development Envelope, and the Lower Fortescue Borefield development envelope that are not authorised to be cleared;

(2) minimise impacts to regionally and locally significant flora species and ecological communities within the Mine Development Envelope and the Lower Fortescue Borefield development envelope not authorised to be cleared under Schedule 1, including but not limited to the Brockman Iron Cracking Clay (PEC);

(3) minimise the impacts to *Triodia basitricha* to maintain the species conservation status; and

(4) maintain the health of the Threatened Ecological Community (TEC) Themeda Grassland within the Mine Development Envelope;

8-2 The proponent shall consult with the Department of Biodiversity, Conservation and Attractions in the preparation of the plan/s required by condition 7-1 that satisfies the objectives required by condition 8-1.

8-3 The plan/s required by condition 7-1 shall include provisions required by condition 7-2 to address impacts to conservation significant flora and vegetation health including but not limited to: changes to groundwater levels and groundwater quality; changes to surface flows; dust and weeds.

9 Flora and Vegetation – weeds

9-1 The proponent shall manage the implementation of the proposal to meet the following environmental objective:

(1) prevent any increase in the diversity of weed species or the abundance of weeds attributable to the proposal.

9-2 The proponent shall prepare a plan required by condition 7-1 that satisfies the requirements of condition 7-2, to meet the outcome required by condition 9-1.

9-3 The proponent shall continue to implement the version most recently approved by the CEO of the *Weed Management Plan 45-PL-EN-0013* until the CEO has confirmed by notice in writing that the plan required by condition 7-1 satisfies the requirements of condition 7-2 to meet the objective required by condition 9-1.

10 Flora and vegetation – Groundwater and surface water dependent vegetation and water levels

10-1 The proponent shall manage the proposal to meet the following environmental objectives:

(1) maintain the health of Groundwater Dependent Ecosystems, Potentially Groundwater Dependent Ecosystems, and other riparian vegetation associated with Weelumurra Creek, as shown in Figure 3 of Schedule 1 and defined by the geographical coordinates in Schedule 2, consistent with baseline surveys conducted in accordance with condition 5-3: and

(2) maintain the health of vegetation described as 'potentially groundwater dependent' within the drawdown cone of the Lower Fortescue Borefield as shown in Figure 4 of Schedule 1 and defined by the geographical coordinates in Schedule 2, consistent with baseline surveys conducted in accordance with condition 5-3;

(3) maintain water levels in permanent pools in Kangeenarina Creek, which are not authorised to be removed by Schedule 1, consistent with pre-mining surveys;

(4) maintain the health of riparian vegetation associated with permanent pools and semi-permanent pools in Kangeenarina Creek that are not authorised to be removed by Schedule 1 consistent with pre-mining surveys;

(5) maintain water levels in permanent and semi-permanent pools associated with Weelumurra Creek at a level that approximates natural seasonal variability as determined using baseline data and analogue sites selected and described in accordance with condition 5-3; and

(6) minimise impacts to the health of vegetation associated with Zalamea Creek south of the existing rail line, which is not authorised to be cleared by Schedule 1, consistent with baseline surveys undertaken in accordance with condition 5-3 to maintain habitat values of the vegetation.

10-2 The plan required by condition 7-1 shall include provisions required by condition 7-2 which are informed by baseline data collected prior to mining or in accordance with condition 5-3, and which address changes to groundwater levels, changes to surface water flows, and vegetation health for the areas of vegetation defined in condition 10-1.

10-3 The proponent shall prepare a plan required by condition 7-1 that satisfies the requirements of condition 7-2 to meet the outcomes of condition 10-1.

10-4 The proponent shall continue to implement the *Kangeenarina Pools Supplementation Plan – Northern Pools Addendum 600SO-00018-RP-HY-0003* until notified by the CEO that the plan meets the requirements of conditions 10-1(3), and 10-1(4).

11 Inland waters environmental quality – prevent impacts to groundwater from exposure or interaction with Lignite

11-1 The proponent shall manage the implementation of the proposal to meet the following environmental objectives:

(1) prevent contamination of groundwater as a result of oxidation of lignite or mobilisation of metals and metalloids from areas of lignite identified in the Queen\s mine area as shown in Figure 5 of Schedule 1 and delineated in the coordinates in Schedule 2.

(2) prevent subsequent contamination of surface water as a result of groundwater discharge contaminated by the oxidation of lignite or

mobilisation of metals and metalloids from areas of lignite in the Queens mine area as shown in Figure 5 of Schedule 1 and delineated in the coordinates in Schedule 2.

11-2 The proponent shall prepare the plan/s required by condition 7-1 that satisfies the requirements of condition 7-2, to meet the outcomes required by condition 11-1.

11-3 The plan required by condition 7-1 shall:

(1) be informed by the investigations required by condition 6-2;

(2) include details of management actions required to maintain an appropriate buffer distance from the lignite as determined in studies required by condition 6-2(2);

(3) provide details of how groundwater would be managed during operations and prior to any decommissioning or fracturing of the hydraulic barrier in the event that contamination of groundwater occurs.

11-4 The proponent shall ensure that the extent of dewatering in the Queens area does not approach within 10m horizontally or vertically of the lignite body shown in Figure 5 of Schedule 1 and described by the coordinates in Schedule 2 prior to approval in writing by the CEO of a management plan required by condition 7-1 that meets the outcomes required by condition 11-1.

12 Terrestrial Fauna – conservation significant fauna

12-1 The proponent shall manage the implementation of the proposal to meet the following environmental objective:

(1) minimise direct and indirect impacts on conservation significant fauna species and their habitat, including, but not limited to the Pilbara Olive Python, Northern Quoll, and Pilbara Leaf-nosed Bat.

12-2 The plans required by condition 7-1 shall include provisions required by condition 7-2 to manage impacts on conservation significant fauna including from, but not limited to, loss of habitat, changes to surface water flows, vehicle strike, noise and light.

12-3 The proponent shall continue to implement the version most recently approved by the CEO of the *Conservation Significant Fauna Management Plan 100-PL-EN-0022* until the CEO in consultation with the Department of Biodiversity, Conservation and Attractions has confirmed by notice in writing that the plan required by condition 7-1 satisfies the requirements of condition 7-2 to meet the objective required by condition 12-1.

13 Hydrological Processes – groundwater drawdown within Karijini National Park

13-1 Within 12 months of issue of this Statement, the proponent shall prepare and submit a Condition Environmental Management Plan to meet the following outcome:

(1) ensure that there is no drawdown of groundwater associated with the proposal at the boundary of, or within, Karijini National Park.

13-2 The Condition Environmental Management Plan shall:

(1) specify trigger criteria that must provide an early warning that the threshold criteria identified in condition 13-2 may not be met;

(2) specify threshold criteria to demonstrate compliance with the environmental outcomes specified in condition 13-1. Exceedance of the threshold criteria represents non-compliance with these conditions;

(3) specify monitoring to determine if trigger criteria and threshold criteria are exceeded;

(4) specify trigger level actions to be implemented in the event that trigger criteria have been exceeded;

(5) specify threshold contingency actions to be implemented in the event that threshold criteria are exceeded; and

(6) provide the format and timing for the reporting of monitoring results against trigger criteria and threshold criteria to demonstrate that condition 13-1 has been met over the reporting period in the Compliance Assessment Report required by condition 3-1.

13-3 After receiving notice in writing from the CEO in consultation with the Department of Biodiversity, Conservation and Attractions that the Condition Environmental Management Plan satisfies the requirements of condition 13-2 the proponent shall:

(1) implement the provisions of the Condition Environmental Management Plan; and

(2) continue to implement the Condition Environmental Management Plan until the CEO has confirmed by notice in writing that the proponent has demonstrated the outcomes specified in conditions 13-1 have been met.

13-4 In the event that monitoring indicates exceedance of threshold criteria specified in the Condition Environmental Management Plans, the proponent shall:

(1) report the exceedance in writing to the CEO within 7 days of the exceedance being identified;

(2) implement the threshold contingency actions specified in the Condition Environmental Management Plans within 24 hours and continue implementation of those actions until the CEO has confirmed by notice in writing that it has been demonstrated that the threshold criteria are being met and the implementation of the threshold contingency actions is no longer required;

(3) investigate to determine the cause of the threshold criteria being exceeded;

(4) investigate to provide information for the CEO to determine potential environmental harm or alteration of the environment that occurred due to threshold criteria being exceeded; and

(5) provide a report to the CEO within 21 days of the exceedance being reported as required by condition 13-4(1). The report shall include:

   (a) details of threshold contingency actions implemented;

   (b) the effectiveness of the threshold contingency actions implemented, against the threshold criteria;

   (c) the findings of the investigations required by condition 13-4(3) and 13-4(4);

   (d) measures to prevent the threshold criteria being exceeded in the future;

   (e) measures to prevent, control or abate the environmental harm which may have occurred; and

   (f) justification of the threshold remaining, or being adjusted based on better understanding, demonstrating that outcomes will continue to be met.

13-5 The proponent:

(1) may review and revise the Condition Environmental Management Plans, or

(2) shall review and revise the Condition Environmental Management Plans as and when directed by the CEO.

13-6 The proponent shall implement the latest revision of the Condition Environmental Management Plans, which the CEO has confirmed by notice in writing, satisfies the requirements of condition 13-2.

14 Subterranean Fauna

14-1 The proponent shall manage the implementation of the proposal to meet the following environmental objectives:

(1) maintain the biodiversity and ecological integrity of troglofauna which have been identified through baseline surveys to have potentially restricted distributions or potentially restricted habitat; and

(2) manage groundwater drawdown at the Southern Borefield and Lower Fortescue Borefield to minimise impacts to stygofauna species, including each of the thirteen stygofauna species which have been identified through baseline surveys to have potentially restricted distributions or potentially restricted habitat.

14-2 The proponent shall prepare a Subterranean Fauna Management Plan required by condition 7-1 that satisfies the requirements of condition 7-2, to meet the objectives required by condition 14-1.

14-3 The plan required by condition 7-1 shall include provisions required by condition 7-2 to address the following in relation to excavation and dewatering both within and outside the development envelopes for the proposal:

(1) a detailed targeted sampling plan and habitat investigations to demonstrate that troglofauna species are not restricted to the mine development envelope;

(2) a detailed stygofauna sampling plan to validate predictions that stygofauna will persist in groundwater within areas of drawdown associated with the Southern Borefield and the Lower Fortescue Borefield; and

(3) details of management actions, including exclusions zones and changes to groundwater abstraction regimes, to be implemented in the event that targeted sampling and investigations indicate that the objectives required by condition 14-1 may not be met.

14-4 The proponent shall continue to implement the version of the plan most recently approved by the CEO until the CEO has confirmed by notice in writing that the plan required by condition 7-1 satisfies the requirements of condition 7-2 to meet the objectives required by condition 7-1.

15 Rehabilitation and Closure – Rehabilitation and decommissioning of the mine and borefield

15-1 The proponent shall manage the implementation of the proposal to meet the following environmental objective:

(1) ensure that the proposal is rehabilitated and decommissioned in an ecologically sustainable manner.

15-2 Within six months of the issue of this Statement, or as otherwise agreed in writing by the CEO, the proponent shall prepare and submit a Mine Closure

Plan addressing the cumulative revised proposal in accordance with the *Guidelines for Preparing Mine Closure Plans,* May 2015 (or any subsequent revisions of the guidelines), on advice of the Department of Mines, Industry Regulation and Safety; and the Department of Biodiversity, Conservation and Attractions.

15-3 The proponent shall continue to implement the version of the *Solomon Project Mine Closure Plan (SO-PL-EN-002)* most recently approved by the CEO in writing until the CEO has confirmed by notice in writing that that the Mine Closure Plan satisfies the requirements of condition 15-2 to meet the objective required by 15-1.

15-4 The plan shall include completion criterion for each domain of the mine to enable the proponent to demonstrate that closure objectives will be met, including, but not limited to, backfilling of pits to preclude the formation of mine pit lakes, prevention of impacts to groundwater quality adjacent to Weelumurra Creek, reinstatement of groundwater flows to Weelumurra Creek, reinstatement of groundwater flows to permanent pools in Kangeenarina Creek, and maintenance of vegetation in Zalamea Creek south of the existing rail line.

15-5 The plan shall include a schedule of progressive rehabilitation for all areas of clearing within the mine development envelope.

15-6 The plan shall include a monitoring framework for the monitoring of groundwater levels and groundwater quality to enable the proponent to demonstrate that groundwater associated with Weelumurra Creek and permanent pools in Kangeenarina Creek meets the following objectives:

(1) groundwater flows have returned to a level which supports water levels in the permanent pools consistent with pre-mining conditions;

(2) groundwater flows are self-supporting; and

(3) groundwater quality is consistent with pre-mining groundwater quality as determined by baseline surveys conducted in accordance with condition 5-3.

15-7 The plan shall include a performance report for the period since the last revision of the plan, including, but not limited to:

(1) a gap analysis and risk assessment to determine what further information is required in relation to rehabilitation and decommissioning of each domain or feature;

(2) progress towards meeting information gaps, including results of research activities and rehabilitation trials;

(3) identification of actual progressive rehabilitation against the schedule of progressive rehabilitation required in condition 15-5; and

(4) progress against completion criteria.

15-8 Three years prior to the closure of the Solomon Iron Ore Mine, the proponent shall prepare and submit a Final Mine Closure Plan addressing the cumulative revised proposal in accordance with the *Guidelines for Preparing Mine Closure Plans,* May 2015 (or any subsequent revisions of the guidelines), and addressing the requirements of conditions 15-1, 15-4, 15-6 and 15-7 to the satisfaction of the CEO on advice of the Department of Mines, Industry Regulation and Safety; and the Department of Biodiversity, Conservation and Attractions.

16 Offsets – Mine and Borefield

16-1 In view of the significant residual impacts and risks as a result of implementation of the proposal, including the clearing of 'Good to Excellent' condition native vegetation, the Priority Ecological Community 'Brockman Iron cracking clay communities of the Hamersley Range', and riparian vegetation, the proponent shall contribute funds calculated pursuant to condition 16-2. This funding shall be provided to a government-established conservation offset fund or an alternative offset arrangement providing an equivalent outcome as determined by the Minister.

16-2 The proponent's contribution to the fund identified in condition 16-1 shall be paid biennially, the first payment due on 31 May in the second year following the issue of this Statement. The amount of funding will be made on the following basis and in accordance with the approved Impact Reconciliation Procedure required by condition 16-4:

(1) $750 AUD (excluding GST) per hectare of 'Good to Excellent' condition native vegetation cleared within the Mine Development Envelope or Lower Fortescue Borefield Development Envelope (Development envelopes are delineated in Figure 1 and defined by the geographic coordinates in Schedule 2) within the Hamersley IBRA subregion; or

(2) $1500 AUD (excluding GST) per hectare of 'Good to Excellent' condition native vegetation cleared within the Mine Development Envelope or Lower Fortescue Borefield Development Envelope (Development envelopes are delineated in Figure 1 and defined by the geographic coordinates in Schedule 2) within the Fortescue IBRA subregion; or

(3) $1500 AUD (excluding GST) per hectare of riparian vegetation (as defined in Table 3 of Schedule 1) or Priority Ecological Community "Brockman Iron Cracking clays' cleared within the Mine Development Envelope or Lower Fortescue Borefield Development Envelope (Development envelopes are delineated in Figure 1 and defined by the geographic coordinates in Schedule 2) within the Hamersley IBRA subregion; or

(4) $3000 AUD (excluding GST) per hectare of riparian vegetation or Priority Ecological Community "Brockman Iron Cracking clays' cleared within the Mine Development Envelope or Lower Fortescue Borefield Development Envelope (Development envelopes are delineated in Figure 1 and defined by the geographic coordinates in Schedule 2) within the Fortescue IBRA subregion.

16-3 The 4416 ha of clearing in the mine development envelope approved under Ministerial Statement 862 is exempt from the requirement to offset under condition 16-2.

16-4 Within 12 months of the date of this Statement, the proponent shall prepare an Impact Reconciliation Procedure to the satisfaction of the CEO.

16-5 The Impact Reconciliation Procedure required pursuant to condition 16-4 shall:

(1) include a methodology to identify clearing of 'Good to Excellent' condition native vegetation in the Hamersley and Fortescue IBRA subregions; Priority Ecological Community "Brockman Iron Cracking clays' and riparian vegetation;

(2) require the proponent to submit spatial data identifying areas of each environmental value that has been cleared;

(3) include a methodology for calculating the amount of clearing undertaken during each biennial time period; and

(4) state that the biennial time period commences on 1 March prior the date of this Statement, and that the due date for submitting the results of the Procedure for approval of the CEO is 31 March following the end of each biennial time period.

16-6 The real value of contributions described in condition 16-2 will be maintained through indexation to the Perth Consumer Price Index (CPI), with the first adjustment to be applied to the first contribution.

16-7 Should the proponent be required to provide an offset under a condition of approval of the Australian Government under the *Environment Protection and*

Biodiversity Conservation Act 1999, the proponent may write to the CEO seeking a reduction in the funding required under condition 16-2, provided that the total offset amount provided for any given hectare of clearing does not fall below that specified in condition 16-2.

Hamersley Rail Line

17 Flora and vegetation and Hydrological Processes – Flora and vegetation including Mulga within and downstream of the Rail Development Envelope.

17-1 The proponent shall manage the implementation of the proposal to meet the following environmental objectives;

(1) maintain the health of populations of regionally and locally significant flora species and ecological communities not authorised to be cleared in Schedule 1; including but not limited to *Gompholobium karijini,* within the rail development envelope; and

(2) Maintain the health of Mulga and other significant vegetation downstream of the rail line consistent with pre-development surveys.

17-2 The proponent shall prepare a plan required by condition 7-1 that satisfies the requirements of condition 7-2, to meet the objective required by condition 17-1.

17-3 The proponent shall continue to implement the version most recently approved by the CEO of the *Solomon Rail Project Mulga Management Plan (SO-PL-EN-0011)* until the CEO has confirmed by notice in writing that the plan/s required by condition 7-1 satisfies the requirements of condition 7-2 to meet the objective required by condition 17-1(2).

18 Rehabilitation and Decommissioning - Rail

18-1 The proponent shall manage the implementation of the proposal to meet the following environmental objective:

(1) ensure that the rail line within the rail development envelope is decommissioned and rehabilitated consistent with the requirements of the *Railway and Port (The Pilbara Infrastructure Pty Ltd) Agreement Act 2004.*

18-2 The proponent shall prepare a plan required by condition 7-1 that satisfies the requirements of condition 7-2, to meet the objective required by condition 18-1.

19 Offsets - Rail

19-1 In view of the significant residual impacts and risks as a result of implementation of the proposal, including the clearing of 'Good to Excellent' condition native vegetation, the proponent shall contribute funds calculated pursuant to condition 16-2. This funding shall be provided to a government-established conservation offset fund or an alternative offset arrangement providing an equivalent outcome as determined by the Minister.

19-2 The proponent's contribution to the fund identified in condition 16-1 shall be paid biennially, the first payment due on 31 May in the second year following the issue of this Statement. The amount of funding will be made on the following basis and in accordance with the approved Impact Reconciliation Procedure required by condition 16-4:

(1) $750 AUD (excluding GST) per hectare of 'Good to Excellent' condition native vegetation cleared within the Rail Corridor Development Envelope (Development envelopes are delineated in Figure 1 and defined by the geographic coordinates in Schedule 2) within the Chichester or Hamersley IBRA subregions; or

(2) $1500 AUD (excluding GST) per hectare of 'Good to Excellent' condition native vegetation cleared within the Rail Corridor Development Envelope (Development envelopes are delineated in Figure 1 and defined by the geographic coordinates in Schedule 2) within the Fortescue IBRA subregion.

19-3 The 1897 ha of clearing in the rail corridor envelope approved under Ministerial Statement 862 is exempt from the requirement to offset under condition 19-2.

19-4 Within 12 months of the date of this Statement, the proponent shall prepare an Impact Reconciliation Procedure to the satisfaction of the CEO.

19-5 The Impact Reconciliation Procedure required pursuant to condition 19-4 shall:

(1) include a methodology to identify clearing of 'Good to Excellent' condition native vegetation in the Chichester, Hamersley and Fortescue IBRA subregions;

(2) require the proponent to submit spatial data identifying areas of 'Good to Excellent' native vegetation that has been cleared;

(3) include a methodology for calculating the amount of clearing undertaken during each biennial time period;

(4) include a methodology for calculating the amount of temporary vegetation clearing for the railway line and related infrastructure that has commenced rehabilitation within twelve months of clearing;

(5) state that the biennial time period commences on 1 March prior the date of this Statement, and that the due date for submitting the results of the Procedure for approval of the CEO is 31 March following the end of each biennial time period.

(6) identify that any areas cleared within the Rail Development Envelope (Development envelopes are delineated in Figure 1 and defined by the geographic coordinates in Schedule 2) in the Pilbara bioregion that have not commenced rehabilitation within 12 months of clearing are to be considered part of the "railway line and related infrastructure" and must be included in the area subject to condition 19-2.

19-6 The real value of contributions described in condition 19-2 will be maintained through indexation to the Perth CPI, with the first adjustment to be applied to the first contribution.

19-7 Should the proponent be required to provide an offset under a condition of approval of the Australian Government under the *Environment Protection and Conservation Biodiversity Act 1999,* the proponent may write to the CEO seeking a reduction in the funding required under condition 19-2, provided that the total offset amount provided for any given hectare of clearing does not fall below that specified in condition 19-2.

[Signed on 2 October 2017]

Hon Stephen Dawson MLC
MINISTER FOR ENVIRONMENT

Schedule 1

Table 1: Summary of the Proposal

Proposal Title	Solomon Iron Ore Project
Short Description	Develop and operate the Solomon Iron Ore Mine, located approximately 60 kilometres north of Tom Price, including the Southern Borefield and Lower Fortescue Borefield, and operate the existing Hamersley Rail line.

Table 2: Location and authorised extent of physical and operational elements

Column 1	Column 2	Column 3
Element	**Location**	**Authorised Extent**
Mine and associated infrastructure, including the Southern Borefield	Figure 1 and Figure 2	Clearing of no more than 16,131 ha of native vegetation within the 36,602 ha mine development envelope, including no more than 11 ha of direct clearing within the Brockman Iron Cracking Clay PEC.
Hamersley Rail line and associated rail infrastructure, water infrastructure for Lower Fortescue Borefield	Figure 1	Clearing of no more than 2,174 ha of native vegetation within the 29,257 ha combined rail and rail spur corridor development envelopes.
Lower Borefield and Associated Infrastructure	Figure 1	Clearing of no more than 154 ha of native vegetation within the 25,092 ha Lower Borefield development envelope.
Water supply – Lower Fortescue Borefield	Figure 1	Up to 14 Gigalitres per annum (GL/a) from the Lower Fortescue Borefield within the Lower Fortescue Borefield development envelope
Water Supply – Southern Borefield	Figure 2	Up to 12 GL/a from the Southern Borefield within the mine development envelope.
Dewatering		Dewatering for mining to be confined within the Channel Iron Deposit and within the mine development envelope.
Dewater disposal		Processing and operational water supply requirements

Backfilling of mine pits		Pits to be backfilled to an extent that prevents the formation of pit lakes

Table 3: Abbreviations and Definitions

Acronym or Abbreviation	Definition or Term
CEO	The Chief Executive Officer of the Department of the Public Service of the State responsible for the administration of section 48 of the *Environmental Protection Act 1986*, or his delegate.
EPA	Environmental Protection Authority
EP Act	*Environmental Protection Act 1986*
ha	Hectare
Conservation Significant	Species that are listed under the *Environment Protection and Biodiversity Conservation Act 1999* and *Wildlife Conservation Act 1950*, and the Department of Biodiversity, Conservation and Attractions Priority Species that are likely to have their conservation status changed by the proposal.
'Good to Excellent' condition native vegetation	As defined in Technical Guide – Flora and Vegetation Surveys for Environmental Impact Assessment (EPA, 2015) or any subsequent revisions of this guide.
Riparian Vegetation	The distinctive vegetation associated with a wetland or watercourse. [Department of Environment and Conservation – *Native vegetation clearing legislation in Western Australia* (Version 2 April 2010)]. For the purpose of the offset calculation, riparian vegetation is classified as vegetation units within the riparian zone, comprising the eleven vegetation mapping units described in Figure 8 of the Response to Submissions document (FMG, 2016)
Semi-permanent pools	A pool that is present in most years but will dry out during periods of drought when groundwater levels fall below the level of the pool.

Figures

Figure 1 Regional Location and Development Envelopes

Figure 2 Mine Development Envelope including location of Southern Borefield

Figure 3 Groundwater Dependent Vegetation and Potentially groundwater dependent vegetation associated with Weelumurra Creek

Figure 4 Potentially groundwater dependent vegetation associated with the Lower Fortescue Borefield

Figure 5 Extent of Lignite in the Queens area

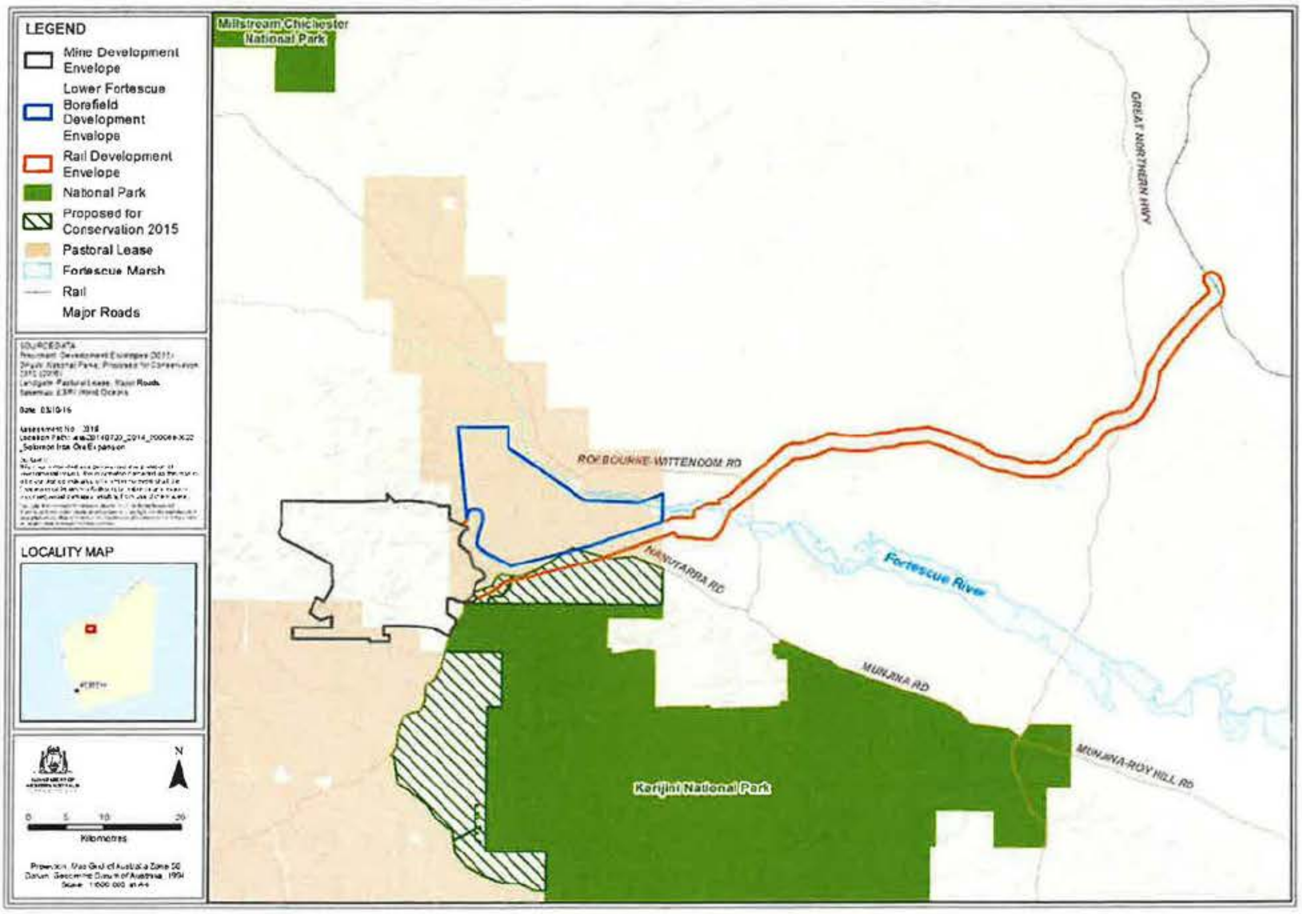

Figure 1 Regional Location and Development Envelopes

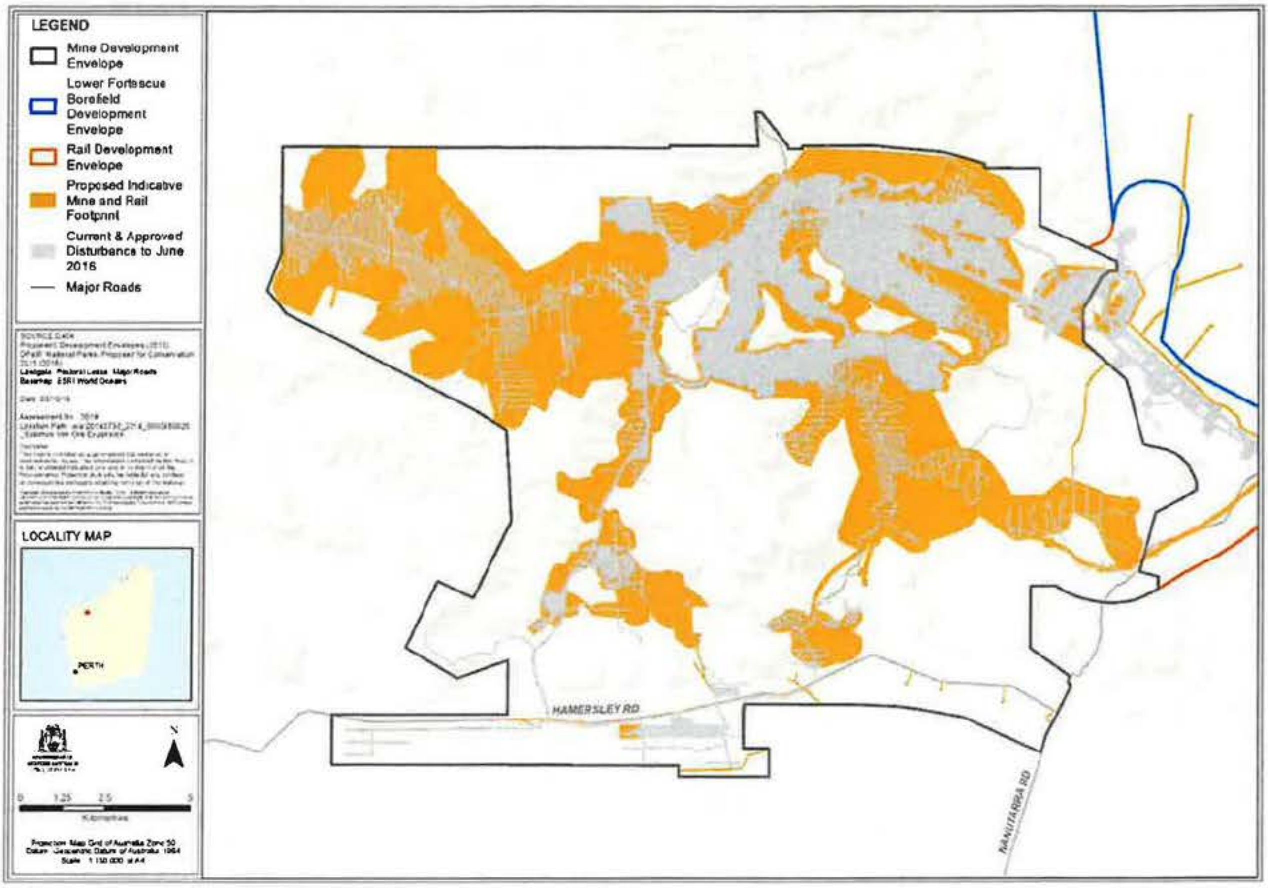

Figure 2 Mine Development Envelope including location of Southern Borefield

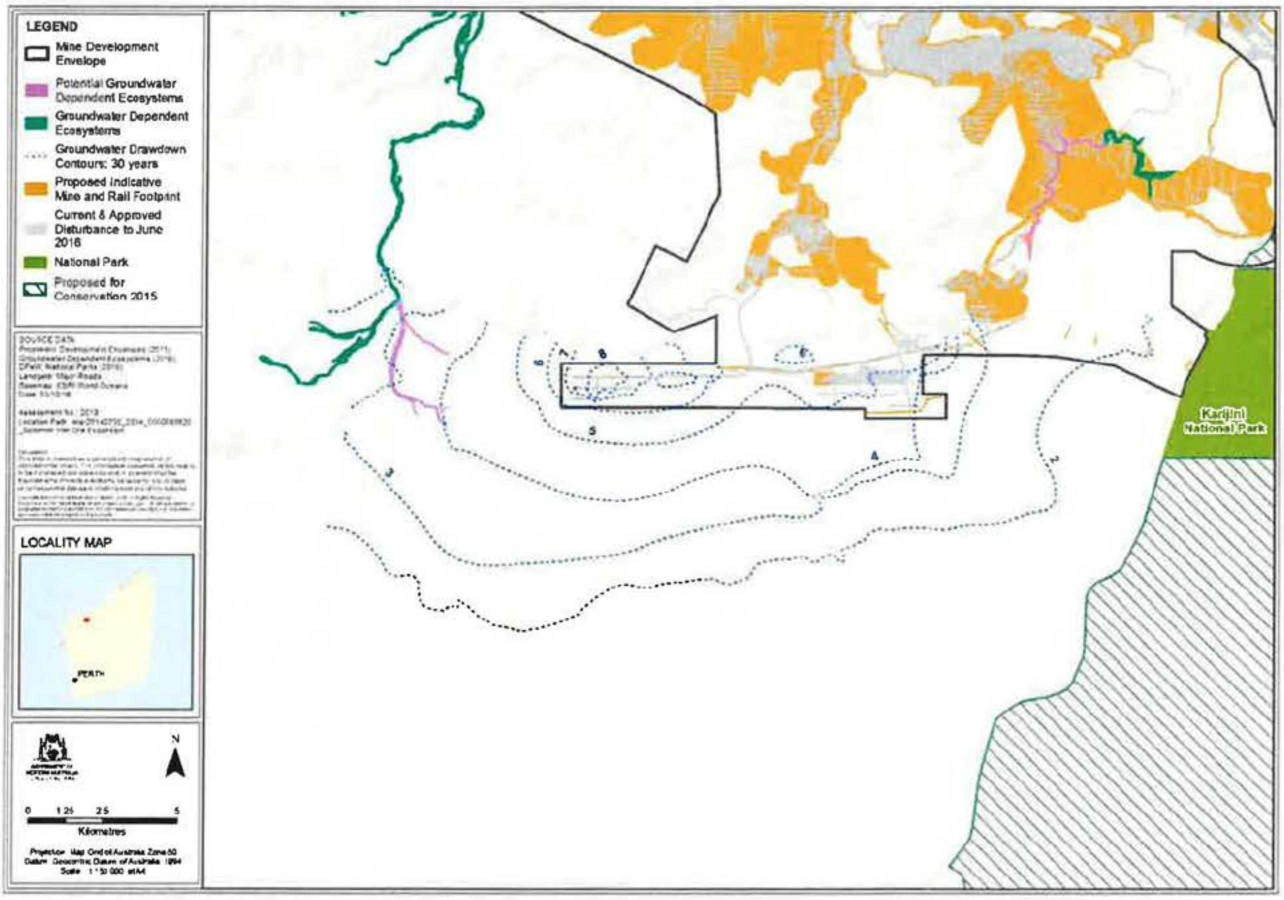

Figure 3 Groundwater Dependent Vegetation and Potentially groundwater dependent vegetation associated with Weelumurra Creek

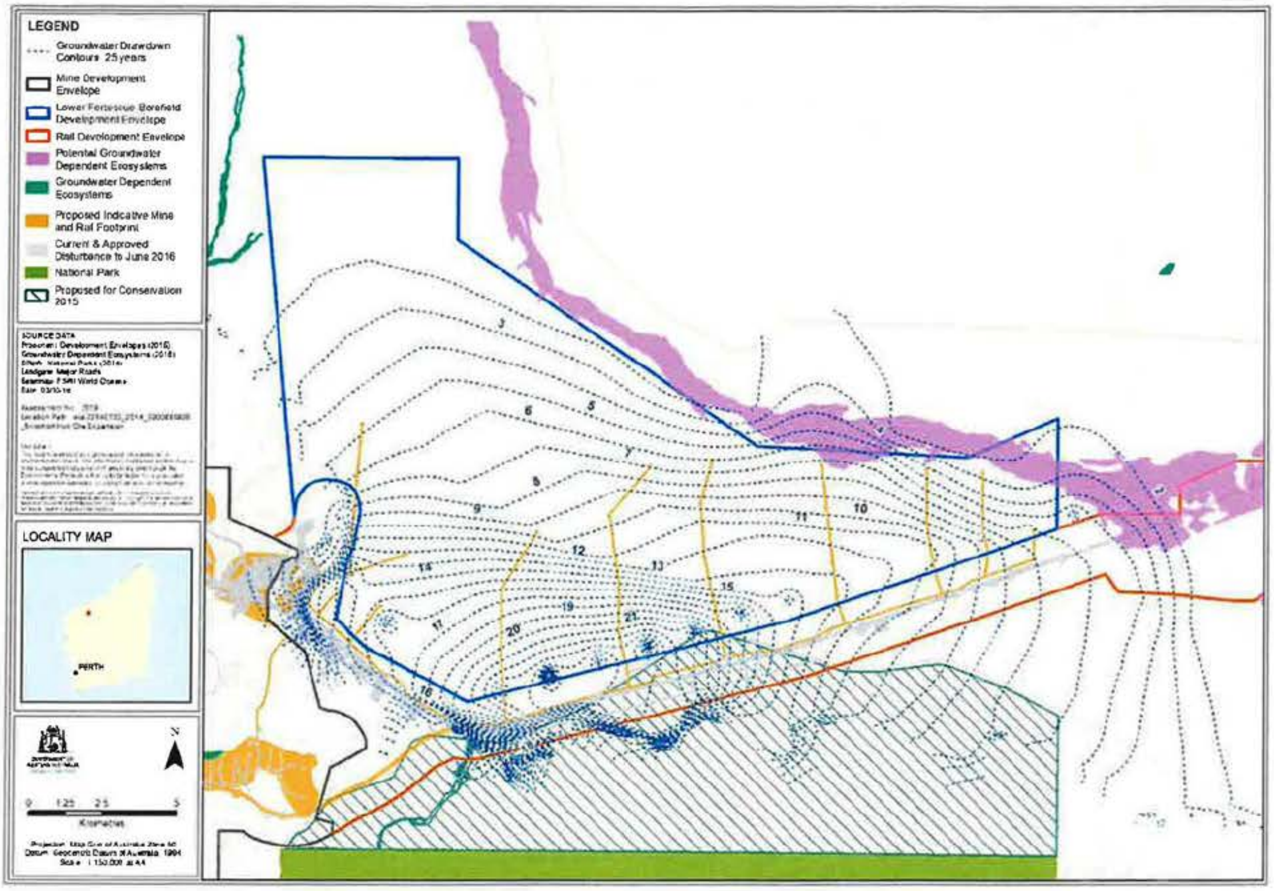

Figure 4 Potentially groundwater dependent vegetation associated with the Lower Fortescue Borefield

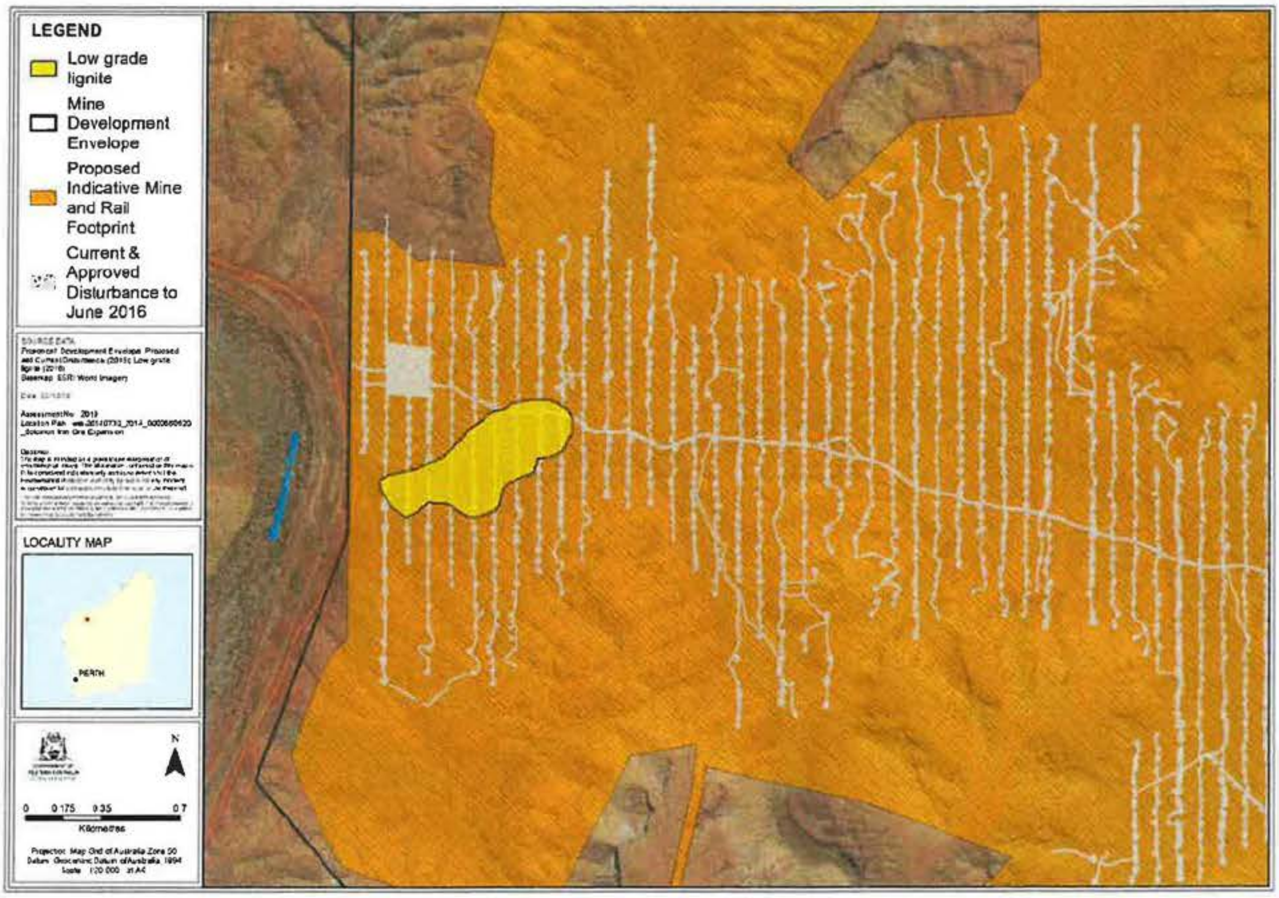

Figure 5 Extent of Lignite identified in the Queens area.

Schedule 2

Geographic Coordinates

Coordinates defining the Solomon Mine Development Envelope are held by the Department of Water and Environmental Regulation, Document Reference Number (2016-1478676856293).

Coordinates defining the Solomon Lower Borefield Development Envelope are held by the Department of Water and Environmental Regulation, Document Reference Number (2016-1478676855627).

Coordinates defining the Solomon Rail Development Envelope are held by the Department of Water and Environmental Regulation, Document Reference Number (2016-1478676857524).

Coordinates defining the extent of Groundwater Dependent Ecosystems and Potential Groundwater Dependent Ecosystems associated with Weelumurra Creek are held by the Department of Water and Environmental Regulation Document Reference Number (2016-1478676854331).

Coordinates defining the extent of Potential Groundwater Dependent Ecosystems associated with the Lower Fortescue Borefield are held by the Department of Water and Environmental Regulation, Document Reference Number (2016-1478676856931).

Coordinates defining the extent of the Lignitic layer in the Queens mine area are held by the Department of Water and Environmental Regulation, Document Reference Number (2016-1478676855160).

"CILO-5"

WAD 37 of 2022

Federal Court of Australia

District Registry: Western Australia

Division: General

YINDJIBARNDI NGURRA ABORIGINAL CORPORATION RNTBC

Applicant

STATE OF WESTERN AUSTRALIA & ORS

Respondents

This is the annexure marked "**CILO-5**" referred to in the affidavit of Christopher Ian Leonard Oppenheim sworn on 4 August 2023.

Signature of witness

Hamish Hamilton Robertson

a legal practitioner who has held a practice certificate for at least 2 years and who holds a current practice certificate.

Fortescue
The New Force in Iron Ore

Plan

Kangeenarina Pools Supplementation Plan

Solomon

21 February 2020

SO-00000-PL-EN-0003: Rev 5

	Kangeenarina Pools Supplementation Plan		
Document_Revision Number	Rev 5		**21/02/2020**
Status	IFU - ISSUED FOR USEIFU - ISSUED FOR USE		
Summary of Changes	Responded to DWER comments		
Author	M. Carroll	Signature	20/02/2020
Checked or Squad Review# (if applicable)	F. Rowland	Signature	21/02/2020
Approved	M. Dowling	Signature	21/02/2020
Access to this document:	PUBLIC USE (ACCESS TO ALL)PUBLIC USE (ACCESS TO ALL)	**Next Review Date (if applicable)**	

Revision History *(to be completed for each version retained by Document Control)*

Author	Checker	Approver	Rev No.	Status	Issued Date
D LaceyD Lacey	I BrunnerI Brunner	I BrunnerI Brunner	1	IFUIFU	10/05/201210/05/2012
A Jackson	B Willis-Jones	B Willis-Jones	2	IFUIFU	20/12/2013
A Jackson	C Oppenheim	B Willis-Jones	2A	IFU	7/05/2014
C Looby	FMG-SQ-100-00762	J Barclay	3	IFU	10/09/2018
F. Rowland		J. Barclay	4	IFU	21/01/2019
F. Rowland		M.Carroll	4A	IFR	10/02/2020

EXECUTIVE SUMMARY

Fortescue Metals Group Ltd (Fortescue) was granted approval under Part IV of the *Environmental Protection Act 1986* (EP Act) to develop the Solomon mine site (the Project), subject to the conditions of Ministerial Statement (MS) 1062.

The purpose of this Plan is to meet the requirements of Condition 10-1 (3) of MS 1062, which states:

> *10-1 (3) "maintain water levels in permanent pools in Kangeenarina Creek, which are not authorised to be removed by Schedule 1, consistent with pre-mining surveys"*

This Plan includes "permanent" pools in Kangeenarina Creek which are outside the mine disturbance envelope (MDE) only.

This Plan also provides adaptive managements measures and monitoring strategies which will guide mitigation measures.

Fortescue proposes to mitigate impacts to the Kangeenarina Pools through supplementation of water in Kangeenarina Creek via two buried slotted pipes that allows direct recharge to the aquifer. In addition to this infiltration supplementation system, water can be supplemented from up to four spigots along reaches of the creek.

PURPOSE: To meet the legal requirements of Condition 10-1(4) of MS 1062

Proponent: Fortescue Metals Group

EPA Factor/s and objectives: Inland water and hydrological process

Proposal: Public Environmental Review: Solomon Iron Ore Project: Sustaining Production (SO-RP-EN-0141): EPA Assessment NO: 2019

Objective: Condition 10-1(3) Maintain water levels in permanent pools in Kangeenarina Creek, which are not authorised to be removed by Schedule 1, consistent with pre-mining surveys

Key Environmental Values:

- Conservation significant fauna and their critical habitats; Groundwater dependent vegetation (GDV); Groundwater dependent systems

Key Impacts and Risks:

- Localised groundwater drawdown; Injection of excess groundwater resulting in groundwater mounding; Potential impacts to groundwater dependent vegetation

Management-based provisions

Management Actions	Management targets	Monitoring	Reporting
Condition 10-1(3) Maintain water levels in permanent pools in Kangeenarina Creek, which are not authorised to be removed by Schedule 1, consistent with pre-mining surveys			

Management Actions

Undertake a baseline survey of permanent pools prior to the first monitoring event to:

- Identify the baseline for permanent pools at impact and reference sites
- Compare permanent pool levels between impact and reference sites.
- Identify the existing groundwater dependent vegetation associated with permanent pools. See *Vegetation Health Management and Monitoring Plan* (100-PL-EN-1020).

The baseline survey should be undertaken in accordance with the Baseline Survey Plan approved under Condition 5-3 of MS 1062.

Timing: Construction

Risk based priority: High

Implement the supplementation strategy which includes:

- Reticulation of groundwater abstracted via two pipelines and up to four spigots
- Use of buried diffuser lines capable of recharging supplemented water directly into the aquifer
- Abstraction and supplementation of around 70 L/s or 2.2 GL/annum through the spigot lines along with a further 80 L/s or 2.5 GL/annum supplemented through the buried diffuser system
- Supplementation of the spigot lines sourced from the dewatering operations at Trinity deposit
- Supply for the buried discharge system from the 17ML Raw Water Storage Facility.

Timing: Construction, Operations, Decommissioning, Closure

Risk based priority: High

Management targets

Trigger Criteria (KMB12S)

Water table elevations decline, due to drawdown impacts, up to 0.5 m below the measured baseline range.

Trigger (KMB12S): 509.5mAHD

Threshold Criteria (KMB12S)

Water table elevations decline, due to drawdown impacts, up to 1.0 m below the measured baseline range

Threshold (KMB12S): 509.0mAHD

Monitoring

Location	Monitoring parameters	Method	Timing/ Frequency
KMB12S	Groundwater level	Field collection/ water level indicator	Weekly
KMB14S	Groundwater level	Field collection/ water level indicator	Weekly
KMB15S	Groundwater level	Field collection/ water level indicator	Weekly
Supplementation Pipeline	Sediment loading Water scour	Visual inspection	Weekly
CG05	Pool level	Manual	Weekly

See the *Vegetation Health Monitoring and Management Plan* (100-PL-EN-1020) for monitoring requirements for surface water and groundwater dependent vegetation.

Location of groundwater and surface water monitoring sites (See Figures).

When monitoring results indicate a potential impact on pool levels or groundwater dependent vegetation health, implement corrective actions and any reporting requirements. Update management actions where required, to inform an adaptive management approach to vegetation management across the business.

Reporting

Annual reporting will be undertaken in accordance with the OEPA's *Post Assessment Guideline for Preparing a Compliance Assessment Report (CAR), Post Assessment Guideline No. 3.*

In the event that management targets were exceeded during the reporting period, the CAR will include a description of the effectiveness of the contingency actions that have been implemented to manage the impact and any adaptive management measures applied as a result of the exceedance.

In the event that monitoring, tests, surveys or investigations indicate an exceedance of a management target has occurred within the reporting period, Fortescue will:

- Where the exceedance is attributable to construction, operation or decommissioning activities, report the exceedance in writing to the OEPA within 21 days of the exceedance being identified
- Investigate to determine the cause of the management targets being exceeded in accordance
- Provide a report to the OEPA within 90 days of the exceedance being reported

In the event that monitoring, tests, surveys or investigations indicate that one or more management actions have not been implemented, Fortescue will:

Implement a monitoring program to determine the effectiveness of the supplementation strategy on pool levels. See *Vegetation Health Management and Monitoring Plan* (100-PL-EN-1020) for monitoring associated with groundwater and surface water dependent vegetation. **Timing:** Construction, Operation, Decommissioning, Closure **Risk based priority:** High			• Report the failure to implement management action(s) in writing to the OEPA within 7 days of identification • Investigate to determine the cause of the management action(s) not being implemented • Investigate to provide information for the OEPA to determine potential environmental harm or alteration of the environment that occurred due to the failure to implement management actions • Provide a report to the OEPA within 21 days of the reporting required by condition 7-5(1) of MS1062
When monitoring results indicate a potential impact on pool levels implement corrective actions and any reporting requirements. See *Vegetation Health Management and Monitoring Plan* (100-PL-EN-1020) for corrective actions for groundwater and surface water dependent vegetation. **Timing:** Construction, Operation, Decommissioning, Closure **Risk based priority:** High			
Update the Plan and Supplementation Program where required, to inform an adaptive management approach to vegetation health and pool supplementation. Where required update the *Vegetation Health Management and Monitoring Plan* (100-PL-EN-1020). **Timing:** Construction, Operation, Decommissioning, Closure **Risk based priority:** High			

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1. INTRODUCTION

Fortescue Metals Group Limited (Fortescue) operates the Solomon Project (the Project), located in the Shire of Ashburton approximately 60 km north of Tom Price in the Pilbara region of Western Australia (Figure 1).

The Solomon mine was originally approved under Part IV of the Environmental Protection Act pursuant to Ministerial Statement (MS) 862 which was then superseded by MS 1062.

The Kangeenarina Pools Supplementation Plan (Plan) was initially prepared in accordance with Condition 11.2 of MS 862.

This Plan has been developed to reflect the requirements of MS 1062 and therefore supersedes the previous versions of this Plan.

1.1 Objectives and Scope

The purpose of this Plan is to meet the requirements of Condition 10-1 (3) of MS 1062, which states:

> *10-1 (3) "maintain water levels in permanent pools in Kangeenarina Creek, which are not authorised to be removed by Schedule 1, consistent with pre-mining surveys"*

10-1 (3) states that water levels are to be maintained in permanent pools which are not authorised to be removed by Schedule 1. The scope of this Plan therefore includes "permanent" pools in Kangeenarina Creek and excludes semi-permanent pools. The scope of the Plan is also restricted to permanent pools which are outside the MDE only (Figure 2).

This Plan includes the requirement to maintain pool water levels within the observed natural range, but not necessarily mimicking seasonal fluctuations and not excluding the temporary, short-term occurrence of comparatively small-scale drawdown in the pool setting, provided the watertable remains within a specified range at specific monitoring sites.

This Plan also provides adaptive management measures and monitoring strategies which will guide mitigation measures. Potential impacts are managed through a supplementation programme, which involves reticulation of groundwater through buried infiltration and/or a series of spigots into the local watercourses, enabling direct recharge to both upstream sections of the creek and the selected pools.

2. KANGEENARINA CREEK POOLS

2.1 Permanent and Semi-Permanent Pools

Schedule 1 of MS 1062 defines semi-permanent pools as "A pool that is present in most years but will dry out during periods of drought when groundwater levels fall below the level if the pool". This Plan does not include semi-permanent pools.

Permanent and semi-permanent pools exist on local reaches of the Kangeenarina Creek (Fortescue, 2010 and MWH, 2010a). Subsequent surveys of the Kangeenarina Creek pools system were undertaken in December 2011. It was interpreted (MWH, 2010a; URS, 2011) that these pools are formed by groundwater discharge from the Kings Deposit CID aquifer, with episodic recharge from cyclonic events expected to be important in sustaining the pools. During extended periods between major rainfall and stream flow recharge events, selected pools and reaches of the Kangeenarina Creek may become dry.

Kangeenarina pools system includes permanent pools; defined as those that do not dry out during periods of drought, and semi-permanent pools. Further baseline assessments are needed to characterise the extents and distribution of these pools and will be conducted as part of the Baseline Survey Plan (SO-PL-EN-0022).

2.2 Hydrology

The Solomon Project Area contributes to the upper watershed formed by the Lower Fortescue River Catchment. The main local surface water drainage systems include the Kangeenarina Creek and Weelumurra Creek, both of which predominantly shed surface water from south to north towards the Fortescue River.

Kangeenarina Creek is the main drainage system through Trinity and the Valley of the Kings. It flows north through the Solomon Project site and then north east for approximately 14 km before discharging into the Lower Fortescue River through an alluvial fan (MWH, 2010).

Kangeenarina Creek essentially is a mobile bed stream with discontinuous pools, some of which appear to be stagnant while others have base flow (Lesleighter, 2012). Monitoring of stream flows in Kangeenarina Creek during Tropical Cyclone Heidi (estimated to result in rainfall event of magnitude close to a 2- year ARI) showed that peak flows occurred with 2 - 3 hours and receded within 6 hours confirming the flashy response of the catchment. Timing of future storm events may not always be consistent with this as it is dependent on rainfall duration, but this data provides an indication of the speed of the catchment response.

Other observations from the 2011/2012 wet season suggest that the catchments have high initial loss rates, in the order of 50 mm after prolonged dry periods. It was also noted that even with a high antecedent moisture condition, catchments still required in the order of 20 mm of rainfall in order to generate stream flow. This is consistent with suggested values for North West soil types presented in Australian Rainfall and Runoff (Pilgrim, 1987).

Pools Distributions

A total of 108 individual pools were surveyed (December 2011), occurring as two parallel north to northeast trending watercourses, with varying degrees of connection between individual pools. The two parallel watercourses form a braided stream setting with separation by intermediate banks in the south and merging aspects to the north. Dewatering activities required by mine plans in neighbouring Kings and Trinity deposits has resulted in a reduction in the spatial extent of the pool system to the south.

The pools now stretch over an approximate 2.5 km reach of the Kangeenarina Creek; with the first visible pool positioned adjacent to Kangeenarina Creek Supplementation line 4. The first kilometre stretch of pools lies within the MDE, and are excluded from management in this Plan. The downstream limit of pools in Kangeenarina Creek has not been defined at this stage and evidence suggests the pools continue for some distance beyond the northern mapped extent.

Pool Water Level Characteristics

The depth of pools surveyed in early 2012 averaged 0.5 m, with a maximum depth of 1.6 m. The pool at sample point CG05 was recorded having a depth 0.61 m; this has since increased to 0.86 m in January 2020. The base of the pool was recorded as 508.55 m AHD.

Surface water levels monitored along the Kangeenarina pools system indicate pool elevations fall from 509.34 to 504.23 m AHD (Pool 78 through to 108). This amounts to 5.11 m difference over 1.5 km, which is a gradient of roughly 0.0034 (dimensionless) and similar to that interpreted from recent contouring of water table elevations (Figure 5). The Kangeenarina pools have an upstream water elevation of approximately 510m AHD.

Seasonal fluctuations of the pools are characterised based on several pool hydrographs (Figures 3). The hydrograph can be divided into three water level stages:

1. A high GWL stage with sharp rises and falls seen in response to surface water flows as the result of rainfall events (December to March).
2. A plateau GWL stage seen in response to negligible rainfall (April to November)
3. A declining GWL stage seen in response to negligible rainfall and high phreatic evaporation (September to December).

The data reflect Pilbara-wide characteristics and trends, with episodic recharge linked to high rainfall events and subsequent gradual decline in the interim before the next significant recharge event. The pool hydrograph suggests that some of the Kangeenarina pools can become dry under baseline conditions during prolonged dry spells as groundwater levels fall and baseflow is reduced, but that they also respond very quickly to localised rainfall runoff and recharge (Figure 3).

2.3 Hydrogeology in Pools Area

Aquifer Systems

There are four main stratigraphic units that are considered relevant to the pools setting. These include:

1. The upper alluvial aquifer representing the water table.
2. Upper CID.
3. Lower CID.
4. Weathered/fractured bedrock aquifer.

The thickness of each unit is relatively uniform beneath the creek line. Exceptions occur for the alluvial succession, which varies in thickness up to about 12 m and pinches out altogether. The top of bedrock and ground surface both fall away at similar gradients along the downstream alignment of the Kangeenarina Creek until the narrowing of the valley. After which, a bedrock ridgeline, acts as a bottleneck, limiting groundwater through-flow and enabling local surface expression of the water table.

The conceptual model presents pools on Kangeenarina Creek as groundwater mounded behind a narrow and constrained downstream flow path. The aquifer system is full to a natural capacity with pools considered expressions of the water table.

Groundwater Levels

Water table elevations range from 513.57 mAHD seen upstream of the current supplementation systems, decreasing downstream to 504.53 mAHD as shown in the most northern monitoring site KMB15S. Measured depths to the water table ranged from 0.9 to 15.8 m bgl. The measured depths typically decreased towards the centre of the creek line and often express at the surface as local pools. Levels are similar in all aquifers, with slight downward heads generally evident from the alluvial to upper and lower CID aquifers. Head differences are generally within 0.1 m; however, there is evidence of upward head differences of up to 0.8 m from the bedrock unit to the Upper CID.

Groundwater Flow

Monitoring data indicates decreasing groundwater elevations downstream and a general flow pattern to the northeast, aligning with stream flow direction. The flow direction is similar in all units. The water table flow direction correlates with the location of the Kangeenarina Creek supplementation systems with the highest groundwater elevations observed at the points of discharge and infiltration.

Topography and surveyed pool elevations confirm that the pools themselves are an expression of the water table. Figure 5 shows the inferred groundwater contours of the water table elevations. The hydraulic gradient is low with a 15.8 m decrease over the domain, representative of a gradient of about 0.005 (dimensionless).

2.4 Conceptual Model of Kangeenarina Pools

A number of drainage channels and aquifer features associated with the Kangeenarina Creek contribute to recharge and groundwater throughflow convergence near to where the pools occur. These are the upstream Kangeenarina Creek valley, Valley of Kings and an unnamed tributary trending northwest to southeast with confluence upstream of the pools. Further, it is interpreted that a narrowing of the valley that hosts Kangeenarina Creek due to the northern bedrock ridgeline, acts as a bottleneck, limiting groundwater through-flow and enabling local surface expression of the water table.

The conceptual model presents pools on Kangeenarina Creek as groundwater mounded behind a narrow and constrained downstream flow path. The aquifer system is full to a natural capacity with pools considered expressions of the water table. Findings indicate only minor vertical head gradients between the four stratigraphic units, which seems to suggest a good degree of aquifer interconnection. Cross-sections through the Kangeenarina Creek pools area with interpreted groundwater environment are shown in Figures 6 and 7.

3. POTENTIAL IMPACTS

Groundwater abstraction associated with mining and water supply may result in potential drawdown and drying impacts on the Kangeenarina pools outside the MDE.

Potential impacts and monitoring of groundwater dependent vegetation is discussed in the *Vegetation Health Monitoring and Management Plan (100-PL-EN-1020)*.

3.1 Pools Impact Assessment

3.1.1 Groundwater Flow Model

Fortescue have developed a groundwater flow model of the Solomon Project, which allows predictive assessments of mine dewatering drawdown impacts on Kangeenarina Creek. The model was initially based on a preliminary groundwater model developed by NTEC (2010) designed to describe the groundwater flow processes within the Solomon Project Area. Fortescue took ownership of the groundwater model in 2012 and have undertaken regular updates through to the present. These updates have increased the level of detail in the model and improved the accuracy.

The model was updated for assessment of the required dewatering and associated hydrogeological impacts of the Life of Mine (LoM) mine plan (Fortescue 2015b). The updated model allowed for an improved predictive assessment of the impacts of abstraction on the groundwater resource and environmental receptors, including the Kangeenarina pools, as a result of mining. The model presents:

- A linear relationship to estimate the amount and distribution of recharge.
- A gamma distribution model to simulate the temporal distribution of recharge to groundwater systems with relatively deep groundwater levels;
- A steady-state calibration of the numerical model using average measured watertable elevations to approximate the long-term average groundwater levels.
- Transient flow calibration of the numerical model.

Model Details

MODFLOW-SURFACT version 3.0 was used as the numerical engine for the updated groundwater model, and Groundwater VISTAS v6 as the model pre and post-processing graphical user interface.

The model domain was selected to cover the mine resource areas and the hydrogeologically-associated environmentally sensitive areas (including the pools) with sufficient offset to mitigate the effect of the uncertainties at the external boundaries. The extent of the model domain is 25 km x 12 km. The domain has been divided uniformly into 40 m x 40 m numerical cells.

The model includes four layers aligned with the conceptual hydrostratigraphy. These layers represent:

- Alluvial deposits.
- Upper CID.
- Lower CID.
- Weathered bedrock.

The model features numerous zones defined by various hydraulic properties, including hydraulic conductivity, storage, recharge and evapotranspiration. The use of multiple hydraulic property zones in the model exist to accommodate the potential need for fine-tuning the modelled spatial variations in hydraulic properties to better fit observed groundwater levels. Determination of zone values stems from pumping test analyses, abstraction responses and known literature.

Comprehensive detail on the formulation of model properties and zoning is provided in the Fortescue Report *Groundwater Flow Modelling Assessment of the Solomon LoM R120ii* (Fortescue 2015b).

3.1.2 Modelling of Impacts to Pools

A predictive model was run to determine the impact to the permanent pools as the result of dewatering/abstraction activities with supplementation limited to current design capabilities. Modelled scenarios showed that groundwater levels at KMB12S can be maintained in the short-term (Figure 8). In contrast, modelled scenarios were run to simulate groundwater levels should there be no supplementation in Kangeenarina Creek. Results from this scenario showed drawdown reaching KMB12S by about December 2017.

3.2 Knowledge and Model Gaps

The model has been prepared using information and hydrogeological knowledge available at the time and for the purpose of initial semi-quantitative assessments of pit dewatering requirements for the Kings and Trinity Deposits under future mining scenarios. Several uncertainties exist in the knowledge of Kangeenarina pools environment and the groundwater flow model. Assumptions made because of these uncertainties may influence the predicted drawdown impacts on the pools of Kangeenarina Creek and simulated supplementation strategies developed to off-set these potential impacts. The uncertainties include:

1. Recharge and evaporation potentials, both seasonal and associated with episodic events.
2. Limited information on long-term, seasonal and episodic water table fluctuations at the pools.

Supplementation at Kangeenarina Creek has been underway since 2014, and there has been considerable development in terms of the understanding of the area and the hydrogeological responses to supplementation. Nevertheless, to mitigate potential uncertainties, a conservative approach has been adopted with all aspects of the models and planning.

4. PROPOSED MANAGEMENT STRATEGY AND ACTIONS

4.1 Key Assumptions and Principles

The proposed management strategy incorporates several design themes and assumptions, including:

- Maintaining water table (and pool) elevations within the observed and interpreted natural range, with the water table remaining within a specified range at specific monitoring sites.
- It will not necessarily mimic seasonal fluctuations.
- Recognition that the natural water table elevation fluctuation seasonally is a response to recharge from episodic rainfall events characterised by:
  - Initial sharp, short-term responses that temporarily increase the water table elevations, commonly in the range 0.5 to 1.5 m.
  - Longer-term residual mounding of the water table above seasonal low elevations. The magnitude of the mounding is locally observed in the range up to 0.8 m.
  - Subsequent steady decline of the water table elevations.

Monitoring data since early 2012 indicates water table elevations associated with the permanent pools on Kangeenarina Creek (Figure 3) show seasonal water table elevations in the range from 509.05 to 512.0 m AHD (Table 1). It is evident that measured seasonal fluctuations, including short-term peaks, range from 0.89 to 2.09 m. Seasonal water level fluctuations will continue to be observed and assessed.

Table 1: Monitoring Water Table Fluctuations in Kangeenarina Pools.

Monitoring Site	Minimum (mAHD)	Maximum (mAHD)	Range (m)
KMB12S	509.91	512.0	2.09
CG05 (Pool 78)	509.05	511.33	2.28

4.2 Supplementation Methodology

Given the distance of the injection wells used in initial supplementation to the Kangeenarina pools (i.e. over 3 km), the utilisation of this injection system to maintain water levels in the permanent pools is inefficient. As a result, Fortescue is currently utilising two methods of direct supplementation to maintain water levels within the permanent pools.

The design of the supplementation strategy includes the reticulation of groundwater abstracted from the Queens and Trinity Deposits via a pipeline to four spigots on selected reaches of Kangeenarina Creek (Figure 9). Additionally, a DN300 buried diffuser line capable of recharging supplemented water directly into the aquifer has been in operation since June 2016. A second line is in the final stages of design, with operation set to commence in June 2020.

The current system design allows for abstraction and supplementation of around 70 L/s or 2.2 GL/annum through the spigot lines along with a further 80 L/s or 2.5 GL/annum supplemented through the existing buried diffuser system. The second buried line will increase capacity of the entire system; however the placement of the line seeks to reduce recirculation from dewatering and thereby conserve water whilst maintaining supplementation to Kangeenarina Creek Supplementation for the spigot lines is currently sourced from dewatering operations at the Trinity Deposit, south of Kangeenarina Creek. Supply for the existing buried discharge system is gravity fed via a DN200 pipeline sourced from the 17ML Raw Water Storage Facility (RWSF). Supply for the second buried diffuser system will be sourced from the 7ML RWSF, itself fed by dewatering operations at Trinity Deposit, and the transfer from the 17ML RWSF.

Current LOM modelling indicates the capacity of the supplementation system described above is capable of maintaining groundwater levels at the permanent pools. Should any future iterations to the mine plan require changes to the supplementation system to mitigate any potential impacts then those proposed changes will be communicated with the DWER and any changes will be updated in future iterations of this Plan.

Fortescue will ensure that this method doesn't result in significant scouring and/or increased sediment loading within the vicinity or downstream of the discharge spigots. In addition, the supplementation will not be used for excess dewatering disposal.

Groundwater monitoring sites have been selected to support the operation of this Plan (Table 2). These sites will inform and measure success in maintaining the permanent pools.

Table 2: Summary of Groundwater Monitoring Locations for the Kangeenarina Pools

ID	Installation Date	Easting	Northing	Comments
KMB12S	December 2011	590,527	7,555,053	Groundwater monitoring site. Previously referred to as MB12
KMB14S	February 2015	590,645	7,555,506	Groundwater monitoring site. 450m downstream of KMB12S.
KMB15S	February 2015	590,451	7,555,998	Groundwater monitoring site. 520m downstream from KMB14S/D

5. RISK BASED MANAGEMENT ACTIONS AND TARGETS

In previous versions of the Plan, surface water sites were assigned trigger levels, however as these pools receive artificial surface water supplementation it would be inappropriate to assign trigger levels. Since the pools are conceptualised as being the surface expression of groundwater, trigger levels are assigned to nearby groundwater monitoring bores.

5.1 Groundwater Trigger and Limit Criteria

A three-tier adaptive approach is proposed to manage water levels as outlined below:

Tier 1 - Trigger water table elevations

Specified lower-bound water table elevation criteria in selected monitoring sites. The use of trigger water table elevations would inform the preferred lower-bound water table elevations for successful supplementation. The trigger water table elevations typically reflect the lowest observed values. The triggers would also guide initial management responses should comparatively small-scale drawdown impact the permanent pools.

Tier 2 - Trigger water table elevations

Water table elevation criteria which extend 0.5 m below the tier 1 trigger elevations. The trigger criteria provide a guide that the supplementation system is not performing to expectation, and consequently drawdown impacts are propagating downstream of the supplementation spigots and onto selected monitoring sites. Breaching of the tier 2 trigger criteria would initiate increasingly urgent management contingency actions.

Tier 3 - Limit water table elevations

Specified lower-bound water table elevation criteria in selected monitoring bores extending 0.5 m below the tier 2 trigger criteria. The limit criteria, if measured, indicate the supplementation system is failing to meet its objectives. The breaching of the tier 3 limit criteria would require communication with the CEO under Condition 7-4 of MS 1062.

The trigger and limit criteria provide a link between measured and/or predicted baseline water table fluctuations. The trigger and limit criteria would not be met under circumstances whereby:

- Tier 1 Trigger - water table elevations decline, due to drawdown impacts, to the bottom of the measured baseline range.
- Tier 2 Trigger – water table elevations decline, due to drawdown impacts, up to 0.5 m below the measured baseline range.

- Tier 3 Limit - water table elevations decline, due to drawdown impacts, up to 1.0 m below the measured baseline range.

The trigger and limit drawdowns criteria of 0.5 and 1.0 m have been derived to provide a conservative approach to protection of the pools. As mentioned in Section 2.2, the base of CG05, proximal to KMB12S was recorded as 508.55 m AHD. Groundwater drawdown of 0.5 (509.5 m AHD), will not cause reversal of groundwater gradients from the adjacent pool. Groundwater drawdown of 1.0 (509.0 m AHD), will result in reversal of groundwater gradients from the adjacent pool, but with a potential outcome of less than 0.1 m of pool level decrease from the lowest baseline level (509.07 m AHD).The management actions for the proposed groundwater bore trigger levels are designed to ensure the pool level does not decline to the dry-period low elevations.

Four groundwater monitoring bores were drilled in late 2015 to further characterise hydrogeological conditions downstream of KMB12S. The location of these sites are situated on an exploration tenure (E47/1334 & E47/1319) that is due to expire in 12 – 24 months and subsequently trigger levels have not been assigned to these bores in the event monitoring access cannot be obtained. Plans are in place to obtain continued monitoring access through the application of a Miscellaneous Licence however the timing of this approval is unclear. Monitoring bores KMB14S and KMB15S will be monitored whilst access remains available.

Trigger levels for KMB12S alone have subsequently been developed in line with current three-tier staged approach, based on the justification above. The trigger criteria for groundwater levels may be adjusted upon receipt of additional hydrogeological and/or vegetation root depth data. Provisional trigger and limit criteria are provided in Table 3.

Table 3: Trigger and Limit Criteria for Groundwater

Bore ID	Tier 1 - Trigger	Tier 2 -Trigger	Tier 3 - Limit
KMB12S	510.0	509.5	509.0

5.2 Contingency Actions

5.2.1 Actions for Breach of Tier 1 Trigger Criteria

The proposed actions for the occurrence of watertable elevations declining below the Tier 1 trigger criteria are shown in Table 4.

Table 4: Proposed Actions for a Tier 1 (Trigger)

Step	Action	Timeframe*
1	Verify groundwater levels and interpretation of comparative influences of seasonal watertable fluctuations and drawdown impacts.	One week
2	Inform internal stakeholders of breach of trigger criteria.	One week
3	Implement revisions to the monitoring plan, with increased frequency of data collection.	One week
4	Develop and inform internal stakeholders of revised watertable and pool monitoring and possible contingency actions in the event of increased drawdown. These actions would be driven by findings of an audit of the supplementation system and identification of options that promote upgrades that enable watertable recovery to above the trigger criteria.	Two weeks
5	If trigger breach is determined to be the result of dewatering activities, increase re-injection rates (if practical).	Two weeks

*time since becoming aware of the breach

5.2.2 Actions for Breach of Tier 2 Trigger Criteria

Contingency measures and timetables for delivery of relevant information for a breach in the Tier 2 Trigger Criteria are described below in Table 5:

Table 5: Proposed Actions for a Tier 2 (Trigger)

Step	Action	Timeframe*
1	Verify groundwater levels and interpretation of comparative influences of seasonal watertable fluctuations and drawdown impacts.	One week
2	Review of trigger criteria in context with measured seasonal fluctuations and interpretations of drawdown distributions and amplitude.	One week
3	Inform the relevant regulatory stakeholders of watertable elevation decline below trigger criteria.	One week
4	Increase re-injection rates, if practical.	One week
5	Conduct root cause analyses that look to determine reasons for the propagation of drawdown.	Two weeks
6	Assess options that address and mitigate the root causes of drawdown propagation, including re-injection system upgrades.	Two weeks
7	Develop and inform stakeholders (internal) of revised watertable and pool monitoring together with contingency actions in the event of progressive increase of drawdown towards the limit criteria. These actions would be driven by the findings of the root cause analysis and options assessment that mitigate the root causes of downstream drawdown propagation.	Two weeks
8	Develop action plans for implementation under circumstances of breaches of limit criteria. These action plans would be intended to enable watertable recovery to above the trigger criteria.	Two months

*time since becoming aware of breach

5.2.3 Actions for Breach of Tier 3 Limit Criteria

Contingency measures and timetable for a Tier 3 limit breach are aligned to the measured detailed in Condition 7-4 of MS 1062, and are as shown in Table 6.

Table 6: Proposed Actions for a Tier 3 (Limit)

Step	Action	Timeframe*
1	Report the exceedance in writing to the CEO within 21 days of the exceedance being identified.	Three weeks
2	Investigate to determine the cause of the management targets being exceeded, including updating and amending the root cause analysis.	Four weeks
3	Provide a report to the CEO within 90 days of the exceedance being reported as required by condition 7-4(1). The report shall include: (a) cause of management targets being exceeded; (b) the findings of the investigation and root cause analysis; (c) details of revised and/or additional management actions to be implemented to prevent further breaches, including details on supplementation system upgrade if applicable (d) relevant changes to proposal activities	Within 90 days of the exceedance being reported

*time since becoming aware of breach

6. MONITORING AND REPORTING

As required by condition 7-2 (4) of Ministerial Statement 1062, the environmental monitoring strategy below identifies all monitoring sites within the area of the permanent pools and the parameters to be monitored as part of the Plan. The monitoring program will continue to develop and be amended as ongoing studies are assessed, and as additional data is collected during the life of mining.

6.1 Monitoring Infrastructure

The purpose of the monitoring program is to monitor any drawdown effects on the permanent pools. Three groundwater monitoring bores will be monitored (Table 7) (Figure 2); as summarised in the proposed monitoring program shown in Table 8.

The monitoring bore network is expected to measure any unplanned drawdown prior to potential impact to the permanent pools. Continued monitoring of the network will allow the effectiveness of the Plan to be assessed and adaptive management steps to be taken as required.

As discussed in Section 5; monitoring bores KMB14S and KMB15S are located on exploration tenure that is due to expire under exploration licences (E47/1334 & E47/1319). These bores will continue to be monitored, as allowed by tenure access, with future monitoring access to be applied for under a miscellaneous licence.

Table 7: Groundwater Monitoring Bore Infrastructure Details

Drilled Bore ID	Easting	Northing	Elevation	Cased Depth (mbgl)	Slotted Interval (mbgl)	Screened Lithology
KMB12S	590527.64	7555053.94	511.08	6	3.0 - 6.0	Alluvium
KMB14S	590645.15	7555505.67	508.46	6	1.0 - 6.0	Alluvium
KMB15S	590451.02	7555998.01	505.34	5	1.5 - 5.0	Alluvium

Table 8: Monitoring Parameters and Frequencies

Sites	Parameters	Frequency	Method	Comments
KMB12S, KMB14S* and KMB15S*.	Groundwater levels	Weekly	Logger and/or manual	Water levels collected weekly
Supplementation pipeline	Sediment loading and water scour	Weekly	Visual Inspection	Pipeline and spigots visually inspected for leaks, scouring and sediment loading.
CG05	Pool level	Weekly	Manual	Water levels collected weekly

*Will be monitored dependent on access.

6.2 Reporting

Fortescue will generate an annual report detailing monitoring results; which will be provided to CEO along with the Compliance Assessment Report required by Condition 3-1 of MS 1062. The report will adhere to the conditions of 7-2(6) of MS 1062.

A brief report containing relevant supporting monitoring data and/or supplementation strategies will be supplied to the CEO should the Tier 3 Limit Criteria be breached, as per the conditions 7-4 of MS 1062.

7. REVIEW AND REVISION

This Plan will be reviewed and revised in accordance with Condition 7-6 (1) of MS 1062. Revisions to the Plan may occur to:

- Include details of baseline surveys as a result of the *Baseline Survey Plan* required by Condition 5 of MS 1062.
- Incorporate updated groundwater modelling.
- Incorporate the findings of the hydrological and hydrogeological monitoring data collected and the effectiveness of the proposed supplementation strategies.
- Include selected engineering designs that support the conservation of the pools from the impacts of long-term groundwater abstraction and drawdown of the watertable.

Other data which may inform revisions to the Plan include:

- Natural seasonal fluctuations in watertable and pool elevation data. The selected control sites and monitoring bores would inform the characteristics of these fluctuations.
- Further understanding on the natural system and longer-term water levels and vegetation requirements.
- Interpreted drawdown distributions and magnitudes linked to groundwater abstractions from site.

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Figure 1: Site Setting

LEGEND

- Kangeenarina Creek
- FMG Mine Pit Outlines
- FMG Managed Tenements
- s38 – Referral
- Kangeenarina Pools

Data Source(s):
All, FMG, 2018

N

0 1 2 3 4 5
Kilometres

FIGURE 1
SITE SETTING

Requested By: C.Looby — Date: 26/09/2018
Drawn By: C.Meyer — Size: A3L
Revised By: sroestenburg — Revision: 3
Approved By: P.Mastalir — Confidentiality: 0
Scale: 1:75,000
Coordinate System: GDA 1994 MGA Zone 50
Document Name: SO_MP_HY_0087.001_r3

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Figure 2: Kangeenarina Pools

LEGEND

- CG05 Surface Water Monitoring Location
- KMB12S Monitoring Bore
- KMB14S Monitoring Bore
- KMB15S Monitoring Bore
- Kangeenarina Creek Infiltration System
- Kangeenarina Creek Supplementation System
- Brackish
- Water Conveyance System
- FMG Mine Pit Outlines
- Turkeys Nest
- Kangeenarina Pools

Data Source(s):
All, FMG, 2018

N

0 100 200 300 400 500
metres

FIGURE 2
KANGEENARINA POOLS

Requested By: C.Looby	Date: 26/09/2018
Drawn By: C.Meyer	Size: A3L
Revised By: sroestenburg	Revision: 3
Approved By:P.Mastalir	Confidentiality: 0
Scale: 1:9,000	
Coordinate System: GDA 1994 MGA Zone 50	
Document Name: SO_MP_HY_0087.002_r3	

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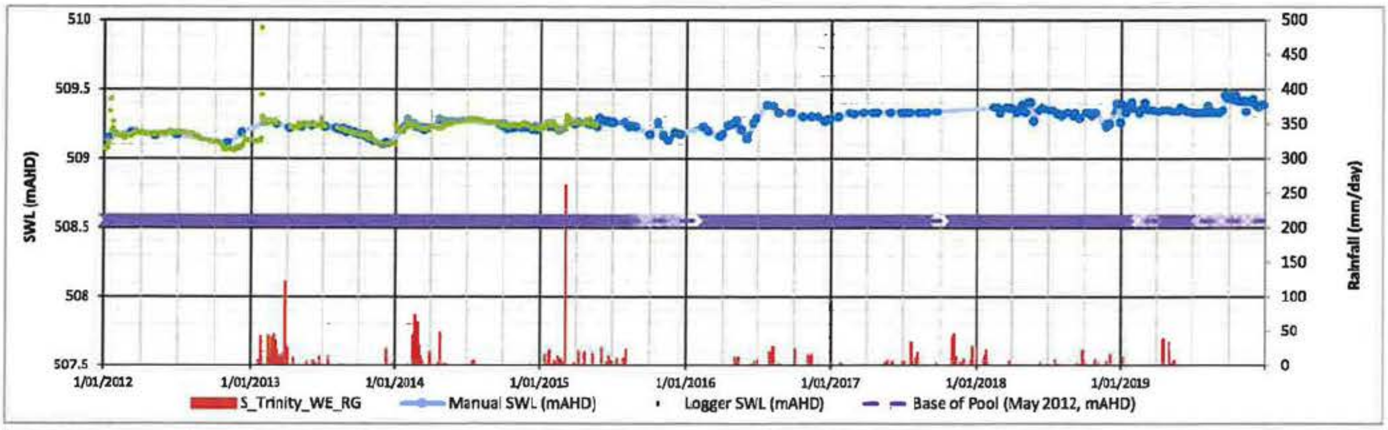
Figure 3: Pool 78 (CG05) Hydrograph

CG05 Pool Hydrograph

EnviroSys ID :	CG05	**Easting :**	590524	**5C Licence :**	#N/A
Site Type :	Surface Water Monitoring	**Northing :**	7555180	**Aquifer :**	Detritals
Location :	Kangeenarina (KA)	**Tenement :**		**Rain Gauge :**	S_Trinity_WE_RG
Comments :	#N/A				



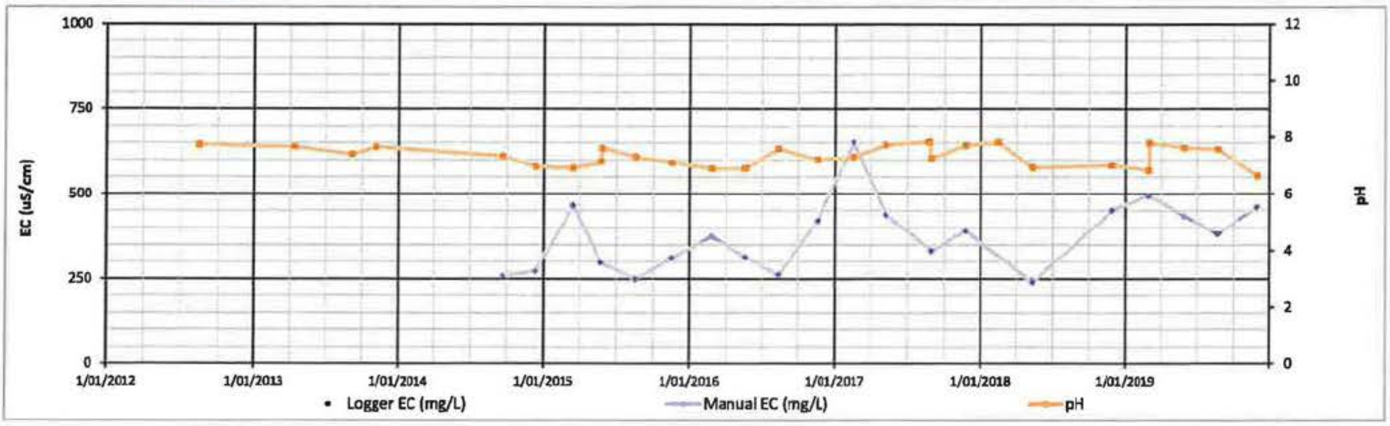
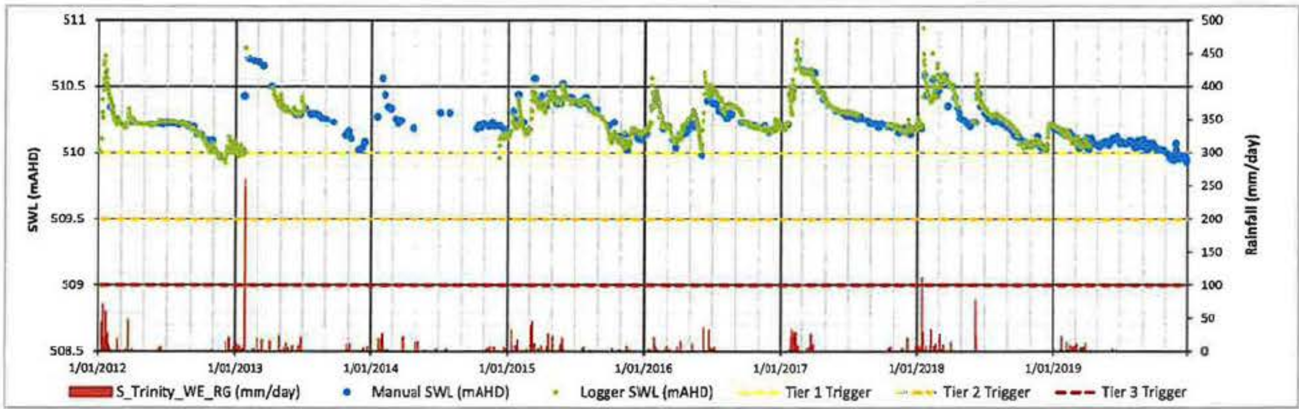
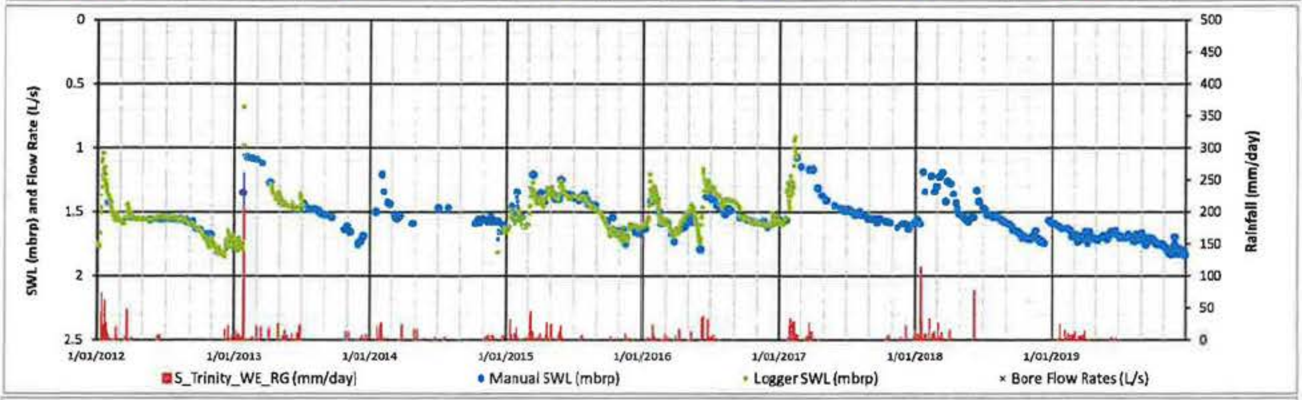


Figure 4: KMB12S Hydrograph

KMB12S Hydrograph

EnviroSys ID :	KMB12S	**Easting :**	590528	**SC Licence :**	N/A
Site Type :	Monitoring Bore (M)	**Northing :**	7555054	**Aquifer :**	Alluvial
Status :	Monitored	**TOC Elevation :**	511.767 mAHD	**Screen Interval :**	3.0 - 6.0 mbgl
Location :	Kangeenarina (KA)	**Tenement :**	M 47/1431	**Rain Gauge :**	S_Trinity_WE_RG





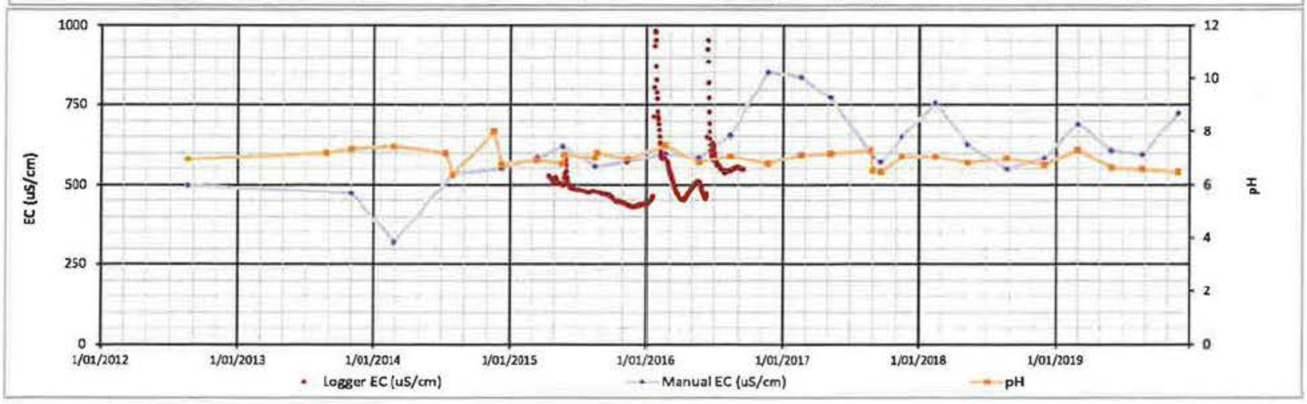
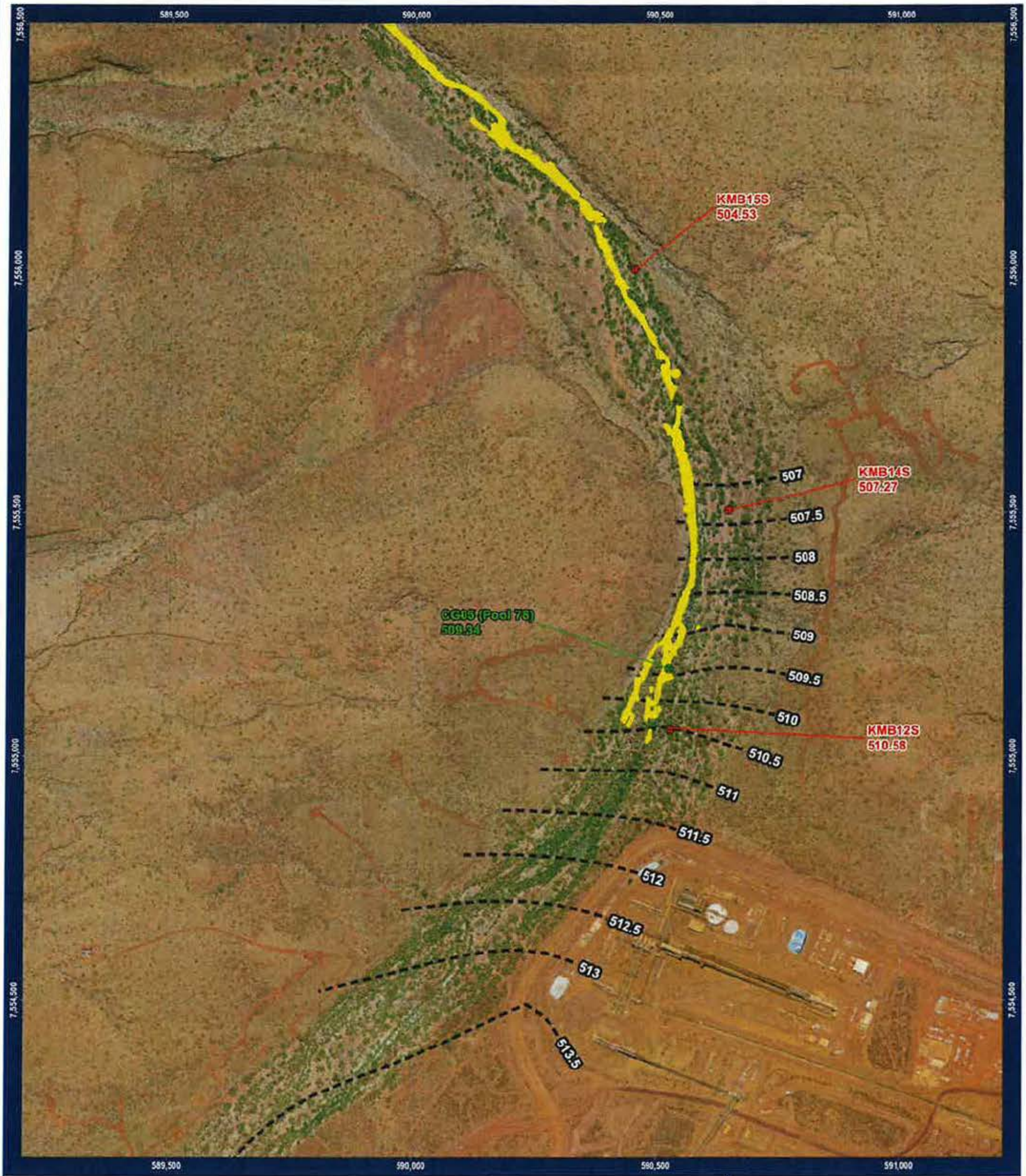


Figure 5: Kangeenarina Creek Groundwater Contours



LEGEND

- January 2018 Kangeenarina Creek Groundwater Contours (mAHD)
- Kangeenarina Creek Monitoring Bores (January 2018 Water Levels)
- CG05 (Pool 78)
- Kangeenarina Pools

N

0 50 100 150 200 250
metres

FIGURE 6
KANGEENARINA CREEK
GROUNDWATER CONTOURS

Requested By: C Looby
Drawn By: C Meyer
Revised By: sroeslenburg
Approved By: Paul Mastalir
Scale: 1:7,500
Coordinate System: GDA 1994 MGA Zone 50
Document Name: SO_MP_HY_0087.003_r3

Date: 26/09/2018
Size: A3P
Revision: 3
Confidentiality: 1

Data Source(s):
Main map, URS, 2012
Topography, Geoscience Australia, 2013

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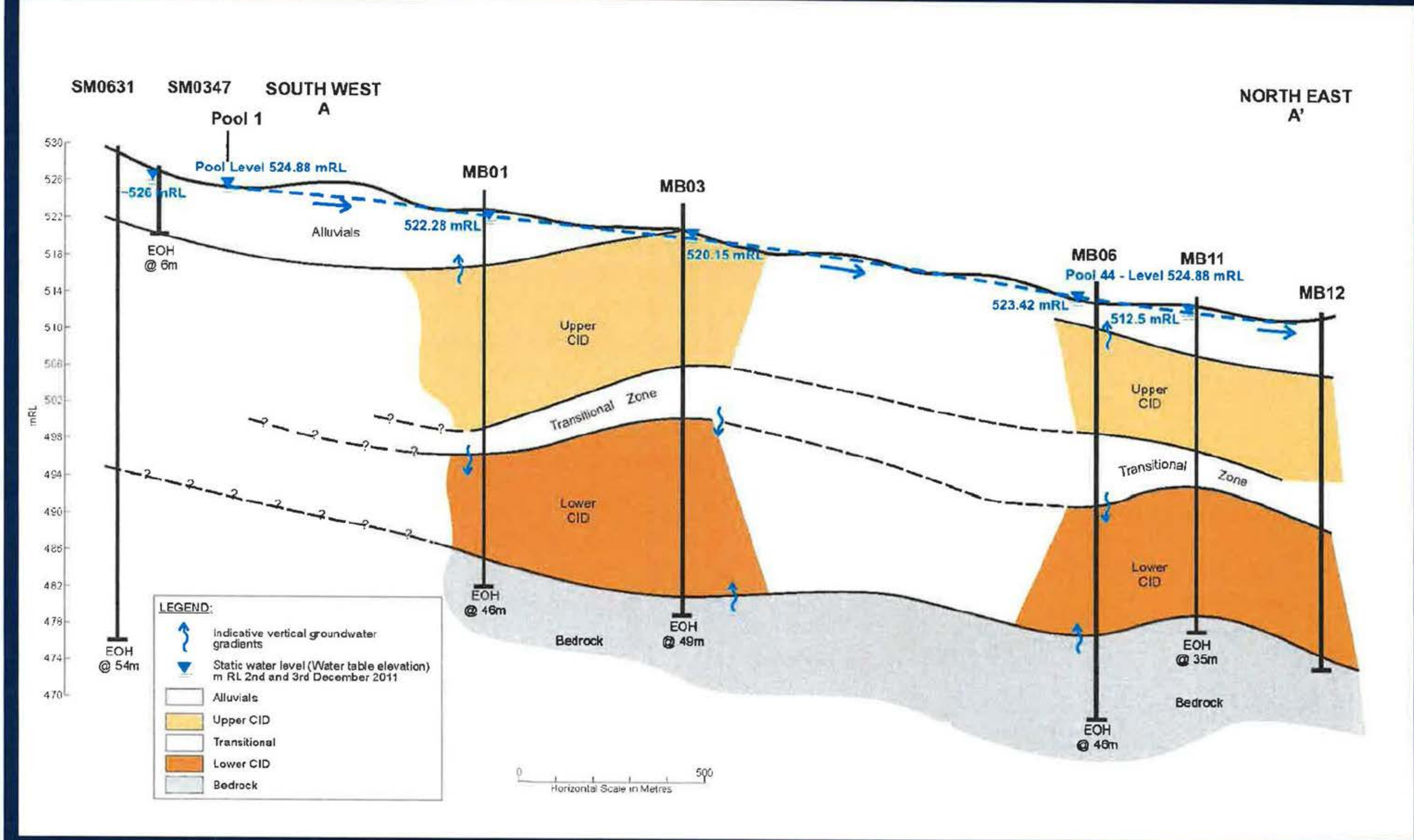
Figure 6: Kangeenarina Creek Cross Section - Parallel



Data Source(s):
Cross Section, URS, 2012

Requested By: Andrew Jackson
Drawn By: Sacha Fielden
Revised By: sfielden
Approved By: Paul Mastalr
Page: A3
Document Name: SO_MP_HY_0058.005

Date: 20/12/2013
Size: A3L
Revision: 0
Confidentiality: 1

FIGURE 7
KANGEENARINA CREEK CROSS SECTION – PARALLEL

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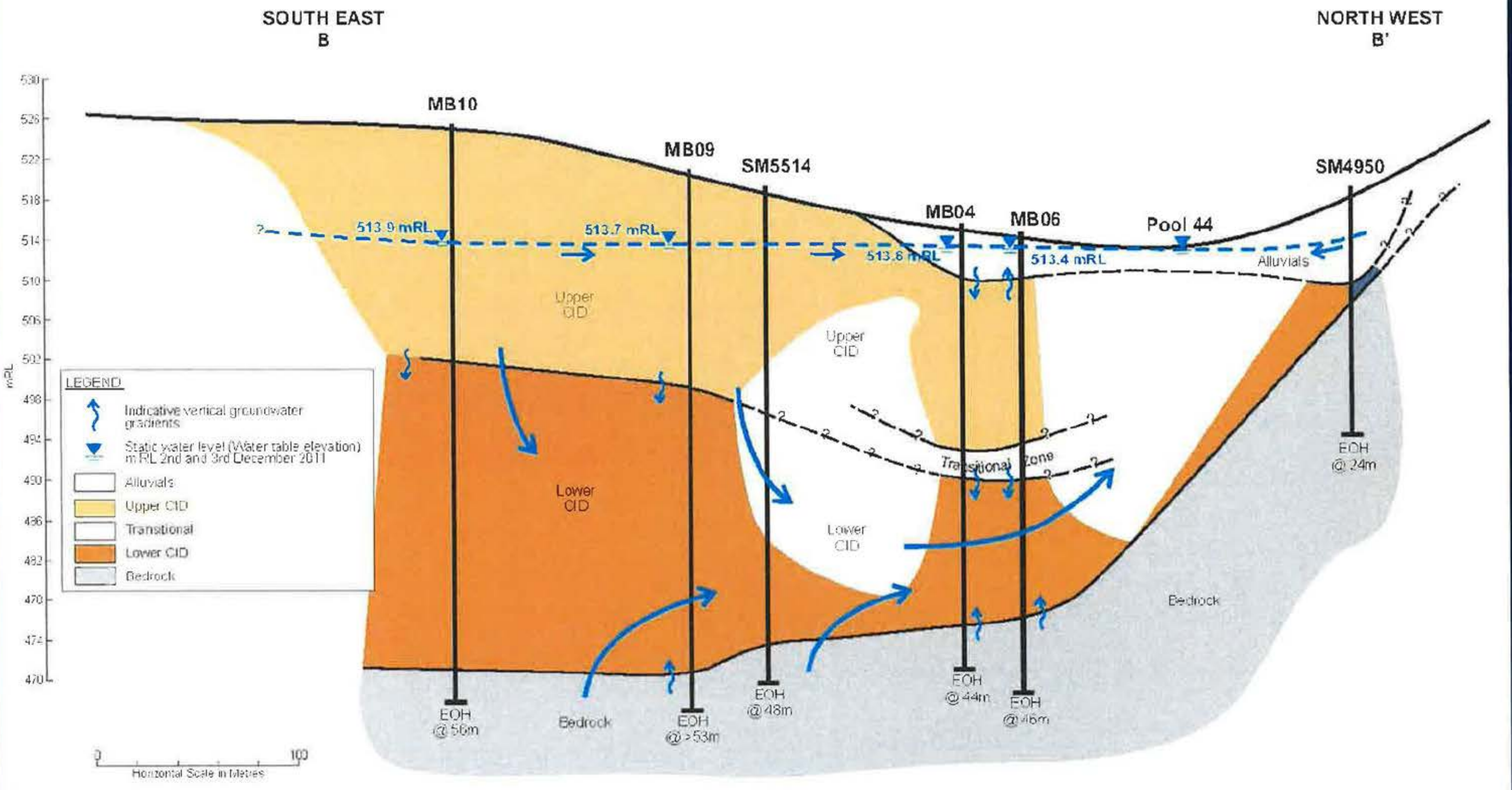
Figure 7: Kangeenarina Creek Cross Section - Perpendicular



Requested By: Andrew Jackson
Drawn By: Sacha Fielden
Revised By: sfielden
Approved By: Paul Mastalir
Page: A3
Document Name: SO_MP_HY_0058.006

Date: 20/12/2013
Size: A3L
Revision: 0
Confidentiality: 1

FIGURE 8
KANGEENARINA CREEK
CROSS SECTION – PERPENDICULAR

Fortescue Metals Group Ltd
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Data Source(s):
Cross Section, URS, 2012

Figure 8: Modelled Impacts without Supplementation

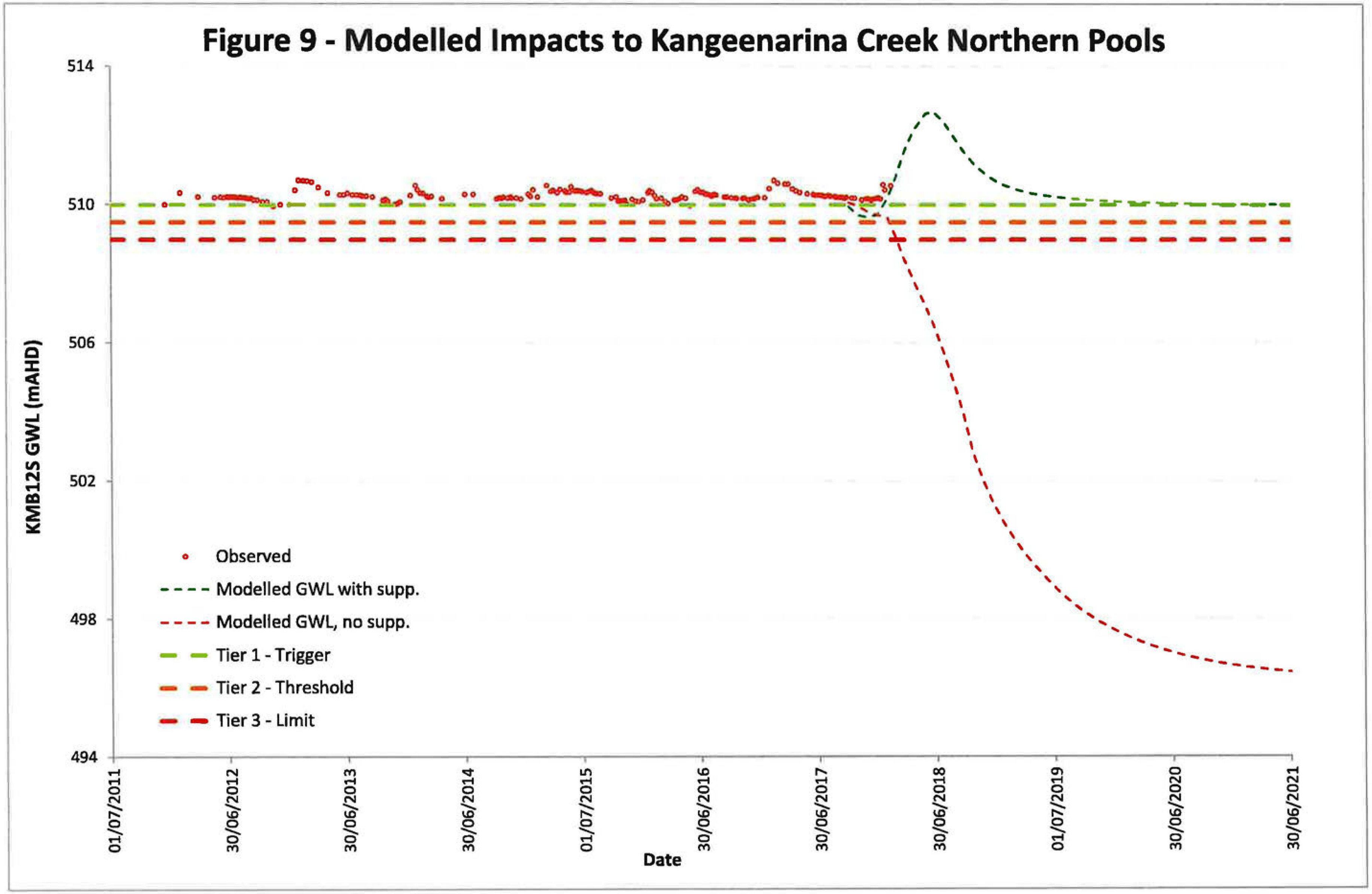
Figure 9 - Modelled Impacts to Kangeenarina Creek Northern Pools
KMB12S GWL (mAHD)
514
510
506
502
498
494
Observed
Modelled GWL with supp.
Modelled GWL, no supp.
Tier 1 - Trigger
Tier 2 - Threshold
Tier 3 - Limit
01/07/2011
30/06/2012
30/06/2013
30/06/2014
01/07/2015
30/06/2016
30/06/2017
30/06/2018
01/07/2019
30/06/2020
30/06/2021
Date

Figure 9: Supplementation Infrastructure Plan

LEGEND

- Comms Tower
- Infrastructure
- Kangeenarina Creek Buried Infiltration System A
- Kangeenarina Creek Buried Infiltration System B
- Kangeenarina Creek Surface Supplementation System
- Water Conveyance System
- Kangeenarina Pools

Data Sources:
Aerials; FMG, Landgate

N

0 200 400 600 800 1,000
metres

KANGEENARINA CREEK SUPPLEMENTATION INFRASTRUCTURE PLAN

Requested By: M. Carroll
Drawn By: M. Carroll
Revised By: mcarroll
Approved By: M. Carroll
Scale: 1:15,000
Coordinate System: GDA 1994 MGA Zone 50
Document Name: SO_MP_HY_0087.007_r6

Date: 10/02/2020
Size: A3L
Revision:6
Confidentiality: 0

Fortescue Metals Group Ltd
The New Force in Iron Ore

"CILO-6"

WAD 37 of 2022

Federal Court of Australia

District Registry: Western Australia

Division: General

YINDJIBARNDI NGURRA ABORIGINAL CORPORATION RNTBC

Applicant

STATE OF WESTERN AUSTRALIA & ORS

Respondents

This is the annexure marked "**CILO-6**" referred to in the affidavit of Christopher Ian Leonard Oppenheim sworn on 4 August 2023.

Signature of witness

Hamish Hamilton Robertson

a legal practitioner who has held
a practice certificate for at least
2 years and who holds a current
practice certificate.

Fortescue
The New Force in Iron Ore

Plan

Weelumurra Creek Supplementation Plan

Solomon

24/06/2021
SO-PL-EN-0023: Rev 5

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	Weelumurra Creek Supplementation Plan		
Document_Revision Number	SO-PL-EN-0023: Rev 5		**24/06/2021**
Status	**IFU - ISSUED FOR USE**		
Summary of Changes	From Rev 1:Changes to address comments from the EPA and updates to monitoring points in the plan From Rev 3&4: Confirmation of pool monitoring points; removal of early mining references, revised trigger levels and inclusion of Weelumurra South management discussion		
Author	M Carroll	Signature	1/07/2021
Checked or Squad Review# (if applicable)	C Heary	Signature	1/07/2021
Approved	J Barclay	Signature	1/07/2021
Access to this document:		**Next Review Date (if applicable)**	

Revision History *(to be completed for each version retained by Document Control)*

Author	Checker	Approver	Rev No.	Status	Issued Date
C. Looby	FMG-SQ-100-00721	J. Barclay	0	IFU	3/08/2018
F. Rowland		J. Barclay	1	IFU	21/01/2019
C. Looby		M. Carroll	2	IFU	08/02/2019
C. Looby		M. Carroll	3	IFU	18/09/2019
C. Looby		M. Carroll	4	IFU	25/09/2019

EXECUTIVE SUMMARY

Fortescue Metals Group Limited (Fortescue) operates the Solomon Project (the Project), located in the Shire of Ashburton approximately 60 km north of Tom Price in the Pilbara region of Western Australia. The Project area hosts several pools on the local watercourses, including the Weelumurra Creek Pools located west of the Queens Deposit. Baseline surveys indicate permanent and semi-permanent pools are limited to the lower (Northern) reaches of the Weelumurra Creek, whilst intermittent pools may occur in the upper (Southern) reaches. It is recognised that, without management, groundwater abstraction for mine pit dewatering from Queens will potentially lower the watertable and impact the pools in the lower reaches of Weelumurra Creek.

Potential impacts of dewatering drawdown on the lower reaches of Weelumurra Creek can be managed through a water management system comprised of supplementation via a re-injection network, and a hydraulic barrier. The development and operation of this water management system will be governed by this Condition Management Plan (the Plan). The purpose of the Plan is to provide adaptive risk-based management actions to meet the objectives outlined in condition 10-1 (5) of Ministerial Statement (MS) 1062.

To assess impacts and initiate management actions, a three-tiered management target system will be enacted. Breaching of any of the target levels associated with these tiers will trigger a specific management approach. A detailed monitoring programme is planned to monitor the performance of the management actions (supplementation) against the defined management targets.

There are no semi-permanent or permanent pools in the upper reaches of Weelumurra Creek and no management is required to comply with condition 10-1 (5) of MS 1062. An expansion of this Plan's scope would occur if supplementation at Weelumurra Creek is required to comply with other conditions of MS 1062, as informed by the relevant conditional management plan.

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PROVISIONS TABLE

PURPOSE: To meet the legal requirements of Condition 10-1(5) of MS 1062

Proponent: Fortescue Metals Group

EPA Factor/s and objectives: Hydrological process

Proposal: Public Environmental Review: Solomon Iron Ore Project: Sustaining Production (SO-RP-EN-0141): EPA Assessment No: 2019

Objective: Condition 10-1(5) Maintain water levels in permanent and semi-permanent pools associated with Weelumurra Creek at a level that approximates natural seasonal variability as determined using baseline data and analogue sites selected and described in accordance with condition 5-3

Key Environmental Values: Groundwater dependent systems

Key Impacts and Risks: Localised groundwater drawdown resulting in changes to water levels or duration of permanent and semi-permanent pools

Management-based provisions

Condition 10-1(5) Maintain water levels in permanent and semi-permanent pools associated with Weelumurra Creek at a level that approximates natural seasonal variability as determined using baseline data and analogue sites selected and described in accordance with condition 5-3.

Management Actions

Undertake a baseline survey of permanent pools in accordance with the Baseline Survey Plan approved under Condition 5-3 of MS 1062. Where required, update the Weelumurra Creek Supplementation Plan with the results of the baseline survey

Timing: Construction

Risk based priority: High

Implement the supplementation strategy to:

- Maintain the westerly hydraulic gradient at the downstream end of Queens (i.e. towards the pools).
- Maintain groundwater levels at and downstream of Warp 16 within the range observed under natural conditions.

Key aspects of the strategy include:

- The injection bores are in a north-south line along this buffer
- Supplementation is based on conceptual designs and predictive models, so an adaptive management approach is proposed.

Timing: Construction, Operations, Decommissioning, Closure

Risk based priority: High

Implement a monitoring program to determine the effectiveness of the supplementation strategy on pool levels.

Timing: Construction, Operation, Decommissioning, Closure

Risk based priority: High

When monitoring results indicate a potential impact on pool levels implement corrective actions and any reporting requirements.

Timing: Construction, Operation, Decommissioning, Closure

Risk based priority: High

Update the Plan and Supplementation Program where required by this or related Plans, to inform an adaptive management approach to supplementation.

Timing: Construction, Operation, Decommissioning, Closure

Risk based priority: High

Management targets

Tier 1 Trigger Criteria (Warp 16)

Groundwater level <505.03 m AHD over two consecutive monthly measurements

Tier 2 Trigger Criteria (Warp 16)

Groundwater level <504.62 m AHD over two consecutive fortnightly measurements

Tier 3 Threshold Criteria (Warp 16)

Groundwater level <504.22 m AHD over two consecutive fortnightly measurements

Tier 1 Trigger Criteria (Weelumurra Well)

Groundwater level <479.94 m AHD over two consecutive monthly measurements

Tier 2 Trigger Criteria (Weelumurra Well)

Groundwater level <479.84 m AHD over two consecutive fortnightly measurements

Tier 3 Threshold Criteria (Weelumurra Well)

Groundwater level <479.74 m AHD over two consecutive fortnightly measurements

Monitoring

Location	Monitoring parameters	Method	Timing/ Frequency
Warp 16	Groundwater level	Field collection/ water level indicator	Monthly[1]
Weelumurra Well	Groundwater level	Field collection/ water level indicator	Monthly[1]
Weelumurra Pool WEEL_SS1	Pool level	Field collection/ water level indicator	Monthly
Weelumurra Pool WEEL_SS2	Pool level	Field collection/ water level indicator	Monthly
Re-injection monitoring bore WIM007	Groundwater level	Field collection/ water level indicator	Weekly
Re-injection monitoring bore WIM009	Groundwater level	Field collection/ water level indicator	Weekly

Note – if sites are dry or inaccessible, no reading will be taken.

[1] Readings will increase to fortnightly below the tier 1 trigger level

Location of groundwater and pool monitoring sites (See Figures).

When monitoring results indicate a potential impact on pool levels or groundwater dependent vegetation health (as informed by the *Vegetation Health Monitoring and Management Plan* (100-PL-EN-1020)), implement corrective actions and any reporting requirements. Update management actions where required, to inform an adaptive management approach.

Reporting

Annual reporting will be undertaken in accordance with the OEPA's *Post Assessment Guideline for Preparing a Compliance Assessment Report* (CAR), Post Assessment Guideline No. 3.

In the event that management targets were exceeded during the reporting period, the CAR will include a description of the effectiveness of the contingency actions that have been implemented to manage the impact and any adaptive management measures applied as a result of the exceedance.

Reporting in accordance with Condition 7-4, which states:

In the event that monitoring, tests, surveys or investigations indicate an exceedance of a management target has occurred within the reporting period, Fortescue will:

- *Where the exceedance is attributable to construction, operation or decommissioning activities, report the exceedance in writing to the OEPA within 21 days of the exceedance being identified*
- *Investigate to determine the cause of the management targets being exceeded in accordance*
- *Provide a report to the OEPA within 90 days of the exceedance being reported*

Reporting in accordance with Condition 7-5, which states:

In the event that monitoring, tests, surveys or investigations indicate that one or more management actions have not been implemented, Fortescue will:

- *Report the failure to implement management action(s) in writing to the OEPA within 7 days of identification*
- *Investigate to determine the cause of the management action(s) not being implemented*
- *Investigate to provide information for the OEPA to determine potential environmental harm or alteration of the environment that occurred due to the failure to implement management actions*
- *Provide a report to the OEPA within 21 days of the reporting required by condition 7-5(1) of MS1062.*

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1. INTRODUCTION

Fortescue Metals Group Limited (Fortescue) operates the Solomon Project (the Project), located in the Shire of Ashburton approximately 60 km north of Tom Price in the Pilbara region of Western Australia (Figure 1). The Project contains the Valley of the Kings (Kings), Firetail and the Valley of the Queens (Queens) mining areas. The Kings mining area can be further subdivided into the Kings, Trinity, Zalamea, Castle Valley and Fredericks mining areas (Figure 2).

Mining at the Project commenced in 2012 from the Firetail deposit, before continuing to the Kings deposit where mining is currently ongoing.

The Project comprises mining a combination of Channel Iron Deposits (CID), Detrital Iron Deposits (DID) and Bedded Iron Deposits (BID) in the Kings, Trinity and Firetail areas. The CID deposits, where saturated, also form a palaeochannel aquifer system, within which preferred groundwater flow paths may develop.

The Project area hosts pools on several of the local watercourses, including:

- Kangeenarina Creek Pools – various permanent and ephemeral pools on the lower reaches of the creek, north of the Kings Deposit.
- Weelumurra Creek Pools – various permanent and ephemeral pools on the lower reaches of the creek, west of the Queens Deposit.
- Zalamea Gorge Pools – ephemeral pools southeast of the Kings Deposit.

The shallow watertable settings of these creeks and pools support phreatophytic (groundwater dependent) and potentially phreatophytic vegetation. It is recognised that abstraction from the Queens Deposit will potentially lower the watertable and impact the pools on Weelumurra Creek.

This Plan is applicable only to Weelumurra Creek; with the other pools (described above) addressed during previous studies.

1.1 Objectives and Scope

The purpose of this Condition Management Plan is to detail risk-based management actions to mitigate the impacts of groundwater abstraction and pit dewatering at the Solomon Mine on the Weelumurra Creek area. The Plan details the methodology to be implemented by Fortescue to meet Condition 10-1 (5) of Ministerial Statement (MS) 1062:

> *10-1 (5) "maintain water levels in permanent and semi-permanent pools associated with Weelumurra Creek at a level that approximates natural seasonal variability as determined using baseline data and analogue sites selected and described in accordance with condition 5-3"*

Condition 10-1 (5) of MS 1062 is interpreted as a requirement to maintain watertable (and pool) elevations within the observed natural range. The condition does not necessary require the mimicking of seasonal fluctuations but includes the temporary, short-term occurrence of comparatively small-scale declines in pool water level, provided the watertable remains within a specified range at specified trigger monitoring sites.

Fortescue interprets any small-scale declines in pool water level to be reflective of natural water table fluctuations relating to climate and/or variations observed in supplementation rates.

Fortescue proposes to manage potential impacts; as outlined in Condition 10-1 (5) of MS 1062 through a water management system, which will be comprised of supplementation via a re-injection network, and a hydraulic barrier. Supplementation will involve injecting groundwater into the CID palaeochannel aquifer between the pools and dewatering or abstraction activities. Injection will occur via re-injection bores so as to prevent any direct disturbance to Weelumurra Creek itself, which is a listed heritage restricted zone.

This Plan details the supplementation programme and includes:

- A description of baseline environmental conditions at the pools.
- A discussion on potential dewatering related impacts on the pools.
- Outlines the management strategy and supplementation methodology.
- Details the management targets and management actions.
- Monitoring and reporting requirements.

Management of impacts to groundwater dependent vegetation, a requirement of Condition 10-1(1) of MS 1062, is detailed in the Vegetation Health Monitoring and Management Plan (100-PL-EN-1020).

2. ENVIRONMENT

2.1 Solomon Project Area

The Solomon Project area climate, geology, hydrology and hydrogeology has been summarised in the Solomon Triennial Aquifer Review (Fortescue, 2017).

2.2 Weelumurra Creek

2.2.1 Hydrology

Weelumurra Creek is located to the southern and western extent of the Solomon Project area (Figure 3). It flows in a north westerly direction around the Project area to discharge into the Lower Fortescue River, approximately 30 kilometres downstream of the Kangeenarina Creek discharge point. The Weelumurra Creek system is significantly larger than Kangeenarina and Zalamea Creek systems, with a total catchment area of 2,295 km^2.

Hamersley Road, Solomon Airport and the section of Castle Road between Hamersley Road and Kanji Camp all contribute to the Weelumurra Creek catchment upstream of Queens. Sub-catchment boundaries and stream channels are poorly defined in this part of the catchment, due to a large expanse of flat topography to the south of Solomon. Because of this flat topography, there is some interaction between the adjacent Fortescue River South Branch and Weelumurra floodplains to the south-east of Solomon, and between the adjacent Caves Creek and Weelumurra Creek floodplains to the south-west of Solomon. Just south of Hamersley road, an incised channel is formed which drains from the flat Weelumurra floodplain northwards through a series of calcrete outcrops. This incised channel forms the start of the main Weelumurra Creek channel, which then flows in a north Westerly direction towards the Lower Fortescue floodplain. The start of this incised channel coincides with the incidence of the potentially groundwater dependant vegetation shown in Figure 4.

The catchment of the Valley of the Queens drains in a westerly direction towards Weelumurra Creek. Flow from the Queens catchment enters the main branch of Weelumurra Creek through ten No. 3 m diameter RCP culverts under the Rio Tinto railway. The main channel is not incised and has low channel banks and consequently five No. 2 m diameter RCP culverts are located to the south to convey breakout flows from the main channel under the railway.

2.2.2 Hydrogeology

2.2.2.1 Weelumurra North

Hydrostratigraphy

The aquifer units in the Northern Weelumurra area are interpreted to be consistent with the description in the Solomon Triennial Aquifer Review (Fortescue, 2017), with a shallowing of bedrock at the very northern extent below the modern day Weelumurra Creek (FMG, 2019). Figure 5 provides the conceptual hydrostratigraphy in the nearby Queens deposit (to the east) and Figure 6 a long section in the shallow bedrock area where CID is pinching out. Based on nearby drilling data, it is believed that the Alluvial and Upper CID unit have relatively homogeneous hydraulic properties, but the Lower CID may have a large spatial variability in permeability.

The thickness of each unit beneath Weelumurra Creek is uncertain, as limited drilling has occurred within the creek line. Based on nearby bores Warp 16 and Fish Hooks, which are situated at the far western end of Queens adjacent to the Weelumurra Creek (Figure 7), the base of the CID aquifer is about 60 m below ground surface, with approximately 15 m of Alluvial sediments, 20 m of Upper CID and 25 m of Lower CID. Due to the erosional properties of Weelumurra Creek, it is likely the alluvial sediments are less than 15 m thick at the pool setting. Unit thicknesses are expected to be fairly consistent for the Upper and Lower CID units, although the palaeochannel is understood to diverge from the modern day creek and pool alignment, leading to a pinching out of CID and rise in bedrock elevations beneath the pools.

Groundwater Flow

Monitoring data indicates decreasing groundwater elevations downstream along Weelumurra Creek and a general flow pattern to the northwest, aligning with stream flow direction. The flow direction is believed to be the same in all units. The watertable flow direction correlates with topographic gradients (FMG, 2019) and surveyed pool elevations confirm that the pools are an expression of the watertable.

Additionally, groundwater in the adjoining Queens deposit flows west through the Valley of the Queens where it then flows to the north joining groundwater and surface water flow from upstream of Weelumurra Creek. The groundwater elevation contours steepen towards the Weelumurra Creek discharge area in Queens, likely as a response to the build-up of groundwater behind the junction as two significant groundwater throughflow volumes intersect.

Upwards flow is expected in the groundwater discharge zone coincident with the location of the permanent pools whilst downwards gradients are likely to occur in the recharge and throughflow zones, coincident with the locations of intermittent and semi-permanent pools (Figure 6).

Groundwater Levels

Groundwater level hydrographs for Warp 16 and Weelumurra Well are shown in Graph 1 and Graph 2. Warp 16 is located at the upstream end of the Weelumurra North pools, at the junction between Queens and Weelumurra Creek. Weelumurra Well is located at the downstream end of the Weelumurra North pools (Figure 7)

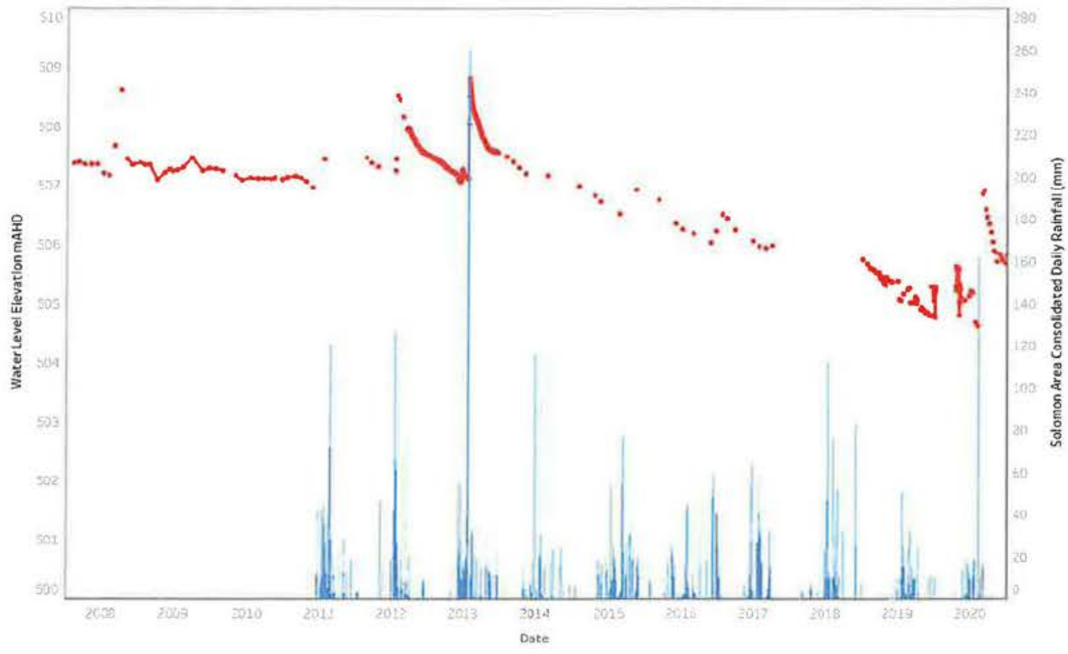
Graph 2 and Graph 3, and the summary in Table 1 below, indicate watertable elevations range from 479.9 to 508.8 m AHD. Downstream, Weelumurra Well elevations range from 479.9 to 480.8 m AHD, whilst upstream, Warp 16 elevations range from 505.1 to 508.3 m AHD. This equates to a range of 0 (i.e. expressing at surface) and 7 m below ground level.

At the upstream end, the range in levels is 3.7 m, however broad scale seasonal fluctuations vary between 0.5 to 0.9 m. Initial sharp, short-term peaks in watertable elevations (in response to large rainfall events) can be up to 1.5 m based on the Warp 16 hydrograph. Water levels at Warp 16 may be influenced by 3rd party abstraction. At the downstream end, the range in levels is 0.9 m, with broad scale seasonal fluctuations between 0.2 and 0.5 m.

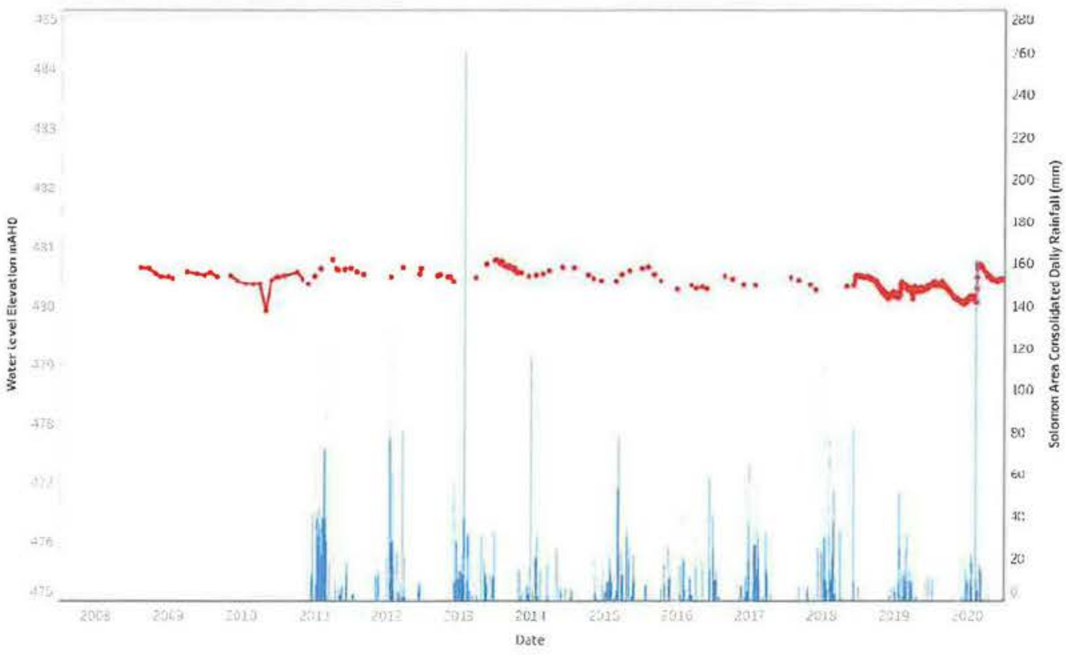
The observed hydrograph in the upstream Warp 16 indicates a long-term decline of about 2 m, prior to an almost rise of 1 m in levels following rainfall associated with Tropical Cyclone Damien in January 2020. The long-term decline is attributed to be the result of declining rainfall in recent years, with early effects of dewatering superimposed thereon. The long-term decline response is less pronounced at the downstream location of Weelumurra Well, which reflects its location in the discharge zone of the groundwater system (FMG, 2019).

Table 1: Watertable Fluctuations at Weelumurra Groundwater Monitoring Locations

Monitoring Bore	Location	Minimum (mAHD)	Maximum (mAHD)	Range (m)
Warp 16	Upstream	505.1	508.8	3.7
Weelumurra Well	Downstream	479.9	480.8	0.9



Graph 1: **Hydrograph of Warp 16 from 2007 to 2020**



Graph 2: **Hydrograph of Weelumurra Well from 2007 to 2020**

2.2.2.2 Weelumurra South

Hydrostratigraphy

The Weelumurra South pools were originally identified from a single 2004 aerial image, and are located at the headwaters of Weelumurra Creek, coincident with a large calcrete and bedrock outcrop. Mapped potentially groundwater dependent vegetation are also located along the creek at this location. No drilling has been undertaken in the immediate vicinity of the creek owing to heritage and land access constraints; however proximal downhole information and field mapping of geology has supported the conceptual hydrogeological section shown in Figure 8.

The pool setting is that of an alluvial channel incised into a hard calcrete layer. The depth of incision is likely to range between 5 to 20 m, with a mixture of weathered calcrete fines, gravel and sand forming the substrate. The calcrete is either underlain by additional Tertiary material or bedrock units of the Brockman Iron Formation.

Groundwater Flow

It is assumed the groundwater flow regime is connected to the broader alluvial groundwater regime of the surrounding Southern Fortescue and Sheila Valleys. Groundwater flow is towards the north, in the flow direction of Weelumurra Creek.

Groundwater Levels

Interpolation of available groundwater levels up and downgradient of Weelumurra South indicates a groundwater level of 5 to 10 m bgl, supported by the eco-hydrogeological assessment of vegetation along the creek (FMG, 2019).

2.2.3 Weelumurra Pools

Permanent, semi-permanent and intermittent pools exist on local reaches of Weelumurra Creek. A pool census was first undertaken by Fortescue in 2015 (Fortescue, 2015), which involved the visual assessment of pool size and distribution from aerial images at selected times over a nine-year period (2004 to 2013). The baseline surveys undertaken since have advanced this initial understanding with (FMG, 2019):

- Verification of inferred and observed pool locations from aerial photographs - 2004 to 2019. Importantly, aerial photographs from later stages of the year (dry season) were utilised to help characterise semi-permanent and permanent pools only. Multiple aerials were considered to reduce shading and solar influences.
- Weelumurra Pools Characterisation Study including the installation of pool water level loggers, pool surveys and hydrochemistry sampling at Weelumurra Creek and Weelumurra West.

- Weelumurra South riparian vegetation assessment.
- Creek bed geomorphology studies to characterise changes in stream morphology and the potential impact on pools.
- Consolidation of historic pools surveys, groundwater monitoring and reports.

The pool census demonstrated that there are permanent and semi-permanent pools in Weelumurra North Weelumurra Creek downstream of Valley of the Queens. However, many pools tend to migrate upstream or downstream with movement of creek bed sediments. Pools often join up in some years and are separate in others. There is no evidence of pool persistence in Weelumurra South, leading to their baseline designation as intermittent.

The Baseline Survey Technical Report (Appendix 1) describes the basis of characterisation for these pools, developed from baseline surveys and the characterisation system referenced in the Pilbara Groundwater Allocation Plan (DoW, 2013). Table 2 summarises the pool characteristics for each class of pool, with the spatial location of each pool type illustrated in Figure 9.

Table 2: Pool classification and characterisation system (from FMG (2019))

Pool	Typical Groundwater Location	Geomorphic Location	Main Water Source	Groundwater Connection	Years Assessed (DoW Classification)
Permanent	Discharge Zone	Main Channel(s)	Groundwater	Continuous	100%
Semi-Permanent	Throughflow Zone	Secondary channels/low Terrace Main Channel (Throughflow Zones)	Initially surface water. Groundwater sustained	Med-long term connection (4 to 12 months)	60-99%
Intermittent	Largely Throughflow and Recharge Zones	Typically, within overflow channels on low and high terrace. But also, upstream main channels	Surface Water	Short Term (days to 3 months)	<60%

The report in Appendix 1 contains full details regarding the baseline data for Weelumurra Creek's pools; with details referenced throughout the following sections.

2.2.3.1 Weelumurra North

The baseline of the Weelumurra North pool system is reflected in Figure **6**. The pools are groundwater supported, with groundwater recharge occurring primarily via stream flow along the main channel, and groundwater throughflow from the Queens and Weelumurra palaeochannels and overlying alluvium.

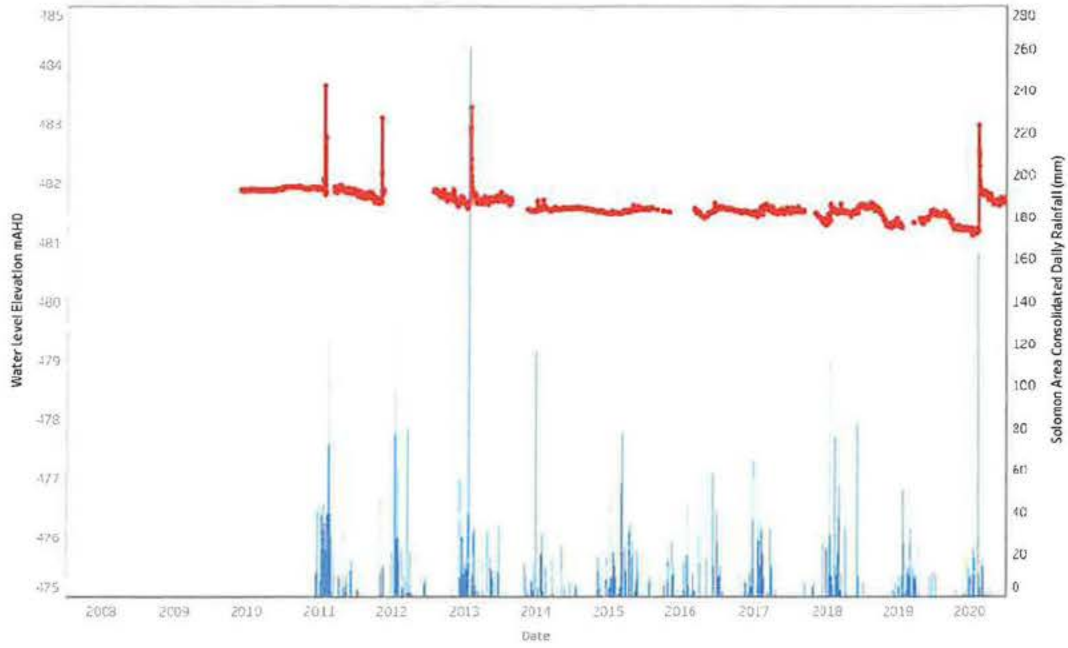
Permanent groundwater pools occur only in the discharge zone, which is at the downstream extent of where pools have been observed. As indicated in Graph 3, pool water levels have a limited range (<1 m), declining even in times of extended drought. The pool locations are primarily within the main creek channel and may migrate as the creek morphology changes. The depths of the pools vary for the same reason, forming in scour points in the main channel.

Semi-permanent pools are typically located in the throughflow zone; upstream from the permanent pools, also within the main creek channel. These pools are recharged with surface water and supported by elevated groundwater levels following significant rainfall events (>50 mm). Overtime (six to twelve months) these pools lose their connection with the water table as groundwater levels decline due to evapotranspiration and discharge downstream. Additional semi-permanent pools are located within the main groundwater discharge zone in secondary flow channels generally located at slightly higher elevations within the creek low terrace.

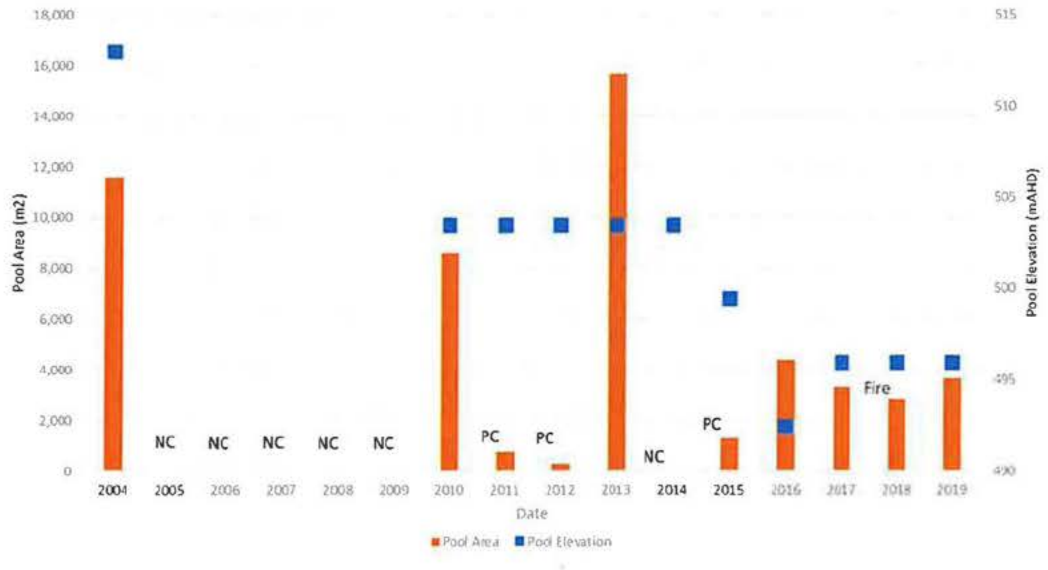
Intermittent pools occur in recharge zones further upstream and in secondary flow channels along the low and high terrace geomorphic zones following significant rainfall and surface water flow events. These pools are present in wetter years and dry out as their connection with the underlying water table is lost.

The pool census data indicates there has been an overall decline in the areal extent of pools between 2003 and 2019, although evidence from significant wet years suggests an up to 60% increase in area, is possible (Graph 4). As regional groundwater levels have declined since 2014, in line with the current drying period, what are now understood to be semi-permanent and intermittent pools have migrated further downstream, with permanent pools located solely within the groundwater discharge zone.

Assessment of climate trends provides context to the baseline setting at Solomon, with Fortescue's early operations occurring towards the end of a 'wetting' period in the 110-year rainfall record. Observations used in the original PER submission in 2014 would have reflected the outcome of 11 years of almost double the long term average annual rainfall, followed by a another 6 years of above average rainfall. Since 2014, there has been a gradual return to a cumulative rainfall deficit, with discharge exceeding recharge.



Graph 3: Hydrograph of Weelumurra Downstream from 2007 to 2020



Graph 4: Weelumurra Census Pool Area and Discharge Elevation (from FMG (2019))

2.2.3.2 Weelumurra South

Noticeable pools were only identified in the Weelumurra South area in 2004, towards the latter end of 11 years of above average rainfall. No field records were taken of the pools at the time as it was prior to Fortescue's presence in the area.

The conceptual ecohydrogeological model of Weelumurra South developed during baseline surveys (Figure 8) further supports the understanding that these pools are intermittent, and not associated with the groundwater regime required to support semi-permanent or permanent pools.

3. POTENTIAL IMPACTS

Groundwater abstraction associated with mine dewatering and water supply may result in drawdown in Weelumurra Creek. As per Condition 10-1 (5) impact and mitigation measures in this Plan focus on groundwater level drawdown.

3.1 Sensitive Receptors

Consistent with Condition 10-1 (5) of MS 1062, the sensitive receptors of Weelumurra Creek include the permanent and semi-permanent pools found only in the Northern area Weelumurra Creek (Figure 7).

3.2 Pools Impact Assessment

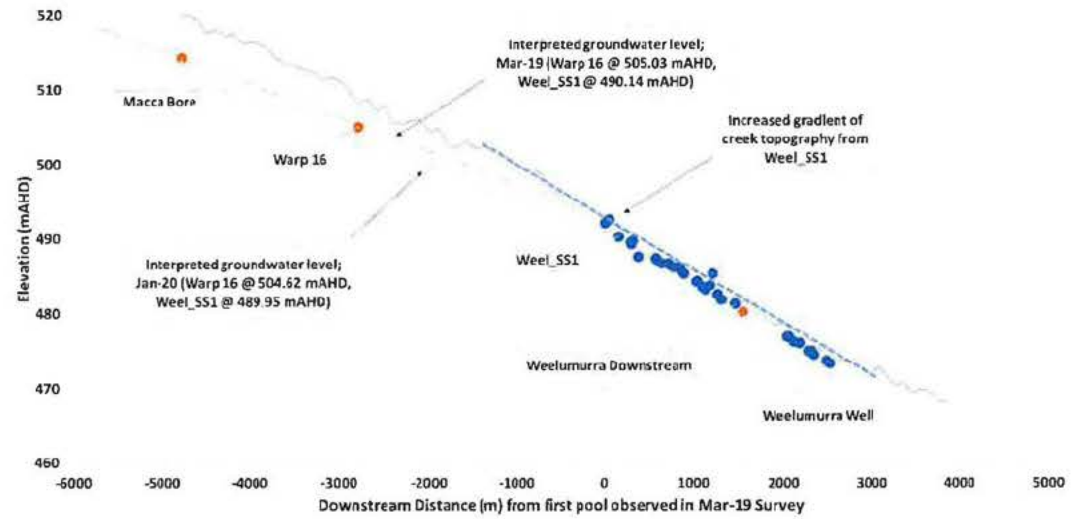
3.2.1 Queens Groundwater and Pool Occurrence

The baseline survey report (Appendix 1) included a snapshot of groundwater and pool levels for a March 2019 field survey. This data, illustrated in Graph 5 indicated pool occurrence is linked to the upstream groundwater gradient, providing the groundwater throughflow required to maintain groundwater levels which express in scoured out areas of the creek bed.

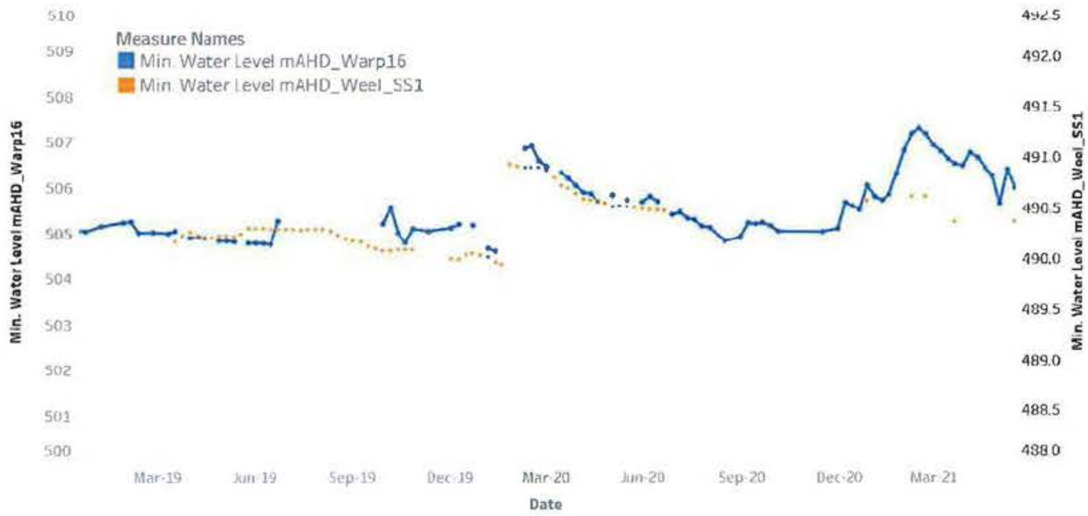
More recent data from ongoing monitoring of semi-permanent pool location Weel_SS1, illustrates the relationship between groundwater level at Warp 16 and that of the pool, particularly during periods of no recharge or immediately following recharge events dominated by creek flow. As annotated in Graph 6, supplementation does result in localised mounding at Warp 16 which has a more subdued change in water levels at the downstream pool.

From an impact perspective, a sustained decline in groundwater levels at Warp 16, impacting longer term throughflow, will lead to a decline in levels at the semi-permanent pool. Short term (weekly) variations are not expected to materially impact the pool water balance. The likely outcome of upstream water levels on pool extent is annotated in Graph 5; March 2019 pools include the semi-permanent Weel_SS1, and 2 other upstream locations.

A similar relationship between Warp 16 groundwater levels and downstream permanent pool levels (i.e. Weelumurra Downstream) is not observed. As described in the baseline survey report, these locations are in the groundwater discharge zone, with changes to groundwater levels buffered by upwards flow gradients associated with bedrock constraints to groundwater throughflow.



Graph 5: Weelumurra topography and groundwater gradient with pool occurrence.



Graph 6: Minimum weekly water levels at Warp 16 and Weel_SS1 for 2019 to 2021

3.2.2 Groundwater Flow Model

Fortescue have developed a groundwater flow model of the Solomon Project, which allows predictive assessments of mine dewatering drawdown impacts on Weelumurra Creek. The model was initially based on a preliminary groundwater model developed by NTEC (2010) designed to describe the groundwater flow processes within the Solomon Project Area. Fortescue took ownership of the groundwater model in 2012 and have undertaken regular updates through to the present. These updates have increased the level of detail in the model and improved the accuracy.

The model was updated for assessment of the required dewatering and associated hydrogeological impacts of the Life of Mine (LoM) mine plan (Fortescue 2015b). The updated model allowed for an improved predictive assessment of the impacts of abstraction on the groundwater resource and environmental receptors, including the Weelumurra pools. The model included updates to the hydrogeological conceptualisation of the Weelumurra palaeochannel aquifers to adequately simulate the pools at Weelumurra Creek. The model presents:

- A linear relationship to estimate the amount and distribution of recharge.
- A gamma distribution model to simulate the temporal distribution of recharge to groundwater systems with relatively deep groundwater levels;
- A steady-state calibration of the numerical model using average measured watertable elevations to approximate the long-term average groundwater levels.
- Transient flow calibration of the numerical model.

Model Details

USG-TRANSPORT version 1.1.1, an enhanced version of the public domain MODFLOW-USG code, was used as the numerical engine for the updated groundwater model, and Groundwater VISTAS v7 as the model pre and post-processing graphical user interface.

The model domain was selected to cover the mine resource areas and the hydrogeologically-associated environmentally sensitive areas (including the pools) with sufficient offset to mitigate the effect of the uncertainties at the external boundaries. The extent of the model domain is 25 km x 12 km. The domain has been divided uniformly into 40 m x 40 m numerical cells.

The model includes four layers aligned with the conceptual hydrostratigraphy. These layers represent:

- Alluvial deposits.
- Upper CID.
- Lower CID.
- Weathered bedrock.

The model features numerous zones defined by various hydraulic properties, including hydraulic conductivity, storage, recharge and evapotranspiration. The use of multiple hydraulic property zones in the model exist to accommodate the potential need for fine-tuning the modelled spatial variations in hydraulic properties to better fit observed groundwater levels. Determination of zone values stems from pumping test analyses, abstraction responses and known literature.

The long term annual average of the distributed recharge over the entire model domain is about 3.0% of the long-term average of the annual rainfall at the Wittenoom station, which is near the lower end of the generally expected range of 2-10% in the Pilbara region. The evaporation extinction depth in the Weelumurra Creek is set at 5 m below ground level.

Constant head boundary conditions are applied to the inflow boundary segments. A constant head boundary is also applied to outflow at the northwest corner of the model domain. Fresh bedrock enveloping the palaeochannel hydrostratigraphy is set as a no-flow boundary. Groundwater discharge through pool settings are defined by drains, whilst Connected Linear Network (CLN) conduits were set up in the model to simulate pit dewatering.

Comprehensive detail on the formulation of model properties and zoning is provided in the Fortescue Report *Groundwater Flow Modelling Assessment of the Solomon LoM R120ii* (Fortescue 2015b).

3.2.3 Assessment of Management Requirements

Impacts from Pool Supplementation

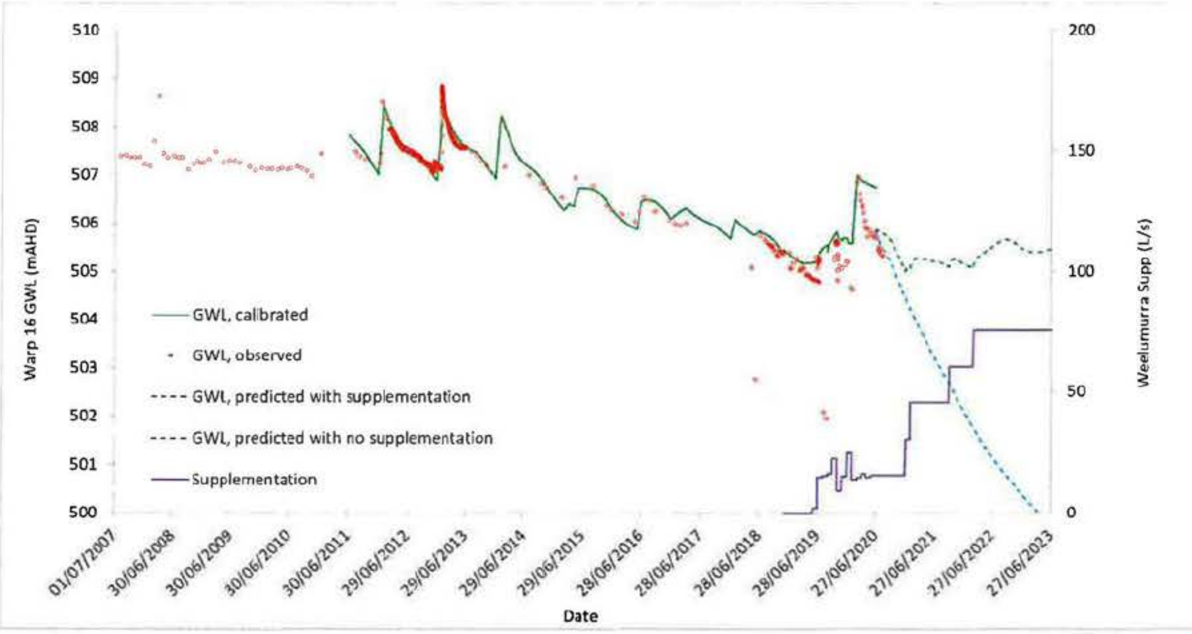
The model was also used to undertake a predictive simulation, with groundwater supplementation used to offset drawdown resulting from dewatering of the Queens Mining area. A series of reinjection bores were simulated up gradient of the discharge and throughflow zones in Weelumurra Creek (Figure 7), at a distance of 200 m from the western boundary of Fortescue's mining tenement M47/1410.

The bores are screened through the upper and lower CID to allow maximum recharge to the main aquifers feeding the groundwater fed pools.

The results of the revised predictive simulation with and without supplementation are shown on the hydrograph on Graph 7, along with observed data. The simulated groundwater levels at Warp 16 (upgradient of the pools) are shown over time, with the modelled supplementation volumes required to maintain groundwater levels at the desired elevation.

The groundwater level at Warp 16 declines at a rate observed under natural regression following the recharge event from Tropical Cyclone Damien in February 2020. This decline is arrested by stepwise increase in injection from 15 L/s (current rate as at June 2020) to 75 L/s by the end of the simulation period. Predicted groundwater levels from the model under these supplementation schedules show that impacts to the pools can be avoided and groundwater elevations at Warp 16 can be maintained in the pre-dewatering ranges.

Further modelling analysis will be undertaken with each iteration to the mine plan and as monitoring data is collected, with adjustments to the reinjection network as required to counteract drawdown from Queens dewatering.



Graph 7: Modelled Effect of Supplementation on Warp 16 Groundwater Levels

3.3 Knowledge and Model Gaps

The model has been prepared using information and hydrogeological knowledge available at the time and for the purpose of assessments of pit dewatering requirements for the Queens Deposit. Some uncertainties exist in the knowledge of the Weelumurra Creek pools environment. Assumptions made because of these uncertainties may influence the predicted drawdown impacts on the pools of Weelumurra Creek and simulated supplementation strategies developed to off-set these potential impacts. The uncertainties include:

- Limited information on the hydrogeological setting underneath the Weelumurra Creek pools due to absence of drilling data. The current conceptualisation is conservative in assuming unimpeded vertical connectivity between the CID and alluvial aquifers

- Uncertainty with respect to the quantification of groundwater-surface water interactions at the Weelumurra pools as a result of the lack of monitoring bores in the immediate area to correlate groundwater responses to surface water runoff.

4. PROPOSED MANAGEMENT STRATEGY AND ACTIONS

This Plan is intended to provide an adaptive management strategy given the uncertainties regarding the groundwater and surface water characteristics of the local pools environment, and some uncertainty regarding predicted impacts on the pools. As such the Plan will be revised as additional hydrological, hydrogeological and monitoring data is collected and the effectiveness of the proposed management strategy is determined through operation.

4.1 Key Assumptions and Principles

The proposed management strategy incorporates several design themes and assumptions. These include:

- Regional groundwater trends are generally observed to be in a natural decline since 2015 as referred to in Section 2.2.
- Maintaining watertable (and pool) elevations within a specified range at specific monitoring sites. Water levels will not necessarily mimic seasonal fluctuations if conservative lower bound fixed triggers are required.
- Recognition that the natural watertable elevation fluctuation seasonally is a response to recharge from episodic rainfall events characterised by:
  - (i) Initial sharp, short-term responses that temporarily increase the watertable elevations.
  - (ii) Longer-term residual mounding of the watertable above seasonal low elevations.
  - (iii) Subsequent steady decline of the watertable elevations.
- No access to the pools for the purpose of direct supplementation will be possible without disturbing the heritage value of the site.
- Pools are an expression of groundwater; therefore management of groundwater levels in the throughflow and discharge zones will act to maintain the pools.

4.2 Management Methodology

A water management system comprised of supplementation via a re-injection network, and a hydraulic barrier is proposed to maintain groundwater levels at Warp 16 and downstream. The supplementation system is designed to:

- Maintain the westerly hydraulic gradient at the downstream end of Queens (i.e. towards the pools).
- Maintain groundwater levels at and downstream of Warp 16 within the range observed under natural conditions.

The supplementation strategy incorporates re-injection of groundwater into a series of injection bores. Injection bore placement will be guided by modelling predictions and field observations, but are generally expected to be placed in a series of north-south lines across the CID palaeochannel valley floor (such as the existing line shown in Figure 7).

The supplementation system will be developed to ensure sufficient capacity to meet the predicted supplementation volumes required to maintain the target groundwater levels. Water for supplementation will be sourced initially from abstraction bores in Queens, prior to sourcing from dewatering of the nearby Queens pits once large-scale abstraction commences. Longer term water supply for supplementation may be sourced from supplementary sources as required.

It has been assumed that maintaining watertable elevations within the upstream reaches of the pools (close to Warp 16) would prevent impacts from dewatering activity to the groundwater environment and pools further downstream. It is also assumed that the CID palaeochannel aquifer system is vertically integrated, thus characterised by comparatively high vertical hydraulic conductivity and limited differences in groundwater levels between the aquifer units. Therefore, successful outcomes would be achievable irrespective of whether supplementation volumes are applied at the watertable or within the Lower CID.

The hydraulic barrier is a supporting management strategy that acts to decrease aquifer permeability and retard the flow of groundwater through the palaeochannel. It will be developed as required to reduce supplementation volumes, with timing and placement supported by groundwater modelling predictions.

4.3 Timing

The supplementation system has been operable since early 2019. The timing and magnitude of supplementation, plus expansions to the reinjection network will be based on management and performance criteria described in Section 5, and the results of numerical groundwater modelling simulations.

5. RISK BASED MANAGEMENT ACTIONS AND TARGETS

5.1 Groundwater Trigger and Threshold Criteria

An adaptive approach has been developed using a three-tier staged management structure for conservation of the permanent and semi-permanent pools on Weelumurra Creek, through managing groundwater levels in the locality of the pools. The management structure is intended to progressively elevate management actions based on increasing risk of potential impact.

- Tier 1 Trigger: This trigger will guide initial management responses should comparatively small-scale watertable decline be observed, potentially from dewatering drawdown. The Tier 1 trigger does not constitute a Conditional Management Target and, as such, does not require communication with the EPA under Condition 7-4 of MS 1062.
- Tier 2 Trigger: This trigger indicates management may not be performing to expectation, and consequently drawdown impacts may potentially propagate downstream of the re-injection bores. Breaching the trigger criteria would initiate increasingly urgent management corrective actions, however it does not constitute a Conditional Management Target. It would not therefore require communication with the EPA under Condition 7-4 of MS 1062.
- Threshold: This represent a level below which the management objective is at risk of not being met. In other words, that permanent pools dry out and semi-permanent pools are at risk of becoming intermittent. The threshold criteria indicates the management is failing to meet its objectives or that measures are inappropriate. It is considered a Conditional Management Target. The breaching of the threshold criteria would therefore require initiation of actions under Condition 7-4 of MS 1062, with associated communication to DWER.

Table 3 summarises the trigger and threshold criteria selected, justified in the following section.

Table 3: Trigger and Threshold criteria for Groundwater

Bore ID	Tier 1 – Trigger	Tier 2 – Trigger	Tier 3 – Threshold
Warp 16	Groundwater level <505.03 m AHD over two consecutive monthly measurements	Groundwater level <504.62 m AHD over two consecutive fortnightly measurements	Groundwater level <504.22 m AHD over two consecutive fortnightly measurements
Weelumurra Well	Groundwater level <479.94 m AHD over two consecutive monthly measurements	Groundwater level <479.84 m AHD over two consecutive fortnightly measurements	Groundwater level <479.74 m AHD over two consecutive fortnightly measurements

Groundwater bores are currently considered a more robust monitoring option for managing Weelumurra Creek pools' water levels for the reasons noted in Section 4.1, namely:

- The creek morphology is dynamic and pools themselves may be scoured or infilled by flow events;
- Logger installations have already been washed away by flow events, with data lost

In addition, the listing of the creek as a heritage restricted zone, and subsequent consultation with the traditional owners, has confirmed Fortescue is unable to drill bores or install any permanent monitoring installations or visually impacting devices in the creek restricted zone. This includes cementing star pickets into the ground or strapping telemetry units to nearby trees. Fortescue is negotiating tenure access for bore locations on the margins of the creek to augment the approved low impact monitoring undertaken of the pools.

5.1.1 Warp 16 Justification

The basis for Warp 16 trigger and threshold levels relate to the assessment referenced in Section 3.2.1, with the objective of managing groundwater levels to:

(i) Preserve the presence of permanent pools located downstream of Weel_SS1; and

(ii) Enable semi-permanent persistence of pools located upstream of and including Weel_SS1

If groundwater levels at Warp 16 are sustained between the tier 1 and 2 triggers (505.03 mAHD and 504.62), it is expected semi-permanent pools persistence will be maintained at approximately the conditions observed in March 2019. If groundwater levels continue to drop over time to the tier 2 trigger, the pool levels at Weel_SS1 will potentially reach the lowest observed values, with an equivalent depth of approximately 0.2 m.

Within the ranges above, permanent and semi-permanent pools will persist, although the extent of the latter may recede downstream, as observed in the baseline data. Fortescue's proposed contingency actions (Section 5.2.1) will be aimed at managing this period of groundwater level decline should it occur and ensuring management measures are in place to recover groundwater levels prior to the threshold value being reached.

A threshold value of 504.22 m AHD is proposed beyond which, if the level is sustained, all semi-permanent pools are at risk of becoming intermittent, and there is expected to be an increased risk to the persistence of permanent pools. This value equates to the expected elevation of the base of the pool at Weel_SS1, with an additional 0.2 m buffer.

It is also noted that trigger levels will not apply when monitoring data from Warp 16 is pump affected by abstraction from Warp 16. This may occur during periods where Warp 16 is used for Rio Tinto's operational purposes, as happened in 2019. Fortescue plans to replace Warp 16 with a new monitoring bore when an access agreement with Rio Tinto is finalised to enable drilling to take place. Revisions of the plan will also shift trigger level management to future bores located as close to the semi-permanent pools in the creek as permitted by access constraints.

5.1.2 Weelumurra Well Justification

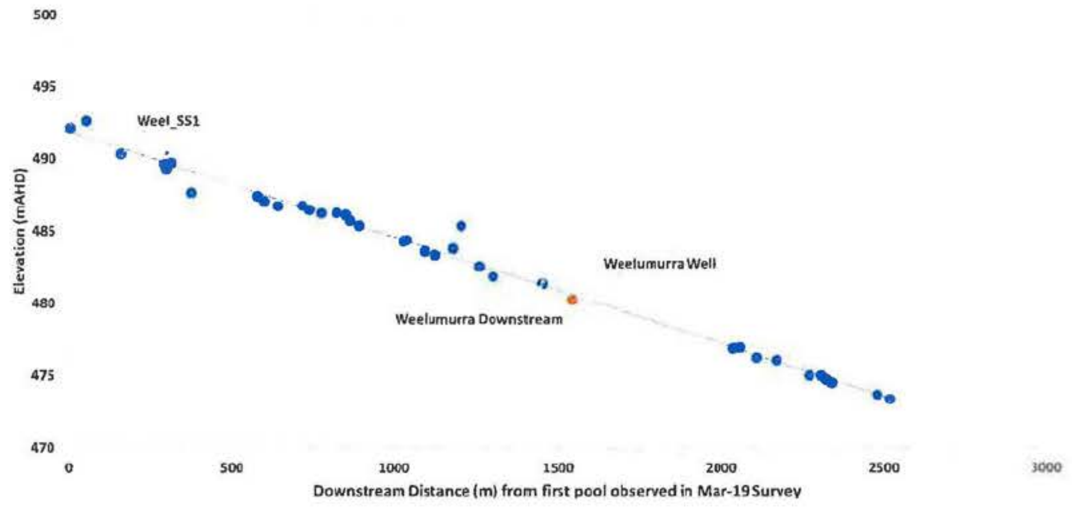
Baseline data observations of pool levels indicate Weelumurra Well, whilst not within the creek channel, has a water level which lies on the linear trendline of pool levels in the discharge zone (Graph 8). Water levels within the well therefore reflects that of groundwater beneath (or expressing at) the creek surface at the nearest point to the well.

Graph 9 indicates how Weelumurra Well and Weelumurra Downstream (a pool monitoring location), when adjusted for spatial offset, display the same pattern and magnitude of water level change during periods of water level stress. The same pattern is not evident in early monitoring data, where it is expected that pool levels were at their highest; supplemented by frequent surface water flow events (FMG, 2019).

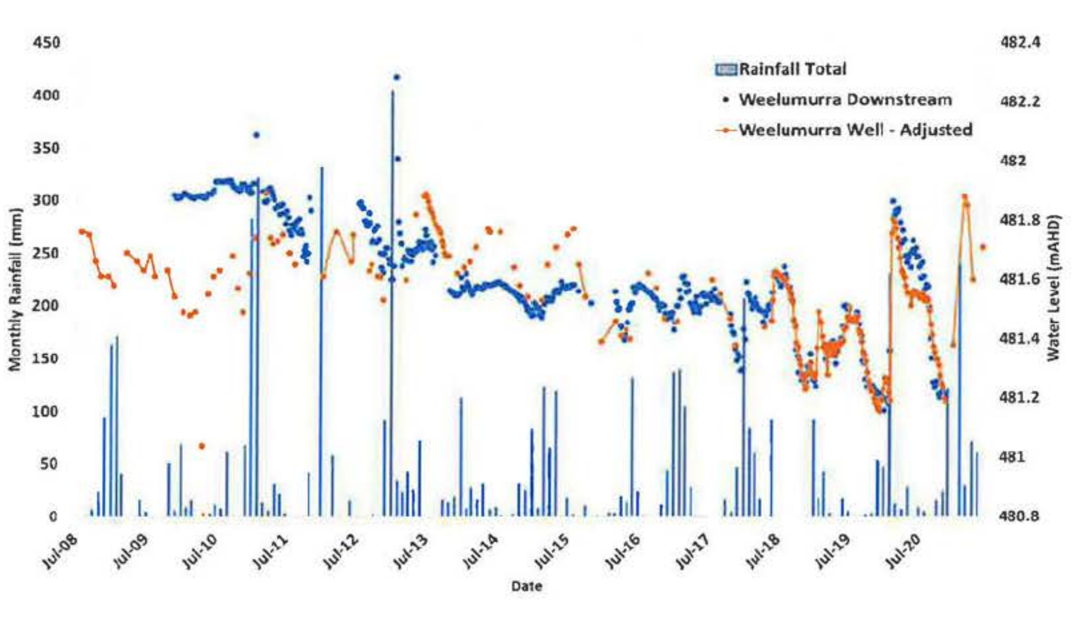
Weelumurra Downstream in periods of drought is approximately 0.3 m deep (actual depth varies with sediment load and location of measurement) and Fortescue proposes a threshold of 0.3 m below the lowest recorded value (480.04 mAHD in January 2020) at Weelumurra Well is adopted as a threshold value.

A basic assessment of the negative rate of change of water levels (rate of decline) in both Weelumurra Well and Weelumurra Downstream has been completed to appropriate trigger settings and contingency action durations. A histrogram of the rate of decline calculated between consecutive water level measurements, is shown in Graph 10. Almost half of all data indicate a rate of decline of less than 0.05 m per month, with the higher rates of decline most likely associated with water level recession following recharge events (Graph 11). This assessment suggests an appropriate trigger level interval of 0.1 m, particularly with monthly monitoring, to capture prolonged drying trends potentially associated with Fortescue's activity.

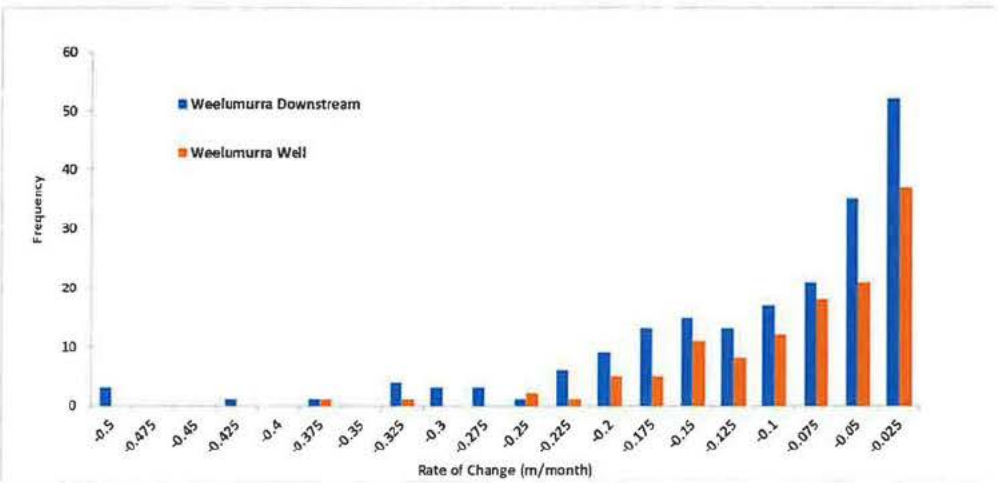
Validation of trigger and threshold exceedances in the context of Fortescue's activities would have to take place by referencing upstream groundwater and pool monitoring data. Weelumurra Well is owned by a neighbouring pastoral operation and a windmill arrangement currently feeds a small tank and trough providing a water source for livestock. This operation has minimal impact on monitored water levels and is deemed appropriate for use in this Plan. However, Fortescue has no control on the potential of the bore being equipped by the pastoral owner over the course of this Plan for larger volumes of abstraction. Pump affected levels in this situation may be more notable and trigger levels will not apply. It is noted that this circumstance is deemed highly unlikely to occur.



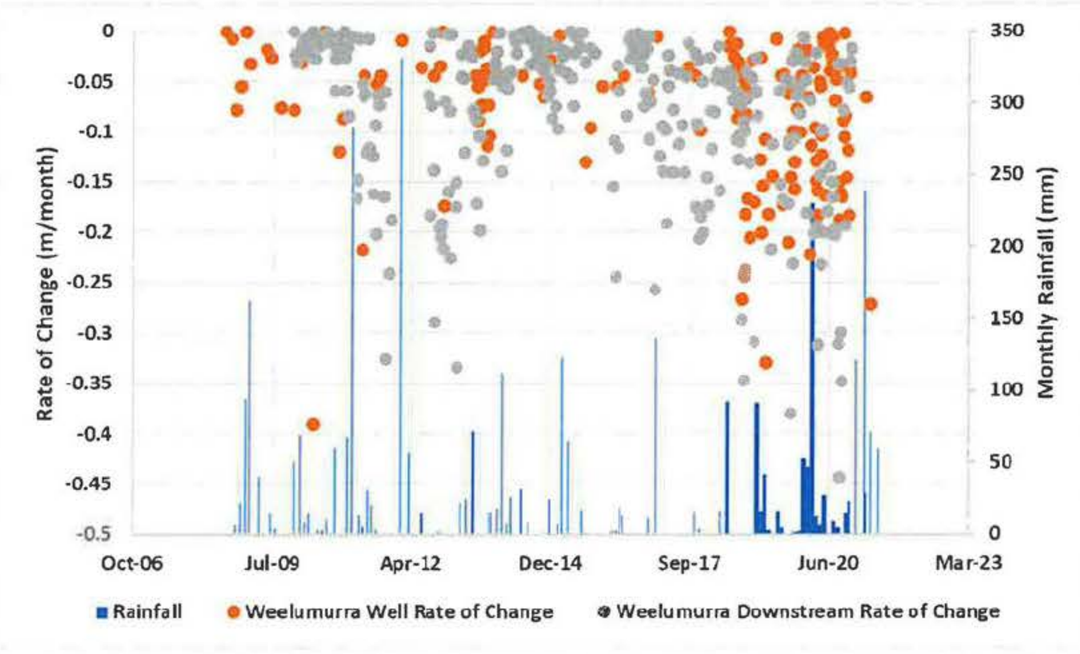
Graph 8: **Observed water level in pools and Weelumurra Well along Weelumurra Creek, downstream of uppermost pool noted in March 2019 survey.**



Graph 9: **Weelumurra Downstream pool levels compared with adjusted Weelumurra Well groundwater levels.**



Graph 10: **Histogram comparing rate of decline at both Weelumurra Downstream and Weelumurra Well**



Graph 11: **Rate of decline at both Weelumurra Downstream and Weelumurra Well compared to monthly rainfall**

5.2 Contingency Actions

5.2.1 Breach of Trigger or Threshold Criteria

The proposed actions for the occurrence of watertable elevations declining below the Tier 1, 2 and Threshold trigger criteria are shown in Table 4, Table 5, and Table 6 respectively. Contingency measures and timetable for a Tier 3 threshold breach are aligned to the measured detailed in Condition 7-4 of MS 1062.

Table 4: Proposed Actions for a Tier 1 (Trigger)

Step	Action	Timeframe*
1 (for a single exceedance event)	Implement revisions to the monitoring plan, with increased frequency of data collection to fortnightly	One week
2 (if exceedance is sustained for a month)	Verify groundwater levels and interpretation of comparative influences of seasonal watertable fluctuations and drawdown impacts. This includes comparison against levels measured at available pool sites (**Table 7**)	One week
3	Inform internal stakeholders of breach of trigger criteria	One week
4	Develop and inform internal stakeholders of revised watertable and pool monitoring and possible contingency actions in the event of increased drawdown. These actions would be driven by findings of an audit of the supplementation system and identification of options that promote upgrades that enable watertable recovery to above the trigger criteria	Two weeks
5	If trigger breach is determined to be the result of dewatering activities, increase re-injection rates (if practical)	Two weeks

*time since becoming aware of the breach

Table 5: Proposed Actions for a Tier 2 (Trigger)

Step	Action	Timeframe*
1	Verify groundwater levels and interpretation of comparative influences of seasonal watertable fluctuations and drawdown impacts. This includes comparison against levels measured at the Weelumurra Pool site	One week
2	Review of trigger criteria in context with measured seasonal fluctuations and interpretations of drawdown distributions and amplitude	One week
3	Inform stakeholders (internal) of watertable elevation decline below trigger criteria and revised watertable and pool monitoring schedule.	One week
4	Increase re-injection rates, if practical as a short term measure	One week
5	Conduct root cause analyses that look to determine reasons for the propagation of drawdown	Two weeks
6	If analyses indicates exceedance is not a result of Fortescue's activity, report findings in writing to the EPA and seek revision to trigger and threshold criteria	Three weeks
7	Assess options that address and mitigate the root causes of drawdown propagation, including re-injection system upgrades or dewatering modifications	Six weeks
8	Develop and inform stakeholders (internal) of contingency actions in the event of progressive increase of drawdown towards the threshold criteria. These actions would be driven by the findings of the root cause analysis and options assessment that mitigate the root causes of downstream drawdown propagation and enable watertable recovery.	Two months

*time since becoming aware of breach

Table 6: Proposed Actions for a Tier 3 (Threshold)

Step	Action	Timeframe*
1	Report the exceedance in writing to the CEO within 21 days of the exceedance being identified	Three weeks
2	Investigate to determine the cause of the management targets being exceeded, including updating and amending the root cause analysis	Four weeks
3	Provide a report to the CEO within 90 days of the exceedance being reported as required by condition 7-4(1). The report shall include: (a) cause of management targets being exceeded; (b) the findings of the investigation and root cause analysis; (c) details of revised and/or additional management actions to be implemented to prevent further breaches, including details on supplementation system upgrade if applicable (d) relevant changes to proposal activities	Within 90 days of the exceedance being reported

*time since becoming aware of breach

5.2.2 Breach of Vegetation Health Monitoring and Management Plan

In the event that management targets under the Vegetation Health Monitoring and Management Plan (100-PL-EN-1020) are not met for monitoring of the upper reaches of Weelumurra Creek, it is proposed to investigate and interpret the cause of the target not being met. If the cause of the target breach is determined to be due to FMG abstraction induced drawdown, FMG will instigate supplementation within the approved MDE to manage groundwater levels proximal to the potentially groundwater dependent vegetation community.

This Plan will be updated to reflect the addition of supplementation, and include further monitoring and management targets.

5.2.3 Failure to Implement of Contingency Actions

In the event that there is a failure to increase supplementation when required, Fortescue will undertake an investigation and reporting process in line with Condition 7-5 of MS 1062.

6. MONITORING AND REPORTING

As required by Condition 7-2 (4) of MS 1062, the environmental monitoring strategy below identifies all sites and parameters to be monitored as part of this Condition Management Plan.

6.1 Monitoring Infrastructure

Groundwater and pool monitoring sites have been selected to support the operation of the Plan (Table 6 and Figure 10). These sites would inform and measure success in maintaining the pools and will be used as measurement sites for comparison against trigger levels defined in Section 5.

The use of Warp 16 and Weelumurra Well as monitoring sites may at times be limited, as Warp 16 is owned and operated by Rio Tinto, whilst Weelumurra Well is a pastoral bore. The locations were selected due to their relatively long period of data collection; however, Fortescue plans to replace Warp 16 with a new monitoring bore in the vicinity of its current locations. Monitoring will be conducted at both existing and new sites to allow for sufficient overlap and correlation of the data sets.

Pool monitoring at two sites, WEEL_SS1 and WEEL_SS2, is included in the Plan. These sites are located within a heritage restricted zone with access agreed to through consultation with the Traditional Owners. Should a flood event destroy the installations or change the creek morphology, Fortescue may be required to reinitiate consultation for shifting monitoring.

Monitoring of two re-injection monitoring bores is proposed as part of this Plan and these are detailed below. These locations will be replaced with more westerly monitoring bores as the supplementation system develops to the west.

Table 7: Summary of Groundwater Monitoring Locations

Location	Type	Easting	Northing	TOC Elevation (m AHD)
Warp 16	Groundwater	575635	7553524	511.7
Weelumurra Well	Groundwater	572638	7556383	486.34
Weelumurra Downstream	Pool monitoring	572777	7556239	481.97
WEEL_SS1	Pool monitoring	572948	7555029	490.77
WEEL_SS2	Pool monitoring	573228	7554745	493.93
WIM007	Groundwater	575897	7553045	513.44
WIM009	Groundwater	575873	7553553	513.94

6.2 Monitoring Parameters and Frequencies

A summary of the proposed monitoring program is shown in Table 7. Continued monitoring of the network will allow the effectiveness of the Plan to be assessed and adaptive management steps to be taken as required.

Table 8: Monitoring Parameters and Frequencies

Sites	Parameters	Frequency
Warp 16 Weelumurra Well	Groundwater levels	Monthly[1]
Weelumurra Pool Sites, WEEL_SS1, WEEL_SS2	Pool water level	Quarterly datalogger downloads
WIM008 WIM009	Groundwater levels	Weekly

Note – if sites are dry or inaccessible, no reading will be taken. Creek monitoring frequency proposed to reduce interaction with restricted heritage zone.

[1] Monitoring frequency will increase to fortnightly as a response to a tier 1 exceedance

6.3 Reporting

Fortescue will generate an annual report detailing monitoring results; which will be provided to DWER along with the Compliance Assessment Report required by Condition 3-1 of MS 1062. The report will adhere to the conditions of 7-2(6) of MS 1062.

In addition, brief reports, in the form of a memorandum containing relevant supporting monitoring data and/or supplementation strategies, will be supplied to the CEO of the EPA should the Tier 3 Threshold Criteria be breached, as per the conditions 7-4 of MS 1062. Details and timeframes for these reports are detailed in Section 5.2.

7. REVIEW AND REVISION

This plan will be reviewed and revised in accordance with Condition 7-6 (1) of MS 1062. Revisions to the plan may occur to:

- Incorporate updated groundwater modelling should this be required.
- Include selected engineering designs that support the conservation of the pools from the impacts of long-term groundwater abstraction and drawdown of the watertable.
- Update the referenced monitoring locations and associated trigger and threshold criteria when Fortescue is able to install new monitoring bores and develop a basis for revised trigger levels in the vicinity of Warp 16 to remove the potential for interruption of monitoring data in the case of Rio Tinto use of Warp 16.
- Update referenced monitoring locations associated with Weelumurra Creek pools when access is granted to drill outside the heritage restricted zone.
- Update referenced monitoring locations associated with the supplementation system as this develops and migrates to the west.
- Facilitate and manage supplementation activity in other areas along Weelumurra Creek that may be required to comply with Condition 10-1(1) of MS 1062. The driver for such an update will be triggered by contingency actions within the Vegetation Health Monitoring and Management Plan (100-PL-EN-1020)

Other data which may inform revisions to the Plan include:

- Natural seasonal fluctuations in watertable and pool elevation data. The selected control sites and monitoring bores would inform the characteristics of these fluctuations.
- Interpreted drawdown distributions and magnitudes linked to groundwater abstractions from site.
- The hydrogeology at the Weelumurra pools and relationships between surface water and groundwater at this setting.

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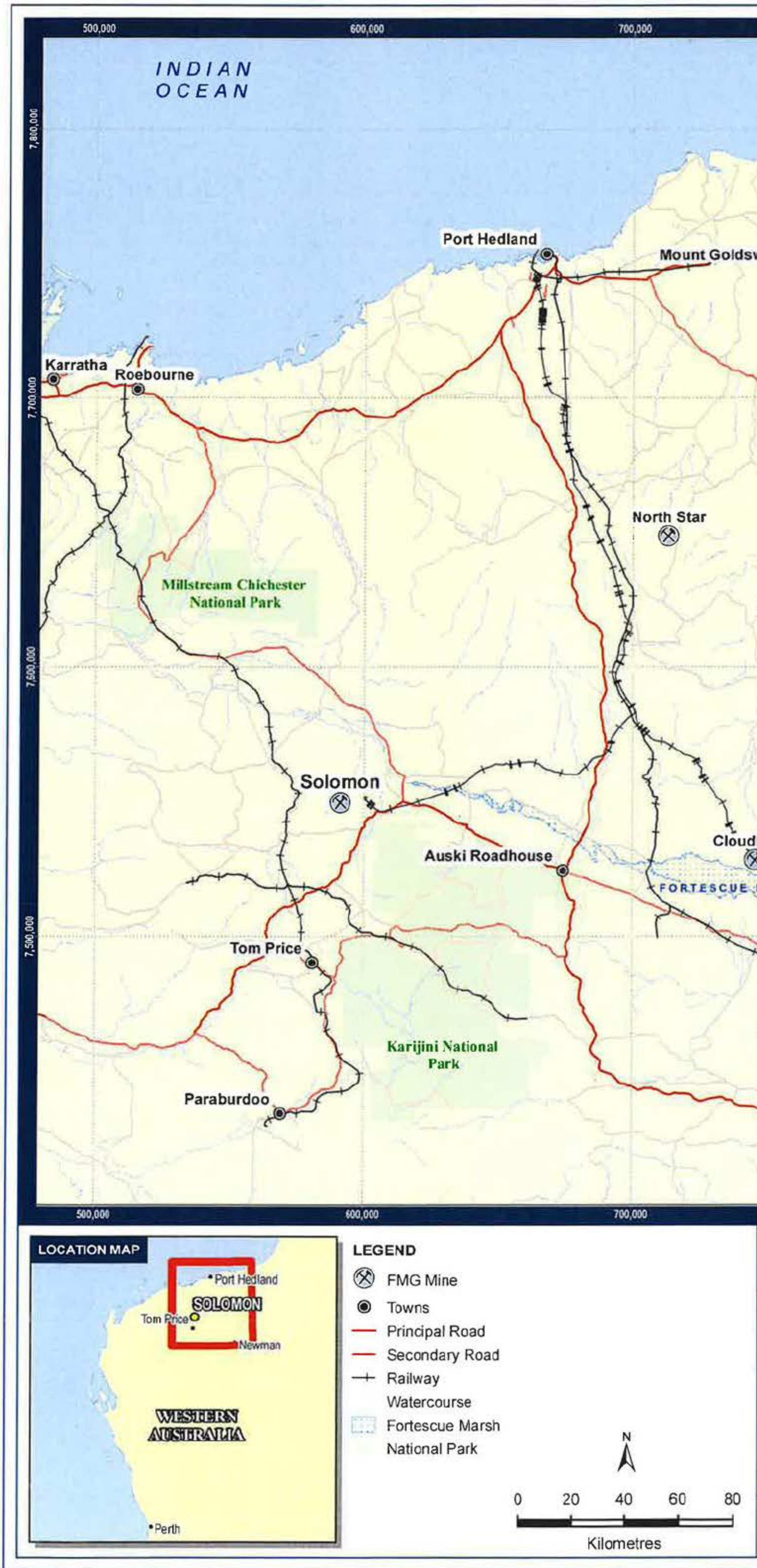
Figure 1: Solomon Project Location



Solomon Project Location

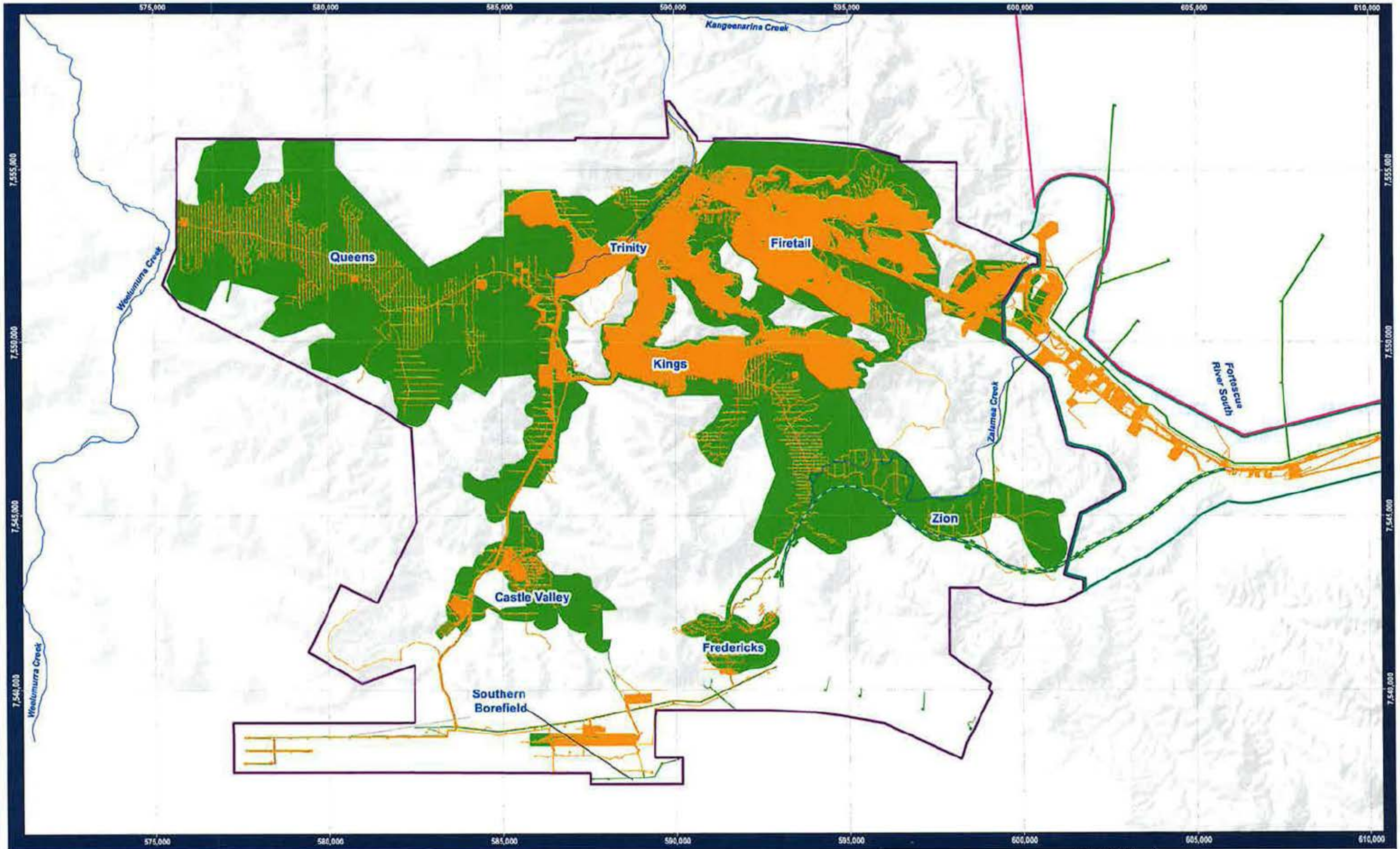
Requested By: Andrew Jackson
Drawn By: Sacha Fielden
Revised By: rmaconachie
Approved By: B Ralebala
Scale: 1:2,000,000
Coordinate System: GDA 1994 MGA Zone 50
Document Name: SO_MP_HY_0076.001_r0

Date: 6/02/2015
Size: A4P
Revision: 0
Confidentiality: 1

Data Source(s):
Landsat 2005 Imagery, Topography, Geoscience Australia, 2013
National Parks, Landgate, 2014

Fortescue Metals Group Ltd

Figure 2: Solomon Mining Areas



LEGEND

- Approved Rail Spur Alignment
- Proposed Indicative Mine and Rail Footprint
- Current & Approved Disturbance to June 2016

Development Envelopes

- Rail Corridor Development Envelope
- Lower Fortescue Borefield Development Envelope
- Mine Development Envelope

Data Sources:
50K Drainage, Pools, Major Roads, Landgate, 2014
Government TEC / PEC Sites, DPaW
All other data, FMG, 2014

N

0 1 2 3 4
Kilometres

Requested By: Amy Barker
Drawn By: Hamish Wallace
Revised By: mcarroll
Approved By: Bridget Raisbala
Scale: 1:100,000
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Document Name: SO_MP_EN_0308.001_r10_Layouts_Map2

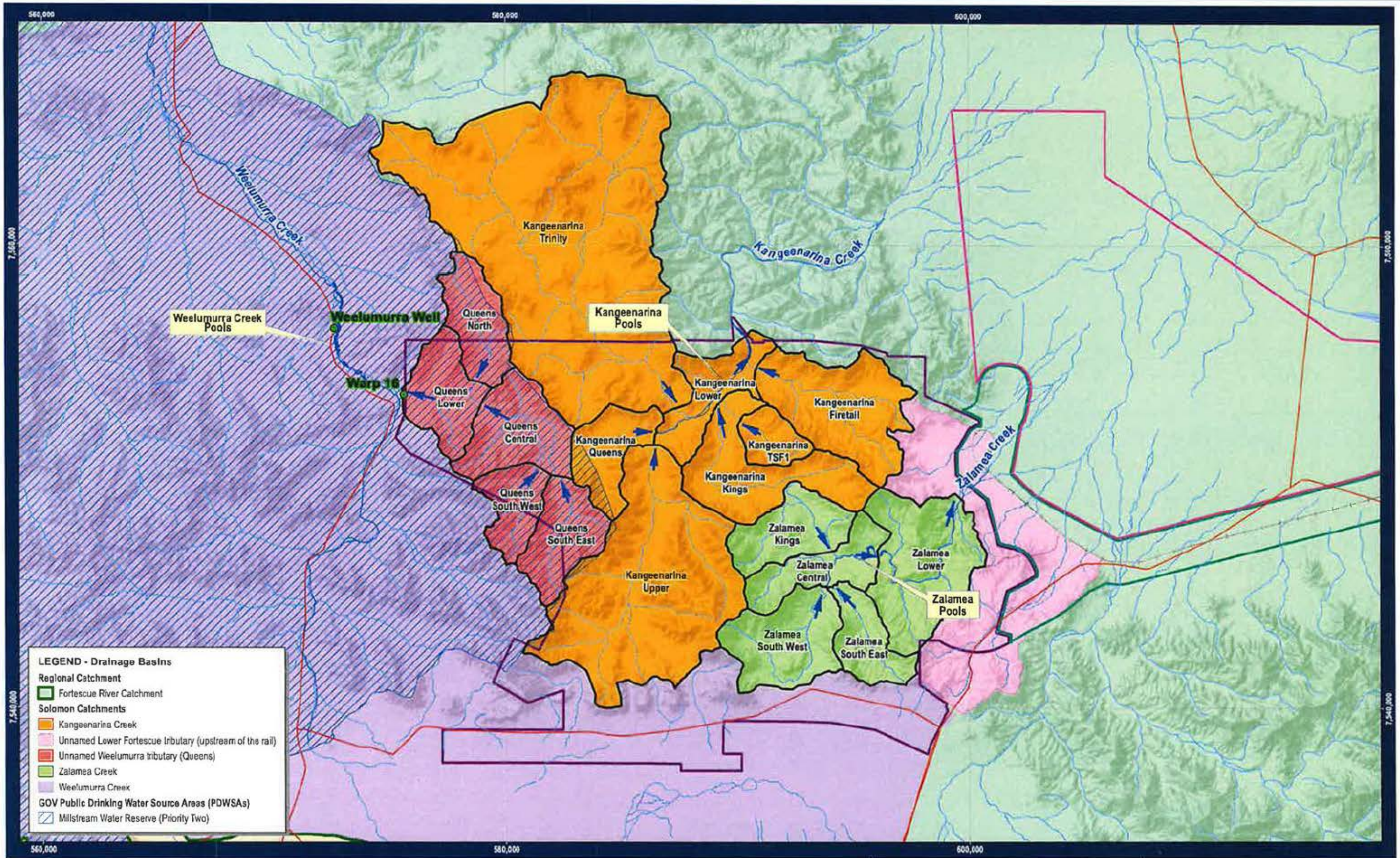
Date: 25/06/2018
Size: A3L
Revision: 10
Confidentiality: 0

Solomon Mining Areas

Fortescue Metals Group Ltd

Figure 3: Catchments and Major Drainages

Surface Water Subcatchments and Major Drainage in the Solomon Project Area



LEGEND

- Major Road
- FMG Rail Alignment
- Drainage
- Pools
- Flow Direction
- DIWA Significant Wetlands

Development Envelopes

- Rail Corridor Development Envelope
- Lower Fortescue Borefield Development Envelope
- Mine Development Envelope

Data Sources:
Locality, Pools, Major Roads, 50K Drainage, Landgate, 2014
Hydrographic catchments, Dept. of Water, 2014
DIWA Significant Wetlands, Aust. Gov. Dept. of the Environment, 2014
All other data, FMG, 2015

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0 1 2 3 4 5
Kilometres

Requested By: R. Warrington
Drawn By: J. Burke
Revised By: mcarroll
Approved By: Bridget Ralebala
Scale: 1:150,000
Coordinate System: GDA 1994 MGA Zone 50
Document Name: SO_MP_EN_0343_r5

Date: 25/06/2016
Size: A3L
Revision: 5
Confidentiality: 1

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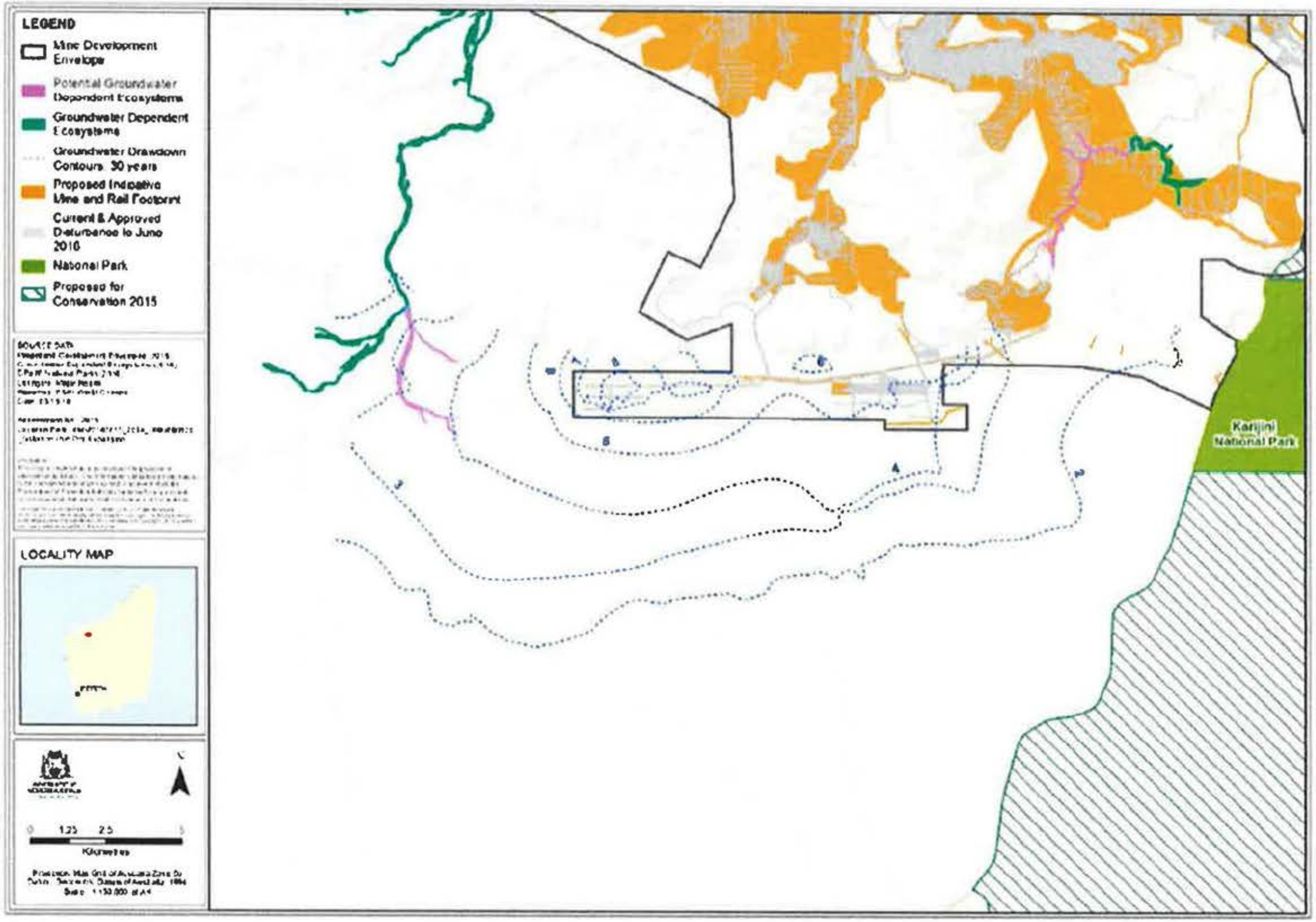
The New Force in Iron Ore

Figure 4: Figure 3 of Ministerial Statement 1062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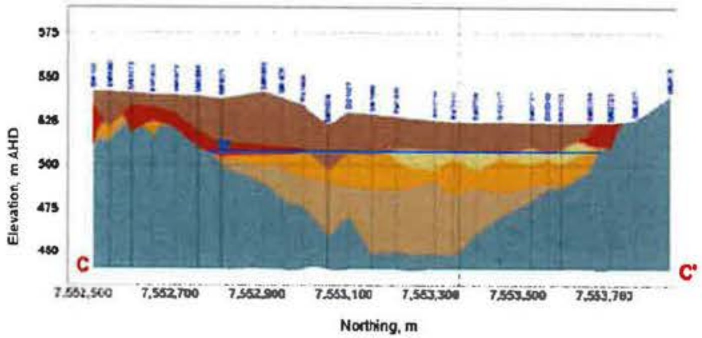
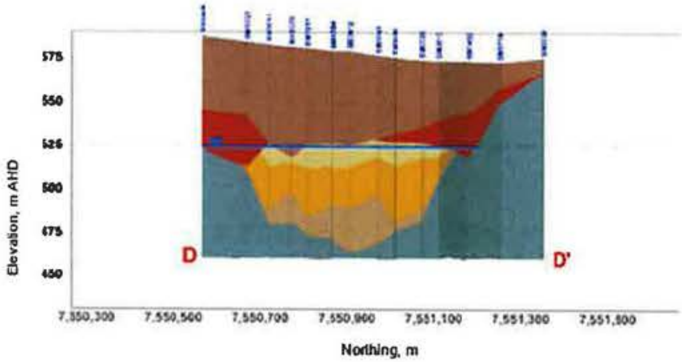
Mine Development Envelope
Potential Groundwater Dependent Ecosystems
Groundwater Dependent Ecosystems
Groundwater Drawdown Contours 30 years
Proposed Indicative Mine and Rail Footprint
Current & Approved Disturbance to June 2016
National Park
Proposed for Conservation 2015
LOCALITY MAP
Karijini National Park
0
1.25
2.5
5
Kilometres

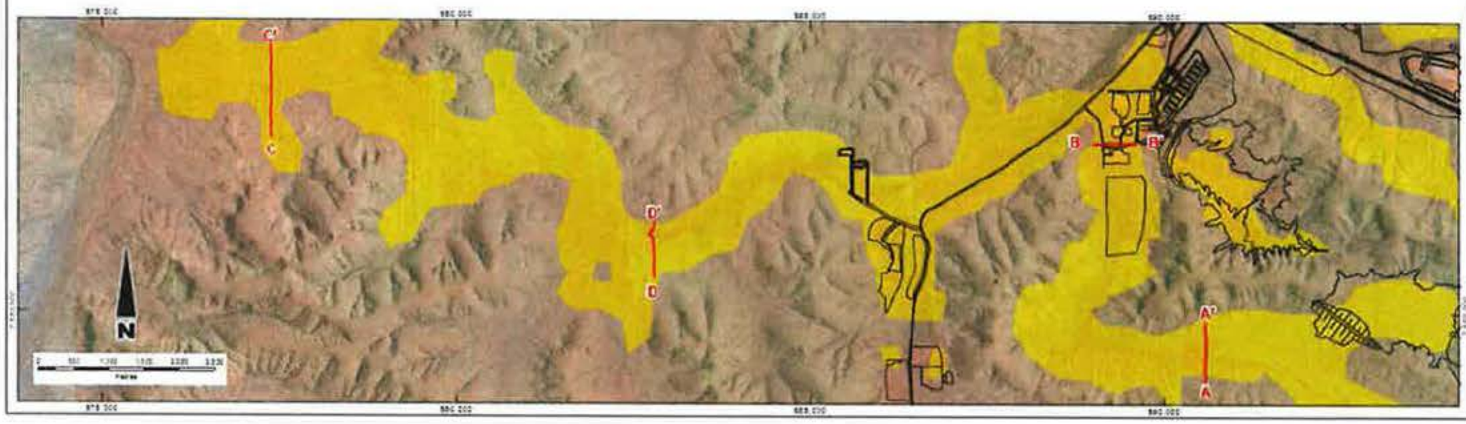
Figure 5: Queens Hydrostratigraphy

Section CC'



Section DD'





LEGEND

- Current Resource Extent (indicative)
- Cross Section
- Proposed Infrastructure
- Groundwater Level

Geology

- Alluvial Deposit
- Detrital Iron Deposit
- Bedded Iron Deposit
- Oakover Formation (Hardcap)
- Upper CID
- Lower CID
- Brockman Formation

NOTES

Coordinate System: GDA 1994 MGA Zone 50

COPYRIGHT

Aerial imagery provided by client.
ACRES Landsat 7 Mosaic imagery sourced from Geoscience Australia 2005.
Other data provided by client.

Golder Associates

CLIENT Fortescue Metals Group
DOCUMENT 117646036-052-R-Rev2
DATE 04 May 2012
COMPILED SGW
APPROVED DMT

H3 Assessment Report

HYDROGEOLOGIAL CROSS SECTION (QUEENS)

FIGURE 7.2

Figure 6: Weelumurra Creek Conceptual Long Section

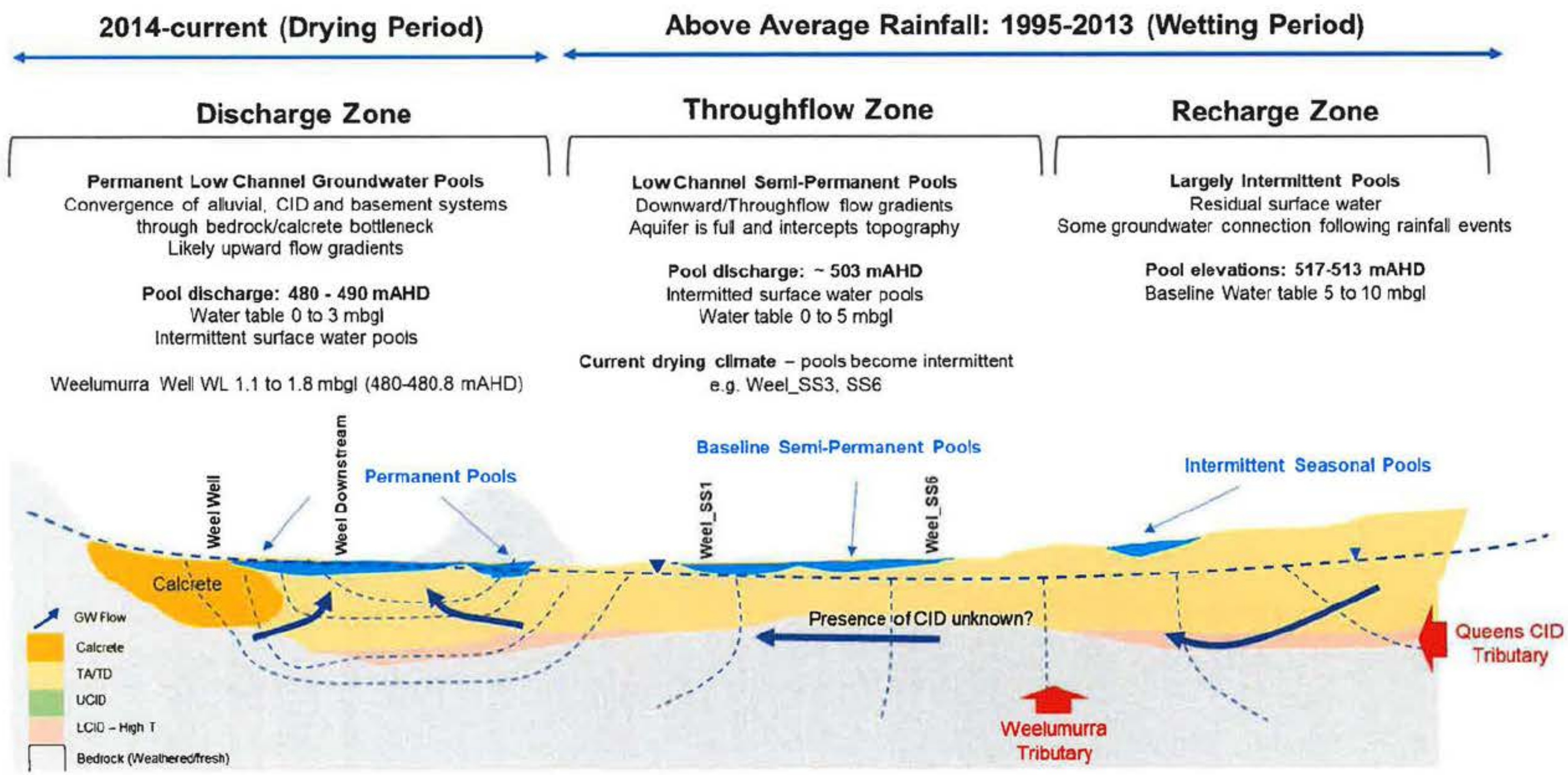
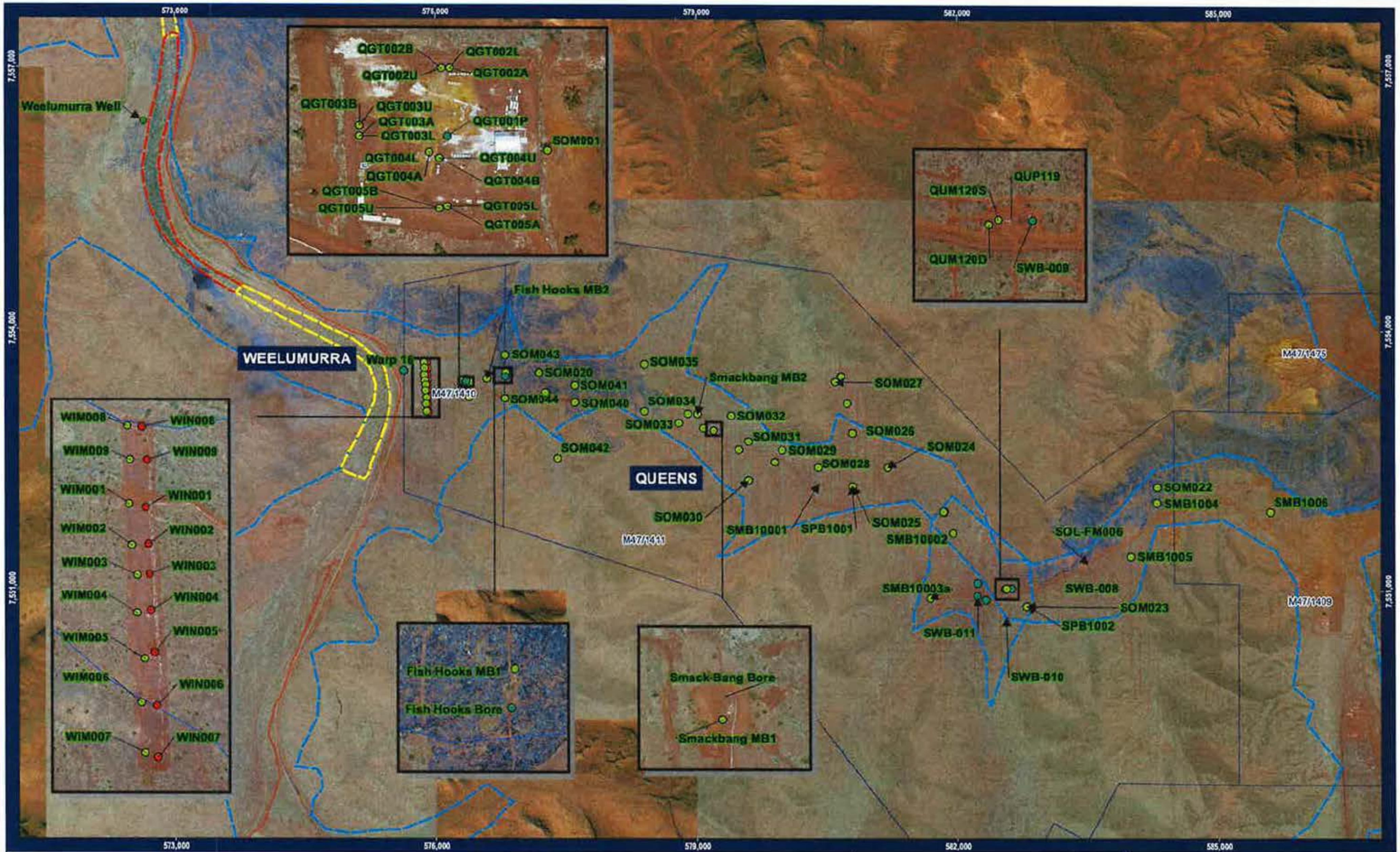

2014-current (Drying Period)
Above Average Rainfall: 1995-2013 (Wetting Period)
Discharge Zone
Throughflow Zone
Recharge Zone
Permanent Low Channel Groundwater Pools
Convergence of alluvial, CID and basement systems
through bedrock/calcrete bottleneck
Likely upward flow gradients
Pool discharge: 480 - 490 mAHD
Water table 0 to 3 mbgl
Intermittent surface water pools
Weelumurra Well WL 1.1 to 1.8 mbgl (480-480.8 mAHD)
Low Channel Semi-Permanent Pools
Downward/Throughflow flow gradients
Aquifer is full and intercepts topography
Pool discharge: ~ 503 mAHD
Intermitted surface water pools
Water table 0 to 5 mbgl
Current drying climate – pools become intermittent
e.g. Weel_SS3, SS6
Largely Intermittent Pools
Residual surface water
Some groundwater connection following rainfall events
Pool elevations: 517-513 mAHD
Baseline Water table 5 to 10 mbgl
Weel Well
Weel Downstream
Permanent Pools
Baseline Semi-Permanent Pools
Weel_SS1
Weel_SS6
Intermittent Seasonal Pools
Calcrete
Presence of CID unknown?
Queens CID Tributary
Weelumurra Tributary
GW Flow
Calcrete
TA/TD
UCID
LCID – High T
Bedrock (Weathered/fresh)

Figure 7: Groundwater and Pool Locations



LEGEND

Groundwater Locations
- Monitoring Bore
- Production Bore
- Injection Bore

- Discharge Zone
- Recharge Zone
- Throughflow Transition Zone
- FMG Managed Mining Tenements

Data Source(s):
Topography, Geoscience Australia, 2013
Imagery, FMG and Landgate, 2018
All other data, FMG, 2018.

Requested By: C.Looby
Drawn By: C.Meyer
Revised By: mcarroll
Approved By: P.Mastalir
Scale: 1:40,000
Coordinate System: GDA 1994 MGA Zone 50
Document Name: SO_MP_HY_0088.004_r3

Date: 1/07/2021
Size: A3L
Revision: 1
Confidentiality: 1

Groundwater Locations and Pool Characterisation Zones

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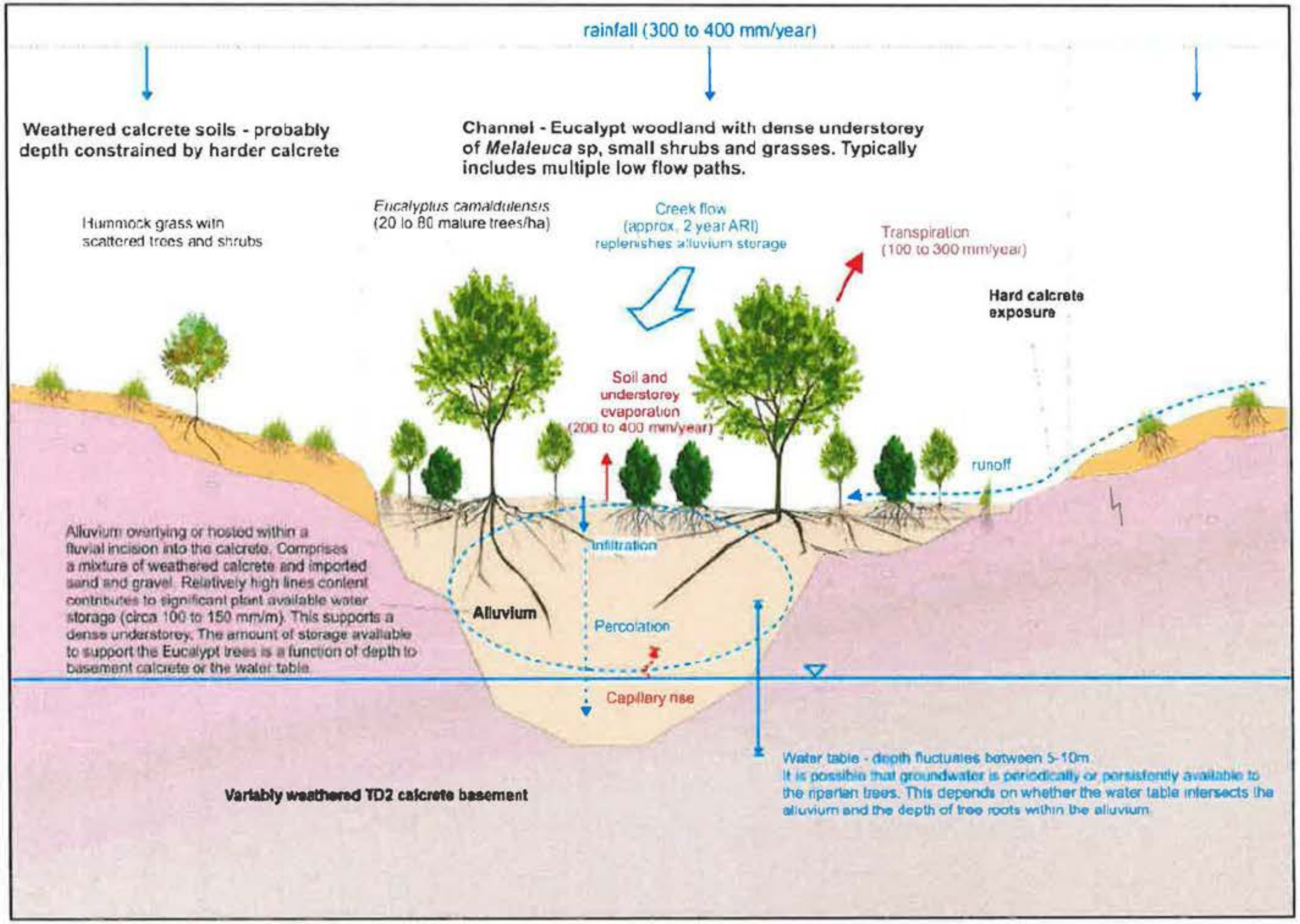
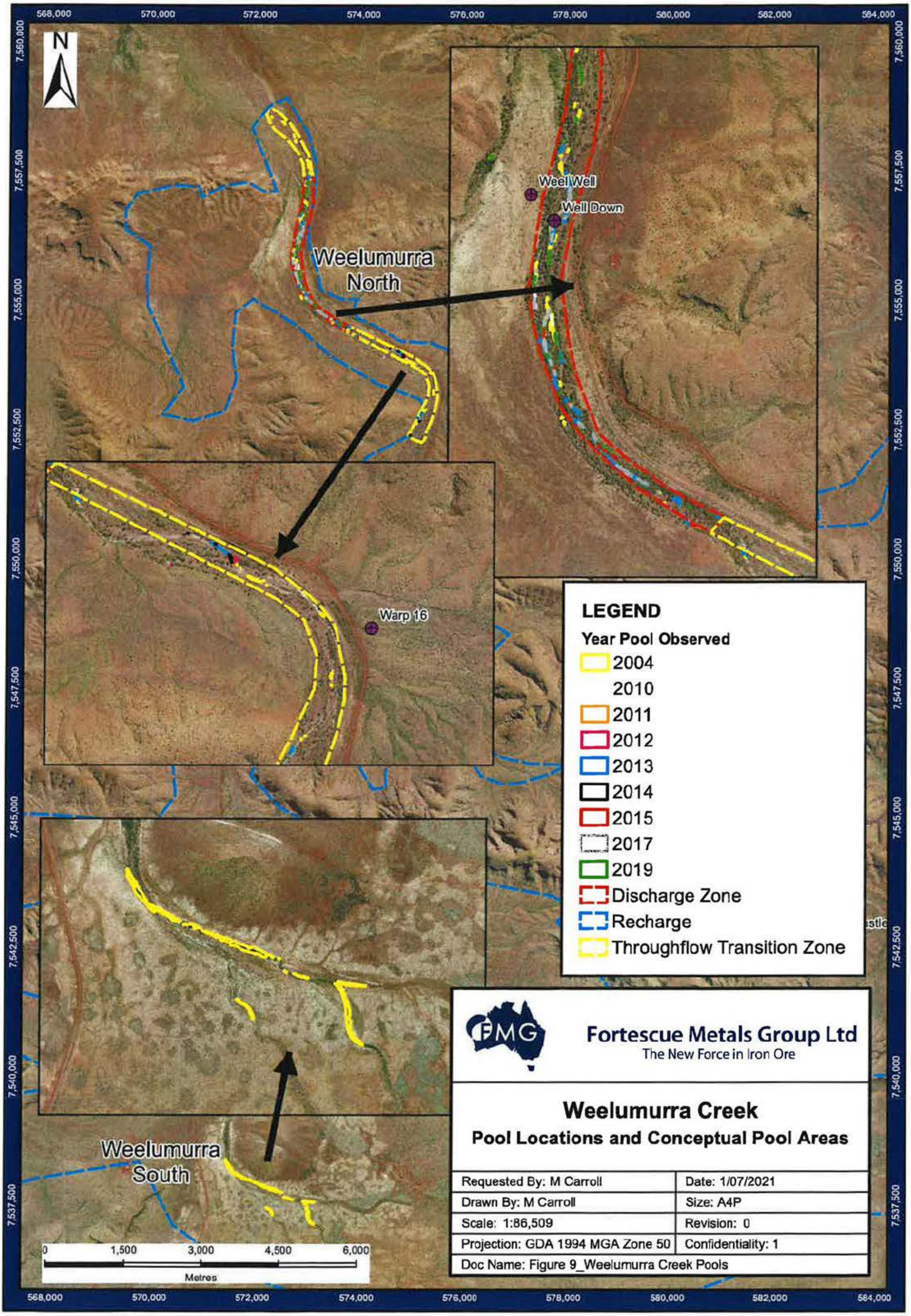
Figure 8: Weelumurra South Conceptual Cross Section



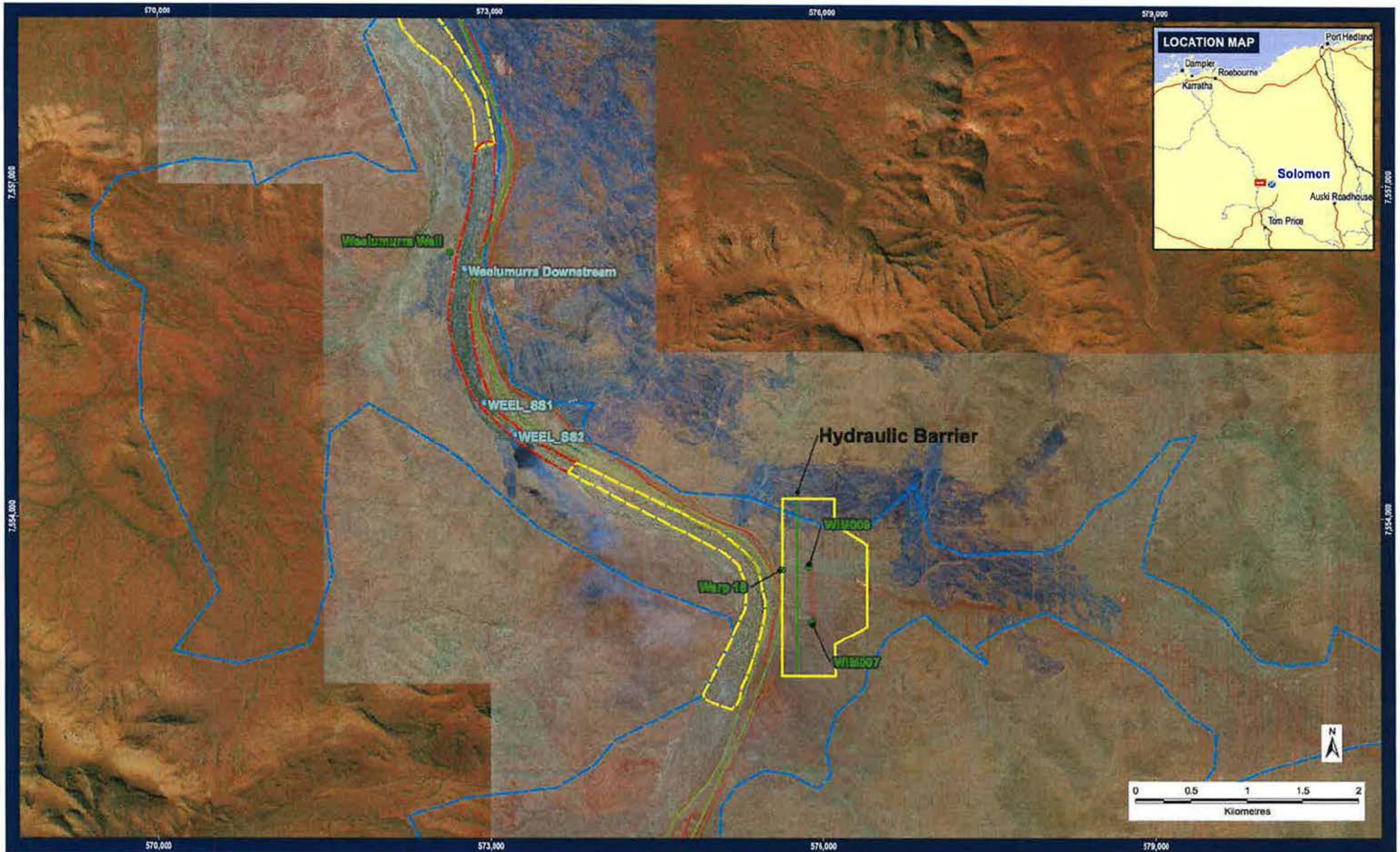
rainfall (300 to 400 mm/year)
Weathered calcrete soils - probably depth constrained by harder calcrete
Channel - Eucalypt woodland with dense understorey of *Melaleuca* sp, small shrubs and grasses. Typically includes multiple low flow paths.
Hummock grass with scattered trees and shrubs
Eucalyptus camaldulensis (20 to 80 mature trees/ha)
Creek flow (approx. 2 year ARI) replenishes alluvium storage
Transpiration (100 to 300 mm/year)
Hard calcrete exposure
Soil and understorey evaporation (200 to 400 mm/year)
runoff
Infiltration
Alluvium overlying or hosted within a fluvial incision into the calcrete. Comprises a mixture of weathered calcrete and imported sand and gravel. Relatively high fines content contributes to significant plant available water storage (circa 100 to 150 mm/m). This supports a dense understorey. The amount of storage available to support the Eucalypt trees is a function of depth to basement calcrete or the water table.
Alluvium
Percolation
Capillary rise
Water table - depth fluctuates between 5-10m
It is possible that groundwater is periodically or persistently available to the riparian trees. This depends on whether the water table intersects the alluvium and the depth of tree roots within the alluvium.
Variably weathered TD2 calcrete basement

Figure 9: Weelumurra Creek Pool Classification



568,000
570,000
572,000
574,000
576,000
578,000
580,000
582,000
584,000
7,560,000
7,557,500
7,555,000
7,552,500
7,550,000
7,547,500
7,545,000
7,542,500
7,540,000
7,537,500
N
Weel Well
Well Down
Weelumurra North
Warp 16
Weelumurra South
LEGEND
Year Pool Observed
2004
2010
2011
2012
2013
2014
2015
2017
2019
Discharge Zone
Recharge
Throughflow Transition Zone
Fortescue Metals Group Ltd
The New Force in Iron Ore
Weelumurra Creek
Pool Locations and Conceptual Pool Areas
Requested By: M Carroll
Date: 1/07/2021
Drawn By: M Carroll
Size: A4P
Scale: 1:86,509
Revision: 0
Projection: GDA 1994 MGA Zone 50
Confidentiality: 1
Doc Name: Figure 9_Weelumurra Creek Pools
0
1,500
3,000
4,500
6,000
Metres

Figure 10: Management and Monitoring Locations



LEGEND

- Pool Monitoring Points
- Groundwater Monitoring Points
- Rio Tinto Rail
- Discharge Zone
- Recharge Zone
- Throughflow Transition Zone
- Water Management System Area

Data Source(s):
Topography, Geoscience Australia, 2013
Imagery, FMG and Landgate, 2018
All other data, FMG, 2018.

Requested By: C.Looby
Drawn By: C.Meyer
Revised By: mcarroll
Approved By: P.Mastalir
Scale: 1:31,130
Coordinate System: GDA 1994 MGA Zone 50
Document Name: SO_MP_HY_0088.007_r4

Date: 1/07/2021
Size: A3L
Revision: 1
Confidentiality: 1

Monitoring and Management Locations

Fortescue Metals Group Ltd

Appendix 1: Baseline Survey Technical Report

"CILO-7"

WAD 37 of 2022

Federal Court of Australia

District Registry: Western Australia

Division: General

YINDJIBARNDI NGURRA ABORIGINAL CORPORATION RNTBC

Applicant

STATE OF WESTERN AUSTRALIA & ORS

Respondents

This is the annexure marked "**CILO-7**" referred to in the affidavit of Christopher Ian Leonard Oppenheim sworn on 4 August 2023.

Signature of witness

Hamish Hamilton Robertson

a legal practitioner who has held
a practice certificate for at least
2 years and who holds a current
practice certificate.

IN THE NATIONAL NATIVE TITLE TRIBUNAL PRINCIPAL REGISTRY WESTERN AUSTRALIA

WF 13/15
WF 13/16

BETWEEN:

STATE OF WESTERN AUSTRALIA Government Party

AND

THOMAS JACOB, STANLEY WARRIE, ALLUM CHEEDY, KEVIN GUINESS, ANGUS MACK, MICHAEL WOODLEY, JOYCE HUBERT, PANSY SAMBO, JEAN NORMAN, ESTHER PAT, JUDITH COPPIN, MASIE INGIE ON BEHALF OF THE YINDJIBARNDI # 1 PEOPLE (WC03/3) Native Title Party

AND

FMG PILBARA PTY LTD (ACN 106 943 828)
(M47/1473 & M47/1475) Grantee Party

AFFIDAVIT OF CHRISTOPHER IAN LEONARD OPPENHEIM
AFFIRMED 19 MAY 2014

Contents

Filed on behalf of:	FMG Pilbara Pty Ltd (Grantee Party)		
Prepared by:	Ken Green		
Law firm:	Green Legal		
Tel:	92616192	Fax:	94141851
Email:	kgreen@greenlegal.com.au		
Address for service:	Suite 2, Level 4, 28 The Esplanade, Perth, Western Australia, 6000		
File ref:	FMGLTD012		
Doc ref:	T:\Green Legal\Files\FMGLTD174 S35 Appln (WF13-15 & 16)\Affidavit - Oppenheim\WF13-15 & 16 Affidavit of Oppenheim (Final).docx		

I, Christopher Ian Leonard Oppenheim of 143 Baden Street, Joondanna, Western Australia, Geologist, affirm:

1. I am employed by Fortescue Metals Group Ltd ("**Fortescue**") as a Specialist Hydro-Geologist.

2. I hold the following tertiary qualifications:

   (1) a Bachelor of Science (double major in geology and geography) awarded by the Otago University of New Zealand; and

   (2) a Post Graduate Certificate – Ground Water Science awarded by Flinders University of South Australia.

3. Prior to being employed by Fortescue, I was employed:

   (1) for 6½ years by URS Australia Pty Ltd as a hydro-geologist; and

   (2) for 2½ years by Portman Iron Ore as a geologist.

4. I report to Bobak Willis Jones, FMG's Manager for Hydro-Geology.

5. My duties include technical lead for groundwater matters at Fortescue's Solomon mine. This includes responsibility for dewatering, water supply and approvals compliance in respect of groundwater obligations under Fortescue's various approvals.

6. I confirm that the facts contained in this affidavit are, unless stated to the contrary, within my own personal knowledge and belief and are both true and correct. In the case of facts obtained from other sources, I believe those facts to be true to the best of my knowledge, information and belief.

Satellite Springs

7. As part of my duties, I have had to consider the hydrogeology of Satellite Springs as well as any likelihood of impact to Satellite Springs arising from Fortescue's mining operations.

8. Satellite Springs is a naturally occurring spring.

9. It is shown on the map which is annexed and marked CILO1.

10. It is locoated directly to the north of proposed mining lease M47/1475 and to the west of proposed mining lease M47/1473.

11. As part of its mining operations, Fortescue intends to dewater, that is, lower the groundwater table, in some areas near Satellite Springs.

No Impact From Dewatering

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

15. Annexed and marked CILO2 is a diagram prepared at my instruction. It shows:

(1) the drainage catchments in the Solomon mining area. Each catchment collects, directs the flow of, and stores, rainwater;

(2) by way of black coloured arrows, the paths of surface water flows; and

(3) by way of a red line, the Satellite Springs Sub-Catchment.

16. The diagrapm CILO2 demonstrates that:

(1) water flows from the Satellite Springs Sub-Catchment into Kangeenarina Creek;

(2) no portion of Kangeenarina Creek supplies water to Satellite Springs; and

(3) the Satellite Springs Sub-Catchment is independent of any other proximate catchment.

[redacted]

[redacted] [redacted]

[redacted] [redacted]

[redacted]

[redacted] [redacted]

[redacted] [redacted]

[redacted] [redacted]

[redacted] [redacted]

[redacted] [redacted]

[redacted] [redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

Affirmed by Christopher Ian Leonard Oppenheim at Perth in Western Australia on 19 May 2014 before me:)
)
)

Signature of an *"experienced lawyer"* under the Oaths, Affidavits and Statutory Declarations Act 2005 of Western Australia

IN THE NATIONAL NATIVE TITLE TRIBUNAL
PRINCIPAL REGISTRY
WESTERN AUSTRALIA

WF 13/15
WF 13/16

BETWEEN:

STATE OF WESTERN AUSTRALIA — Government Party

AND

THOMAS JACOB, STANLEY WARRIE, ALLUM CHEEDY, KEVIN GUINESS, ANGUS MACK, MICHAEL WOODLEY, JOYCE HUBERT, PANSY SAMBO, JEAN NORMAN, ESTHER PAT, JUDITH COPPIN, MASIE INGIE ON BEHALF OF THE YINDJIBARNDI # 1 PEOPLE (WC03/3) — Native Title Party

AND

FMG PILBARA PTY LTD (ACN 106 943 828)
(M47/1473 & M47/1475) — Grantee Party

THIS IS THE ANNEXURE MARKED CILO1 REFERRED TO IN THE AFFIDAVIT OF CHRISTOPHER IAN LEONARD OPPENHEIM SWORN 19 MAY 2014

AMcKenzie

Signature of witness

LEGEND

- ▲ Satellite Spring
- Drainage Line
- FMG Live M Tenements
- FMG Pending M Tenements
- Ethnographic Heritage Places

Data Source(s):
Topography; Geoscience Australia, 2013, Tenements, DMP, 2014
Aerial photography, Landgate, 2013. All other data, FMG, 2014

N

0 250 500 750 1,000
metres

SOLOMON MINE
SATELLITE SPRING, FMG'S CURRENT AND PENDING MINING LEASES AND SUB CATCHMENT AREA

Requested By: Chris Oppenheim
Drawn By: Sacha Fielden
Revised By: sfielden
Approved By
Scale 1:15,000
Coordinate System: GDA 1994 MGA Zone 50
Document Name: SO_MP_HY_0065r1

Date 19/05/2014
Size A3L
Revision 1
Confidentiality 1

Fortescue Metals Group Ltd

IN THE NATIONAL NATIVE TITLE TRIBUNAL
PRINCIPAL REGISTRY
WESTERN AUSTRALIA

WF 13/15
WF 13/16

BETWEEN:

STATE OF WESTERN AUSTRALIA Government Party

AND

THOMAS JACOB, STANLEY WARRIE, ALLUM CHEEDY, KEVIN GUINESS, ANGUS MACK, MICHAEL WOODLEY, JOYCE HUBERT, PANSY SAMBO, JEAN NORMAN, ESTHER PAT, JUDITH COPPIN, MASIE INGIE ON BEHALF OF THE YINDJIBARNDI # 1 PEOPLE (WC03/3) Native Title Party

AND

FMG PILBARA PTY LTD (ACN 106 943 828)
(M47/1473 & M47/1475) Grantee Party

THIS IS THE ANNEXURE MARKED CILO2 REFERRED TO IN THE AFFIDAVIT OF CHRISTOPHER IAN LEONARD OPPENHEIM SWORN 19 MAY 2014

JM McKenzie

Signature of witness

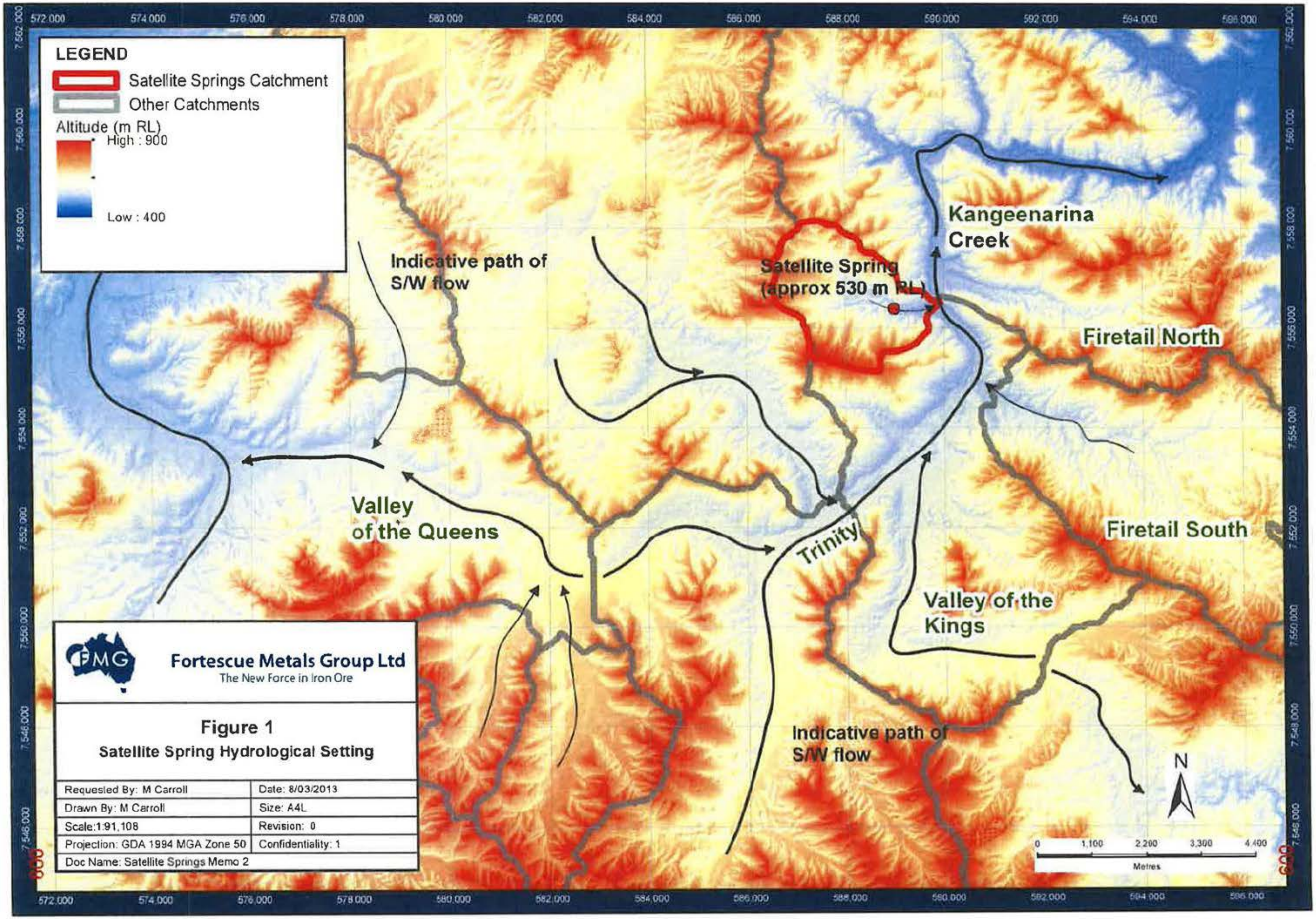


Figure 1
Satellite Spring Hydrological Setting

Requested By: M Carroll	Date: 8/03/2013
Drawn By: M Carroll	Size: A4L
Scale:1:91,108	Revision: 0
Projection: GDA 1994 MGA Zone 50	Confidentiality: 1
Doc Name: Satellite Springs Memo 2	

IN THE NATIONAL NATIVE TITLE TRIBUNAL
PRINCIPAL REGISTRY
WESTERN AUSTRALIA

WF 13/15
WF 13/16

BETWEEN:

STATE OF WESTERN AUSTRALIA — Government Party

AND

THOMAS JACOB, STANLEY WARRIE, ALLUM CHEEDY, KEVIN GUINESS, ANGUS MACK, MICHAEL WOODLEY, JOYCE HUBERT, PANSY SAMBO, JEAN NORMAN, ESTHER PAT, JUDITH COPPIN, MASIE INGIE ON BEHALF OF THE YINDJIBARNDI # 1 PEOPLE (WC03/3) — Native Title Party

AND

FMG PILBARA PTY LTD (ACN 106 943 828)
(M47/1473 & M47/1475) — Grantee Party

THIS IS THE ANNEXURE MARKED CILO3 REFERRED TO IN THE AFFIDAVIT OF CHRISTOPHER IAN LEONARD OPPENHEIM SWORN 19 MAY 2014

JAMcKenzie

Signature of witness

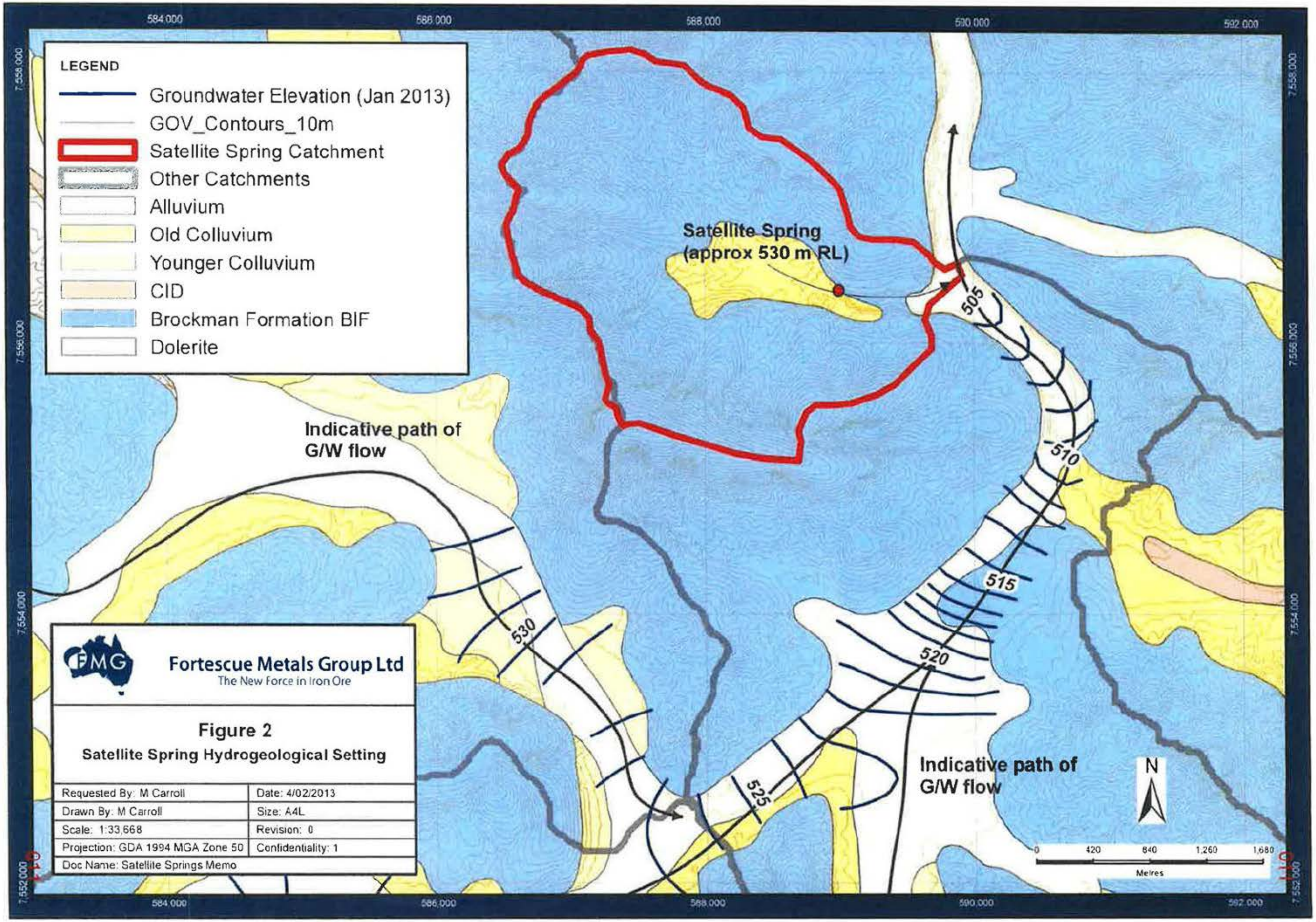


Figure 2

Satellite Spring Hydrogeological Setting

Requested By: M Carroll	Date: 4/02/2013
Drawn By: M Carroll	Size: A4L
Scale: 1:33,668	Revision: 0
Projection: GDA 1994 MGA Zone 50	Confidentiality: 1
Doc Name: Satellite Springs Memo	

NOTICE OF FILING

Details of Filing

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Date of Lodgment:	4/08/2023 4:20:05 PM AWST
Date Accepted for Filing:	4/08/2023 4:20:14 PM AWST
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File Title:	YINDJIBARNDI NGURRA ABORIGINAL CORPORATION RNTBC (ICN 8721) AND STATE OF WESTERN AUSTRALIA & ORS
Registry:	WESTERN AUSTRALIA REGISTRY - FEDERAL COURT OF AUSTRALIA

Registrar

Important Information

This Notice has been inserted as the first page of the document which has been accepted for electronic filing. It is now taken to be part of that document for the purposes of the proceeding in the Court and contains important information for all parties to that proceeding. It must be included in the document served on each of those parties.

The date of the filing of the document is determined pursuant to the Court's Rules.