

**Report**

# **Christmas Creek Expansion Public Environmental Review – Response to Public Submissions**

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**Christmas Creek**

**25 September 2015  
CC-RP-EN-0120**



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## 1. INTRODUCTION

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Fortescue Metals Group Ltd (Fortescue), as the Proponent, proposes to expand iron ore mining and processing operations at the existing Christmas Creek Mine (Christmas Creek) in the Pilbara region of Western Australia (the Proposal).

A Public Environmental Review (PER) document for the Proposal was prepared in accordance with Part IV of the *Environmental Protection Act 1986* (EP Act). The PER was issued for public comment over a four week period commencing 23 March 2015 and closing on 20 April 2015. During this period government agencies, non-government organisations, stakeholders and members of the general public were invited to make submissions to the Environmental Protection Authority (EPA) in regards to the proposal.

Following the closing of the public review period the Office of the Environmental Protection Authority (OEPA) collated the submissions received and communicated the summary to Fortescue. The following sections of this document have been prepared by Fortescue as a response to the submissions received.

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## 2. OFFICE OF THE ENVIRONMENTAL PROTECTION AUTHORITY (OEPA) COMMENTS

Table 1: Response to OEPA comments

Item	OEPA Comment	Proponent Response
<b>Flora and Vegetation</b>		
1.1	<p>Cumulative impacts</p> <p>Calculation of cumulative impacts to vegetation units, Mulga communities and the Fortescue Marsh has not been changed since the draft PER and needs to be updated to address the points below.</p> <p>In EPA Report No. 1492, expansion of the adjacent Cloudbreak proposal, the EPA notes that "based on the locally mapped extent, there will be approximately 83%, 96% and 43% of the Mulga vegetation, Samphire vegetation and the Coolibah/River Red Gum creekline vegetation, respectively, remaining after the Roy Hill, the Christmas Creek and the Cloudbreak Life of Mine projects have been developed". In its report, the EPA stated that it was "concerned that surface water flow to the Fortescue Marsh may be impeded as approximately 75% along the northern boundary is likely to be cumulatively impacted by mining operations and may result in unacceptable changes to the ecology of the Marsh".</p> <p>Please revise the cumulative impacts analysis, incorporating this information, for the Christmas Creek Expansion.</p>	<p><i>Note: EPA Report for Cloudbreak LoM was Report No 1429 not 1492.</i></p> <p>The OEPA comment raises two issues, one related to cumulative impacts of disturbance to signification vegetation units and the second relating to impacts of surface water flow into the Fortescue Marsh (the <b>Marsh</b>).</p> <p><b>Cumulative Impacts to Vegetation Units:</b></p> <p>Direct cumulative impacts to mulga, samphire and Coolibah/River Red Gum vegetation are detailed in section 9.8 of the PER. Fortescue estimates that 34.8% of Mulga mapped within the projects (Christmas Creek, Cloudbreak, Roy Hill Mine and Fortescue's Port Hedland to Christmas Creek rail duplication) will be disturbed. Additionally, Fortescue estimates 0.04% of Samphire and 24.8% of the known Coolibah/River Red Gum vegetation will be disturbed by the four Projects.</p> <p>The data used to calculate the details provided in section 9.8 of the PER was sourced from surveys undertaken by Fortescue for the Christmas Creek, Cloudbreak and Port Hedland to Christmas Creek rail duplication projects. Using this data, Fortescue has aggregated the surveys to eliminate any duplicate data. The data associated with Roy Hill Iron Ore was obtained from publicly available documents.</p> <p><b>Cumulative Impacts to Surface Water Flows:</b></p> <p>Cumulative impacts to surface water inflows to the Marsh is addressed in section 7.7.1 of the PER and summarised that <i>"During the mining process, the flows are estimated to reduce by 3 GL/a, or approximately 1% of the total flow volume. Following rehabilitation, flows are anticipated to increase slightly to an average of 279 GL/a (Table 19, Worley Parsons 2014)."</i> Additionally Appendix 5G of the PER - <i>Christmas Creek Life of Mine Expansion Fortescue Marsh Catchment Water Balance Study</i> (Worley Parsons 2014) provides further information on the modelling undertaken to support this assessment.</p> <p>Section 7.7.1 of the PER concludes <i>"Given the relatively small change in volume and the high variability of annual flows to the Fortescue Marsh, these impacts are considered to be negligible. This change in volumes is also not anticipated to affect surface water residence times in the Fortescue Marsh"</i>.</p> <p>In the PER Fortescue makes reference to the continued implementation of the current <i>Surface Water Management Plan</i> (100-PL-EN-1015) to manage surface water within the proposal area and ensure surface water flows to the Marsh are maintained. Results of the implementation of this plan are provided to the OEPA annually in the Compliance Assessment Report (CAR).</p>
1.2	<p>Cumulative impacts</p> <p>The PER states that the Mulga vegetation types in the Proposal area are located to the north of the Fortescue Marsh and on the foot-slopes of the Chichester Range. These are considered ecologically important as they represent the northern limit of distribution of Mulga dominated vegetation and are therefore less extensive than the southern distribution, are floristically diverse, include areas in very good to good condition in comparison to the lesser condition Mulga vegetation south of the Fortescue Marsh. The cumulative impact to Mulga vegetation types, as stated in the PER, will result in a 35% reduction in regional representation along the northern Fortescue Marsh. This value is based on direct impact only and does not include indirect impacts from sheet flow impediments or other waste related impacts.</p> <p>Please provide revised reduction calculations, including indirect impacts.</p>	<p>Section 9.7.3 of the PER details the indirect disturbance to Mulga vegetation as a result of alteration to surface water flows. Fortescue estimates 439 ha of Mulga will be indirectly impacted by sheet flow shadowing during implementation of the Proposal. In section 9.7.2 Fortescue summarises that <i>"no indirect impacts to Mulga vegetation as a result of groundwater mounding are expected"</i>.</p> <p>In the <i>Cloudbreak Life of Mine Project - Report 1429</i> the EPA reported the expected indirect impacts to Mulga from the Cloudbreak project is approximately 744 ha. The estimated cumulative indirect impact to mulga communities associated with the Christmas Creek and Cloudbreak projects is 1,183 ha.</p> <p>Table 36 of the PER estimates the percentage loss of mulga through direct disturbance to be 15% of the known occurrences of mulga vegetation inside and outside the mine Survey Areas. The potential loss of a further 1,183 ha of mulga vegetation through indirect processes would increase the total loss proportion to 16.9%.</p> <p><i>Roy Hill Iron Ore Mine (RHIO) Stage 1 Public Environmental Review</i> states that the project will disturb 1,879 ha of mulga</p>



Item	OEPA Comment	Proponent Response
		<p>vegetation. The RHIO PER makes no reference to indirect disturbance. With the addition of the RHIO disturbance to the cumulative figure it is estimated the total loss of mulga (direct and indirect) will be 19.8% of the known mulga vegetation. Fortescue considers the total cumulative loss of mulga associated with the Proposal and neighbouring mining operations to be significantly below the 30% of pre-clearing extent threshold determined by the EPA.</p> <p>Fortescue also implements the <i>Vegetation Health Monitoring and Management Plan</i> (CC-PL-EN-0004) at Christmas Creek. The plan incorporates monitoring the health of Mulga vegetation, Samphire vegetation and Coolibah/River Red Gum creekline vegetation in order to identify any indirect impacts to these vegetation types associated with the alteration of groundwater levels or surface water flows within the proposal area. Results of the implementation of this plan are provided to the OEPA annually in the CAR.</p>
1.3	<p>Cumulative impacts</p> <p>Similarly, the stated 25% regional reduction in groundwater dependent vegetation does not include impacts from groundwater drawdown or surface water flow alteration. Riparian vegetation is often disproportionately impacted by mining operations due to the naturally restricted distribution. The cumulative impact to groundwater dependent vegetation and Mulga vegetation types, based on impacts alone, has the potential to be a significant impact.</p> <p>Please justify with data, evidence that this reduction, together with loss from indirect impacts, is not significant. Currently the only justification is a statement that the reduction is not significant.</p>	<p>Impacts to potentially groundwater dependent ecosystem (GDE) vegetation have been identified as impacts to the vegetation type VT01 consisting of <i>Eucalyptus</i> victrix, and <i>E. camaldulensis</i>, through direct clearing of the vegetation or indirectly through drawdown of the underlying aquifer.</p> <p>Mulga vegetation is considered to be sensitive to groundwater mounding as Mulga is not tolerant of salt entering the root zone and not tolerant of waterlogging (refer to section 9.4.6 of the PER). Section 9.7.2 summarises that no indirect impacts to Mulga vegetation as a result of groundwater mounding are expected, because no areas where depth to groundwater is greater than 2m will experience water mounding to within 2m of the surface (Mulga root zone). The modelling is illustrated in figures 47 – 61 of the PER.</p> <p>Fortescue predicts the cumulative impact of clearing the vegetation unit VT01 from the existing and proposed Christmas Creek mine to be 497 ha, approximately 26% of the extent mapped in the survey area.</p> <p>Section 9.7.2 of the PER details the impacts to vegetation associated with the abstraction and injection of groundwater. Areas where depth to groundwater is less than 5 m without mining occurring and drawdown of greater than 2 m is expected have been mapped on an annual basis and are presented in Figure 47 (2014) to Figure 61 (2028) to determine areas of indirect impact to GDE vegetation (VT01). A small area of VT01 in the southern part of the Survey Area is expected to be affected. This impact commences in 2026 and is expected to continue until 2028. Figure 62 shows the extent of indirect impact areas to VT01 for all years combined. The area of indirect impact to VT01 is 1.1 ha at its largest predicted extent.</p> <p>Given the relatively small extent of indirect impact to GDE identified in the Proposal, Fortescue does not consider the cumulative total of indirectly impacted GDE species significantly increases the already identified 26% direct reduction in GDE through vegetation clearing. Fortescue the total cumulative impact of direct and indirect disturbance would equate to less than 26.1% of the known extent of GDE in the survey area.</p> <p>Additionally section 9.10 of the PER provides the following summary of the GDE impacts:</p> <p><i>Up to 355 ha of GDE vegetation (VT01) will be directly affected by the Proposal and up to 1.1 ha could potentially be indirectly affected by groundwater drawdown; however, floristic analysis demonstrates that VT01 (as floristic group 575) occurs in several locations outside the Survey Area, with 13 sites located within the Survey Area and a further 11 sites located outside the Survey Area (Appendix E of ENV 2013a).</i></p>
1.4	<p>Cumulative impacts</p> <p>The PER states that terrestrial fauna 'habitats occur in the wider region and cumulative impacts are not expected to have significant impacts on the distribution and abundance of [terrestrial] fauna species'. As cumulative impacts to terrestrial fauna have not been quantified there is no evidence to support this statement. Therefore, it is difficult to confidently identify and predict any cumulative impacts.</p> <p>Please provide quantitative data, as per the ESD, to predict the cumulative impacts to fauna habitat, by incorporating the known or predicted impacts on fauna habitats in the context of the Cloudbreak, Christmas Creek and Roy Hill proposals.</p>	<p>Fortescue has compiled Figure 1 (CC_MP_EN_0265_r3) to summarise the extent of the fauna habitats mapped (by Fortescue) across the Chichester Ranges in the vicinity of the Proposal.</p> <p>Table i summarises the habitats mapped and the habitat types within the Cloudbreak and Christmas Creek development envelopes. Fortescue is unable to obtain details on the quantity of each habitat unit within the boundaries of the RHIO development from the relevant PER document or subsequent EPA reports. The lack of data is balanced by the Fortescue mapping (Figure 1) which excludes the majority of the RHIO development boundary.</p>



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		<p>Table i: Summary of fauna habitats mapped by Fortescue.</p> <table><tr><th>Fauna Habitat Type</th><th>Mapped extent (ha)</th><th>Christmas Creek Development Envelope (ha)</th><th>Cloudbreak Mine Envelope (ha)</th><th>Total within Developments (ha)</th><th>% Outside Developments</th></tr><tr><td>Cleared and Developed</td><td>1,012</td><td>882</td><td>77</td><td>959</td><td>5%<sup>#</sup></td></tr><tr><td>Cracking Clays</td><td>1,107</td><td>0</td><td>0</td><td>0</td><td>100%</td></tr><tr><td>Drainage Line and Alluvial Plain</td><td>19,920</td><td>5,732</td><td>2970</td><td>8,702</td><td>56%</td></tr><tr><td>Low Hill</td><td>38,161</td><td>6,423</td><td>4495</td><td>10,918</td><td>71%</td></tr><tr><td>Marsh</td><td>33,273</td><td>579</td><td>0</td><td>579</td><td>98%</td></tr><tr><td>Other</td><td>967</td><td>0</td><td>0</td><td>0</td><td>100%</td></tr><tr><td>Plain Sands</td><td>20,768</td><td>0</td><td>0</td><td>0</td><td>100%</td></tr><tr><td>Stony Plain</td><td>78,450</td><td>19,229</td><td>11384</td><td>30,613</td><td>61%</td></tr></table> <p><sup>#</sup> Denotes – Cleared Habitat outside of CC and CB development envelopes is associated with external land uses (Pastoral, exploration, local government roads etc.).</p> <p>* Denotes – Cleared and developed extent within the DE is underestimated as the portion of the DE that incorporates the access road to the East is outside the extent of habitat mapping.</p> <p>Table i and Figure 1 illustrate that the habitat units within the Proposal are widespread and cumulative percentage of each habitat within the proposed development envelopes is not significant given the extent of each habitat located outside of the development envelopes. Additionally, as detailed in the Proposal, Fortescue is proposing to disturb approximately 54.5 % of the development envelope. A similar approach is applied at Cloudbreak where only a portion of the development envelope is approved to be disturbed. This will result in a larger proportion of the identified habitats remaining undisturbed.</p> <p>Fortescue considers that the data provided in Figure 1 and Table i supports the statements made in in the PER in relation to the cumulative impact to terrestrial habitats.</p>	Fauna Habitat Type	Mapped extent (ha)	Christmas Creek Development Envelope (ha)	Cloudbreak Mine Envelope (ha)	Total within Developments (ha)	% Outside Developments	Cleared and Developed	1,012	882	77	959	5% <sup>#</sup>	Cracking Clays	1,107	0	0	0	100%	Drainage Line and Alluvial Plain	19,920	5,732	2970	8,702	56%	Low Hill	38,161	6,423	4495	10,918	71%	Marsh	33,273	579	0	579	98%	Other	967	0	0	0	100%	Plain Sands	20,768	0	0	0	100%	Stony Plain	78,450	19,229	11384	30,613	61%
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1.5	<p>Cumulative impacts</p> <p>Analysis of the extent of clearing and indirect impacts on new flora species is required. The occurrence of a new Mulga species is significant and should be addressed.</p> <p>Acacia aff. Aneura (long, flat, recurved; FMR35.3) was reported as an unusual specimen by Biota in 2004 and determined to be a distinct taxon by ENV in 2013. The Environmental Review document makes an assertion that Acacia aff. Aneura (long, flat, recurved; FMR35.3) is common and widespread within the Survey area and a dominant of some communities. Supporting evidence needs to be provided to demonstrate the widespread occurrence of Acacia aff. Aneura (long, flat, recurved: FMR35.3) and the low risk to the species from proposal impacts given the predicted 58.1% direct impact to Mulga communities within the Christmas Creek operations.</p>	<p>Acacia aff. aneura (long, flat, recurved; FMR35.3) appears to represent a distinct taxon which may be restricted to the region north of the Fortescue Marsh.</p> <p>Despite this, the species has not been recognised by the Western Australian Herbarium. It is currently only recognised by Malcom Trudgen (who identified the species for the Biota, ENV, and Cardno surveys commissioned by Fortescue). As a result, there are no taxonomic keys for the species and any surveys completed in the Pilbara without his identifications would not record the occurrences of Mulga as a separate species. This may explain why no records of the species occur at other surveys such as those undertaken by Mattiske (2005) at Cloudbreak or surveys in the vicinity of the Kutayi deposit in 2014. One can therefore assume the species range is larger than current records indicate. It is noted however, no records were made of the species at Roy Hill by Ecologia (2009) so some level of restricted distribution is evident.</p> <p>Despite these limitations, to demonstrate its wide occurrence along the northern flanks of the Marsh, Fortescue has mapped the locations of where this species has been recorded in surveys. These include:</p> <ul style="list-style-type: none"><li>51 records from Christmas Creek surveys,</li><li>3 records from Nyidinghu Rail Spur Flora and Vegetation Assessment (Cardno, 2012) over 60 km west of Christmas</li></ul>																																																						

Item	OEPA Comment	Proponent Response
		<p>Creek</p> <ul style="list-style-type: none"> <li>14 records from Biota <ul style="list-style-type: none"> <li>from locations up to 45 km west of the proposal; and</li> <li>locations up to 47 km east of the Proposal boundary.</li> </ul> </li> </ul> <p>Fortescue has prepared Figure 3 (CC_MP_EN_0263.001) detailing the extent of mapped <i>Acacia aff. aneura</i> (long, flat, recurved; FMR35.3) in relation to the Proposal boundary.</p> <p>Fortescue is unable to map further occurrences of this species for the reason discussed above, but from the known records it is clear the species is locally abundant, and distribution covers an east to west extent of approximately 150 km.</p>
1.6	<p>Groundwater management triggers</p> <p>The information in the PER demonstrates that the groundwater dewatering and reinjection is not managed within existing trigger criteria rather they are exceeded on a regular basis.</p> <p>The management triggers (trigger 1) were exceeded regularly in some sites for more than a year. However the impacts of exceeding the triggers on the natural environment have not been provided.</p> <p>This resulted in increased monitoring, the results of which are not available in the PER.</p> <p>Please provide information on the actions that will be implemented to avoid reaching the trigger criteria, to demonstrate that the increased groundwater volumes can be adequately managed.</p>	<p>Section 7.3.4 of the PER describes the groundwater monitoring programme and management triggers.</p> <p>Groundwater trigger levels are defined as:</p> <ul style="list-style-type: none"> <li>Class 1 trigger levels, that have been set as an early warning and signal potential future breaches of Class 2 levels</li> <li>Class 2 trigger levels that are based on regulatory requirements and may cause potential impacts to vegetation due to either excessive mounding or drawdown.</li> </ul> <p>The Class 1 triggers provide an early warning for Fortescue to alter the dewatering and reinjection management to prevent exceedence of the Class 2 triggers. The Class 2 triggers are aligned to the regulatory conditions associated with Ministerial Statement 871. No Class 2 trigger levels have been exceeded at Christmas Creek.</p> <p>The <i>Ground Water Management Plan</i> (100-PL-EN-0029) (PER Appendix 2C) and <i>Christmas Creek Groundwater Operating Strategy</i> (CC-PH-HY-0002) (PER Appendix 5C) contain the actions to be implemented to ensure the Class 2 trigger levels are not exceeded.</p>

#### Terrestrial Fauna

1.7	<p>Short Range Endemic (SRE) species</p> <p>Impacts to SRE invertebrate fauna include the potential for impacts to the millipede <i>Antichiropus</i> sp. 'Christmas', which has only been identified from the existing and proposed mine pit areas. Although this species has been found in three habitat types that are widespread in the region (Figure 13 Subterranean Ecology 2012), there is the potential for cumulative impacts to this species and its habitat when adjoining proposals are considered. The management of SRE invertebrate fauna should be consistent with that for neighbouring proposals including the implementation of exclusion zones and monitoring (for example see Ministerial Statement 824 Roy Hill 1 Iron Ore Mining).</p>	<p>Fortescue does not consider it necessary to undertake further monitoring of SRE species or establish exclusion zones with the Christmas Creek Development Envelope as the two potential SRE species identified within the Proposal are found outside of the development envelope boundary.</p> <p>Fortescue has prepared the attached Figures 1 and 2 to demonstrate the location of the potential SRE species identified and the distribution of habitat (mapped by Fortescue) across the broader region.</p> <p>As detailed on page 181 of the PER the potential SRE spider <i>Karaops</i> sp. 'Christmas' is considered to inhabit cracks and crevices in rocky outcrops, or under the bark of trees. The specimen located at site XC25 was found within a habitat consistent with the 'Stony Plain' habitat unit. An additional specimen was identified in a previous survey at Bonney Downs over 18 km north west of the Christmas Creek site.</p> <p>In Figure 1 Fortescue has mapped over 78,000 ha of Stony Plain habitat in the vicinity of the Chichester Ranges. The PER indicates 4,366 ha of the habitat will be disturbed by the Proposal. Additionally 11,384 ha of the mapped habitat is within the neighbouring Cloudbreak mine development envelope.</p> <p>Although the Bonney Downs specimen is outside of Fortescue's habitat mapping it is understood the specimen was located within the "Low Hill" habitat unit. Fortescue has mapped over 38,000 ha of Low Hill habitat, with over 27,000 ha of this area located outside of the Christmas Creek and Cloudbreak mine development envelopes. The aerial imagery detailed in Figure 2</p>
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Item	OEPA Comment	Proponent Response
		<p>indicates the 'Low Hill' habitat extends further northwards outside of the areas mapped by Fortescue.</p> <p>Fortescue considers there is sufficient habitat for <i>Karaops</i> sp. 'Christmas' outside of the areas indicated to be disturbed by the proposal to eliminate the requirement for exclusion zones. Additionally with a specimen identified from a previous survey at Bonney Downs, Fortescue considers the likelihood of the potential SRE species being well distributed outside of the proposal area as high.</p> <p>Map inserts 1 – 3 of Figure 2 illustrate the locations of the <i>Antichiropus</i> sp. 'Christmas' in relation to the Christmas Creek Development Envelope boundary. Map insert 3 details that site XC 35 is located approximately 30 m outside of the development envelope and is not proposed to be disturbed during implementation of the Proposal.</p> <p>Appendix 7B of the <i>PER Christmas Creek Life of Mine Project SRE Invertebrate Survey</i> describes the habitats associated with the locations of specimens of <i>Antichiropus</i> sp. 'Christmas' were collected from (section 8.4). The habitats include Drainage Lines and Alluvial Plains and Stony Plains, and these habitats are abundant within the area mapped in Figure 1.</p> <p>Map Inserts 1, 2 and 3 of Figure 2 detail the close proximity of the specimen locations to the development envelope boundary (XC27 140 m, XC 33 500 m and XC34 300 m). The inserts also illustrate the continuation of the habitat associated with specimen location outside of the development envelope.</p> <p>Fortescue considers there is sufficient habitat for <i>Antichiropus</i> 'Christmas' outside of the areas indicated to be disturbed by the proposal to eliminate the requirement for exclusion zones. Also given the potential SRE species was collected widely across the survey area in most SRE habitat types Fortescue considers the likelihood of the species being abundant outside of the development envelope as high.</p>
<b>Subterranean Fauna</b>		
1.8	<p>The PER makes contradictory statements regarding the connectivity of subterranean fauna habitat. Page 197 states that 'all troglofauna habitat within the proposal area are likely to be well connected'. However it goes on to state that 'sampling results seem to indicate that a series of 'barriers' occur along the northern flank of the Fortescue Marsh that restricts the ranges of several species'. Therefore, there is doubt regarding troglofauna habitat connectivity and consequently, the likelihood of the four troglofauna species being found outside of the impact area is uncertain. The proponent needs to verify these statements.</p>	<p>Further information in regards to troglofauna habitat and potential barriers is provided in section 7.12 of the PER Appendix 7D - <i>Christmas Creek Expansion Project Subterranean Fauna Assessment (Bennelongia Pty Ltd, 2014)</i>.</p> <p>The statement of page 197 of the PER reads in full <i>"Based on the scale at which geological information is available, all troglofauna habitats within the Proposal area are likely to be well connected with the surrounding habitats. In contrast, sampling results seem to indicate that a series of 'barriers' occur along the northern side of the Fortescue Valley that restrict the ranges of several species"</i>.</p> <p>Fortescue does not consider the statement contradictory. Rather the statement is summarising that the distribution of the geology in the area indicates the troglofauna habitats are well connected however the sampling results indicate that a series of 'barriers' may be present that limit the ranges of several species.</p> <p>Page 34 of Appendix 7D goes on to state <i>"The nature and exact location of these barriers are unknown and, in fact, there are probably different barriers affecting the distributions of different groups of troglofauna. For a species such as Philosciidae 'ISO017', which has a known range of 73 km along the valley (Figure 7.2), there may be no barriers"</i>.</p> <p>Appendix 7D concludes that the utilisation of geological data to characterise habitats has limited capacity to predict the extent of occurrence of troglofauna species along the Marsh.</p>
1.9	<p>Evidence has not been provided to support the statement 'The proposal is not expected to represent an impact to subterranean fauna habitat from pit excavations and groundwater drawdown and mounding'.</p>	<p>Section 11.9, page 199 of the PER provides the context to the statement that <i>"The Proposal is not expected to represent a significant impact to subterranean fauna habitat from pit excavations and groundwater drawdown and mounding"</i>.</p> <p>The basis of the statement is that four of the 69 species of stygofauna collected during the surveys were recorded only within Proposal drawdown impact areas and one species which has been recorded within the Cloudbreak and Proposal drawdown areas. The species are:</p>

Item	OEPA Comment	Proponent Response
		<ul style="list-style-type: none"> <li>• <i>Australocamptus</i> sp. B07</li> <li>• <i>Atopobathynella</i> sp. B02</li> <li>• <i>Bathynella</i> sp. B02</li> <li>• <i>Canthocamptidae</i> sp. B02</li> <li>• <i>Goniocyclops</i> sp. B02</li> </ul> <p>Section 11.9 of PER concludes that following the implementation of management and mitigation measures (outlined in section 11.7) that the:</p> <ul style="list-style-type: none"> <li>• The threat to four of the stygofauna species recorded only within the predicted impact areas associated with the Proposal and Cloudbreak is considered to be low; and</li> <li>• The threat to the stygofauna species <i>Canthocamptidae</i> sp. B02 is uncertain because of limited information on the biology of the species, however the range of other copepods in the area suggests that this species is likely to have a range extending beyond the Proposal impact area.</li> </ul> <p>Twelve species (of the 29 species identified) of troglofauna with restricted distributions were recorded within the proposal area. Of these troglofauna species:</p> <ul style="list-style-type: none"> <li>• eight are likely to extend beyond the Proposal impact areas;</li> <li>• two species (<i>Parajapygidae</i> sp. B24 and <i>Troglarmadillo</i> sp. B30) may be exposed to minor habitat loss due to groundwater mounding; and</li> <li>• a further two species (<i>Anajapygidae</i> sp. B02 and <i>Projapygidae</i> sp. B12) affected by habitat loss associated with pit excavations.</li> </ul> <p>Additionally no subterranean fauna species recorded at the neighbouring Cloudbreak or Roy Hill mines are reliant on the occurrence of species within the Christmas Creek proposal footprint.</p> <p>Fortescue considers the predicted outcome to subterranean fauna species to meet the EPA objectives for subterranean fauna to maintain representation, diversity, viability and ecological function at the species, population and assemblage level.</p>
1.10	<p>In addition the statement that 'the proposal is not expected to represent an impact to subterranean fauna habitat from pit excavations and groundwater drawdown and mounding' (Table ES4) is not correct. Table ES4 lists impacts to nine subterranean fauna species: Five species of stygofauna are expected to be impacted from groundwater drawdown; two troglofauna species and expected to be affected by habitat loss resulting from pit excavation; and two species of troglofauna may be exposed to habitat loss from groundwater mounding.</p> <p>Options for minimisation strategies for the impacts to stygofauna (groundwater abstraction and injection) have been considered. Reducing the impacts to troglofauna through the loss of habitat from abstraction of ore and waste rock has not been considered (section 11.5 and 11.8). Options for the avoidance or minimisation of loss of subterranean fauna habitat of those species currently only known from the impact area should be included, until habitat connectivity has been confidently demonstrated.</p>	<p>The information provided in Table ES4 of the PER is consistent with the statement provided in Section 11.9 of the PER however there does appear to be some discrepancies. It appears Section 11.9 of the PER had been amended during production of the PER and the amendments not transferred to the relevant section of Table ES4.</p> <p>Fortescue concludes the statement of predicted outcomes to subterranean fauna species provided in Section 11.9 of the PER to be correct.</p> <p>Troglofauna habitat is widely distributed across the southern slopes of the Chichester Ranges. Surveys for troglofauna in the Chichester Ranges and along the southern slopes have been undertaken by Fortescue for a number of projects (Cloudbreak, Christmas Creek and Kutayi). Troglofauna specimens have been recovered from 233 locations distributed over 110 km in an east-west direction along the foot slopes of the Chichester Ranges. Figure 4 illustrates the distribution of troglofauna specimen locations and the geology of the region.</p> <p>The following geology types have been successful for recording troglofauna specimens:</p> <ul style="list-style-type: none"> <li>• Achm - Marra Mamba Iron Formation</li> <li>• Czl - ferruginous duricrust 38498</li> <li>• Qa - alluvium 38485</li> </ul>

[illegible]

<sup>1</sup>Minor, M.A., and A.W. Robertson. (2006). *Soil Bugs - An Illustrated Guide to New Zealand Soil Invertebrates* (updated 29-Apr-2015), <http://soilbugs.massey.ac.nz> (9 September 2015).



Item	OEPA Comment	Proponent Response
<b>Rehabilitation and Decommissioning</b>		
1.11	<p>The PER document states, throughout, that one of the major actions to reduce impact is to undertake progressive rehabilitation. However, as outlined in the PER, to-date approximately 5 hectares of borrow pits and roads (minor impact) have been rehabilitated since 2009. There is no evidence that any progressive rehabilitation of mined areas has been carried out since mining began six years ago.</p> <p>The proponent should demonstrate whether progressive backfilling of pits has occurred at either Cloudbreak or Christmas Creek operations, and if so has progressive rehabilitation commenced and what are the outcomes of the rehabilitation. If the results of progressive rehabilitation cannot be provided, the impacts of the proposal should not consider progressive rehabilitation as a mitigating action.</p> <p>It is not possible to estimate the likely success of rehabilitation for the proposal based on the information provided in the PER. Data and evidence from rehabilitation works undertaken within Cloudbreak (refer to Condition 14-1 of Ministerial Statement 899).</p> <p>The absence of any supporting evidence regarding progressive rehabilitation, and the lack of adequate consideration of cumulative impacts of the proposal, do not provide confidence that the proposal can be implemented in a manner that would not impact on the significant environmental features of the Fortescue Marsh.</p>	<p>Section 13.2.6 of the PER details the rehabilitation and revegetation activities undertaken to date. The PER states “<i>Fortescue has conducted 5.7 ha of rehabilitation at Christmas Creek to date</i>” and whilst this figure was accurate at the time the PER document was drafted an additional 9.5 ha of rehabilitation was completed at Christmas Creek during December 2014. In the <i>Compliance Assessment Report for Environmental Protection Authority - 2014</i> (45-RP-EN-1015, submitted to the OEPA on 31 March 2015, Fortescue reported a total of 15.39 ha of completed rehabilitation at Christmas Creek.</p> <p>Progressive backfilling of mining voids at Christmas Creek commenced in 2012. In March 2015 Fortescue provided the <i>2014 Chichester Operations (Christmas Creek and Cloudbreak) Annual Environmental Report</i> (100-RP-EN-9612) to the Department of State Development and DMP. Within the report Fortescue detailed that 404 ha of pit voids have been backfilled and 17 ha of other rehabilitation undertaken for a total of 421 ha of rehabilitation at Christmas Creek. In the same report Fortescue disclosed that at Cloudbreak 410 ha of backfill had been completed and 83 ha of other rehabilitation.</p> <p>At Cloudbreak the 83 ha of rehabilitation includes the completion of bulk earthworks and the closure profiling of three waste rock storage facilities (WRSF's), Green, Cocos 2 and Brampton 3. Fortescue is implementing the <i>Rehabilitation and Revegetation Monitoring Procedure (45-PR-EN-0027)</i> on the rehabilitated WRSF. Results of the monitoring program have been published in the <i>Cloudbreak Rehabilitation Monitoring Report 2014</i> (CB-RP-EN-1056). A copy of this report was provided to the OEPA as Appendix ZZ of the <i>Compliance Assessment Report for Environmental Protection Authority - 2014</i> (45-RP-EN-1015). Further details on the rehabilitation undertaken at Cloudbreak are provided in section 13.2.6 of the PER.</p> <p>The OEPA comment that “<i>it is impossible to estimate the likely success of rehabilitation for the proposal based on the information provided in the PER</i>” is correct given the young age of the rehabilitation completed at Cloudbreak and Christmas Creek. The infancy of the monitoring programs does not allow for any conclusions to be drawn from the monitoring data gathered to date. Some confidence into the success of the rehabilitation program can be garnered from the approach to closure and rehabilitation outlined in the MCP (Appendix 8E) and research and development invested in the development of the supporting documents (Appendices 8B, 8C and 8D).</p>



3. FLORA AND VEGETATION

Table 2: Response to flora and vegetation related public submissions

Item	Submitter	Submission and/or issue	Response to comment																																			
2.1	Department of Parks and Wildlife (DPaW)	<p>The Fortescue Marsh and the fringing mulga woodlands and samphire shrubland communities have been identified as a high priority for conservation reservation due to their significant habitat and specific conservation values, and their lack of representation in the existing reserve system. The proposed Christmas Creek Iron Ore Mine Expansion would affect additional areas within those sections of Roy Hill and Hillside pastoral leases that were identified in 2002 by Parks and Wildlife for exclusion from their respective leases in July 2015 so they could be included in the conservation reserve system. The information provided is not sufficiently detailed to determine the actual impact on these proposed reserve areas.</p> <p>Clear quantitative information should be provided on, the area of the specific vegetation types located within the proposed reserve areas that will be impacted.</p> <p>The proponent is yet to provide a clear estimate of the area and proportion of mulga in the 2015 pastoral lease exclusion area (north of the Fortescue Marsh) that will be impacted by mining. It appears from the information provided that the proposed direct and indirect impacts on the mulga communities to the north of the Marsh is likely to result in only a small proportion of mulga within the proposed reserve area north of the Marsh remaining uncleared.</p>	<p>Fortescue has undertaken additional analysis of the vegetation types an indicative disturbance inside the area of the proposed Fortescue Marsh Conservation Reserve (FMCR) that falls within the Proposal development envelope. Figure 7 (CC_MP_EN_0263.005) illustrates the vegetation units to be disturbed in the proposed FMCR. The indicative disturbance used for the analysis excludes the areas currently approved for disturbance under existing environmental approvals (MS707).</p> <p>Table iii summarises the direct and indirect disturbance to the vegetation types within the proposed FMCR. As detailed Fortescue estimates 1,205.84 ha of Mulga will be directly or indirectly impacted within the proposed FMCR area intersected by the Proposal. This represents 42.6% of the mulga vegetation within the portion of proposed FMCR within the Proposal boundary.</p> <p><b>Table iii: Analysis of vegetation disturbance with proposed Fortescue Marsh Conservation Reserves (FMCR).</b></p> <table><tr><th>Vegetation Type</th><th>Within DE (ha)</th><th>Within FMCR (ha)</th><th>Direct Impact DE (ha)</th><th>Direct Impact FMCR (ha)</th><th>Indirect Sheetflow Impact DE (ha)</th><th>Indirect Sheetflow Impact FMCR (ha)</th></tr><tr><td>Mulga Vegetation</td><td>17886.90</td><td>2830.12</td><td>433.28</td><td>1012.32</td><td>341.75</td><td>193.52</td></tr><tr><td>Riparian Vegetation</td><td>1052.50</td><td>70.50</td><td>366.52</td><td>33019</td><td>0</td><td>0</td></tr><tr><td>Samphire Vegetation</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr><tr><td>Other Vegetation – Not Significant</td><td>13881.82</td><td>404.41</td><td>3203.90</td><td>69.33</td><td>2.73</td><td>1.61</td></tr></table> <p>DE = Proposal Development Envelope, FMCR = Proposed Fortescue Marsh Conservation Reserve</p>	Vegetation Type	Within DE (ha)	Within FMCR (ha)	Direct Impact DE (ha)	Direct Impact FMCR (ha)	Indirect Sheetflow Impact DE (ha)	Indirect Sheetflow Impact FMCR (ha)	Mulga Vegetation	17886.90	2830.12	433.28	1012.32	341.75	193.52	Riparian Vegetation	1052.50	70.50	366.52	33019	0	0	Samphire Vegetation	0	0	0	0	0	0	Other Vegetation – Not Significant	13881.82	404.41	3203.90	69.33	2.73	1.61
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Item	Submitter	Submission and/or issue	Response to comment																																								
2.2		Further information is required to illustrate that all viable alternatives regarding the selection of prospective orebodies and the design and location of infrastructure for the expansion project have been considered in order to minimise impacts on the values of the proposed Roy Hill and Hillside conservation reserve.	<p>Fortescue understands that on 1 July 2015 some areas within the Roy Hill and Hillside pastoral leases will be relinquished. The tenure of these relinquished areas will return to Unallocated Crown Land (<b>UCL</b>) with the existing overlapping <i>Mining Act 1978</i> tenure to remain. It is understood that DPaW wishes to convert the relinquished UCL into the proposed Roy Hill and Hillside conservation reserves.</p> <p>Fortescue has reviewed the Christmas Creek Expansion proposed disturbance with the area of the proposed conservation estate. It has been identified that Figure 46 provided in the PER depicting the intersection of the Christmas Creek Expansion (the Proposal) with the proposed conservation estate is incorrect. The boundary used for the Proposed Fortescue Marsh Conservation Reserve (FMCR) was a boundary provided by the Department of Lands in 2011. An updated proposed boundary of the area to be relinquished from Roy Hill Station was provided by the Department of Lands in mid-2014. The revised boundary reduces the size of the proposed FMCR and reduces the area intersected by the Proposal.</p> <p>Fortescue has undertaken further analysis of the impacts of the Proposal on the areas within the proposed FMCR. Figure 8 (CC_MP_EN_0263.004) attached details the revised intersection of the Proposal with the amended FMCR boundary. Section 9.7.1 (pg. 146) of the PER outlines the direct disturbance inside the proposed FMCR associated with the Proposal. Following the analysis of the disturbance using the 2104 Department of Lands boundary Fortescue has prepared Table iv below.</p> <p><b>Table iv: Direct Disturbance associated with the proposed Fortescue Marsh Conservation Reserve (FMCR).</b></p> <table><tr><th>Description</th><th>Inside development envelope and inside Proposed FMCR (ha)</th><th>Inside development envelope but outside Proposed FMCR (ha)</th><th>Total Inside 33,000 ha development envelope (ha)</th><th>Percentage inside Proposed FMCR of Total Proposal (ha)</th></tr><tr><td>Area of Proposed FMCR inside development envelope</td><td>N/A</td><td>N/A</td><td>3,305.03</td><td>10%</td></tr><tr><td>Existing approved footprint (MS 707)</td><td>88.51</td><td>11,432.18</td><td>11,520.69</td><td>1%</td></tr><tr><td>Indicative Mine Pits</td><td>492.37</td><td>12,308.17</td><td>12,800.54</td><td>4%</td></tr><tr><td>Indicative Miscellaneous Infrastructure</td><td>673.14</td><td>4,085.56</td><td>4,758.70</td><td>14%</td></tr><tr><td>Indicative Tailings Storage</td><td>0.0</td><td>192.65</td><td>192.65</td><td>0%</td></tr><tr><td>Indicative Waste Rock Facilities</td><td>0.0</td><td>2125.68</td><td>2125.68</td><td>0%</td></tr><tr><td>Total Indicative Disturbance^</td><td>1,165.11</td><td>18,712.06</td><td>19,877.57</td><td>6%</td></tr></table> <p>^Please note there is some overlap in the indicative disturbance areas as miscellaneous infrastructure, tailings storage and work rock facilities can be constructed over mined out pits.</p> <p>The revised boundary reduces the area of the proposed FMCR intersected by the Proposal to 3,305 ha or approximately 10% of the Proposal. As detailed in Table iv the proposed direct disturbance inside the proposed FMCR is limited to Mine Pits and Miscellaneous Infrastructure (e.g. roads, pipelines, topsoil storage areas etc.), approximately 6% of the Proposal disturbance is located within the proposed FMCR. This disturbance is dependent on the location of the ore body and suitable geology for reinjection of groundwater. Optional disturbance (e.g. waste rock storage facilities, remote crushing hub and tailings facilities etc.) have been located outside the boundary of the proposed FMCR to minimise the direct disturbance inside the proposed FMCR (refer to Figure 7).</p>	Description	Inside development envelope and inside Proposed FMCR (ha)	Inside development envelope but outside Proposed FMCR (ha)	Total Inside 33,000 ha development envelope (ha)	Percentage inside Proposed FMCR of Total Proposal (ha)	Area of Proposed FMCR inside development envelope	N/A	N/A	3,305.03	10%	Existing approved footprint (MS 707)	88.51	11,432.18	11,520.69	1%	Indicative Mine Pits	492.37	12,308.17	12,800.54	4%	Indicative Miscellaneous Infrastructure	673.14	4,085.56	4,758.70	14%	Indicative Tailings Storage	0.0	192.65	192.65	0%	Indicative Waste Rock Facilities	0.0	2125.68	2125.68	0%	Total Indicative Disturbance^	1,165.11	18,712.06	19,877.57	6%
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Item	Submitter	Submission and/or issue	Response to comment
2.3	Department of the Environment (DoE)	<p>The acceptability of the proposal impacts on Matters of National Environmental Significance (MNES) largely centres on understanding the impacts to vegetation from drawdown/mounding and other changes to hydrology. The drawdown/mounding envelope and study area for the proposal. The full extent of potential impacts to vegetation and habitat for MNES are not fully considered.</p> <p>The Department requests that further information is provided on how impacts on MNES in the drawdown/mounding envelope and any indirect impacts beyond the cursory disturbance envelope have been considered.</p>	<p>Whilst figures 21 -24 of the PER detail areas impacted by groundwater drawdown and mounding extend outside of the development boundary the figures do not illustrate the areas of vegetation that are potentially impacted by the drawdown or mounding.</p> <p>Impacts to potentially groundwater dependent ecosystem (GDE) vegetation have been identified as impacts to the vegetation type VT01 consisting of <i>Eucalyptus</i> victrix, <i>E. camaldulensis</i> through drawdown of the underlying aquifer.</p> <p>Mulga vegetation is considered to be sensitive to groundwater mounding as Mulga is not tolerant of salt entering the root zone and not tolerant of waterlogging (refer to section 9.4.6 of the PER).</p> <p>Section 9.4.6 of the PER also presents details on the research and investigations into the impact of groundwater drawdown and mounding on samphire vegetation.</p> <p>Section 9.7.2 of the PER details the impacts to vegetation associated with the abstraction and injection of groundwater. Areas where depth to groundwater is less than 5 m without mining occurring and drawdown of greater than 2 m is expected are areas where GDE could be impacted through dewatering. Figure 62 of the PER illustrates the extent of indirect impact areas to VT01 for all years of the proposal combined. The area of indirect impact to VT01 is 1.1 ha at its largest predicted extent.</p> <p>Samphire is known to occur only where the depth to groundwater is less than 5 m. Areas where a drawdown of greater than 3 m was shown where the depth to groundwater was less than 5 m without mining have been mapped on an annual basis and are presented in Figure 47 (2014) to Figure 61 (2028) of the PER to determine potential areas of indirect impact to samphire vegetation (VA01 – VA09). No samphire occurs in the area where a drawdown of greater than 3 m is anticipated.</p> <p>Results of the numerical modelling indicate that the only sensitive vegetation anticipated to be potentially impacted by groundwater abstraction is a small area of VT01 (River Red Gum/Coolibah vegetation) in the southern part of the Survey Area (Table 39 of the PER). Cumulative impacts of the Proposal (including direct impacts of clearing discussed in Section 9.7.1 and the indirect impacts discussed in Section 9.7.2 to 9.7.7 of the PER) are summarised in Table 41 of the PER.</p> <p>Section 9.7.2 summarises that no indirect impacts to Mulga vegetation as a result of groundwater mounding are expected, because no areas where depth to groundwater is greater than 2m will experience water mounding to within 2m of the surface (Mulga root zone). The modelling is illustrated in figures 47 – 61 of the PER.</p> <p>Table 40 and Figure 20 of the PER summarise the areas of sheet flow dependent vegetation directly and indirectly impacted by the proposal. The direct and indirect impacts to MNES habitats and individual species are discussed in section 12.5 of the PER. Fortescue considers the relatively small areas of habitats indirectly impacted by groundwater abstraction and injection will have an insignificant impact on MNES species.</p>
2.4		<p><b>Recommendations from Peer Review</b></p> <p>It is unclear whether the recommendations noted in Appendix 5B (Peer review of the FMG hydrogeological assessment) have been incorporated into the water management strategies for this proposal. In addition, the proponent notes that some of the recommendations in appendix 5H (Peer review of Samphire water use modelling) will be addressed using 1-D modelling in the future.</p> <p>The Department suggests that the recommendations from both peer reviews are addressed by the proponent.</p>	<p>The peer review of the hydrogeological assessment (Appendix 5B) provides only a single recommendation, “<i>it is recommended that FMG continue with ongoing development and calibration of the model to improve confidence in dewatering and injection volumes, as well as ensuring alignment with actual responses</i>”.</p> <p>Fortescue continuously reviews and updates its understanding of the hydrogeological processes at Christmas Creek from data collected during operations and this activity will continue as the Proposal is implemented. Further understanding of the hydrogeological model will be provided to DoW via regular aquifer reviews and to the OEPA through annual Compliance Assessment Reports.</p> <p>The revised HYDRUS modelling report, <i>Modelling Analysis of the Impact of Mine Dewatering on Soil Water Availability to the Samphire Vegetation on the Fringe of the Fortescue Marsh</i> is provided as PER Appendix 5H. A previous iteration of the HYDRUS modelling report was peer reviewed by Gavan McGrath UWA (2014). A copy of the peer review is provided as PER Appendix 5H. The majority of the recommendations of this peer review have been addressed in the current version of the HYDRUS modelling report. A summary of recommendations and comments are included in the PER (pages 124 – 126).</p>

Item	Submitter	Submission and/or issue	Response to comment
2.5	Wildflower Society (public submitter No. 1)	<p>The Society's main concern is in regard to impacts of the Proposal on the Fortescue Marsh, which has been recognised as a Nationally Important Wetland of high conservation value.</p> <p>Although the operating company, FMG try to play down the significance of the Fortescue Marsh by stating that the proposal is in Zone 3a, Kulbee Alluvial Flank, which is considered to be one of the zones of lowest environmental significance (FMG 2015, p 51) we note the Proposal is still located adjacent to Zones 1a: Northern Flank and 1b: Marsh, which are identified as zones of highest conservation significance in the EPA's advice to the Minister (EPA 2013). It is evident that impacts of the Proposal rely not only on Zone 3a but also Zones 1a and 1b given that 'the main cumulative effect of mining is the potential reduction of runoff into the (entire) Fortescue Marsh' (FMG 2015, P76).</p> <p>In this regard, to avoid impacts to Zones 1a and 1b, we would have expected that one of FMG's strategies would be to avoid locating infrastructure on or in close proximity to major Marsh tributaries. However, a quick glance at Figures 9 and 13 shows that mine pits and miscellaneous infrastructure for the Proposal have been located on or near many of the various Marsh tributaries including:</p> <ul style="list-style-type: none"> <li>• Christmas Creek;</li> <li>• Kulbee Creek;</li> <li>• Unnamed Creek 1;</li> <li>• Unnamed Creek 2; and</li> <li>• Unnamed Creek 3 (FMG 2015).</li> </ul> <p>FMG states that all surface water diversions will still flow into the Marsh (FMG 2015, p. 68). In order to provide certainty that the current flows of the Marsh tributaries will be maintained by FMG, we ask that the EPA recommend assigning a condition to the proposal that 'FMG maintain current surface water flows into the Marsh for the duration of the Project'.</p>	<p>Fortescue has endeavoured to locate infrastructure away from major tributaries to the Fortescue Marsh. The location of disturbance for mine pits and access roads is dependent to the location of the ore body. Optional infrastructure such as ore processing facilities, remote crushing hubs, workshops and waste rock dumps have been placed away from surface water tributaries, where possible. For example the existing remote crushing hub east of the ore processing facility was constructed to avoid the Young's Creek drainage line (PER figure 9). Additionally mined out pits are utilised for tailings storage facilities or backfilled with overburden to reduce the need for further disturbance for the construction of the tailings storage facilities and waste rock dumps.</p> <p>Fortescue has developed and is currently implementing the <i>Surface Water Management Plan</i> (100-PL-EN-1015, PER Appendix 2B) and <i>Surface Water Monitoring Guidelines</i> (45-GU-EN-0002) at Christmas Creek. The Management Plan and Guidelines outline the management approach to be undertaken to assess and monitor surface water flows during the implementation of the Proposal.</p> <p>A summary of the implementation of the Surface Water Management Plan is provided annually to the OEPA in the CAR. Fortescue considers the current Surface Water Management Plan and Monitoring Guidelines sufficient to maintain the quantity and quality of surface water flowing through the Proposal to the Marsh.</p>

4. HYDROLOGICAL PROCESSES

Table 3: Response to hydrological process related public submissions

Item	Submitter	Submission and/or issue	Response to comment																																																												
3.1	Department of Water (DoW)	<p>Groundwater</p> <p>The groundwater modelling uses average predicted dewatering and injection volumes over the period 2014 to 2028 of 30.4 GL/a (no injection) and 40.5 GL/a (with injection) - with a peak annualised dewatering demand of 73.5 GL/a (with injection) in the year ending June 2015. It is unclear if FMG intend to adhere to the dewatering amounts used in the modelling or increase dewatering to 110 GL/a. It is also unclear what the dewatering and mounding response would be to a sustained 110 GL/a dewatering and injection scenario (with use of up to 35 GL/a).</p> <p>FMG should provide clarification on their intended dewatering and injection regime over the Life of Mine. In addition, FMG should clarify what dewatering sand mounding response is anticipated, should the dewatering and injection regime vary considerably to the dewatering volumes used in the modelling. This information should be provided for assessment, before the DoW can confirm potential impacts have been adequately assessed.</p> <p>DoW will review the Christmas Creek (and Cloudbreak) Groundwater operating strategy (GWOS) to ensure that the bores proposed to be used to monitor water quality to monitor for possible acid metalliferous drainage are suitable and included in the strategy / strategies.</p>	<p>The hydrological modelling presented in the Christmas Creek Iron ore Mine Expansion Public Environmental Review (PER) was undertaken during 2013, resulting in the first year of the model being 2014. The basis of the model was that the expansion mine plan and dewatering would commence simultaneously resulting in the initial peak water abstraction presented in Table 17 of the PER. However the peak water abstraction is now forecast to occur in 2017, with the same trend as to that presented in the PER albeit delayed by two years (Chart 1).</p> <p><b>Chart 1: Revised modelled annual water abstraction hydrograph.</b></p> <table><caption>Estimated data for Chart 1: Revised modelled annual water abstraction hydrograph (GL/a)</caption><thead><tr><th>Model Year</th><th>Base Case</th><th>Dry Scenario</th><th>Wet Scenario</th><th>High Ore Body K</th><th>Low Ore Body K</th></tr></thead><tbody><tr><td>2015</td><td>50</td><td>50</td><td>50</td><td>65</td><td>40</td></tr><tr><td>2017</td><td>75</td><td>70</td><td>65</td><td>110</td><td>55</td></tr><tr><td>2019</td><td>35</td><td>35</td><td>35</td><td>55</td><td>25</td></tr><tr><td>2021</td><td>45</td><td>45</td><td>45</td><td>65</td><td>35</td></tr><tr><td>2023</td><td>45</td><td>45</td><td>45</td><td>55</td><td>35</td></tr><tr><td>2025</td><td>55</td><td>55</td><td>55</td><td>85</td><td>45</td></tr><tr><td>2027</td><td>25</td><td>25</td><td>25</td><td>35</td><td>20</td></tr><tr><td>2029</td><td>20</td><td>20</td><td>20</td><td>25</td><td>15</td></tr><tr><td>2031</td><td>15</td><td>15</td><td>15</td><td>15</td><td>10</td></tr></tbody></table> <p>The current operations dewatering performance is consistent with the hydrological modelling undertaken for the current Water Management Scheme (WMS) assessment (MS871). Figure 9 (attached) was presented in the WMS API supporting document (CC-RP-HY-0004) in 2010 illustrating the predicted areas drawdown for 2015. The drawdown presented in Figure 9 has been converted to groundwater levels (Figure 13) to allow for comparison with Figure 10. Figure 10 (attached) was prepared for the recently published <i>Christmas Creek Groundwater Monitoring Summary, 1st February – 30th April 2015</i> (CC-RP-HY-0053) and represents the current groundwater levels which are consistent with those modelled in 2010, which provides confidence in numerical modelling and their predictions.</p> <p>Figure 21 of the PER illustrates the modelled groundwater drawdown in year 1 of the implementation of the Proposal. The figure details the area of groundwater drawdown extending eastwards as new mining areas are developed. This follows the mining sequence presented in PER Figure 11. It is the development and commencement of dewatering to the east, in combination with existing operations, which combine to simulate the peak dewatering (potentially up to 110GL with consideration of parameter and climatic sensitivity) in the early years of the proposal.</p> <p>The modelled drawdown predicted for mining year 14 (PER Figure 25) has resulted from the mining sequence continuing eastwards and mining pits being developed in the western region of the proposal towards the end of the 14 mining years of the proposal. This presents a worse case situation for dewatering drawdown, where mining and hence dewatering is required across the full strike length of the ore body which produces a large elongated cone of depression. It is predicted the annual volume of water abstracted will decline in the latter years of the model (Chart 1) and groundwater levels begin to rebound (PER Figure 25).</p> <p>The modelling and sensitivity analysis undertaken by Fortescue (PER Appendix 5A) demonstrates the boundary of the dewatered zone is influenced by the area of dewatering operations and the average dewatering rates; as opposed to peak</p>	Model Year	Base Case	Dry Scenario	Wet Scenario	High Ore Body K	Low Ore Body K	2015	50	50	50	65	40	2017	75	70	65	110	55	2019	35	35	35	55	25	2021	45	45	45	65	35	2023	45	45	45	55	35	2025	55	55	55	85	45	2027	25	25	25	35	20	2029	20	20	20	25	15	2031	15	15	15	15	10
Model Year	Base Case	Dry Scenario	Wet Scenario	High Ore Body K	Low Ore Body K																																																										
2015	50	50	50	65	40																																																										
2017	75	70	65	110	55																																																										
2019	35	35	35	55	25																																																										
2021	45	45	45	65	35																																																										
2023	45	45	45	55	35																																																										
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2029	20	20	20	25	15																																																										
2031	15	15	15	15	10																																																										



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			<p>dewatering rates and localised dewatering. Therefore changes to the mine pit sequencing or annual abstraction rates would not dramatically alter the boundary of dewatering zone over the 14 year proposal. This is demonstrated by Figure 11 which illustrates the 1 m drawdown contours from Mining year 14 for the 3 sensitivity scenarios that result in the largest zone of dewatering. The three scenarios illustrated are the expected case (presented in the PER), the dry climate scenario and the high ore body conductivity (K) case (both detailed in PER Appendix 5A).</p> <p>Similarly analysis of the potential indirect impacts to groundwater dependent ecosystems (GDE) associated groundwater drawdown for each scenario did not identify any potential indirect impact greater than the 1.1 ha of GDE, associated with the expected case detailed in section 9.7.2 of the PER. Indirect impact to GDE is expected where the natural groundwater level is within 5 m of the surface and drawdown is greater than 3 m. Fortescue simulated the worst case scenario for indirect impacts using the natural groundwater level during the “Wet Scenario” and the 3 m drawdown contour from year 14 of the “High Ore Body K Scenario”. Figure 12 represents the results of the simulated “worst case” scenario. This resulted in a predicted impact to GDE less than the 1.1 ha for the expected case, presented in section 9.7.2 of the PER.</p> <p>The triennial report submitted with the PER (Appendix 5D) is the final document and incorporates comments received from the DoW on draft versions.</p> <p>Fortescue believes:</p> <ul style="list-style-type: none"> <li>• Class 1 trigger levels serve as an early warning for groundwater level and quality changes; and</li> <li>• Class 2 trigger levels are aligned with groundwater level changes that may potentially impact upon the environment and future beneficial use of the aquifer.</li> </ul> <p>The number of Class 1 exceedances with no Class 2 exceedances illustrates the success in the adaptive management and operation of the Christmas Creek system to respond to changing hydrogeological conditions in order to prevent potential environmental impact. It is suggested that this fact provides good evidence of the adequacy of the trigger system which is in place and that should be continued to be implemented.</p> <p>The baseline groundwater modelling which has been undertaken includes simulation of the time series abstraction and injection outlined in Table 23 of PER Appendix 5A, <i>Hydrogeological Assessment of the Christmas Creek Life of Mine Water Management Scheme</i> (CC-RP-HY-0017), (Peak of 73.5 GL/a and an average of 40.5 GL/a). It is important to note the simulation has been completed with the time series data, not average rates. The predicted drawdown and mounding impacts for this base case scenario are presented spatially in Figures 29- 43 of the PER Appendix 5A and for the five key locations in Figure 44 (of PER Appendix 5A).</p> <p>Sensitivity analysis has also been undertaken to show the likely variation in volumes and impacts as a result of rainfall scenarios and parameter variation.</p> <p>The changes to abstraction rates (including peak volumes up to 110GL/a) are shown in Table 26 of PER Appendix 5A. It is important to note that in this scenario the peak abstraction will not be simulated across all years, this is representative of a 37% increase in base case scenario abstraction which results in a peak of 110 GL/a. This sensitivity has shown (PER Appendix 5A, Table 26) that peak abstraction volumes could range between 56 GL/a and 110 GL/a depending on parameter variation. In all cases the base case scenario provides the anticipated yearly variation in flows.</p> <p>Impacts from these sensitivity assessments are included in tabular format in Tables 27 and 28 for key monitoring points, graphically in Appendix 5 and spatially (for climatic variation) in Appendix 6 (of PER Appendix 5A). This assessment has shown that in all scenarios, even peak abstraction, that the maximum drawdown and mounding at key monitoring locations is less than 3m.</p> <p>Fortescue does not anticipate that a sustained abstraction of 110 GL/a will be realised during implementation of the Proposal, the predicted dewatering rates are anticipated to reflect the base case scenario, within the range of the sensitivity presented. No assessment has been presented to show a sustained abstraction and injection at 110 GL/a as this does not</p>



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			<p>represent a realistic assessment of the proposal.</p> <p>No simulation presented includes for a water demand of 35GL/a as this is not representative of operations. In each sensitivity assessment the mine water use presented in Table 23 (of PER Appendix 5A) has been used for modelling. All excess water has been injected to provide a realistic simulation. Peak water use is simulated to be 12 GL/a, based on ore processing plant design criteria.</p> <p>Fortescue's predicted dewatering and injection regime is provided in Table 23 (of PER Appendix 5A) (base case scenario). Likely variation due to climatic and parameter variation is also presented in terms of abstraction/injection change and impacts. Whilst mine planning and production sequencing alterations cannot be discounted over a twenty four year period of time any changes are likely to result in only minor variations to the yearly volumes in comparison to the sensitivity analysis presented. Quarterly and annual mine plans are assessed from a groundwater perspective and impacts to key receptors and compliance to approval obligations assessed. Comparison and deviation from Life of Mine (LoM) simulated abstraction/injection regimes are compared and discussed as part of the triennial aquifer review process.</p> <p>Groundwater Operating Strategies (GWOS) are designed to address the requirements of approvals sought under the <i>Rights in Water and Irrigation Act 1914</i>. The GWOS is not intended to be used to document and manage the risks associated with other groundwater aspects such as Acid and/or Metalliferous Drainage (AMD), tailings disposal, bulk fuel storage or landfill monitoring. Fortescue has committed to implementing the <i>Acid and/or Metalliferous Drainage Management Plan</i> (100-PL-EN-1016, PER Appendix 2F) and undertaking the <i>Acid and Metalliferous Drainage Sampling Plan</i> 100-PL-EN-1014 at Christmas Creek to assess and manage any potential AMD. Monitoring the impacts to groundwater associated with discharges of waste will be managed under the provisions of Part V of the <i>Environmental Protection Act 1986</i> administered by the Department of Environment Regulation (DER).</p>
3.2	Department of Parks and Wildlife (DPaW)	<p>Groundwater abstraction</p> <p>The proponent should ensure that potential impacts on flora and vegetation communities and the Fortescue Marsh as a result of:</p> <ul style="list-style-type: none"> <li>Groundwater drawdown, mounding, ponding and discharge; and</li> <li>Altered surface water sheet flow and altered stream flow;</li> </ul> <p>are minimised and managed to ensure they remain within clearly defined limits, including those areas outside the identified development envelope, particularly in the proposed Roy Hill and Hillside conservation reserve areas.</p> <p>The impacts proposed by the development should be made clear and confined, as closely as possible, to an agreed footprint of proposed impact. This is particularly relevant to areas within the proposed Roy Hill and Hillside conservation reserve areas, which contain mulga woodlands and samphire shrubland communities of the Fortescue Marsh that are not represented in any formal conservation reserves.</p>	<p>Section 9.10 of the PER lists the expected impacts to flora and vegetation associated with the Proposal. The Proposal is expected to result in the following outcomes in relation to flora and vegetation:</p> <ol style="list-style-type: none"> <li>Disturbance of approximately 7,821 ha, consisting of 7,752 ha of native vegetation (approximately 17,956 ha total disturbance combined with existing mine within a Development Envelope of 33,000 ha) for the mine expansion and associated infrastructure.</li> <li>No clearing or indirect disturbance will occur to the Fortescue Marsh PEC (P1).</li> <li>Up to 4,924 ha of Mulga vegetation will be directly affected by the Proposal and up to 439 ha of sheet flow dependent Mulga will be indirectly affected by altered surface water regime; however, Mulga communities are well represented in the region.</li> <li>No indirect impacts will occur to Mulga vegetation as a result of groundwater drawdown or mounding.</li> <li>Up to 355 ha of GDE vegetation (VT01) will be directly affected by the Proposal and up to 1.1 ha could potentially be indirectly affected by groundwater drawdown; however, floristic analysis demonstrates that VT01 (as floristic group 575) occurs in several locations outside the Survey Area, with 13 sites located within the Survey Area and a further 11 sites located outside the Survey Area (Appendix E of ENV 2013a).</li> <li>No direct impacts to samphire vegetation will result from the Proposal, and no indirect impacts to samphire vegetation through groundwater drawdown are expected.</li> <li>Clearing for the Proposal and potential indirect impacts to vegetation will not compromise any vegetation system by taking it below the "threshold level" of 30% of its pre-clearing extent.</li> <li>No change in the conservation status of conservation significant flora species is expected.</li> <li>Rehabilitation will restore some of the vegetation values of the pre-existing landscape.</li> </ol> <p>Impacts to flora and vegetation communities and the Marsh will be minimised and managed via the implementation of the following management plans and strategies:</p>

Item	Submitter	Submission and/or issue	Response to comment
			<ul style="list-style-type: none"> <li>Vegetation Health Monitoring and Management Plan (CC-PL-EN-0004)</li> </ul>
3.3	Wildflower Society (public submitter No. 1)	<p>Groundwater</p> <p>With the expansion, FMG proposes to extract up to 110 GL/a of groundwater with around 75 GL/a injected. We note that to date (2013/2014), the highest total volume extracted by FMG at the adjacent Christmas Creek mine is 40.3 GL/a, with 20.4 GL/a being injected. The expansion will require almost three times as much dewatering than the current Christmas Creek operations. In this regard there is a much higher risk that dewatering will cause adverse impacts to native vegetation within the Marsh. We understand that average annual water level fluctuations on the Marsh are no greater than 2 m (FMG 2015, 9. 59). We would expect that FMG take all measures necessary during dewatering and injection to ensure that these natural fluctuations are maintained. For this reason we ask that the EPA recommend assigning the following conditions to the proposal that:</p> <ul style="list-style-type: none"> <li>FMG will 'manage groundwater abstraction and disposal (dewatering and injection) in a manner that ensures there is no adverse impact on native vegetation communities attributable to the Project; and</li> <li>That FMG will 'manage groundwater abstraction and disposal (dewatering and injection) in a manner that ensures natural annual water level fluctuations on the Marsh are no greater than 2 m per annum.</li> </ul>	<p>Fortescue believes that the outcomes desired by the submission, that</p> <ul style="list-style-type: none"> <li>FMG will 'manage groundwater abstraction and disposal (dewatering and injection) in a manner that ensures there is no adverse impact on native vegetation communities attributable to the Project; and</li> <li>That FMG will 'manage groundwater abstraction and disposal (dewatering and injection) in a manner that ensures natural annual water level fluctuations on the Marsh are no greater than 2 m per annum.</li> </ul> <p>can be achieved through the continued implementation of the existing groundwater monitoring and management programs using the established groundwater trigger levels.</p> <p>The Class 1 and Class 2 groundwater level triggers have been outlined in the <i>Christmas Creek Groundwater Operating Strategy</i> (CC-PH-HY-0002) (Appendix 5C). The Class 2 water level trigger in the near marsh area is "Change of <math>\pm 1</math> m with regard for climatic trends and seasonal variation". The Class 2 water level triggers in the saline injection area are no less than "2.2 m below ground surface". Fortescue considers the continued implementation of the existing <i>Groundwater Management Plan</i> (100-PL-EN-0029) (PER Appendix 2C) and <i>Christmas Creek Groundwater Operating Strategy</i> as suitable controls to ensure groundwater mounding does not cause groundwater levels to rise within 2m of the surface.</p>
3.4		<p>We understand that injection of groundwater can potentially cause mounding which can potentially impact any vegetation communities or ecosystems that may be sensitive to waterlogging (FMG, 2015, p65). Hydrological modelling undertaken by FMG shows that mounding along the fringe of the Marsh is expected to be no more than 2 m (FMG 2015, p. xi). We ask that the EPA recommend assigning the following condition to the proposal: that FMG 'shall manage the injection of surplus water to ensure that mounding of the groundwater level within the impact zones does not result in groundwater levels rising within 2 m of the surface'.</p>	<p>Additionally implementation of the <i>Vegetation Health Monitoring and Management Plan</i> (CC-PL-EN-0004) (Appendix 2G) will assist in the identification and management of any adverse indirect impacts of vegetation within the Proposal area.</p>
3.5		<p>It is understood that broadscale baseline characterisation of groundwater was not undertaken prior to the commencement of mining and dewatering at the adjacent Christmas Creek mine (FMG 2015, p.87). It is hard to understand how any comparisons can be made between previous groundwater monitoring results at Christmas Creek without baseline data. Nonetheless if FMG is going to ensure that groundwater quality and natural hydrological cycles are maintained, it is critical that baseline data from groundwater and surface water be obtained to determine trigger levels prior to dewatering. We recommend that a condition be placed on FMG to 'undertake broadscale baseline characterisation of groundwater within the Proposal area (subsequent to the commencement of dewatering) and that FMG be 'required to undertake groundwater and surface water quality monitoring on a monthly basis'.</p>	<p>The Proposal is a continuation of the existing Christmas Creek mine approvals (Ministerial Statements 707 and 871). The existing operation is currently undertaking groundwater abstraction and injection as approved. The current operations would inhibit the ability to collect 'broadscale baseline' characterisation of the groundwater.</p> <p>Christmas Creek Groundwater Operating Strategy (GWOS) (CC-PH-HY-0002) (Appendix 5C) incorporates baseline ranges for groundwater data based on analysis of monitoring data collected from Christmas Creek since operations commenced. The baseline ranges have been communicated to the OEPA in annual Compliance Assessment Reports.</p> <p>Fortescue currently undertakes groundwater monitoring on a monthly basis to satisfy the requirements of the GWOS in addition to the conditions of the existing environmental approvals (MS 707 and MS871). Fortescue intends to continue to implement the GWOS and Groundwater Management Plan.</p>
3.6	Roy Hill Iron Ore (RHIO) Public Submitter No. 2	<p>Cumulative impacts</p> <p>The FMG proposal includes inter alia, the following activities:</p> <ul style="list-style-type: none"> <li>Groundwater abstraction,</li> <li>Groundwater reinjection</li> <li>Surface water diversions activities; and</li> <li>In pit tailings and waste disposal.</li> </ul> <p>RHIO considers that these activities have the potential to impact on existing RHIO project infrastructure (including mine pits and surface water diversion structures), mining and dewatering activities and management of sensitive vegetation (groundwater dependent and surface water flow dependent), [see specific comments below],</p> <p>RHIO acknowledges that consultation between FMG and RHIO in regards to groundwater management and water supply issues under the Chichester Joint Water Management Group Terms of Reference has occurred and is</p>	<p>Fortescue has committed to the ongoing implementation of the <i>Stakeholder Consultation ReInjection Management Plan</i>, (CC-PL-EN-0006, PER Appendix 2A). Fortescue proposes Fortescue and RHIO continue consultation on groundwater management through the Chichester Joint Water Management Group.</p>

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3.7		ongoing.  RHIO wishes to ensure that the potential environmental impacts, including cumulative impacts of the above activities are addressed by FMG in the CCE PER proposal	
		<p>Surface water</p> <p>The PER briefly details the requirement for watercourse and surface water flows to be diverted around mine pits, tailings storage facilities (TSF) and waste rock storage facilities</p> <p>There is the potential for environmental impacts from altered flow regimes and volumes. There is limited information in the PER regarding the location of the proposed watercourse diversion/s and the durations of the altered regimes.</p> <p>A mine pit is proposed up to the boundary of RHIO M46/519 (Figure 9 of the PER), which will potentially require the diversion of No Name Creek and an un-named creek. RHIO has constructed surface water management levees within No Name Creek to allow for mining to be undertaken in the northern areas of M46/519. RHIO is also actively monitoring and managing potential impacts to significant vegetation located downstream of the levees.</p> <p>Further alteration of the surface flows of No Name Creek and the un-named creek to allow FMG to undertake mining, may have the potential to result in off-site impacts including alteration of creek flows which could impact on water quality and a decline in the health of the riparian and Mulga vegetation of the RHIO project area.</p> <p>The potential impact of these activities, in particular, offsite downstream impacts has not been fully outlined in the FMG CCE PER.</p>	<p>Fortescue is committed to adopting management measures that ensure flow volume is transferred through the mine operation to the downstream watercourses so that impacts on flows to the Marsh are minimised as summarised in section 7.8.1 of the PER. On this basis it is the intent to minimise impact on the flow volume leaving Fortescue operations and tenements for the watercourses identified as No Name Creek and unnamed creek.</p> <p>Specific locations and details of watercourses/diversions will be developed as the mine planning is further developed as the proposal is implemented. The surface water management measures will be developed under the guiding principles outlined by the <i>Surface Water Management Plan</i> (100-PL-EN-1015, PER Appendix 2B) and the associated documents (e.g. <i>Standard Engineering Specifications for Drainage and Flood Protection</i> (100-SP-CL-0004)) to minimise the impacts to surface water.</p> <p>As the mine planning detail increases and the surface water management infrastructure are defined in greater detail it is suggested that these can be presented to RHIO through the forum of the Chichester Joint Water Management Group.</p>
3.8		<p>Surface water</p> <p>The PER includes a surface flow discharge contingency if adequate injection capacity is not available. The contingency proposes a discharge up to 3.5ML/d of fresh to brackish water for up to 21 days. Monitoring of the water quality and turbidity is required during the discharge</p> <p>There is the potential for environmental impacts from altered flow regimes and volumes. There is limited information presented in the PER regarding the location of the potential contingency discharge locations. The locations are indicated in broad terms. RHIO is concerned that mining in the vicinity of RHIO tenements (located south east of FMG tenure), has the potential to result in environmental impacts.</p> <p>In particular, if the discharge is located upstream of No Name Creek and the un-named creek in FMG M46/351 and M46/355 these impacts may include alteration of flow regimes and impact to RHIO infrastructure, surface water quality and sensitive vegetation.</p>	<p>Contingency discharge of excess groundwater removed from mining areas is regulated under Part V of the <i>Environmental Protection Act 1986</i> and administered by licence L8454/2010/1 (the <b>licence</b>) issued by the DER. The contingency discharge conditions were incorporated into the licence through an amendment granted on 15 March 2012. The current discharge location is DP11 (GDA 94 772347 mE, 7523656 mN) as illustrated in Attachment 4 of the licence. This location is approximately 24 km west of the RHIO tenements and is located on tenement M46/415.</p> <p>Fortescue does not expect any contingency discharge to impact the RHIO tenements given the location of the discharge point and the management measures required by conditions of licence L8454/2010/1. Any impact associated with the contingency discharge will be relatively small, localised and of a limited duration. The licence conditions require Fortescue to provide the DER a report following any discharge event.</p>
3.9		<p>Groundwater</p> <p>FMG are proposing an average annual dewatering volume of 40.5 GL/a and reinjection of 30.8 GL/a.</p> <p>There is the potential for environmental impacts from groundwater drawdown and groundwater mounding. Section 7.7.2 states that there are no cumulative impacts from the dewatering activities of RHIO and the proposed FMG CCE. RHIO suggest that the consultation between RHIO and FMG via the Chichester Joint Water Management Group continues and become more frequent as FMG dewatering, injection and mining activities ramp up on the areas adjacent to the RHIO tenements.</p>	Fortescue agrees with the suggestion from RHIO that Fortescue and RHIO continue consultation through the Chichester Joint Water Management Group.



Item	Submitter	Submission and/or issue	Response to comment
3.10		<p>Groundwater dependent vegetation</p> <p>FMG are proposing an average annual dewatering volume of 40.5 GL/a and reinjection of 30.8 GL/a. The modelled drawdown of the Christmas Creek Expansion is predicted to lower the groundwater levels of RHIO tenement M46/519 (figures 21 to 28). The potential environmental impact is a decline in health of groundwater dependent vegetation (GDV) - RHIO is required under condition 6 of MS 824 and 826 to monitor vegetation health across its mine site in association with groundwater drawdown associated with mining and dewatering activities within mining tenements M46/518 and M46/519.</p> <p>The modelled drawdown from the Christmas Creek Expansion dewatering activities are predicted to lower groundwater levels of tenement M46/519 and in the areas of potential ground water dependent vegetation.</p> <p>The additional drawdown and duration of the drawdown of groundwater in the vicinity RHIO tenure may result in the decline in health of the vegetation within the RHIO tenements not associated with RH activities.</p>	<p>Fortescue agrees that groundwater drawdown associated with the Proposal will impact groundwater levels within neighbouring mining tenements. Section 7.7.2 of the PER addresses the overlap in mine dewatering areas of impact between Christmas Creek and RHIO. Figure 37 illustrates the overlapping groundwater drawdown contours and details that dewatering associated with RHIO proposal will impact areas with Fortescue's tenements.</p> <p>As stated in Section 9.7.2 of the PER "Areas where depth to groundwater is less than 5 m without mining occurring and drawdown of greater than 2 m is expected have been mapped on an annual basis and are presented in Figure 47 (2014) to Figure 61 (2028) to determine areas of indirect impact to GDE vegetation (VT01). A small area of VT01 in the southern part of the Survey Area is expected to be affected. This impact commences in 2026 and is expected to continue until 2028. Figure 62 shows the extent of indirect impact areas to VT01 for all years combined. The area of indirect impact to VT01 is 1.1 ha at its largest predicted extent".</p> <p>The area of impact depicted in the PER is located on the southern boundary of the Proposal. The closest area of potential impact to the RHIO tenement is approximately 5 km.</p> <p>Fortescue has also committed to the ongoing implementation of the <i>Vegetation Health Monitoring and Management Plan</i> (CC-PL-EN-0004) to identify and manage any potential indirect impacts to vegetation associated with the implementation of the Proposal.</p> <p>Fortescue has committed to the ongoing implementation of the Stakeholder Consultation ReInjection Management Plan, (CC-PL-EN-0006, PER Appendix 2A). Fortescue proposes Fortescue and RHIO continue consultation on groundwater management through the Chichester Joint Water Management Group.</p>
3.11	Public submitter No. 4	<p>My concern lies in aspects of FMG Chichester water management, and some technical details of the mine water operations and hydrogeology, which I will describe below. To summarise, my key concerns are:</p> <ol style="list-style-type: none"> <li>1. FMG have not demonstrated learning from their prior undertakings (that of Cloudbreak and what has been happening there) and applying them to a similar scenario</li> <li>2. FMG reactively manage these operations rather than proactively managing for optimum outcomes for the Fortescue Marsh</li> <li>3. FMG are not transparent in their management of water operations with Government regulators, resulting in diminished outcomes for the Fortescue Marsh and a higher risk of unfavourable environmental impact due to their groundwater reinjection.</li> </ol>	<p>Most comments from the respondent appear to be in relation to the Cloudbreak Project, whilst it is acknowledged that the operation of the two sites is closely linked they are managed from an approval perspective as separate sites. Historical operation and learnings from Cloudbreak have been adapted and developed with specific application to Christmas Creek.</p> <p>The key concerns raised by the submission are addressed in the responses below.</p>
3.12		<p>In my time at the Department of Water there were a number of items relating to both Christmas Creek and Cloudbreak that were raised by the Department of Water and were never adequately followed up by FMG, despite repeatedly being raised over years and multiple revisions of Operating Strategies with multiple staff. These included (but not limited to):</p> <ul style="list-style-type: none"> <li>• FMG setting unclear, unmeasurable management objectives that were only vaguely linked to environmental and groundwater monitoring that was taking place</li> <li>• Poor standard of analysis and reporting of monitoring data against management objectives due to the aforementioned point</li> <li>• FMG frequently changing their revised Operating Strategy through removal of items without informing the Department</li> <li>• Re-interpretation of previously approved projects (through EPA processes) due to changes in priorities for mining ore production rates.</li> </ul>	<p>Fortescue's recent revisions of operating strategies have aimed to improve alignment of the ground water monitoring and triggers with ecological receptors, <i>Environmental Protection Act 1986</i> approval obligations and conditions of controlled actions issued under the <i>Environment Protection and Biodiversity Conservation Act 1999</i> (the EPBC Act). The revised <i>Cloudbreak Groundwater Operating Strategy</i> (CB-PH-HY-0009) has recently been approved by DoW. The Christmas Creek operating strategy will be revised to be consistent with the Cloudbreak document.</p> <p>Fortescue has made recent efforts to standardise reporting across the business. The Envirosys database has been continually evolving to assist with the accurate management and assessment of the monitoring data. Recent triennial, annual and quarterly reports present the data more clearly.</p> <p>The <i>Christmas Creek Triennial Aquifer Review - July 2013</i> (CC-RP-HY-0039_Rev No 2) is provided as Appendix 5D of the PER. Within this document Rockwater Pty Ltd provided the report <i>Geochemical Characterisation of Groundwater Relating to Dewatering and ReInjection Operations</i> (Appendix 8). The Rockwater report made a number of recommendations relating to the groundwater monitoring program and QA/QC requirements were made. Fortescue has adopted the recommendations in the most recent review of the Cloudbreak Operating Strategy. As detailed above, the Christmas Creek operating strategy will be revised so that it is consistent with the Operating Strategy recently approved by the DoW</p>

Item	Submitter	Submission and/or issue	Response to comment
			<p>for Cloudbreak.</p> <p>Changes to the Christmas Creek operating strategies are discussed with DoW and updates are provided in draft revisions for DoW comment. A revision of the <i>Christmas Creek Groundwater Operating Strategy</i> (CC-PH-HY-0003) was submitted to DoW in mid-2013. An updated version of the Christmas Creek operating strategy will be submitted to DoW during 2015 to align with approved Cloudbreak document and to provide an update since the 2013 submission.</p> <p>The most recently approved <i>Cloudbreak Groundwater Operating Strategy</i> (CB-PH-HY-0009) was discussed at length both technically and from a practical perspective with DoW prior to submission of the final document. Fortescue received approval of this version of the Cloudbreak Operating Strategy from the DoW on 22 April 2015.</p> <p>Fortescue agrees that the Cloudbreak Project has been through several approval amendments during the life of the project. The changes made reflect the continual evaluation and understanding of the dewatering requirements at Cloudbreak. Additionally the project approvals were staged so that Fortescue could demonstrate the ability to manage the increasing dewatering requirements to the EPA and DoW. However, Christmas Creek has undergone a more planned progression from the original mine approved by Ministerial Statement 707 and subsequent expansion of the water management scheme (approved by Ministerial Statement 871). The water management scheme ministerial statement has a 5 year expiry (August 2016) and the expansion PER (this Proposal) will replace this approval.</p>
3.13		<p>Recommendations</p> <ul style="list-style-type: none"> <li>One of the most important recommendations is that regular visual observations by a suitably qualified professional need to support the trigger warning system. The trigger system set up by FMG is not failsafe - there are flaws in how triggers have been set (i.e. drawdown triggers set in bores that may be prone to upwelling groundwater). This has to be the foundation for their management of groundwater reinjection.</li> </ul>	<p>Fortescue's staff are technically competent to complete the tasks associated with the ongoing monitoring and management of the dewatering and injection projects. Fortescue's team consists of a number of highly qualified and experienced hydrogeologists and Fortescue has established professional relationships with a number of third party consultants to review and provide feedback on Fortescue hydrogeological management and reporting.</p>
		<ul style="list-style-type: none"> <li>A full and independent groundwater bore audit is required south of the reinjection areas if not already underway. This is necessary to ensure all existing bores on the Marsh are capable of withstanding artesian pressure in the Oakover Formation and other aquifers beneath the Tertiary Clay aquitard. Artesian heads have been observed in a number of bores south of Cloudbreak injection areas. Saline spills have occurred due to seepage from bores that do not have shut-off valves. These bores also must be resistant to the corrosion effects of hyper-saline and potentially acidic groundwater.</li> </ul>	<p>An audit of monitoring bores across Christmas Creek and Cloudbreak was undertaken during 2013 following the observation of pressurisation of the Cloudbreak monitoring bores. All bores with potential for flowing conditions at Christmas Creek, with exception of CCE11MB, have been capped. Bore logs have been reviewed and there are no concerns regarding bore construction. Given its location and predicted impact CCE11MB is not considered to be in a high risk location, and any identified aquifer response which alters the risk at CCE11MB will result in measures being taken to cap the bore at this location.</p>
		<ul style="list-style-type: none"> <li>Review conceptual geology and aquifer parameters given findings of the 2013 triennial aquifer reviews for both Christmas Creek and Cloudbreak.</li> </ul>	<p>Revisions of the conceptual geology and aquifer parameters are an ongoing process which utilises that latest geological drilling data and ground water monitoring results. Significant updates will be communicated in annual and triennial reporting to the DoW.</p>

Item	Submitter	Submission and/or issue	Response to comment
		<ul style="list-style-type: none"> <li>Re-calibrate and re-run the groundwater model with new Cloudbreak dewater and reinjection volumes. It appears that they have not done this as part of their Christmas Creek life of mine PER. The model needs to reflect that the Oakover Formation aquifer has now gone artesian under current reinjection volumes. In addition to this, Cloudbreak is now going to be working at up to 150% of the original approved maximum dewater/reinjection volume with an increased number of years at higher dewater/reinjection rates. This needs to be incorporated into this current assessment as the reinjection footprints for both mines may overlap.</li> </ul>	<p>The model utilised in the PER was completed with the most up to date data at the time of assessment. The Christmas Creek proposal was referred to the EPA in October 2013 and the approval time line prohibits more recent operational data from being incorporated. Continual review will be communicated in annual and triennial reporting to DoW.</p>
		<ul style="list-style-type: none"> <li>Set clear, defined and measurable management objectives for the Marsh vegetation that link to directly to water management objectives and monitoring in the Operating strategy. Saying broadly 'no impact to samphire vegetation' is not measurable and clearly not achievable under the current management structure, as vegetation deaths have occurred, and gone unnoticed and unreported.</li> </ul>	<p>Fortescue's recent revisions of operating strategies have aimed to improve alignment of the ground water monitoring and triggers with ecological receptors, <i>Environmental Protection Act 1986</i> approval obligations and conditions of controlled actions issued under the <i>Environment Protection and Biodiversity Conservation Act 1999</i> (the EPBC Act). The revised <i>Cloudbreak Groundwater Operating Strategy</i> (CB-PH-HY-0009) has recently been approved by DoW. The Christmas Creek operating strategy will be revised to be consistent with the Cloudbreak document.</p> <p>Fortescue has made recent efforts to standardise reporting across the business. The Envirosys database has been continually evolving to assist with the accurate management and assessment of the monitoring data. Recent triennial, annual and quarterly reports present the data more clearly.</p>
		<ul style="list-style-type: none"> <li>Ongoing revision of the groundwater model as needed where monitoring told that this occurs internally at FMG, and is meant to occur as per Ministerial conditions, but what is presented in the Christmas Creek expansion PER suggests it is no longer occurring.</li> </ul>	<p>Revisions of the conceptual geology and aquifer parameters are an ongoing process which utilises that latest geological drilling data and ground water monitoring results. Significant updates will be communicated in annual and triennial reporting to the DoW.</p> <p>The model utilised in the PER was completed with the most up to date data at the time of assessment. The Christmas Creek proposal was referred to the EPA in October 2013 and the approval time line prohibits more recent operational data from being incorporated. Continual review will be communicated in annual and triennial reporting to DoW.</p>
		<ul style="list-style-type: none"> <li>Contingency planning for specifically identified environmental incidents such as saline spills onto vegetation, and what they will do with their saline reinjection water if: <ul style="list-style-type: none"> <li>Monitoring indicates changes in water levels due to upward leakage from the Oakover Formation</li> <li>Monitoring indicates changes in shallow aquifer water quality associated with reinjection (they need to specifically monitor and report for this)</li> </ul> </li> </ul>	<p>The Christmas Creek Groundwater operating strategy incorporates a number of contingency measures in response to observations made in field. If monitoring bore data indicates changes in water levels that exceed established triggers, injection rates and volumes are altered and additional bores utilised to minimise the upward movement of water in the Oakover formation.</p> <p>Saline injection monitoring bores are equipped with sensors to stop nearby injection if elevated water levels are experienced.</p>
		<ul style="list-style-type: none"> <li>In addition to the point above, there needs to be a communication plan with the mining production team if this occurs - if changes to dewatering and reinjection occur it will affect mining production rates and this must</li> </ul>	<p>Fortescue's Hydrogeology and Mine Planning teams share a common manager within the business organisational structure</p>



Item	Submitter	Submission and/or issue	Response to comment
		be planned for in the larger scheme of the operations at Christmas Creek.	and work closely together to implement the proposal.
		<ul style="list-style-type: none"> <li>Visual observations of the Marsh looking for expression of saline groundwater at the surface should be part of ongoing monitoring.</li> </ul>	<p>Surface expressions of saline groundwater at the Marsh attributed to the Proposal are not expected to occur. As such visual inspections are not warranted for environmental protection. Early warning of rising groundwater, via the monitoring undertaken in accordance with the GWOS, Fortescue believes is a more proactive method to detect potential surface expression of groundwater before any impact occurs.</p> <p>Fortescue's hydrogeology technicians are constantly working in the vicinity of the injection borefield and Marsh. Additionally Fortescue's groundwater monitoring program incorporates monthly monitoring of bores located within and on the fringes of the Marsh. Opportunistic identification of surface expressions of groundwater can be captured during the planned tasks in these work areas. Any presence of surface water not associated with recent rainfall will be investigated further.</p> <p>Additionally the <i>Vegetation Health Monitoring and Management Plan</i> (CC-PL-EN-0004, PER Appendix 6B) incorporates a number of vegetation monitoring points within or on the fringes of the Marsh. The monitoring program will detect the presence of surface water within the monitoring transects during biannual monitoring programs.</p>
		<ul style="list-style-type: none"> <li>Clearly identify how the Yintas will be managed to preserve cultural and environmental values. This includes who will be monitoring and reporting on hydrology and environmental objectives.</li> </ul>	<p>Figure 13 of the PER identifies the two Yintas located to the south east of the development envelope. Fortescue has developed and is currently implementing the <i>Surface Water Management Plan</i> (100-PL-EN-1015, PER Appendix 2B) and <i>Surface Water Monitoring Guidelines</i> (45-GU-EN-0002) at Christmas Creek. The Management Plan and Guidelines outline the management approach to be undertaken to assess and monitor the Yintas during the implementation of the proposal.</p> <p>A summary of the implementation of the Surface Water Management Plan, and results of surface water monitoring at the Yintas, is provided annually to the OEPA in the CAR.</p>
		<ul style="list-style-type: none"> <li>Implement the QA/QC recommendations provided by Rockwater report (appendix to the 2013 triennial aquifer review).</li> </ul>	<p>The <i>Christmas Creek Triennial Aquifer Review - July 2013</i> (CC-RP-HY-0039_Rev No 2) is provided as Appendix 5D or the PER. Within this document Rockwater Pty Ltd provided the report <i>Geochemical Characterisation of Groundwater Relating to Dewatering and Reinjection Operations</i> (Appendix 8). The Rockwater report contains a number of recommendations relating to the groundwater monitoring program and QA/QC requirements were made. Fortescue has adopted the recommendations in the most recent review of the Cloudbreak Operating Strategy. As detailed above, the Christmas Creek operating strategy will be revised so that it is consistent with the Operating Strategy recently approved by the DoW for Cloudbreak.</p>

## 5. TERRESTRIAL FAUNA - PILBARA OLIVE PYTHON

Table 4: Response to terrestrial fauna (Pilbara Olive Python) related public submissions

Item	Submitter	Submission and/or issue	Response to comment																																																	
4.1	Public submitter No. 3.	<p>The monitoring project for the Pilbara olive python seems inadequate and unlikely to obtain suitable results to determine if any impact is occurring from the project. This is supported by the lack of any further records at the site despite previous records within impact areas.</p> <p>A population needs to be identified before monitoring takes place otherwise the monitoring is pointless; this report essentially describes a targeted survey with minimal survey effort that has failed to record the species.</p> <p>More intensive survey effort should be undertaken and focused on optimal habitat identified most likely to record the species instead of the less than optimal sites identified in the report to identify a population so actual monitoring can take place. Surveying less than optimal habitats defeats the purpose of establishing a monitoring plan and appears to have been a waste of time since there is insufficient/no data for compare impact and control. Considering previous records within impact areas, based on the current monitoring results of no records, the project has had a high degree of impact that has caused them to not be recorded again when it could just be due to the lack of survey effort in some areas.</p>	<p>PER Appendix 7A <i>Christmas Creek Terrestrial Vertebrate Fauna and Fauna Habitat Assessment</i> and Appendix (ENV 2012) 7G <i>Pilbara Olive Python Annual Monitoring Report 2014 (Ecologia 2014)</i> outline the studies undertaken to identify populations of the Pilbara Olive Python (<b>POP</b>) within the Proposal area.</p> <p>The survey methods adopted by ENV and Ecologia were in accordance with EPA’s Guidance Statement No. 56 (EPA 2004), Position Statement No. 3 (EPA 2002) and Technical Guide – Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment (EPA and DEC 2010). Species specific guidelines for surveying the Pilbara Olive Python (DSEWPac 2011) were consulted during the development of monitoring methods. These methods were deemed appropriate for detecting the presence of the POP, when suitable habitats for the species are present, and when weather conditions are optimal for observing active behaviour.</p> <p>Fortescue has been operating in the Chichester region since 2006 and has extensive records of incidents and relocations of snakes. Analysis of snake incidents and sightings/relocations identifies very few interactions with POP in Chichester’s compare to other snake species. Similar analysis completed for Fortescue’s operations at Solomon and North Star in the Pilbara where known populations of POP exist identifies significantly more interactions with POP individuals. Table v provides a summary of the records from across Fortescue’s mining operations.</p>																																																	
4.2		<p>The survey methodology and effort is not well defined in any of the documents. The monitoring survey timing was unlikely to be optimal for recording the species and definitely isn't considered "appropriate to maximise the likelihood of recording POP". During periods of higher temperatures the species does not emerge until later and the short period of time spent at each site only reduced the changes of recording the species even more. How much area was covered at each site within the 30min searching at each site, through searches within this timeframe would only allow small areas to be covered. The species is regularly recorded during the day, particularly in areas of permanent/semi-permanent water. Where were diurnal searches not included?</p>	<p><b>Table v: Summary of snake interactions recorded across Fortescue’s Pilbara mining operations</b></p> <table><tr><th>Site</th><th>Incident Records – All Snakes</th><th>Incident Records – Confirmed POP</th><th>Relocation Records – All Snakes</th><th>Relocation Records – Confirmed POP</th><th>Total Records – All Snakes</th><th>Total Records – POP</th></tr><tr><td>Christmas Creek</td><td>30</td><td>0</td><td>84</td><td>3</td><td>114</td><td>3</td></tr><tr><td>Cloudbreak</td><td>104</td><td>0</td><td>77</td><td>1</td><td>181</td><td>1</td></tr><tr><td><b>Chichester Totals</b></td><td><b>134</b></td><td><b>0</b></td><td><b>161</b></td><td><b>4</b></td><td><b>296</b></td><td><b>4</b></td></tr><tr><td>Solomon</td><td>54</td><td>5</td><td>67</td><td>18</td><td>121</td><td>23</td></tr><tr><td>North Star</td><td>3</td><td>1</td><td>14</td><td>6</td><td>17</td><td>7</td></tr><tr><td><b>Non Chichester Operations</b></td><td><b>57</b></td><td><b>6</b></td><td><b>81</b></td><td><b>24</b></td><td><b>138</b></td><td><b>30</b></td></tr></table>	Site	Incident Records – All Snakes	Incident Records – Confirmed POP	Relocation Records – All Snakes	Relocation Records – Confirmed POP	Total Records – All Snakes	Total Records – POP	Christmas Creek	30	0	84	3	114	3	Cloudbreak	104	0	77	1	181	1	<b>Chichester Totals</b>	<b>134</b>	<b>0</b>	<b>161</b>	<b>4</b>	<b>296</b>	<b>4</b>	Solomon	54	5	67	18	121	23	North Star	3	1	14	6	17	7	<b>Non Chichester Operations</b>	<b>57</b>	<b>6</b>	<b>81</b>	<b>24</b>	<b>138</b>	<b>30</b>
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4.3	<p>With regards to "road spotting transect", were these undertaken on bitumen roads or gravel tracks. If gravel, it is less productive using these for road spotting as they do not retain the temperature like bitumen does and therefore aren't utilised by the species the same way reducing the chances of recording the species. This may have been time better spent active searching at sites.</p>																																																			
4.4	<p>Monitoring methodology should be reviewed as its clearly not working. The species is known to occur from more than one record yet no evidence has been recorded again. Survey effort should focus on optimal habitat and spending more time undertaking nocturnal searches accompanied by diurnal searches for individuals and secondary evidence. Further monitoring following the methodology presented in the monitoring report is unlikely to achieve the desired results.</p>	<p>The anecdotal data provided in Table v supports the findings of the fauna surveys, presented in the PER, that the Proposal area is not suitable habitat for the POP. Evidence from Fortescue’s operations where known populations and habitat of the POP exist (Solomon and North Star) indicates that significantly more interactions with POP are to be expected if populations of POP existed nearby. The lack of interactions with POP at Christmas Creek indicates the Proposal area does not support a population of POP.</p>																																																		

## 6. REHABILITATION AND DECOMMISSIONING

Table 5: Response to rehabilitation and decommissioning related public submissions

Item	Submitter	Submission and/or issue	Response to comment
5.1	Department of Parks and Wildlife (DPaW)	<p>Rehabilitation</p> <p>The development and achievement of best practice completion criteria is encouraged for rehabilitation closure and site relinquishment for areas within the proposed Roy Hill and Hillside conservation reserve areas.</p> <p>Monitoring and annual reporting on the recovery of rehabilitation and closure (including rehabilitation relating to construction activities, i.e. borrow pits, quarries, turkey nests etc.), relevant to completion criteria, until criteria have been met to the satisfaction of Parks and Wildlife for lands managed by the Department.</p>	<p>Fortescue is committed to the development and implementation of a mine closure plan to the requirements of the joint EPA and DMP Guidelines for Preparing a Mine Closure Plan (EPA/DMP 2015).</p> <p>Section 5.4 of the PER Appendix 8E - <i>Mine Closure Plan: Christmas Creek Operations</i> (CC-PL-EN-0012) (the MCP) addresses the proposed conservation estate in developing the post closure land use for the area disturbed by the Proposal. Section 2.5 of the joint EPA and DMP Guidelines requires mine closure plans to be regularly reviewed and updated during the life of the mine. These reviews will provide an opportunity for Fortescue to update the MCP with any changes to post closure land uses identified for areas disturbed by the Proposal (including those within the proposed Roy Hill and Hillside conservation reserve areas).</p>
5.2		<p>Rehabilitation requirements for this proposal, should take into account the proposed conservation reserve areas, with potential for conservation to be the 'end land use'.</p> <p>The proposal presents a residual risk to conservation values and potentially a significant management liability that could fall to Parks and Wildlife unless rigorous rehabilitation and decommissioning conditions are in place. Although it remains unclear whether any of the mined areas will ultimately be suitable for inclusion in the proposed conservation reserve areas, the disturbed areas should be rehabilitated and decommissioned within a suitable timeframe and in an ecological sustainable manner such that the post mining environment is consistent with the local land uses, landscapes and ecological values and avoids significant long-term detrimental impacts on the proposed conservation reserve areas.</p>	<p>The Proposal does not include direct disturbance to any land currently managed by the DPaW.</p> <p>As stated above in response to Recommendation 4, Fortescue is committed to the development and implementation of a mine closure plan to the requirements of the joint EPA and DMP <i>Guidelines for Preparing a Mine Closure Plan (EPA/DMP 2015)</i>.</p> <p>Section 5.4 of the PER Appendix 8E - <i>Mine Closure Plan: Christmas Creek Operations</i> (CC-PL-EN-0012) (the MCP) addresses the proposed conservation estate in developing the post closure land use for the area disturbed by the Proposal. Section 2.5 of the joint EPA and DMP Guidelines requires mine closure plans to be regularly reviewed and updated during the life of the mine. These reviews will provide an opportunity for Fortescue to update the MCP with any changes to post closure land uses identified for areas disturbed by the Proposal (including those within the proposed Roy Hill and Hillside conservation reserve areas).</p>
5.3	Department of Mines and Petroleum (DMP)	Section 13.2.6 describes rehabilitation and re-vegetation activities undertaken at both Christmas Creek and FMG's other Pilbara operations. A description of the rehabilitation activities at Christmas Creek has been provided and identifies that topsoil and/or vegetative material was spread to a depth of 100cm, it is likely that this figure should read 100mm and therefore it may be appropriate to have this checked and revised if needed.	The reference to spreading topsoil and vegetation to a depth of 100cm at the Airport Access Track is an error in the PER. An internal report <i>Rehabilitation Close Out Report – Airport Laydown and Topsoil Storage Area</i> (CC-RP-EN-0103) prepared following the completion of the rehabilitation earthworks confirmed the topsoil and vegetation as spread at a depth of 100 mm.
5.4		Information has been provided relating to the rehabilitation of three waste rock dumps at FMG's Cloudbreak operations and monitoring of these sites commenced in 2014. This is consistent with advice provided by DMP that this information was missing from the draft PER. The results of these trials and those planned for 2015-2017 are critical in the development of specific completion criteria and closure implementation plans.	Fortescue agrees that monitoring of the progressive rehabilitation of landforms undertaken at Cloudbreak is critical to the development of achievable closure criteria and success of the closure and rehabilitation program. Section 10 of the <i>Mine Closure Plan: Christmas Creek Operations</i> (CC-PL-EN-0012) (PER Appendix 8E) (the MCP) details the monitoring programme required for the rehabilitated areas. Fortescue has developed and is implementing the <i>Rehabilitation and Revegetation Monitoring Procedure</i> (45-PR-EN-0027) at Cloudbreak and Christmas Creek. Results from the monitoring will be incorporated into future revisions of the MCP.

Item	Submitter	Submission and/or issue	Response to comment
5.5		<p>A Mine Closure Plan has been included as an appendix to the PER which was not included in the draft PER. The inclusion of the MCP is positive and it is noted that the document generally follows the DMP guidelines for the preparation of mine closure plans. However, many of the closure criteria and commitments are non-specific and of a general nature. In addition some of the closure criteria refer to internal FMGL guidelines which are not available in the Mine Closure Plan or attached to the PER. As such it is difficult to make an assessment of the suitability of the closure criteria provided.</p>	<p>The MCP (PER Appendix 8E) is the first closure plan developed for Christmas Creek in accordance with the joint DMP and EPA Guidelines. Section 2.5 of the Guidelines requires mine closure plans to be regularly reviewed and updated during the life of the mine. These reviews coupled with learnings from the results of implementing the <i>Rehabilitation and Revegetation Monitoring Procedure</i> (45-PR-EN-0027) at Cloudbreak and Christmas Creek will enable Fortescue to further develop closure criteria and commitments specific to Christmas Creek.</p> <p>Fortescue provided DMP with copies of the PER Appendices to support the mine closure plan on the data disc enclosed within the copy of the PER delivered to the DMP on Monday 23<sup>rd</sup> March 2015. The relevant appendices included:</p> <ul style="list-style-type: none"> <li>• Appendix 8B: <i>Planning for Closure: Design of Mineral Waste Rock Landforms</i> 100-PR-EN-1017;</li> <li>• Appendix 8C: <i>Re-establishing Major Watercourses over Backfilled Pits</i> CH-GU-EN-0002; and</li> <li>• Appendix 8D: <i>Case Study: Re-establishing Major Watercourses over Backfilled Pits</i> CH-GU-EN-0003.</li> </ul> <p>As outlined in section 13.4.5 of the PER these documents were only made available in copies of the PER provided to government regulators as the documents contain information that is commercially sensitive.</p>
5.6		<p>As previously identified in DMP's comments for the draft PER, for closure scenarios, the proponent should consider the impact of flooding on the permanent landforms (waste rock dumps, tailings storage facilities and reinstated creek lines) derived from events greater than the 1/100 year ARI scenarios contemplated, including the largest flood events that can be estimated via Probably Maximum Precipitation and associated probably Maximum Flood scenarios.</p>	<p>Sections 13.4.3 and 13.4.4 of the PER include reference to flood modelling and an assessment of impact under a range of hydrological conditions up to and including the Probable Maximum Flood.</p> <p>Future revisions of the Fortescue documents <i>Planning for Closure: Design of Mineral Waste Rock Landforms</i> (100-PR-EN-1017) (Appendix 8B) and <i>Re-establishing Major Watercourses over Backfilled Pits</i> (CH-GU-EN-0002) (Appendix 8C) will incorporate consideration of flood events estimated via Probable Maximum Precipitation and associated Probable Maximum Flood scenarios.</p> <p>Fortescue's <i>Standard Engineering Specifications for Drainage and Flood Protection</i> (100-SP-CL-0004) (the Specifications) referenced in the MCP utilises a number of methods and approaches for determining peak flows. The Specifications require extreme flows to be calculated using the methods outlined in <i>Estimation of Large to Extreme Floods, Book VI in Australian Rainfall and Runoff – A Guide to Flood Estimation</i> (The Institution of Engineers, Australia, 1998).</p>

Item	Submitter	Submission and/or issue	Response to comment
5.7	Department of Water (DoW)	<p>Fortescue states that they will prepare a detailed design for each proposed tailings storage facility prior to the commencement of construction of the facility. This detailed design will incorporate assessment of geotechnical stability of the facility during construction and operation.</p> <p>Supporting documentation indicates that waste rock and tailings may present potential impacts to surface water or groundwater quality. Specifically:</p> <ul style="list-style-type: none"> <li>There may be the potential for metalliferous drainage, resulting in potential short-term impacts to surface water ecosystems, if run-off and infiltration are not adequately managed.</li> <li>Limited tailings test work indicates that As and Ni are above the DEC (2010) ISQG low trigger values. Leachate test work indicates that the (one) tailings sample reported concentrations below ANZECC guidelines - except for Zn. The tailings supernatant reported concentrations for Al, B, Cr and Zn above ANZECC trigger values. This indicates that the short term and initial infiltration of tailings pore water has the potential to impact groundwater ecosystems and downstream surface water ecosystems. Note: background concentrations for many elements exceed ANZECC for freshwater protection (e.g. Cr and Zn).</li> <li>The groundwater chemistry has changed - Ba, Fe and Zn has increased overtime (Tetra Tech 2013).</li> <li>Leachate analysis indicates that mean Cd values are statistically significant when compared with mean regional groundwater values (Tetra Tech 2013).</li> <li>Current leachate analysis is restricted to the use of de-ionised water to simulate exposure to meteoric precipitation. Given FMG's proposal to store tailings and waste rock below the water table - these tests may not simulate exposure to groundwater.</li> </ul>	<p>Fortescue acknowledges the incorrect document was provided with the PER as Appendix 3C. A copy of the correct reference, Golder Associates 2013 <i>Christmas Creek Windich Waste Rock and Tailings Assessment</i> has been included with this response. Additionally a copy of the <i>Tetra Tech 2013 Cloudbreak and Christmas Creek Static Testing Report</i> (December 2013) has also been enclosed.</p> <p>Fortescue recognises the limitations of the acid and metalliferous drainage test work undertaken on tailings samples at the time of drafting the PER. Subsequent to the test work undertaken in the PER supporting documents Fortescue has continued to implement the <i>Acid and/or Metalliferous Drainage Management Plan</i> (100-PL-EN-1016, Appendix 2F) and undertaking the <i>Acid and Metalliferous Drainage Sampling Plan</i> (100-PL-EN-1014) at Christmas Creek. This has resulted in over 40 samples of tailings from the two Christmas Creek Ore Processing Facilities (OPF's) having now been collected and analysed. Preliminary interpretation of the results does not indicate the presence of arsenic and nickel leaching and the majority of results are below detection limits.</p> <p>Further details on the additional Acid Mine Drainage (AMD) test work and determination of potential impacts associated with the tailings storage facilities will be assessed during applications for Works Approvals and Licence Amendments required by Part V of the <i>Environmental Protection Act 1986</i> administered by the DER. Fortescue intends to submit these applications during the second half of 2015 to allow the DER to undertake a parallel assessment whilst the OEPA is considering this Proposal.</p>
5.8		DoW requests the proponent provides the correct tailings and waste rock supporting documentation for review. Appendix 3C is named: Golder Associates 2013 Christmas Creek Windich Waste Rock and Tailings Assessment however the actual appendix is the Vasse TSF expansion, 2012 report.	<p>Fortescue acknowledges the incorrect document was provided with the PER as Appendix 3C. A copy of the correct reference, Golder Associates 2013 <i>Christmas Creek Windich Waste Rock and Tailings Assessment</i> has been included with this response. Additionally a copy of the <i>Tetra Tech 2013 Cloudbreak and Christmas Creek Static Testing Report</i> (December 2013) has also been enclosed.</p>
5.9		The proponent should also provide the Tetra Tech 2013 Cloudbreak and Christmas Creek Static Testing Report (December 2013), referred to in the SRK Consulting 2014 document (Appendix 4). The above two documents are necessary for the Department of Mines and Petroleum, and Department of Environment Regulation to enable adequate assessment of the proposal.	



Item	Submitter	Submission and/or issue	Response to comment
5.10		<p>DoW offers the following comments on the AMD management plan.</p> <ul style="list-style-type: none"> <li>The AMD Management Plan focuses on rock that is excavated and relocated or exposed on pit walls. It does not appear to consider the potential impacts to water quality due to the dewatering of potentially acid forming material.</li> <li>Contingency actions proposed for metalliferous leachates do not offer any tangible strategies for the management/remediation of potential impacts.</li> <li>The short term leach tests propose to use deionised water. This may not reflect groundwater conditions which are variably saline depending on where the waste rock/tailings are stored,</li> <li>The use of GAI as an indicator of elemental enrichment that may be of environmental importance, whilst interesting, does not necessarily indicate the potential for release of water soluble elements. This fact is demonstrated in all geochemical characterisation reports offered as supporting documentation to the proposal.</li> </ul>	<p>Fortescue thanks the DoW for their comments in relation to the <i>Acid and/or Metalliferous Drainage Management Plan</i> (100-PL-EN-1016, the AMD Plan). In addition to the PER the DoW and Fortescue have held ongoing discussions in relation to the development of the AMD Plan and determination of appropriate groundwater quality trigger values.</p> <p>Fortescue does not believe there is any reason to think that excavated rock is going to be significantly different from dewatered material in relation for the potential to generate AMD. Excavated rock will have been dewatered for some time prior to excavation and will be analogous in terms of leaching potential. The sampling undertaken utilise geological samples obtained directly from resource definition drill holes. The drill holes are located inside and outside of the dewatered areas of Christmas Creek.</p> <p>No contingency actions are proposed in the AMD Plan. The plan is designed to detect, then prompt investigation into potentially deleterious material. It is not specific, in order that the correct process is followed for each type of material. If a single management action was put forward for all material types then this may end up being the incorrect approach. Further studies will then be undertaken into the most appropriate option for management.</p> <p>A study to investigate unforeseen interactions between saline groundwater and rock leaching is being considered by Fortescue. However, it is expected that saline solutions will follow the Debye-Hückel theory of reduced ion activity, and that saturated solutions (saline solutions) will be less corrosive than a deionised water solution.</p> <p>Fortescue agrees that the use of the Geochemical Abundance Index (GAI) does not indicate leaching potential, yet is conducted in the Global Acid Rock Drainage (GARD) guide which the EPA has stated Fortescue must comply with. Total element concentration is required when determining the percentage of any particular element being removed by weathering from a material.</p>
5.11		<p>The proponent has used the Solomon Iron Ore mine as an example of rehabilitation undertaken, as an example for future rehabilitation. DoW has been notified by DMP that this rehabilitation has not been undertaken at Solomon as reported, and therefore is unsuitable to be used as an example.</p>	<p>There appears to be some discrepancies in the rehabilitation figures estimated for the Solomon project and reported to OEPA and DMP. Fortescue has reported rehabilitation to the DMP in Annual Environmental Reports (AER) for 2012 and 2013. In the most recent AER for Solomon for the period ending December 31 2014 and submitted in March 2015 Fortescue reported that no rehabilitation was undertaken during 2014.</p> <p>In the <i>Compliance Assessment Report for Environmental Protection Authority - 2014</i> (45-RP-EN-1015)), submitted to the OEPA 31 March 2015, Fortescue reported for the Solomon mine area “<i>To date, a total of 36.46 hectares been rehabilitated. Areas subjected to rehabilitation include areas utilised during construction activities, including borrow pits, laydown areas and access roads. Data and results are presented in the Solomon – Rehabilitation Monitoring 2014 – Report (SO-RP-EN-0090) (Appendix QQ)</i>”.</p> <p>The 56.7 ha of Solomon Rehabilitation referred to on page 240 of the PER included some rehabilitation of borrow pits and access tracks within the Solomon Rail area in the vicinity of the Solomon mine operations.</p>



## 7. OFFSETS

**Table 6: Response to offsets related public submissions**

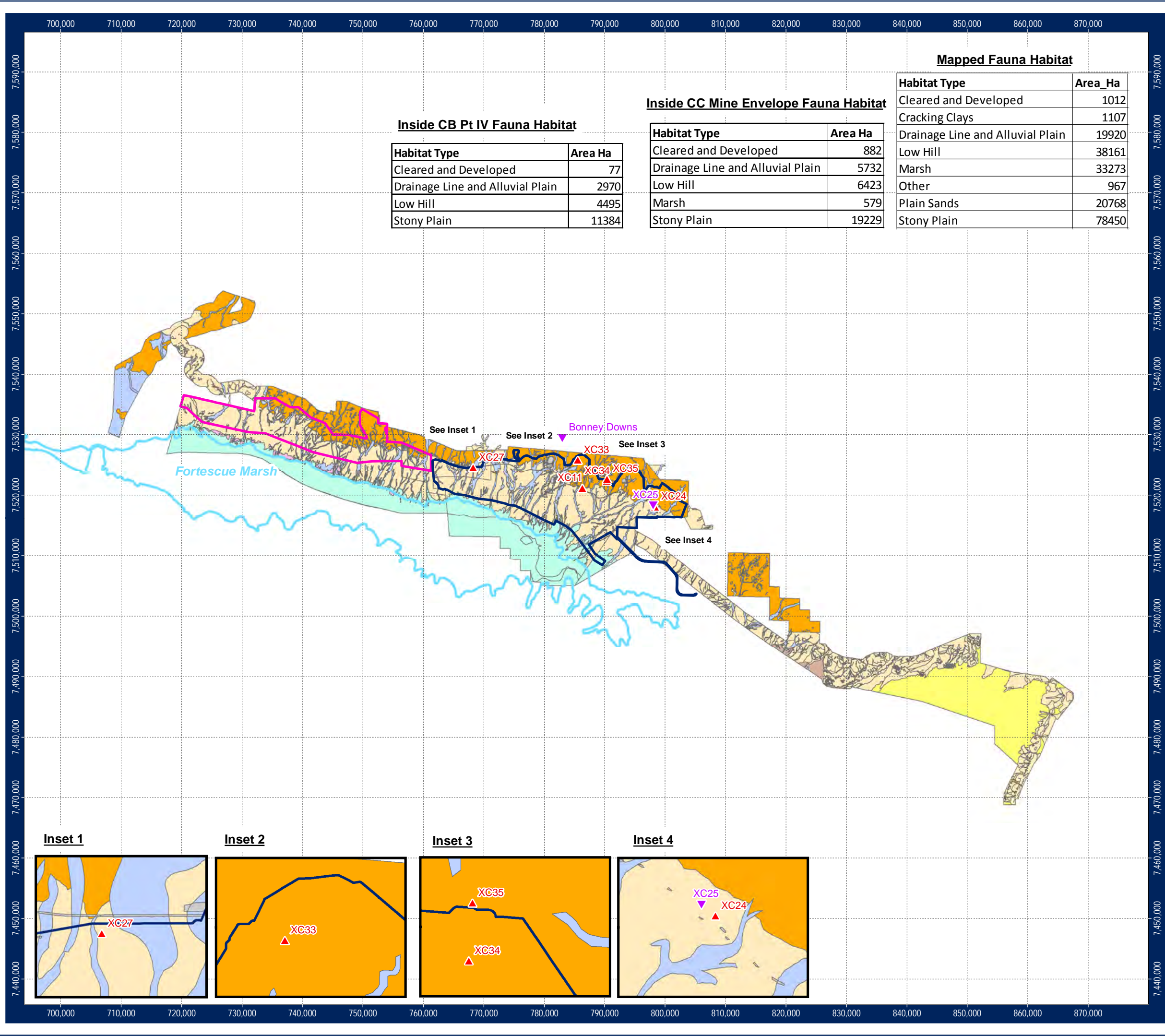
Item	Submitter	Submission and/or issue	Response to comment																																																												
6.1	Department of the Environment (DoE)	<p>On page viii of the Executive Summary the proponent notes the following residual impacts may require offsets under the EPBC Act:</p> <ul style="list-style-type: none"><li>Approximately 14 ha of Marsh habitat type, potentially suitable for the Night Parrot and Australian Painted Snipe;</li><li>Approximately 2,225 ha of potential breeding and foraging habitat for the Night Parrot;</li><li>Approximately 1,117 ha of potential foraging habitat for the Pilbara Olive Python.</li></ul> <p>This contrasts to the information on page 233 and 275 of the PER which lists different species and habitat types. It is unclear why the impacts, habitat types and related species at each section of the PER do not correspond.</p> <p>The Department suggests that the proponent clarify the information provided about particular vegetation communities (marsh habitat, alluvial plans etc.) by providing a table outlining vegetation type; area over which the vegetation covers; and any MNES species which may utilise the area as likely habitat. The table should outline all vegetation community types within the disturbance area (including those not considered as suitable habitat for MNES) so that the total potential habitat that may be impacted by the proposal is clear. To avoid any doubt, this should only cover the new impacts resulting from this proposal.</p> <p>On page 275 the proponent notes that for this project they intend to expand the offsets program required by existing approvals issues under the EPBC Act. This would involve expanding, or contributing to the funding of the Offsets Plan described in section 14.2.1. The Department notes that the proponent's proposed offset strategy referred to in the PER has not yet been submitted by the proponent. Further comment about the suitability of the proposed approach to offsets for this project cannot be provided by the Department until the Offsets Plan is submitted.</p> <p>The Department will consider whether any proposed approach to offsets is appropriate in accordance with the EPBC Act environmental offsets policy.</p>	<p>The areas of residual impacts are presented in the executive summary, pages 233-234 and page 275 of PER and are consistent however the description used and presentation of the figures vary between sections which may have caused the confusion.</p> <p>Fortescue can confirm that the residual impacts associated with the proposal are approximately:</p> <ul style="list-style-type: none"><li>14 ha of Marsh habitat which is suitable habitat for the Greater Bilby, Night Parrot and Migratory birds;</li><li>2,255 ha of Low Hill habitat which is considered potential breeding and foraging habitat for the Night Parrot; and</li><li>1,117 ha of Drainage Line and Alluvial Plain habitat considered potentially suitable foraging habitat for the Pilbara Olive Python and Pilbara Leaf-nosed Bat.</li></ul> <p>Table 51 of the PER provides a summary of all the habitat types to be disturbed by the Proposal. Fortescue has reproduced the table below (Table vi) and incorporated a summary of the MNES species associated with each habitat.</p> <p><b>Table vi: Fauna Habitats Affected by Clearing and MNES Species</b></p> <table><tr><th rowspan="2">Habitat Type</th><th rowspan="2">Extent Within the Survey area (ha)</th><th colspan="2">Cleared (existing mine)</th><th rowspan="2">Proposed Additional Clearing (ha)</th><th colspan="2">Cumulative Impact (Christmas Creek)</th><th rowspan="2">MNES Species</th></tr><tr><th>ha</th><th>%</th><th>ha</th><th>%</th></tr><tr><td>Marsh</td><td>18,406</td><td>24</td><td>0.1</td><td>14</td><td>38</td><td>0.2</td><td>Greater Bilby Night Parrot Migratory Birds</td></tr><tr><td>Drainage Line and Alluvial Plain</td><td>8,673</td><td>1,455</td><td>16.8</td><td>1,117</td><td>2,572</td><td>29.7</td><td>Pilbara Olive Python Pilbara Leaf-nosed Bat</td></tr><tr><td>Stony Plain</td><td>26,119</td><td>5,039</td><td>19.3</td><td>4,366</td><td>9,405</td><td>36.0</td><td>Nil</td></tr><tr><td>Low Hill</td><td>13,976</td><td>3,507</td><td>25.1</td><td>2,255</td><td>5,763</td><td>41.2</td><td>Night Parrot</td></tr><tr><td>Historical Cleared</td><td>110</td><td>110</td><td>100.0</td><td>0</td><td>110</td><td>100.0</td><td>N/A</td></tr><tr><td><b>TOTAL</b></td><td><b>67,284</b></td><td><b>10,135</b></td><td><b>15.1</b></td><td><b>7,752</b></td><td><b>17,888</b></td><td><b>26.6</b></td><td></td></tr></table> <p>As detailed in section 14.2.1 of the PER Fortescue has been preparing the Offsets Plan in consultation with key stakeholders including DPaW, DAFWA, Pilbara Corridors, Pilbara Mesquite Management Committee, pastoralists, Rangelands NRM, Greening Australia and other resources Proponents.</p> <p>It is Fortescue's preference that offset obligations under the EPBC Act be delivered through the Pilbara Strategic Conservation Initiative (PSCI), in lieu of preparing and implementing an Offsets Plan. Fortescue has advised the OEPA and DoE of this. Fortescue considers implementing offsets via the PSCI provides the best opportunity for biodiversity protection in the Pilbara and is consistent with the offset conditions for recent approvals issued under both the EP Act and the EPBC Act for projects in the Pilbara.</p> <p>The PSCI is expected to be established over the next 12-18 months. Whilst this occurs Fortescue proposes to undertake a range of interim land management actions to address offset obligations. Fortescue has recently submitted the Land</p>	Habitat Type	Extent Within the Survey area (ha)	Cleared (existing mine)		Proposed Additional Clearing (ha)	Cumulative Impact (Christmas Creek)		MNES Species	ha	%	ha	%	Marsh	18,406	24	0.1	14	38	0.2	Greater Bilby Night Parrot Migratory Birds	Drainage Line and Alluvial Plain	8,673	1,455	16.8	1,117	2,572	29.7	Pilbara Olive Python Pilbara Leaf-nosed Bat	Stony Plain	26,119	5,039	19.3	4,366	9,405	36.0	Nil	Low Hill	13,976	3,507	25.1	2,255	5,763	41.2	Night Parrot	Historical Cleared	110	110	100.0	0	110	100.0	N/A	<b>TOTAL</b>	<b>67,284</b>	<b>10,135</b>	<b>15.1</b>	<b>7,752</b>	<b>17,888</b>	<b>26.6</b>	
Habitat Type	Extent Within the Survey area (ha)	Cleared (existing mine)				Proposed Additional Clearing (ha)	Cumulative Impact (Christmas Creek)		MNES Species																																																						
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Item	Submitter	Submission and/or issue	Response to comment
			Management Action Plan 2015-2017 outlining these actions, to DoE for approval.
6.2	Wildflower Society (public submitter No. 1)	<p>The residual impact of the proposal to Mulga communities is a loss of 4,924 ha of mulga vegetation to clearing. An additional 439 of mulga vegetation will be exposed to indirect impacts associated with sheet flow shadowing (FMG 2015, p. 149). In the EPA's advice to the Minister, the EPA recommended that existing Mulga communities be protected through the acquisition of Mulga dominated woodland and shrubland in the 2015 pastoral relinquishment conservation reserve system (EPA 2013). Disappointingly, FMG has decided to ignore this recommendation and has chosen not to offset impacts to Mulga communities.</p> <p>FMG's current offset plan falls significantly short of what could be considered an 'adequate offset' under the Western Australian Government Offsets Guidelines. The offset plan only provides indirect offsets such as feral animal control and weed control. Controlling feral fauna species and undertaking weed management cannot be considered an offset, especially since FMG is already responsible for controlling declared pests under the Biosecurity and Agricultural Management Act 2007. With this in mind, and taking into consideration the large scale impact the proposal will have on Mulga communities, we ask that the EPA recommend assigning the condition that 'FMG's offset plan include the acquisition of more than 5,363 ha of Mulga dominated woodland and shrubland in the 2015 pastoral relinquishment conservation reserve system'.</p> <p>22</p>	<p>Due to the land tenure and mineral prospectively of the Pilbara, land acquisition for the purposes of conservation is virtually impossible. This is acknowledged by the OEPA and as such the OEPA is progressing with the establishment of the PSCI to manage offsets in the Pilbara.</p> <p>Since the drafting of the PER, Fortescue has been in discussions with the OEPA and DPaW about consolidating existing offset obligations under the EP and EPBC Acts and delivering them through the PSCI. Fortescue has proposed that contributing to the PSCI would be done in lieu of implementing an Offsets Plan, required under EPBC 2010/5706, 2010/5513, 2010/5567, 2010/5696 and referenced in the PER.</p> <p>Based on current OEPA policy, Fortescue expects an approval for this proposal would include a Ministerial condition that requires a contribution to the PSCI to offset any residual impacts of the proposal. Fortescue supports the management of offsets in the Pilbara via the PSCI believing that it can provide the best opportunity for biodiversity protection in the Pilbara.</p> <p>The OEPA has established the PSCI working group to advise the Minister for Environment on key issues associated with the PSCI including</p> <ul style="list-style-type: none"> <li>the principles that should underpin the development of the PSCI</li> <li>details of governance arrangements, and</li> <li>details of how an implementation plan will be developed.</li> </ul> <p>DPaW is represented by two officers on the working group and it is currently proposed that DPaW will be represented on the proposed 'body' that will provide advice to the Minister for the Environment on the actual offset programs and actions that will be implemented.</p> <p>Fortescue believes DPaW's presence on both these groups will allow the issues raised to be addressed.</p>

## Attachment 1:

Figure 1 – Fauna Habitats

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**Inside CB Pt IV Fauna Habitat**

Habitat Type	Area Ha
Cleared and Developed	77
Drainage Line and Alluvial Plain	2970
Low Hill	4495
Stony Plain	11384

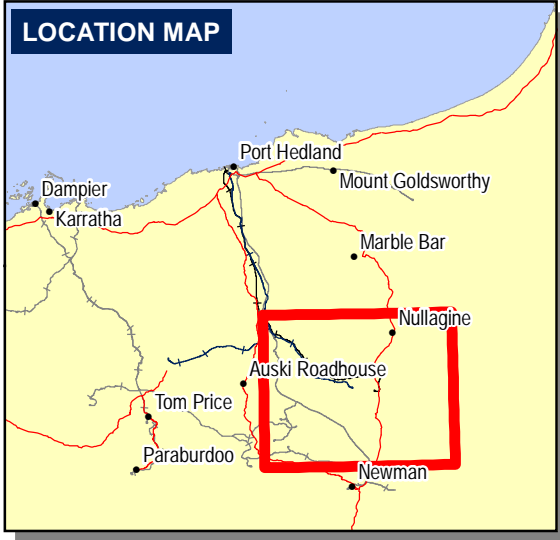
**Inside CC Mine Envelope Fauna Habitat**

Habitat Type	Area Ha
Cleared and Developed	882
Drainage Line and Alluvial Plain	5732
Low Hill	6423
Marsh	579
Stony Plain	19229

**Mapped Fauna Habitat**

Habitat Type	Area_Ha
Cleared and Developed	1012
Cracking Clays	1107
Drainage Line and Alluvial Plain	19920
Low Hill	38161
Marsh	33273
Other	967
Plain Sands	20768
Stony Plain	78450

**LOCATION MAP**



**LEGEND**

- CC Mine Development Envelope
- CB Part IV
- Fortescue Marsh
- Fauna Habitat**
  - Cleared and Developed
  - Cracking Clays
  - Drainage Line and Alluvial Plain
  - Low Hill
  - Marsh
  - Other
  - Plain Sands
  - Stony Plain
- SRE Fauna**
  - Antichiropus sp. 'christmas'
  - Karaops sp. 'christmas'

Data Source(s):  
Fauna habitat is a compilation of Reports  
(ENV, Ecologia, Biota and Ecosape)



**Christmas Creek  
Fauna Habitats**

Requested By: J. Levett  
Drawn By: PM  
Revised By: jlevett  
Approved By:  
Scale: 1:600,000  
Coordinate System: GDA 1994 MGA Zone 50  
Document Name: CC\_MP\_EN\_0265\_r4

Date: 8/09/2015  
Size: A3L  
Revision: 3  
Confidentiality: 1

FMG accepts no liability and gives no representation or warranty, express or implied, as to the information provided including its accuracy, completeness, merchantability or fitness for purpose.



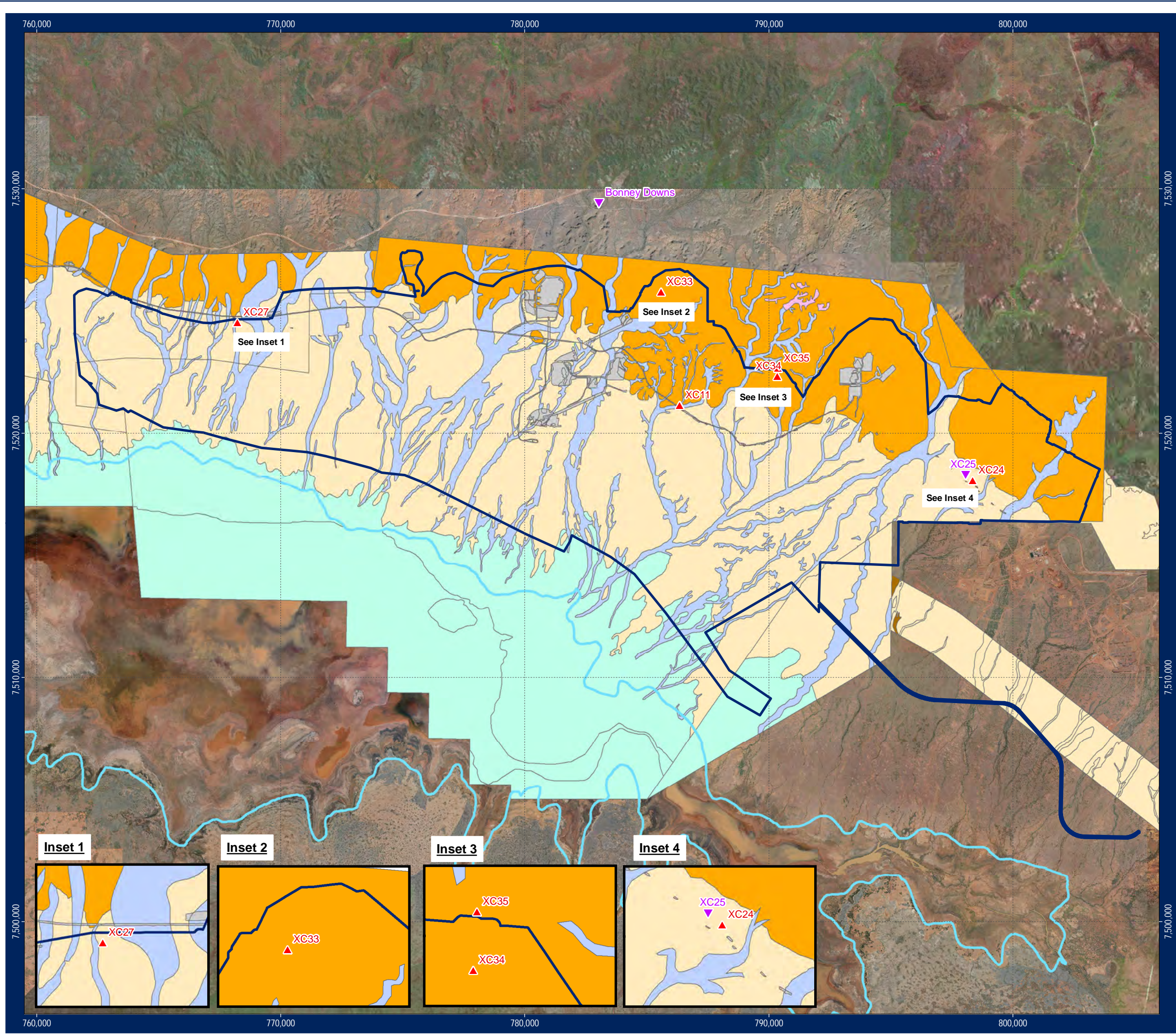
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## Attachment 2:

Figure 2 - Potential SRE Habitat

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### LOCATION MAP

### LEGEND

- CC Mine Development Envelope
- Fortescue Marsh

### Fauna Habitat

- Cleared and Developed
- Cracking Clays
- Drainage Line and Alluvial Plain
- Low Hill
- Marsh
- Other
- Plain Sands
- Stony Plain

### SRE Fauna

- Antichiropus sp. 'christmas'
- Karaops sp. 'christmas'

Data Source(s):  
Fauna habitat is a compilation of Reports  
(ENV, Ecologia, Biota and Ecosape)

N

0 2 4 6 8 10  
Kilometres

### Christmas Creek Fauna Habitats

Requested By: J. Levett	Date: 27/08/2015
Drawn By: PM	Size: A3L
Revised By: jlevett	Revision: 3
Approved By:	Confidentiality: 1
Scale: 1:150,000	
Coordinate System: GDA 1994 MGA Zone 50	
Document Name: CC_MP_EN_0265_SRE_Habitat	

FMG accepts no liability and gives no representation or warranty, express or implied, as to the information provided including its accuracy, completeness, merchantability or fitness for purpose.

**Fortescue Metals Group Ltd**  
The New Force in Iron Ore



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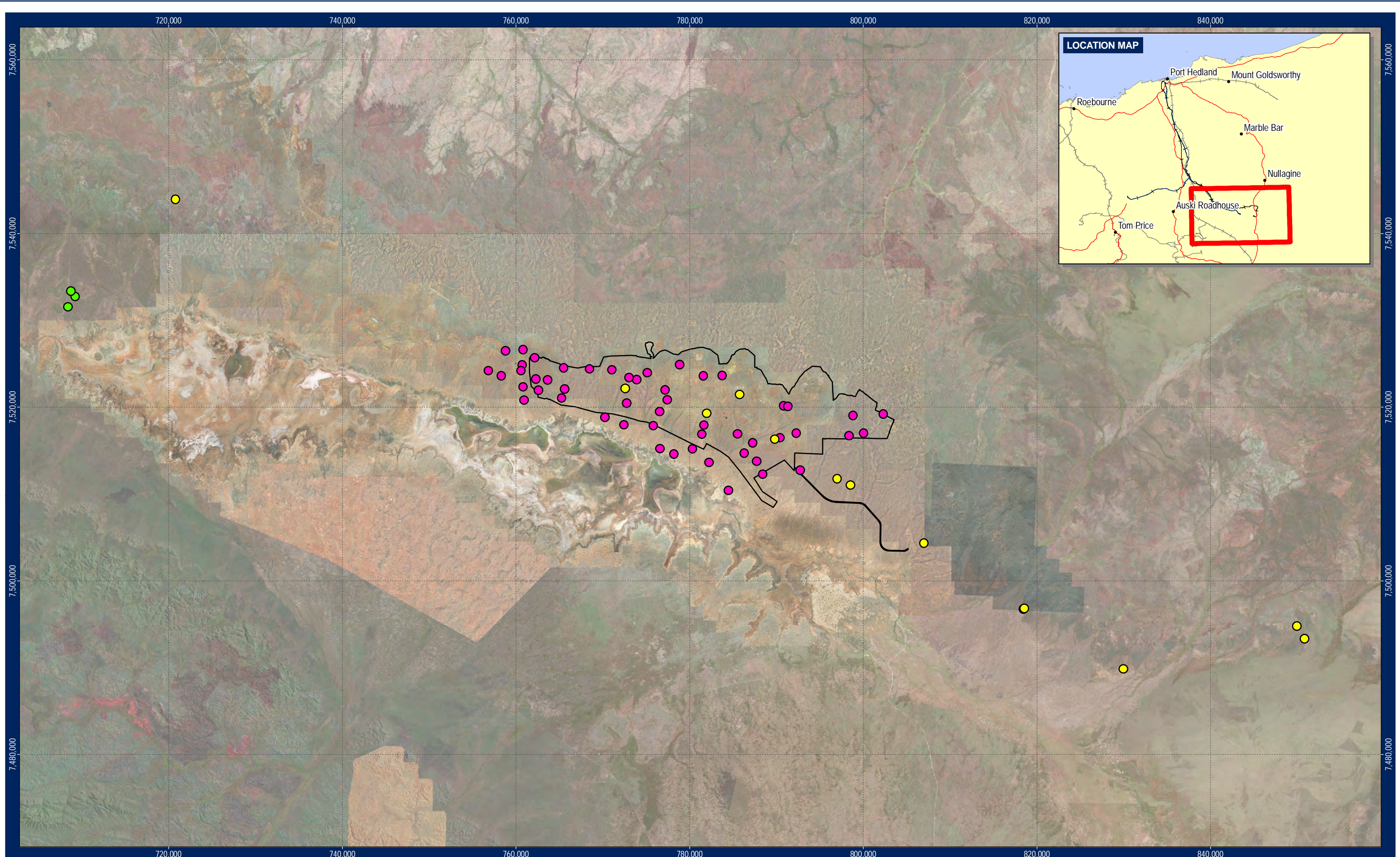


## Attachment 3:

Figure 3 - *Acacia aff.* Aneura Records

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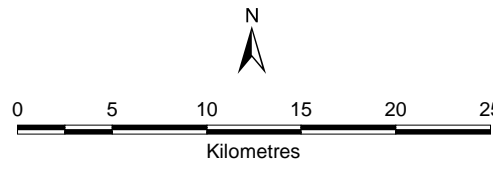




**LEGEND**

- Biota 2004
- Cardno 2012
- ENV 2012
- Christmas Creek Expansion (2014) - Proposed Development Envelope

Data Sources:  
Aerial Imagery, Landgate.  
Aerial Imagery, FMG, 2011-2015.  
Towns, Roads, GA, 2011.  
All other data: FMG, 2004-2015.



Requested By: J. Levett  
Drawn By: S. Costello  
Revised By: scostello  
Approved By: U. George  
Scale: 1:400,000  
Coordinate System: GDA 1994 MGA Zone 50  
Document Name: CC\_MP\_EN\_0263.001

Date: 26/05/2015  
Size: A3L  
Revision: 0  
Confidentiality: 0

FMG accepts no liability and gives no representation or warranty, express or implied, as to the information provided including its accuracy, completeness, merchantability or fitness for purpose.

**Acacia aff. aneura**  
**(long, flat, recurved; FMR 35.3)**  
**Records**

 **Fortescue Metals Group Ltd**  
The New Force in Iron Ore



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## Attachment 4:

Figure 4 - Troglafauna Habitat North of the Fortescue Marsh



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**Geology Units**

**QUATERNARY**

- Qa - alluvium 38485
- Qd - dunes 38496
- Qrc - colluvium 38491
- Qt - lake deposits 38492

**CENOZOIC**

- Czik - Oakover Formation
- Czims - Millstream Formation
- Czk - calcrete 38497

- Czl - ferruginous duricrust 38498
- Czlr - Robe Pisolite
- Czs - sand plain 38499
- Czz - silcrete 42026

**PALEOPROTEROZOIC**


- Lchk - Brockman Iron Formation
- Lchw - Weeli Wolli Formation

**PROTEROZOIC**

- Pd - mafic, ultramafic, intermediate intrusions 74431

**ARCHEAN**

- Abfk - Kylena Formation
- Abfm - Maddina Formation
- Achm - Marra Mamba Iron Formation
- Ad - dolerite, metagabbro 74261
- Adbr - Black Range Dolerite Suite
- Agc - Callina Supersuite
- Agi - Sisters Supersuite
- Agnb - Bamboo Springs Monzogranite
- Agro - Bonney Downs Monzogranite
- Alhw - Wittenoom Formation
- Anbig - Golden Eagle Orthogneiss
- As - siliciclastic sedimentary rocks 74321
- Ashm - Mount McRae Shale and Mount Sylvia Formation
- At - amphibolite 74324
- Aw - schist, amphibolite 74428
- Awf - Fortescue Group
- Awfj - Jeerinah Formation
- Awft - Tumbiana Formation
- Ay - pelitic schist, quartzite 74460



**Fortescue Metals Group Ltd**  
The New Force in Iron Ore

**Christmas Creek Iron Ore Mine**  
**Troglifauna Habitat and Distribution of**  
**Troglifauna Specimens**

Requested By: S McGunnigle	Date: 8/09/2015
Drawn By: J Levett	Size: A3L
Scale: 1:300,000	Revision: 0
Projection: GDA 1994 MGA Zone 50	Confidentiality: 1
Doc Name: CC_Exp_Troglifauna_Habitat_150904	

- All Troglifauna Records North of the Fortescue Marsh
- ▭ Christmas Creek Proposal Development Envelope
- ▭ Cloudbreak - Mine Area - MS899
- ▭ Cloudbreak - Project Area - MS899
- ▨ Fortescue Marsh



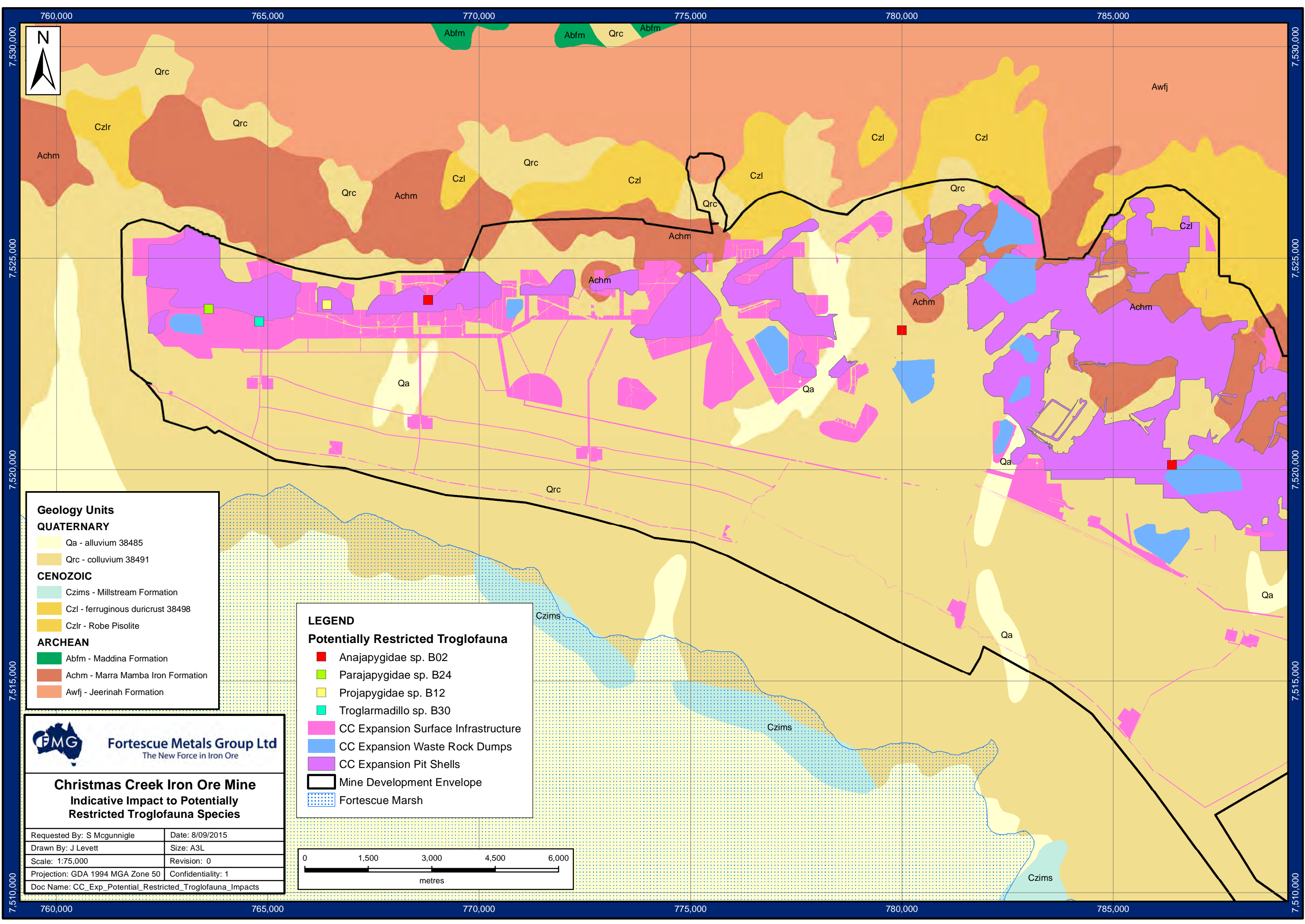
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## Attachment 5:

Figure 5 – Expansion Proposal Potential Restricted Troglifauna Impacts

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**Geology Units**

**QUATERNARY**

- Qa - alluvium 38485
- Qrc - colluvium 38491

**CENOZOIC**

- Czims - Millstream Formation
- Czl - ferruginous duricrust 38498
- Czlr - Robe Pisolite

**ARCHEAN**

- Abfm - Maddina Formation
- Achm - Marra Mamba Iron Formation
- Awfj - Jeerinah Formation

**LEGEND**

**Potentially Restricted Troglofauna**

- Anajapygidae sp. B02
- Parajapygidae sp. B24
- Projapygidae sp. B12
- Troglarmadillo sp. B30
- CC Expansion Surface Infrastructure
- CC Expansion Waste Rock Dumps
- CC Expansion Pit Shells
- Mine Development Envelope
- Fortescue Marsh

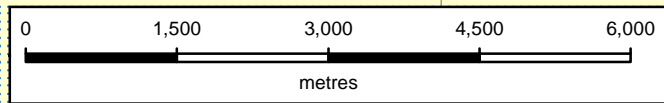


**Fortescue Metals Group Ltd**  
The New Force in Iron Ore

**Christmas Creek Iron Ore Mine**

**Indicative Impact to Potentially Restricted Troglofauna Species**

Requested By: S Mcgunnigle	Date: 8/09/2015
Drawn By: J Levett	Size: A3L
Scale: 1:75,000	Revision: 0
Projection: GDA 1994 MGA Zone 50	Confidentiality: 1
Doc Name: CC_Exp_Potential_Restricted_Troglofauna_Impacts	



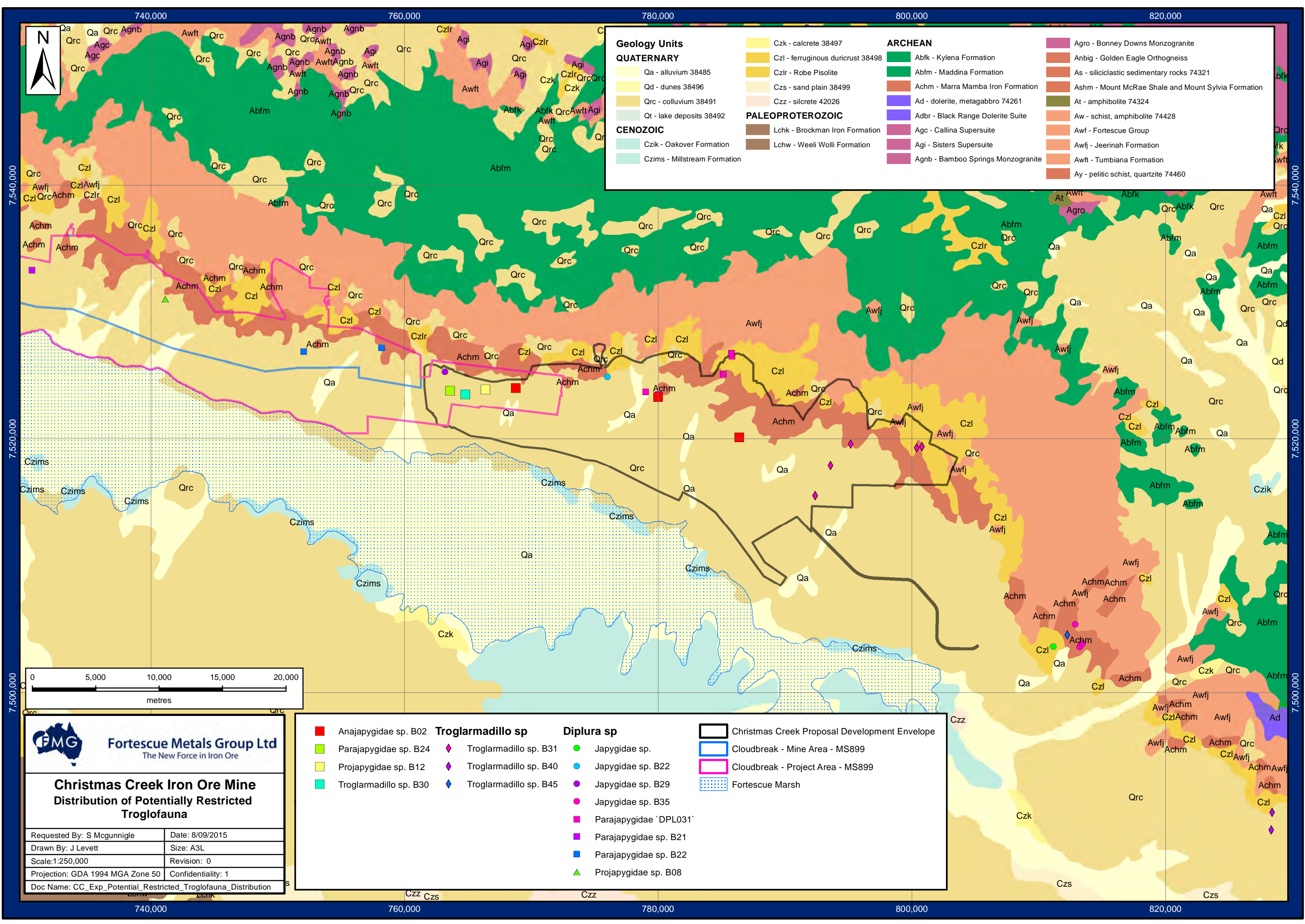
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## Attachment 6:

Figure 6 – Expansion Proposal Troglafauna Distribution

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**Geology Units**  
**QUATERNARY**  
Qa - alluvium 38485  
Qd - dunes 38496  
Qrc - colluvium 38491  
Qt - lake deposits 38492  
**CENOZOIC**  
Czik - Oakover Formation  
Czims - Millstream Formation



















**PALEOPROTEROZOIC**  
Czk - calcrete 38497  
Czl - ferruginous duricrust 38498  
Czlr - Robe Pisolite  
Czs - sand plain 38499  
Czz - silcrete 42026  
Lchk - Brockman Iron Formation  
Lchw - Weeli Wolli Formation

**ARCHEAN**  
Abfk - Kylenea Formation  
Abfm - Maddina Formation  
Achm - Marra Mamba Iron Formation  
Ad - dolerite, metagabbro 74261  
Adb - Black Range Dolerite Suite  
Agc - Callina Supersuite  
Agi - Sisters Supersuite  
Agnb - Bamboo Springs Monzogranite  
Agro - Bonney Downs Monzogranite  
Anbig - Golden Eagle Orthogneiss  
As - siliciclastic sedimentary rocks 74321  
Ashm - Mount McRae Shale and Mount Sylvia Formation  
At - amphibolite 74324  
Aw - schist, amphibolite 74428  
Awf - Fortescue Group  
Awfj - Jeerinah Formation  
Awft - Tumbiana Formation  
Ay - pelitic schist, quartzite 74460

**Fortescue Metals Group Ltd**  
The New Force in Iron Ore

**Christmas Creek Iron Ore Mine**  
**Distribution of Potentially Restricted Troglofauna**

Requested By: S Mcgunnigle	Date: 8/09/2015
Drawn By: J Levett	Size: A3L
Scale: 1:250,000	Revision: 0
Projection: GDA 1994 MGA Zone 50	Confidentiality: 1
Doc Name: CC_Exp_Potential_Restricted_Troglofauna_Distribution	

 Anajapygidae sp. B02	<b>Troglarmadillo sp</b>	<b>Diplura sp</b>	 Christmas Creek Proposal Development Envelope
 Parajapygidae sp. B24	 Troglarmadillo sp. B31	 Japygidae sp. B22	 Cloudbreak - Mine Area - MS899
 Projapygidae sp. B12	 Troglarmadillo sp. B40	 Japygidae sp. B29	 Cloudbreak - Project Area - MS899
 Troglarmadillo sp. B30	 Troglarmadillo sp. B45	 Japygidae sp. B35	 Fortescue Marsh
		 Parajapygidae 'DPL031'	
		 Parajapygidae sp. B21	
		 Parajapygidae sp. B22	
		 Projapygidae sp. B08	

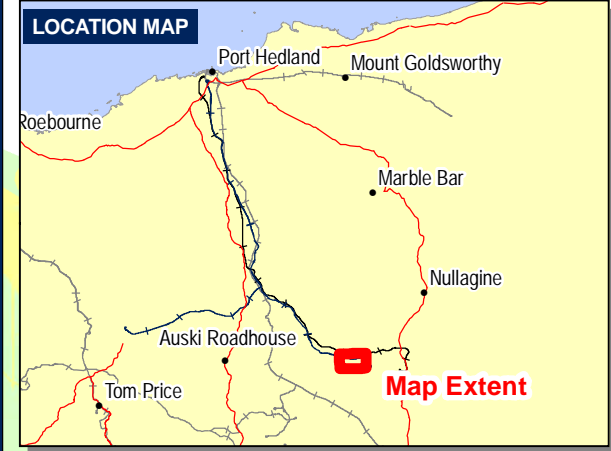
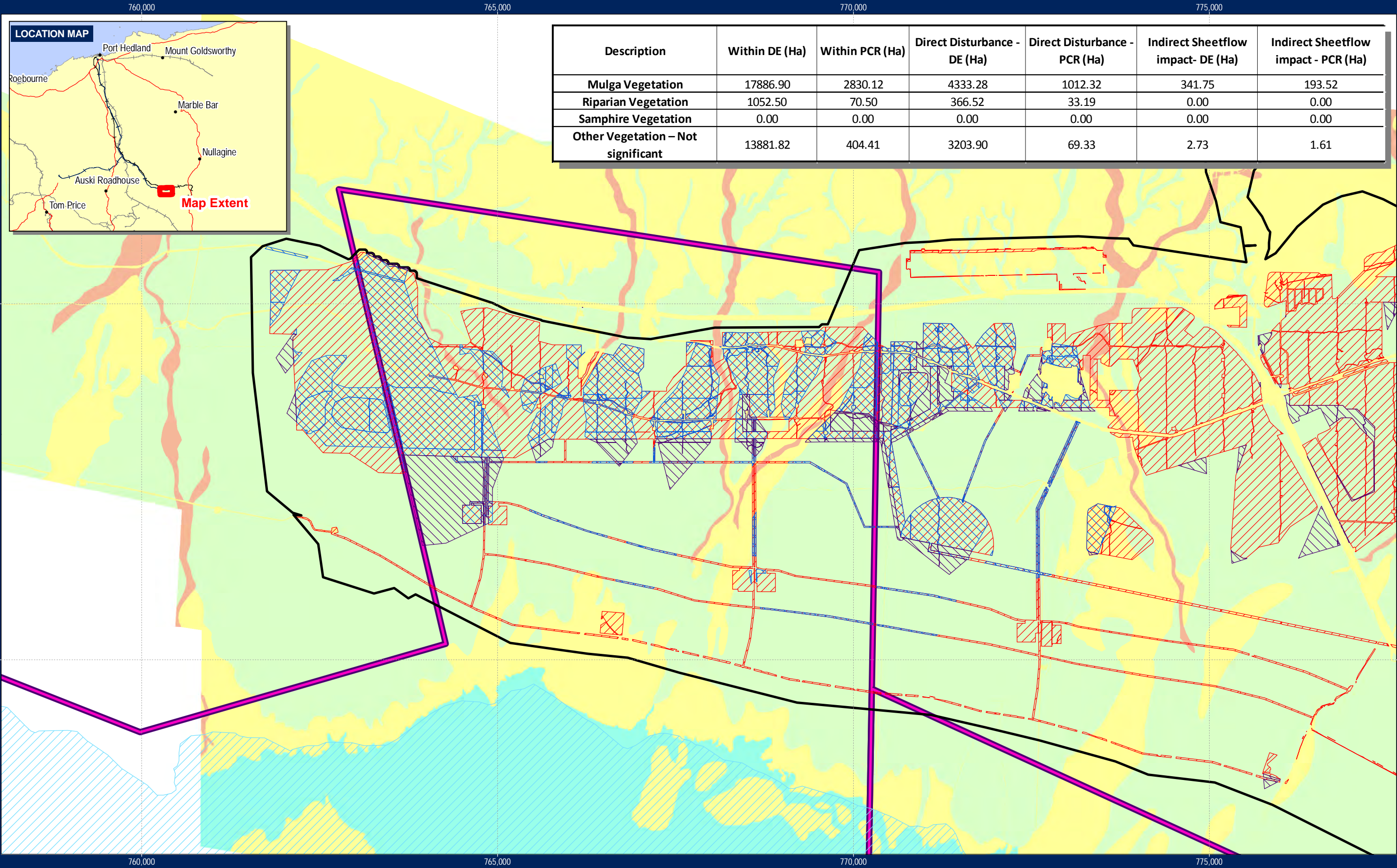


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## Attachment 7:

Figure 7 – Significant Vegetation Impacts within Proposed FMCR  
CC\_MP\_EN\_0263.005

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Description	Within DE (Ha)	Within PCR (Ha)	Direct Disturbance - DE (Ha)	Direct Disturbance - PCR (Ha)	Indirect Sheetflow impact- DE (Ha)	Indirect Sheetflow impact - PCR (Ha)
Mulga Vegetation	17886.90	2830.12	4333.28	1012.32	341.75	193.52
Riparian Vegetation	1052.50	70.50	366.52	33.19	0.00	0.00
Samphire Vegetation	0.00	0.00	0.00	0.00	0.00	0.00
Other Vegetation – Not significant	13881.82	404.41	3203.90	69.33	2.73	1.61

LEGEND

Vegetation Mapping

- Mulga
- Other Vegetation- Non Significant
- Riparian
- Samphire

- Proposed Fortescue Marsh Conservation Reserve - 2014
- Development Envelope
- Indicative Proposed Disturbance
- Direct Sheetflow Impact
- Indirect Sheetflow Impact
- Fortescue Marsh

Data Sources:  
Fortescue Marsh, DIWA, 2011.  
Conservation Reserve, Landgate, 2015.  
Towns, Roads, GA, 2011.  
All other data, FMG, 2015.

N

0123

Kilometres

Requested By: J. Levett  
Drawn By: S. Costello  
Revised By: scostello  
Approved By: U. George  
Scale: 1:50,000  
Coordinate System: GDA 1994 MGA Zone 50  
Document Name: CC\_MP\_EN\_0263.005

Date: 23/06/2015  
Size: A3L  
Revision: 0  
Confidentiality: 0

FMG

Fortescue Metals Group Ltd  
The New Force in Iron Ore

Significant Vegetation Impacts within  
Proposed Conservation Reserve

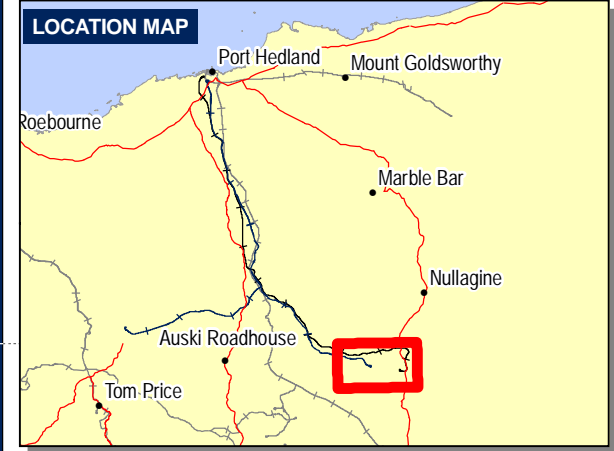
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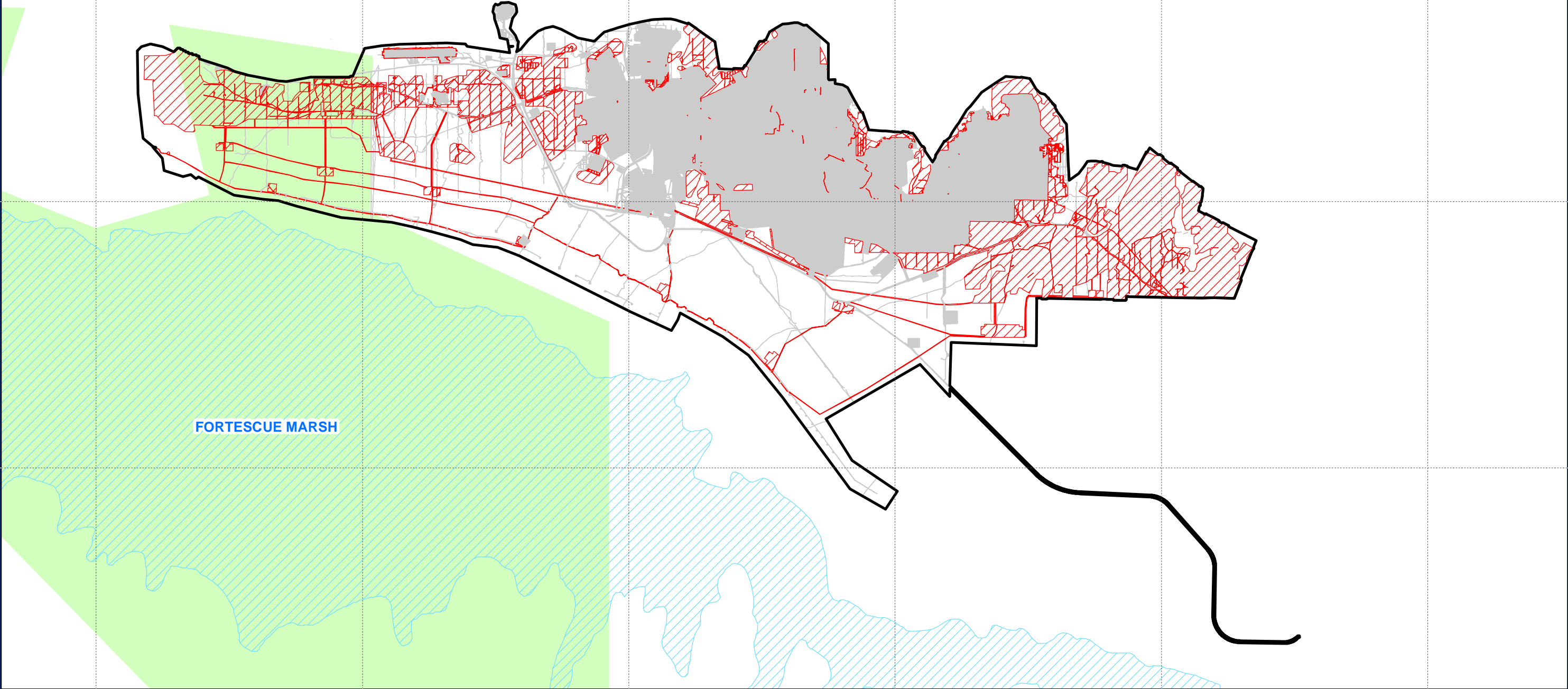
## Attachment 8:

Figure 8 – Revised Proposed FMCR boundary CC\_MP\_EN\_0263.004

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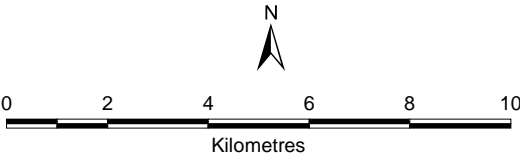
Description	Inside development envelope and inside Conservation Estate	Inside development envelope but outside Conservation Estate	Total Inside 33,000 ha development envelope
Area of Proposed Conservation Estate inside development envelope	N/A	N/A	3,305.03
Existing approved footprint	88.51	11,432.18	11,520.69
Indicative Mine Pits	492.37	12,308.17	12,800.54
Indicative Miscellaneous Infrastructure	673.14	4,085.56	4,758.70
Indicative Tailings Storage	0.0	192.65	192.65
Waste Rock Storage	0.0	2125.68	2125.68



**LEGEND**

- Development Envelope
- Existing Approved Footprint
- Indicative Proposed Disturbance
- Fortescue Marsh
- Proposed Fortescue Marsh Conservation Reserve - 2014

Data Sources:  
Fortescue Marsh, Department of the Environment, 2011.  
Conservation Reserve, Landgate, 2015.  
Towns, Roads, GA, 2011.  
All other data, FMG, 2015.



Requested By: J. Levett  
Drawn By: S. Costello  
Revised By: scostello  
Approved By: B. Ralebala  
Scale: 1:150,000  
Coordinate System: GDA 1994 MGA Zone 50  
Document Name: CC\_MP\_EN\_0263.004

Date: 5/06/2015  
Size: A3L  
Revision: 0  
Confidentiality: 0

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**Proposed Fortescue Marsh  
Conservation Reserve  
2014 Revised Boundary**

**Fortescue Metals Group Ltd**  
The New Force in Iron Ore

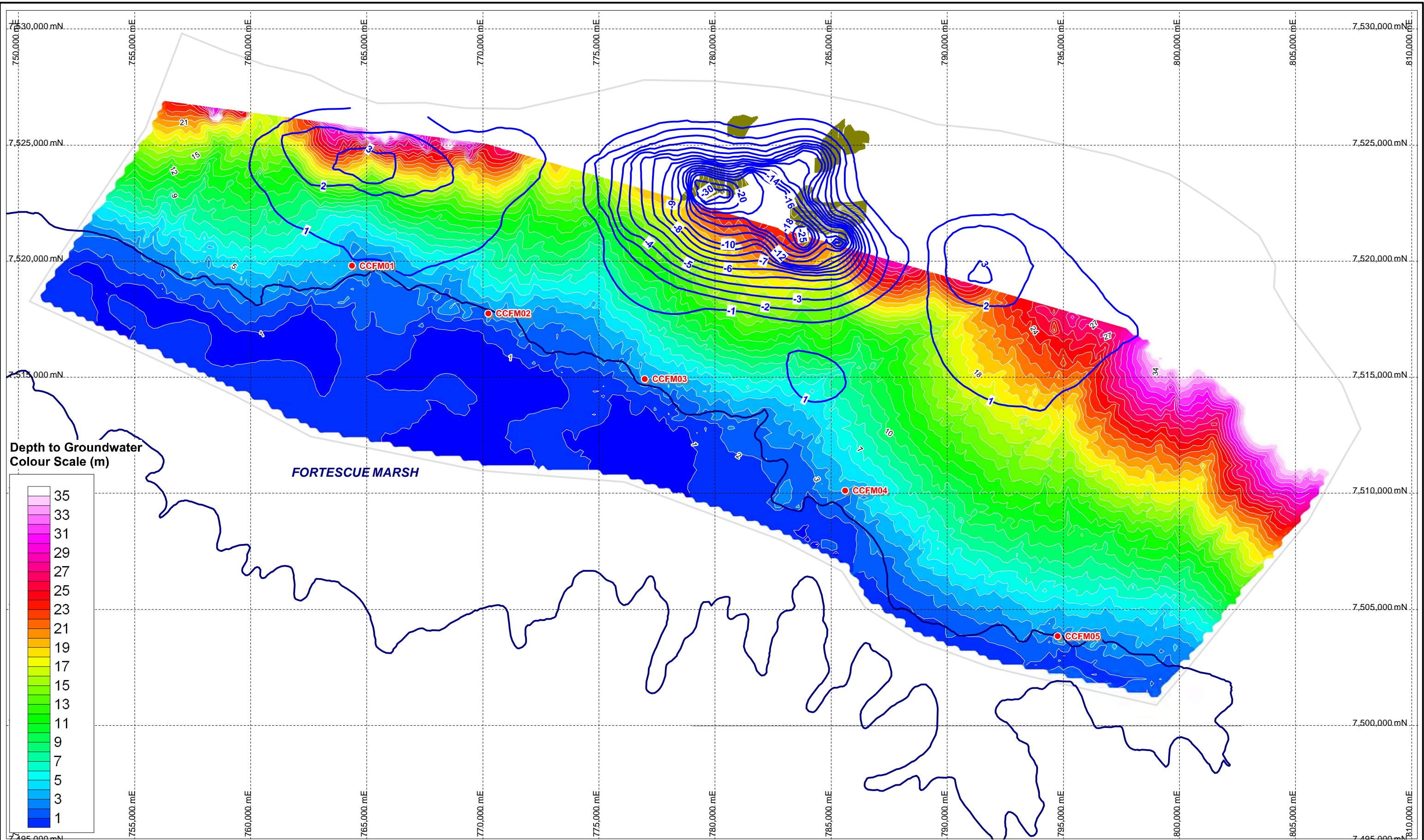
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## Attachment 9:

Figure 9 – Water Management Scheme ARI Groundwater Level Change

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Location Map

— Groundwater drawdown (metres) (-ve numbers) & mounding (+ve numbers), June 2015

— Depth to water table (metres), June 2015 (no dewatering, Tertiary Detritals)

□ Model Domain

□ Fortescue Marsh

■ Mine Plan 2015

● Fortescue Marsh Monitoring Site

N

0 1.25 2.5 5 kilometres

**Fortescue Metals Group Ltd**

**Groundwater Level Change from Baseline & Depth to Groundwater, Average Climate Simulation**

Author: I.Brandes Roos	Date: 26/9/2010
Drawn By: PM	Revision: 2
Dwg No: CC_MP_HY_0047	Confidentiality: 1
Projection: MGA Zone 50 (GDA 94)	Scale: 1:150000

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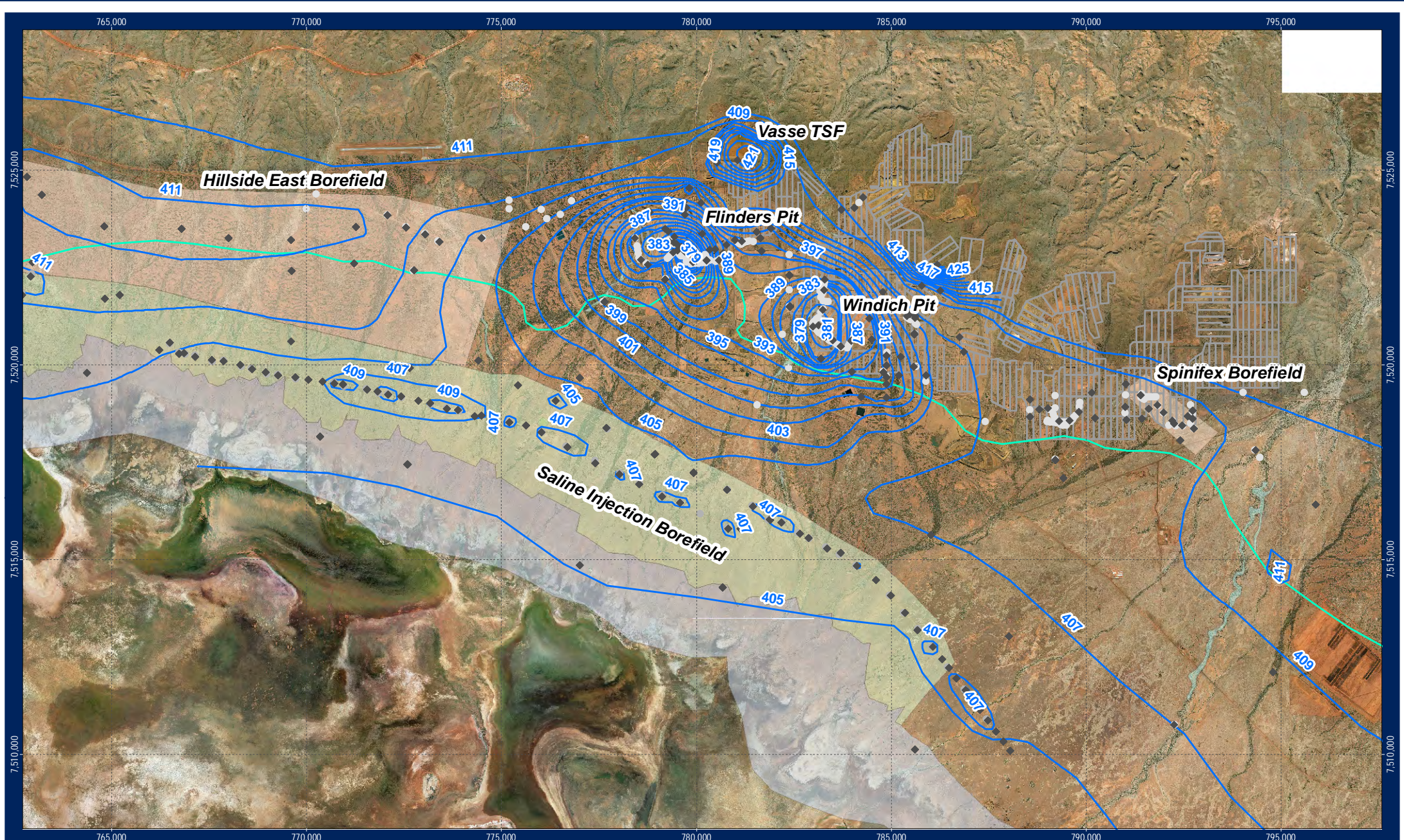


## Attachment 10:

Figure 10 – Christmas Creek Current Groundwater Levels April 2015

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**LEGEND**

- |   |                                  |                         |
|---|----------------------------------|-------------------------|
| ◆ FMG EnviroSys - Monitoring Bore Live - v4.0       | Zone_A_Near_Marsh_Region         | ▭ Mine Strip Boundaries |
| ● FMG EnviroSys - Saline Injection Bore Live - v4.0 | Zone_B_Saline_Injection_Region   | — Oakover Extent        |
| ● FMG EnviroSys - Production Bore Live - v4.0       | Zone_C_Brackish_Injection_Region |                         |
| — CH_2015_Apr_MMF and OF WL (mAHD)                  | Zone_D_Phreatophytic_Region      |                         |



Requested By: M Carroll  
Drawn By: M Carroll  
Revised By: M Carroll  
Approved By:  
Scale: 1:125,000  
Coordinate System: GDA 1994 MGA Zone 50  
Document Name: MASTER\_CC\_Contour Map

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Date: 20/05/2015  
Size: A4L  
Revision: 0  
Confidentiality: 1

**Christmas Creek Quarterly  
MMF and OF WL (mAHD) Contour**

April 2015

**Fortescue Metals Group Ltd**  
The New Force in Iron Ore



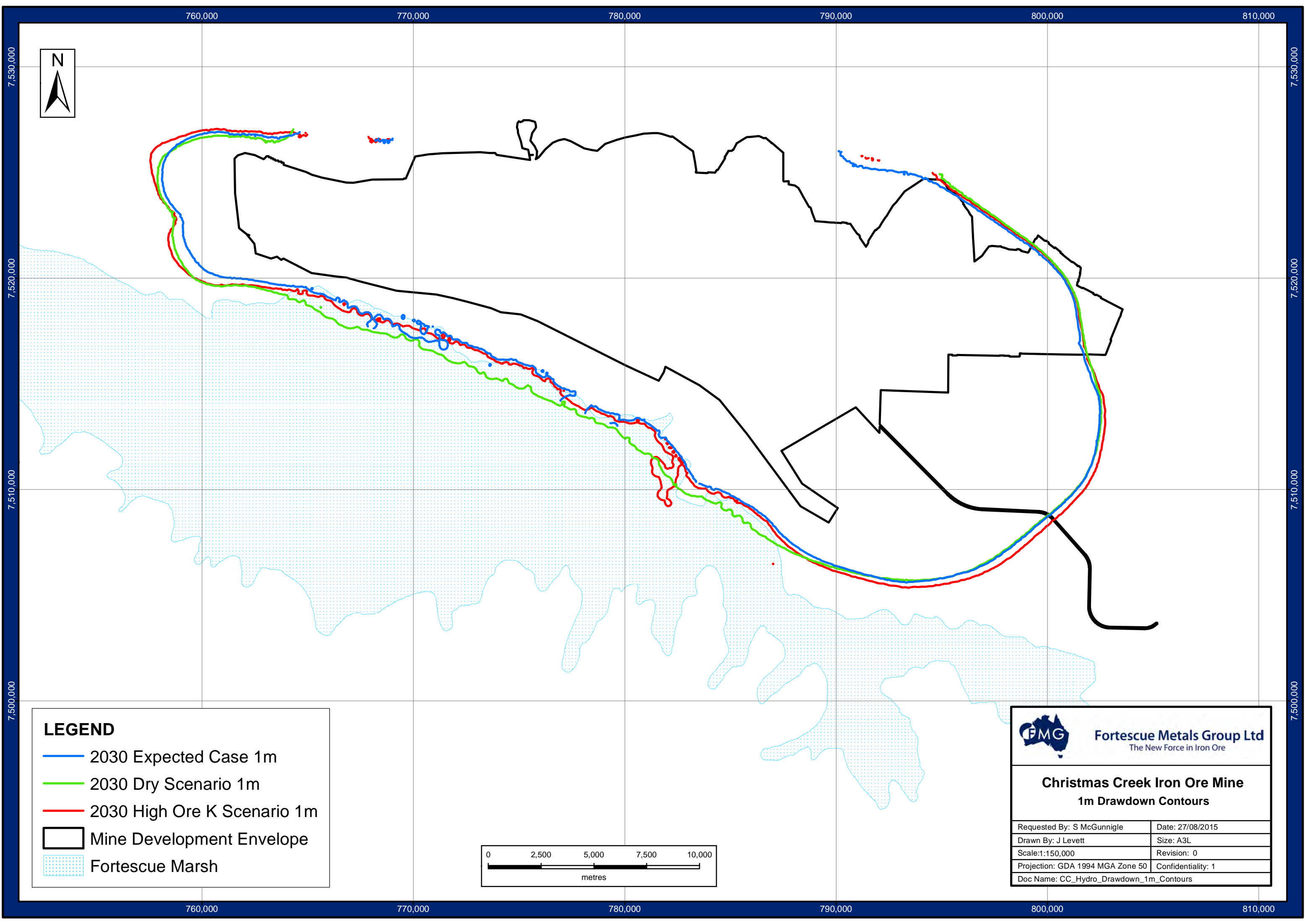
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## Attachment 11:

Figure 11 – Christmas Creek 1m Drawdown Contours

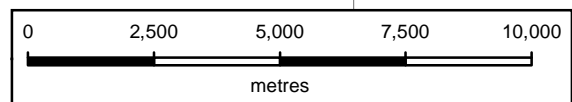


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**LEGEND**

- 2030 Expected Case 1m
- 2030 Dry Scenario 1m
- 2030 High Ore K Scenario 1m
- ▭ Mine Development Envelope
- ▨ Fortescue Marsh





**Fortescue Metals Group Ltd**  
The New Force in Iron Ore

**Christmas Creek Iron Ore Mine**  
**1m Drawdown Contours**

Requested By: S McGunnigle	Date: 27/08/2015
Drawn By: J Levett	Size: A3L
Scale: 1:150,000	Revision: 0
Projection: GDA 1994 MGA Zone 50	Confidentiality: 1
Doc Name: CC_Hydro_Drawdown_1m_Contours	

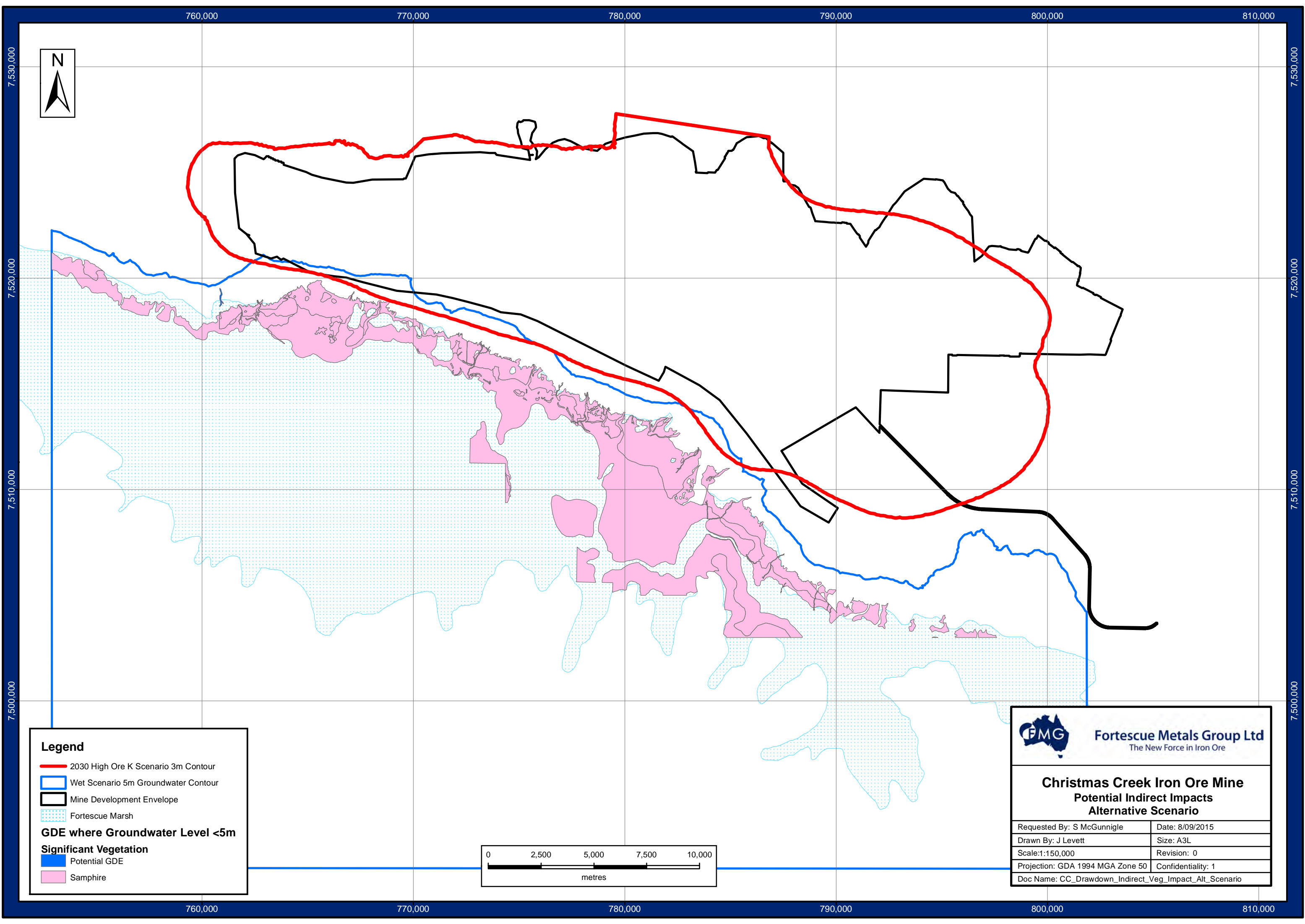
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## Attachment 12:

Figure 12 – Indirect Impact to GDE – Worst Case Dewatering Scenario

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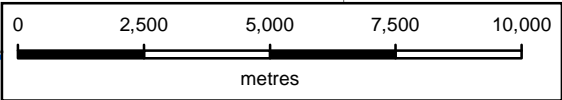
**Legend**


- 2030 High Ore K Scenario 3m Contour
- Wet Scenario 5m Groundwater Contour
- Mine Development Envelope
- Fortescue Marsh

**GDE where Groundwater Level <5m**

**Significant Vegetation**

- Potential GDE
- Samphire





**Fortescue Metals Group Ltd**  
The New Force in Iron Ore

**Christmas Creek Iron Ore Mine**  
**Potential Indirect Impacts**  
**Alternative Scenario**

Requested By: S McGunnigle	Date: 8/09/2015
Drawn By: J Levett	Size: A3L
Scale: 1:150,000	Revision: 0
Projection: GDA 1994 MGA Zone 50	Confidentiality: 1
Doc Name: CC_Drawdown_Indirect_Veg_Impact_Alt_Scenario	

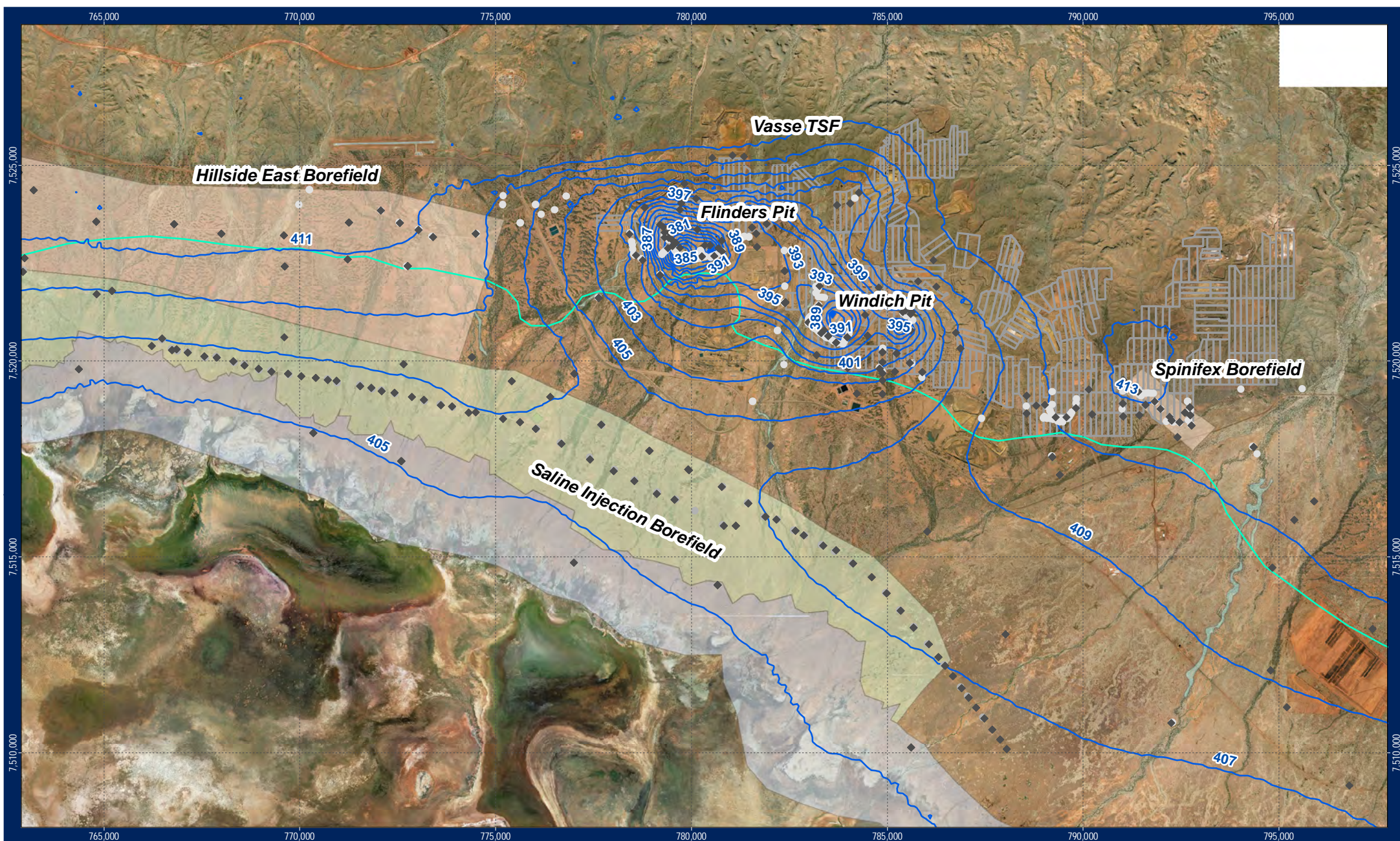
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## Attachment 13:

Figure 13 – 2015 Modelled Groundwater level (mAHD)

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# LEGEND

- ◆ FMG EnviroSys - Monitoring Bore Live - v4.0
- FMG EnviroSys - Saline Injection Bore Live - v4.0
- FMG EnviroSys - Production Bore Live - v4.0
- API Modelled Groundwater Level (mAHD) - 2015
- Zone\_A\_Near\_Marsh\_Region
- Zone\_B\_Saline\_Injection\_Region
- Zone\_C\_Brackish\_Injection\_Region
- Zone\_D\_Phreatophytic\_Region
- Mine Strip Boundaries
- Oakover Extent

0 2 4  
Kilometres



Requested By: M Carroll  
 Drawn By: M Carroll  
 Revised By: pricketts  
 Approved By:  
 Scale: 1:125,000  
 Coordinate System: GDA 1994 MGA Zone 50  
 Document Name: MASTER\_CC\_Contour Map

Date: 18/09/2015  
 Size: A4L  
 Revision: 0  
 Confidentiality: 1

Christmas Creek  
 2015 Modelled Groundwater level (mAHD)  
 2010 API Submission



**Fortescue Metals Group Ltd**  
 The New Force in Iron Ore

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