Government of Western Australia
Department of Water and Environmental Regulation

Decision Document

Environmental Protection Act 1986, Part V

Licensee: Chichester Metals Pty Ltd

Licence: L8454/2010/2

Registered office: 87 Adelaide Terrace
EAST PERTH WA 6872

ACN: 109 264 262

Premises address: Christmas Creek Mine Site
Tenements E46/610, E46/612, M46/320, M46/321, M46/322, M46/323, M46/324, M46/325, M46/326, M46/327, M46/328, M46/329, M46/330, M46/331, M46/332, M46/333, M46/334, M46/335, M46/336, M46/337, M46/338, M46/339, M46/340, M46/341, M46/342, M46/343, M46/344, M46/345, M46/346, M46/347, M46/348, M46/349, M46/350, M46/351, M46/352, M46/353, M46/354, M46/355, M46/403, M46/406, M46/412, M46/413, M46/414, M46/415, M46/416, M46/417, M46/418, M46/419, M46/420, M46/421, M46/422, M46/423, M46/424, G46/7, L46/49, L46/56, L46/58, L46/86, L46/87, L46/106, L46/111, E46/566 and L46/66
MULGA DOWNS WA 6751

Issue date: Thursday, 20 August 2015

Commencement date: Monday, 24 August 2015

Expiry date: Saturday, 23 August 2036

Decision

Based on the assessment detailed in this document the Department of Water and Environmental Regulation (DWER), has decided to issue an amended Licence. DWER considers that in reaching this decision, it has taken into account all relevant considerations and the Licence and its conditions will ensure that an appropriate level of environmental protection is provided

Decision Document prepared by: Sonya Poor
Licensing Officer

Decision Document authorised by: Alana Kidd
Delegated Officer

Contents

1 Purpose of this Document

This decision document explains how the department has assessed and determined the application and provides a record of DWER's decision-making process and how relevant factors have been taken into account. Stakeholders should note that this document is limited to DWER's assessment and decision making under Part V of the *Environmental Protection Act 1986* (EP Act). Other approvals may be required for the proposal, and it is the proponent's responsibility to ensure they have all relevant approvals for their Premises.

2 Administrative summary

<table>
<tr><th colspan="3">Administrative details</th></tr>
<tr><td>Application type</td><td colspan="2">Works Approval ☐
New Licence ☐
Licence amendment ☒
Works Approval amendment ☐</td></tr>
<tr><td rowspan="8">Activities that cause the premises to become prescribed premises</td><td>Category number(s)</td><td>Assessed design capacity</td></tr>
<tr><td>5</td><td>77 million tonnes per year</td></tr>
<tr><td>6</td><td>43 million tonnes per year (injected)</td></tr>
<tr><td>52</td><td>54 MW using fuel other than natural gas</td></tr>
<tr><td>54</td><td>1,040 cubic metres per day</td></tr>
<tr><td>57</td><td>2,000 used tyres</td></tr>
<tr><td>64</td><td>10,000 tonnes per annual period</td></tr>
<tr><td>73</td><td>15,183.1 cubic metres in aggregate</td></tr>
</table>

Application verified Application fee paid	Date: 05/11/2018 Date: 08/11/2018	
Works Approval has been complied with Compliance Certificate received	Yes☐ No☐ N/A☒ Yes☐ No☐ N/A☒	
Commercial-in-confidence claim	Yes☐ No☒	
Commercial-in-confidence claim outcome	N/A	
Is the proposal a Major Resource Project?	Yes☒ No☐	
Was the proposal referred to the Environmental Protection Authority (EPA) under Part IV of the *Environmental Protection Act 1986*?	Yes☒ No☐	Referral decision No: Managed under Part V ☐ Assessed under Part IV ☒
Is the proposal subject to Ministerial Conditions?	Yes☒ No☐	Ministerial statement No: 1033 EPA Report No: 1567
Does the proposal involve a discharge of waste into a designated area (as defined in section 57 of the *Environmental Protection Act 1986*)?	Yes☐ No☒ Department of Water consulted Yes ☐ No ☒	
Is the Premises within an Environmental Protection Policy (EPP) Area Yes☐ No☒ If Yes include details of which EPP(s) here.		
Is the Premises subject to any EPP requirements? Yes☐ No☒ If Yes, include details here, eg Site is subject to SO_2 requirements of Kwinana EPP.		

3 Executive summary of proposal and assessment

The Christmas Creek Mine Site (Premises) is owned and operated by Chichester Metals Pty Ltd (Licensee), a wholly owned subsidiary of Fortescue Metals Group Ltd (FMG). The Premises has been assessed as a "prescribed premises" as it meets the requirements of categories 5, 6, 52, 54, 57, 64 and 73 under Schedule 1 of the *Environmental Protection Regulations 1987* (EP Regulations). The Premises has been in operation since 2010.

The Premises encompasses the following mine and infrastructure:

- Open pits;
- Run of mine (ROM) pads;
- Waste rock dumps;
- Remote crushing hub (RCH);
- Permanent and mobile ore processing facilities (OPFs);
- Tailings storage facilities (TSFs);
- Mine dewatering and reinjection infrastructure;
- Diesel powered power station;
- Wastewater treatment plants (WWTPs) and associated irrigation areas;
- Water treatment plant;
- Putrescible and inert landfills;

- Bulk and satellite fuel storage;
- Bioremediation facility;
- Workshops and washdown bays; and
- Accommodation and administration buildings.

The Premises is located approximately 110 kilometres (km) north of Newman and approximately 70 km south-west of Nullagine in the Pilbara region of Western Australia (Figure 1). The Premises is within the Hillside, Roy Hill and Bonney Downs pastoral leases. The Premises is located directly east of the Cloudbreak Iron Ore Mine which is also owned and operated by the Licensee; and directly west of the Roy Hill Iron Ore Mine which is owned and operated by Roy Hill Iron Ore Pty Ltd.

Figure 1. Regional location of the Premises

Descriptions of the primary activities which fall within the description of the category of prescribed premises in Schedule 1 of the EP Regulations, and of related activities are described below.

Premises description

Category 5 – Processing or beneficiation of metallic or non-metallic ore

The Premises comprises a series of open pits, serviced by two OPFs. Mobile crushing and screening facilities support the operation of the OPFs. Two ore products, Rocket and Special Fines, are produced at the Premises.

OPF1 and associated infrastructure covers approximately 238 hectares (ha) and consists of a plant feed system, primary crusher, scrubbing and screening house containing primary and product screens, secondary, tertiary and rolls crushers, desanding plant and ore stockpiles. OPF1 has a design capacity of 29 million tonnes (Mt) per annum (Mtpa).

OPF2 and associated infrastructure covers approximately 127 ha and consists of a primary crusher, coarse ore storage, wet scrubbing, jig plant (to remove shale), crushing area including secondary and

tertiary crushers, desanding plant, stockpiles, stacker and reclaimer. OPF2 has a design capacity of 48 Mtpa.

The RCH operated at the Premises comprises of two ROM bins and apron feeders, mineral sizer for surface mine material, gyratory crusher for drill and blast material, crushed ore vault and transfer conveyors. Ore from the RCH is transferred to the OPFs for further processing via a 7 km long overland conveyor.

To reduce silica and alumina content, low grade ore is subject to wet processing through two desand plants, located at OPF1 and OPF2. Approximately 4 Mtpa of tailings residue, a by-product of the wet processing, is disposed of via deposition into in-pit TSFs. There is currently four TSFs at the Premises; Vasse, Windich, Flinders Strip 12 and Flinders In-Pit (IP) TSFs. Currently, only Windich, Flinders Strip 12 and Flinders IPTSF are operational. Tailings deposition into Vasse TSF has ceased as the facility has reached its storage capacity.

Mobile crushing and screening facilities are operated to support the permanent OPFs. No clearing of vegetation is undertaken for the mobile plants, which are generally located in cleared areas adjacent to the OPFs or pits, at remote ROMs or in existing laydown areas. The number of mobile plants on the Premises varies in response to specific operational and construction requirements. In aggregate the permanent OPFs and mobile plants have a production capacity of 77 Mtpa.

Iron ore is transported via rail to FMG's Anderson Point Materials Handling Facility in Port Hedland for export.

Category 6 – Mine dewatering

Groundwater abstraction is undertaken to enable the mining of ore below the water table and provide mine site water supply. Extracted groundwater is used onsite where possible for purposes such as dust suppression and ore processing. Abstracted water in excess of demand is disposed of via injection into the same interconnected aquifer from which the water was taken. The Licensee is currently licensed under this Licence to reinject up to 43 gigalitres (GL) per annum (GLpa) of mine dewater at the Premises.

The Premises sits over three main connected aquifers, the fresh-brackish Tertiary Detritals, brackish Marra Mamba Formation and the hypersaline Oakover Formation. As approximately 70% of the ore body lies below the water table, mine dewatering provides a large amount of the water supply for the Premises. Excess groundwater is returned to either the Marra Mamba or Oakover Formation aquifers by bore reinjection, dependent on salinity.

There is currently 22 brackish water injection bores installed at the Premises, located in areas west of the active mining area (Hillside East). Reinjection in this area typically targets the mineralised Marra Mamba Formation. Saline injection is undertaken between the southern limit of the resource area and the northern limit of the Fortescue Marsh. The Oakover Formation is the target aquifer of the saline reinjection and has a salinity which is typically between 30,000 milligrams per litre (mg/L) to 150,000 mg/L Total Dissolved Solids (TDS). There are currently 49 saline injection bores in operation at the Premises. During this amendment (January 2019) the Licensee is proposing to install 11 new saline injection bores (refer to Appendix D).

Injection systems consist of networks of injection bores and interconnected pipelines. Water is injected to the bore via a downhole flow control valve, which eliminates air from entering the hole. Transfer and settlement ponds facilitate the bulk flow transfer and/or settlement of suspended material in mine dewater. Separate facilities exist for the purpose of handling brackish and saline water. All ponds are lined with high density polyethylene (HDPE) and saline transfer ponds have

telemetry infrastructure to monitor water level and water level trends. The information is displayed as live data, displayed remotely and SMS messages are send for any breaches of pre-set levels. Polyethylene pipe, which complies with Australian Standards, is used to convey water around site. Valves and boosters pumps are regularly installed along bulk lines to allow for isolation of sections should damage occur or during maintenance activities. Flow meters located throughout the water delivery and distribution network are installed in accordance with the *Guidelines for water meter installation* for the purpose of recording flow volumes. Pressure gauges are installed on bulk pipelines approximately every kilometre.

Category 52 – Electric power generation
The Christmas Creek power station comprises of 27 x 2 megawatt (MW) diesel fuelled Cummins QSK78-G9 generators, which provides power for the Premises. Diesel required for the operation of the power station is stored in the existing bulk fuel storage facility at the Premises.

Category 54 – Sewage facility
The Licensee operates two, Category 54 WWTPs at the Premises; the Construction Camp WWTP and Karntama Camp WWTP. The WWTPs have a combined design capacity of 1,040 cubic metres per day (m^3/day). Treated wastewater from the WWTPs is discharged to land via two separate irrigation areas.

The Licensee operates a sludge handling unit at the Karntama Camp WWTP to treat and dispose of sludge onsite, as opposed to having it removed for offsite disposal. Approximately 3,000 litres (L) per day of sludge is processed, resulting in approximately 320 tonnes of biosolids requiring disposal annually. The biosolids are disposed of within the existing landfill at the Premises in accordance with the *Landfill Waste Classification and Waste Definitions 1996*. Wastewater produced during the treatment process is returned to the Karntama Village WWTP for treatment.

Twelve small Biomax systems, with throughputs less than 20 m^3/day, are also operated within the Premises; with treated wastewater discharged to separate irrigation areas. These small WWTPs do not meet the production or design capacity of a Category 85 prescribed premises, as specified in Part 2 of Schedule 1 of the EP Regulations. There are no cumulative impacts associated with the operation of the Biomax systems and subsequent discharge of treated wastewater, as treated water is directed to separate irrigation areas. The Delegated Officer has considered the size of the WWTPs and lack of cumulative impacts; and determined not to consider the Biomax systems further in this assessment. The Licensee has a responsibility to comply with the legislative requirements of other government regulators with respect to the operation of these systems, including but not limited to the WA Department of Health. It is also noted that the provisions of the *Environmental Protection (Unauthorised Discharges) Regulations 2004* may apply.

Category 57 – Used tyre storage
The Licensee stores up to 2,000 used tyres on site at any one time in two separate tyre storage areas located at the Central Contractors Yard 1 (CCY1) and Central Contractors Yard 2 (CCY2).

Category 64 – Class II putrescible landfill
The Licensee operates a Class II putrescible landfill at the Premises which accepts up to 5,000 tonnes of waste per annum, as well as a number of used tyre and untreated timber/concrete disposal locations within waste rock dumps and mining voids. In aggregate, the putrescible and inert waste landfills accept up to 10,000 tonnes of waste per annum.

Category 73 – Bulk storage of chemicals, etc.
The Premises has three significant fuel storage areas; the bulk fuel storage facility, the CCY1 and CCY2. These storage areas are supplemented by seven satellite fuel storages around the operational area. A number of smaller mobile fuel storage areas are operated onsite. These mobile

facilities are regularly moved, in cases weekly, to where mining is actively taking place. Fuel storage pods of less than 4,000 L are also located onsite, associated with the groundwater abstraction pumps. These fuel pods are also regularly moved depending on operational requirements. The permanent fuel storage areas and their fuel storage capacity is shown in Table 1.

Table 1: Summary of the fuel storage facilities at the Premises

Location Name	No. of Tanks	Tank Volume (L)	Total Volume (L)
Bulk Fuel Storage Facility	2	3,521,117	7,042,234
Power Station 1 & 2	2	110,000	220,000
Power Station 3	1	52,400	52,400
Power Station 4	1	20,200	20,200
JV and KC Camp	2	10,000	20,000
CCY1	6	100,000	600,000
CCY2	36	110,000	3,960,000
CCY1 MLG Crushing	1	55,000	55,000
CCY2 Young Dome	2	110,000	220,000
CCY2 Orica	1	62,000	62,000
LV's	1	18,000	18,000
	1	19,000	19,000
Diggers Workshop	5	20,000	100,000

Rebuild Workshop	3	55,000	165,000
	3	35,000	105,000
	3	10,000	30,000
CCA Hydrocarbon Tanks	5	80,000	400,000
	4	15,000	60,000

Related activities

The bioremediation facility and Karntama Camp reverse osmosis (RO) plant do not meet the description of the category of prescribed premises in Schedule 1 of the EP Regulations, however are related to the primary activities and give rise to emissions and discharges; and have therefore been considered in this assessment.

Bioremediation facility

A bioremediation facility is located near the Windich pit. The facility consists of three pads approximately 25 metres (m) in length and width and lined with HDPE liner. The contaminants in the soil to be remediated are hydrocarbons, primarily diesel, hydraulic oil and engine oil.

Water treatment plant

The Licensee operates the Karntama Camp RO plant at the Premises to treat bore water to an acceptable quality for potable use. The design capacity of the RO plant is 375,000 kilolitres (kL) per annum. Approximately 200,247 kL of potable water and up to 97,706 kL of reject water is produced annually. Reject water from the treatment process is discharged to the Karntama Camp WWTP irrigation area, accounting for 40% of the irrigated wastewater. The average combined TDS concentration of final effluent to the Karntama irrigation area is approximately 4,035 mg/L (FMG 2018c).

The Licensee also operates the Construction Camp RO plant. Reject water from this RO plant was historically stored in Franco's turkey's nest and used for dust suppression. As mining has moved away from the Franco's turkeys nest there is no longer an operational requirement for the use of this water. The Licensee is proposing to dispose of the RO reject water to the finals tank at the existing Construction Camp WWTP where it will be mixed with wastewater effluent prior to disposal via irrigation at the existing Construction Camp irrigation area. There is no change to the category 54 design capacity of the Existing Licence as a result of this proposed change. Refer also to Appendix E – Emissions to land including monitoring.

Location and siting

Sensitive land uses

No significant communities are located in the vicinity of the Premises. The nearest sensitive land uses include Roy Hill Station and Marillana Homestead, located 30 km and 41 km respectively from the Premises. There are three pastoral bores located within the premises boundary; these being 22 Mile bore, Ricks bore and Gorge bore. Figure 2 below depicts the location of these bores within the premises boundary.

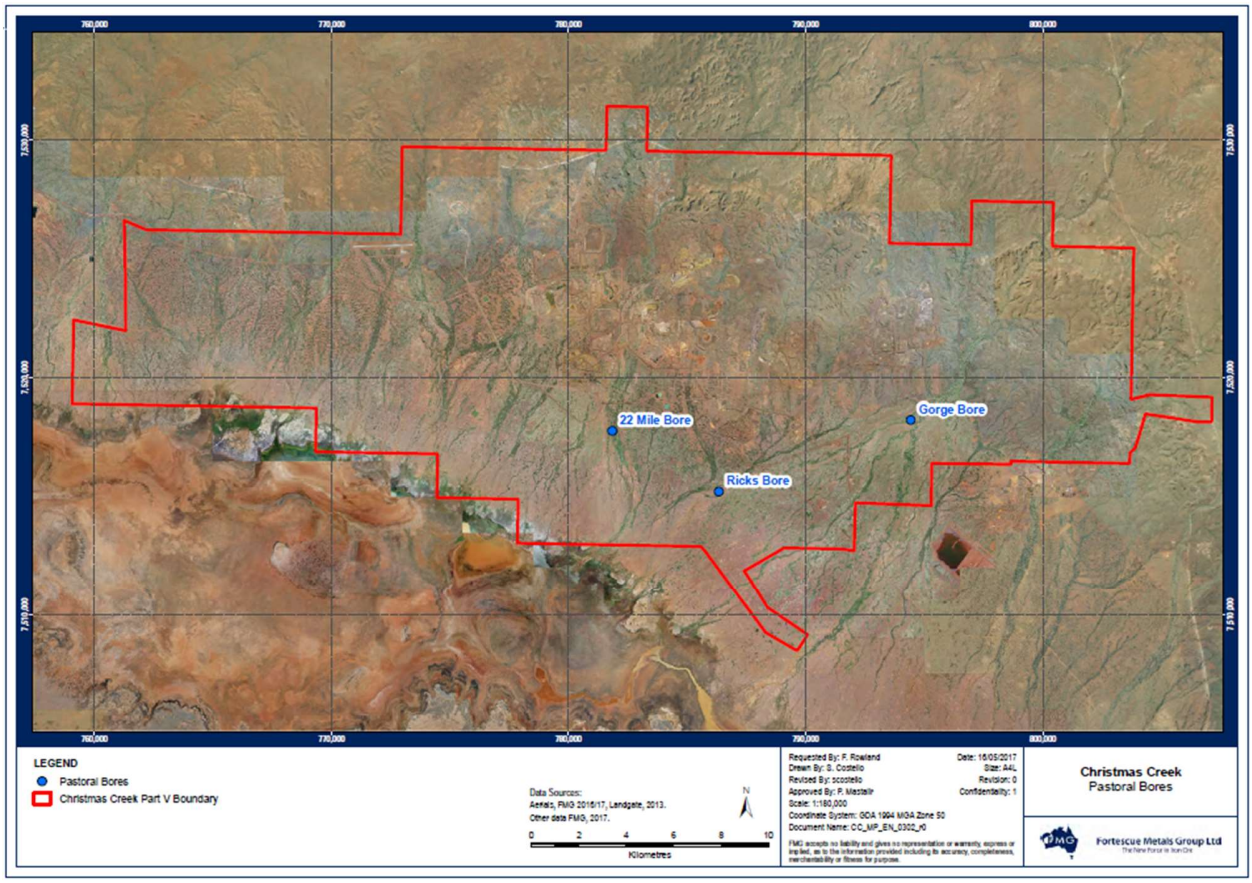

Figure 2: Pastoral bore locations

The workforce operates on a fly-in/fly-out basis and is housed at the accommodation camps located within the prescribed premises boundary. As the accommodation camps are operated by the Licensee, they are not considered by DWER to be a sensitive land use or receptor for the purpose of assessing the risks of emissions and discharges associated with the operation of the prescribed activities.

Aboriginal heritage surveys have been undertaken across the site since 2003 which have identified 1,573 heritage sites across Licensee's Christmas Creek and Cloudbreak mine sites. A Cultural Heritage Management Plan has been prepared for the site and the Licensee is required to comply with the requirements of the *Aboriginal Heritage Act 1972*.

Specified Ecosystems

The *Guidance Statement: Environmental Siting* describes specified ecosystems as areas of high conservation value and special significance that may be impacted as a result of activities upon or emissions and discharges from prescribed premises. The specified ecosystems relevant to the Premises are identified below.

The Premises lies between 1 km to 10 km north of the Fortescue Marsh, which is listed in *A Directory of Important Wetlands in Australia* and also listed as a Priority 1, Priority Ecological Community (PEC) (PEC, 2017). Figure 3 depicts the location of the Premises relative to the Fortescue Marsh. The Premises development envelope intersects the Fortescue Marsh management zones, 1a Northern

Flank (highest environmental significance) and 3a Kulbee Alluvial Flank (lowest environmental significance), as defined in the Environmental Protection Authority's (EPA) Section 16(3) of the EP Act advice for the Fortescue Marsh (Report 1484). The mine development envelope is adjacent to zone 1b Marsh, which is also of highest environmental significance (Report 1484).

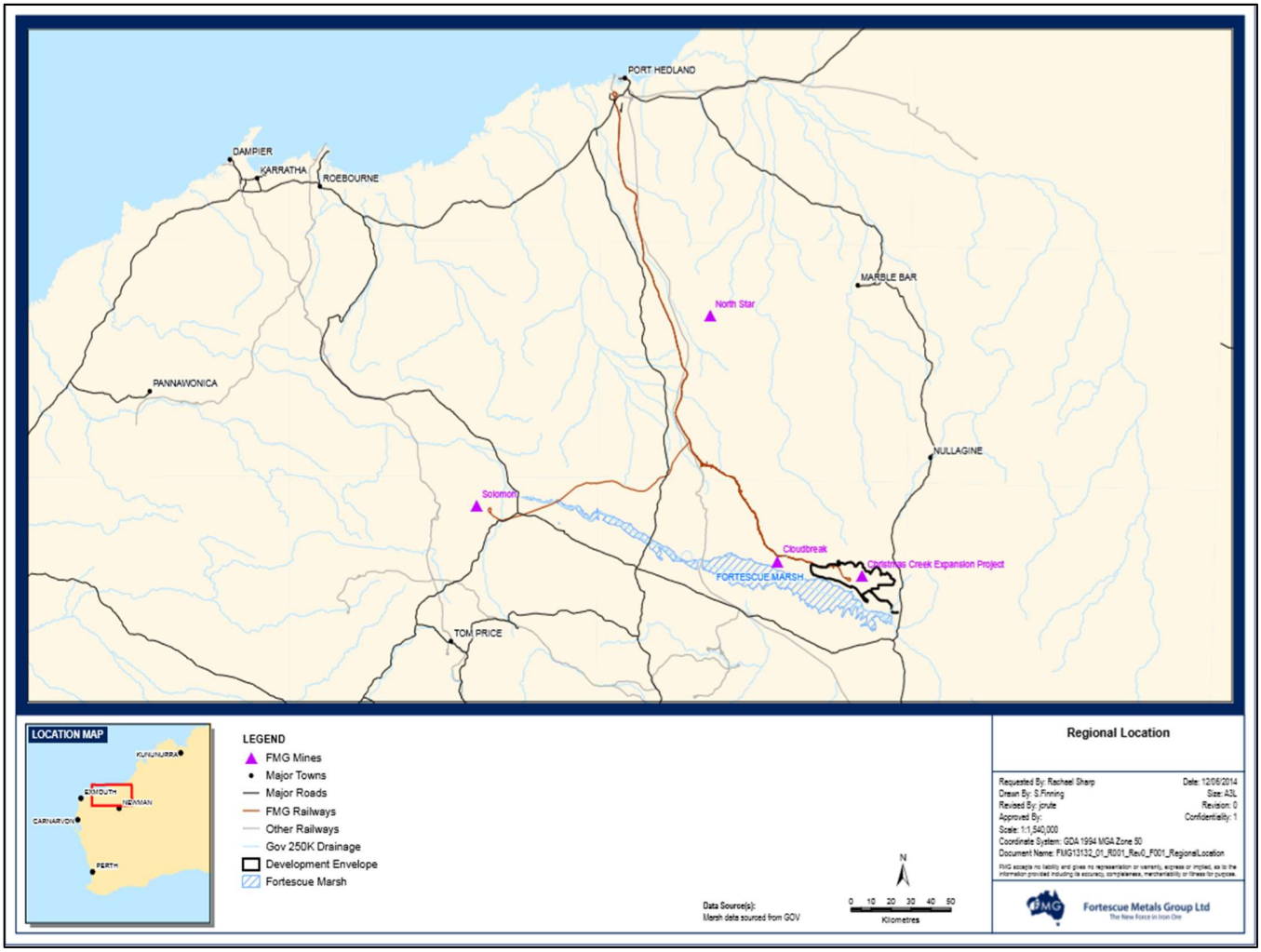

Figure 3: Location of the Premises relative to the Fortescue Marsh

Ecologically important vegetation communities in and adjacent to the Premises include Mulga, Samphire and Coolibah/River Red Gum Vegetation. Mulga vegetation is located within the Fortescue Marsh management zones 1a and 3a (Report 1484). Mulga is significant as in this area it is the northern extent of Mulga vegetation in Western Australia and is floristically diverse from other Mulga vegetation in the bioregion (Report 1567). Samphire is locally restricted to the Fortescue Marsh and contains conservation significant flora identified as a value for management zone 1b (Report 1484). Coolibah and River Red Gum have been identified as ecologically important vegetation communities, occurring along creek lines in and adjacent to the premises.

The Premises mine development envelope also intersects the proposed Fortescue Marsh Conservation Reserve, which includes pastoral lease exclusion areas. Once established, the conservation reserve will be managed by the Department of Biodiversity, Conservation and

Attractions. The EPA recommended in Section 16(3) of the EP Act advice on *Cumulative environmental impacts of development in the Pilbara region* that the lease exclusion area be afforded the highest possible level of conservation tenure (Report 1567).

Flora and vegetation surveys have identified 15 priority flora within the survey area, comprising five species of Priority 1, one Priority 2, six Priority 3 and two Priority 4.

There are no Threatened flora species pursuant to the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) or Declared Rare Flora (DRF) pursuant to the *Wildlife Conservation Act 1950* (WC Act) recorded within the survey area.

Four habitat types have been identified within the mine development envelope which are likely to support conservation significant fauna (Report 1567), as follows:

- Marsh (Low halophytic shrubland) – potential habitat for the Greater Bilby and migratory birds;
- Drainage Line and Alluvial Plain (Creekline and shrubland and/or eucalypt open woodland) – potential foraging habitat for Pilbara Olive Python and Pilbara Leaf-nose Bat, and potential habitat for Short Range Endemic (SRE) invertebrate species;
- Low Hill (Spinifex covered hills and ranges) – potential habitat for the Northern Quoll and the Night Parrot, and potential SRE habitat; and
- Stony plain (Snakewood and Mulga woodland) – potential SRE habitat.

Surveys undertaken as part of the Christmas Creek Iron Ore Mine Expansion Project have recorded 313 invertebrate fauna species (43 mammals, 165 birds, 99 reptiles and six amphibians). This included seven species protected under the EPBC Act and WC Act, including:

- Northern Quoll – endangered under the EPBC Act and Schedule 1 under the WC Act;
- Night Parrot – endangered under the EPBC Act and Schedule 1 under the WC Act;
- Greater Bilby – vulnerable under the EPBC Act and Schedule 1 under the WC Act; and
- Pilbara Leaf-nosed Bat – vulnerable under the EPBC Act and Schedule 1 under the WC Act.

The Northern Quoll, Night Parrot and Greater Bilby are identified as values in the Fortescue Marsh management zones 1a and 1b (Report 1484).

Vegetation and flora

Vegetation within the Premises consists of a mosaic of low woodland with Mulga in valleys and hummock grasslands, low open tree steppe with snappy gum (*Eucalyptus leucophloia*) over *Triodia wiseana*, and kanji (*Acacia pyrifolia*) over soft Spinifex and *Triodia wiseana* hummock grasslands. The Premises occurs within the Fortescue Botanical District of the Eremaean Botanical Province (Beard 1975).

Topography

The regional topography is dominated by the Hamersley Plateau in the south and the Chichester Ranges in the north, separated by the Fortescue Valley. The pre-mining topography of the area can be described as gently undulating, with a maximum relief from the Fortescue Valley to the Chichester Ranges of approximately 50-200 m.

Geology and soils

The Premises is located in the Hamersley Basin area of the Pilbara craton. The Chichester Ranges dominants the landscape, comprised of the south dipping Marra Mamba Formation which is overlain by a Quaternary/Tertiary sedimentary sequence, and underlain by the black shales of the Jeerinah Formation at the top of the Fortescue Group. The Oakover Formation comprises a sequence of lacustrine carbonate, silcrete and mudstone rocks that have been deposited in the paleodrainage of

the Fortescue Valley (FMG 2014). The orebody mined at the Premises occurs within the mineralised Marra Mamba Formation.
Superficial soils at the Premises comprise clayey gravels and silty gravels, and include fill, alluvium and/or detrital material.

Regional hydrology
The Premises is located in the upper Fortescue River catchment which is subject to localised thunderstorm and cyclonic rainfall events, which generally occur between December to April and can result in very large runoff events. Numerous creeks from the southern and northern flanks of the Fortescue Valley discharge to the Fortescue Marsh. From the Chichester Ranges, surface water flows in a southerly direction, through the project area, to the Fortescue Marsh.

Broad scale flooding of the Fortescue Marsh occurs on a frequency of about one year in ten, with inundation persisting for three to six months (Report 1429). Yintas (semi-permanent pools) are located along the northern shoreline of the Fortescue Marsh. Channel flow occurs in the northern part of the project area and sheet flow occurs over land in the broad shallow front within the southern portion of the project area.

Surface water runoff is generally of low salinity and turbidity, which increases during peak periods of flooding. Water stored on the Fortescue Marsh dissipates through evaporation and seepage. The evaporation process increases water salinity levels in the marsh, which is believed to seep into the valley floor alluvial deposits.

The primary mechanisms for groundwater recharge in the area are infiltration recharge from direct rainfall and local stream flow on Marra Mamba Formation and Tertiary detrital/alluvium, infiltration recharge associated with ponding on the Fortescue Marsh and inflow from aquifers located to the north of the project area. The groundwater system beneath the Fortescue Marsh is considered to be a closed system with limited outflow to the west beneath the Goodardarie Hills.

Groundwater in the project area is generally brackish (>500 mg/L TDS and becomes increasingly saline towards the Fortescue Marsh and with depth (>100,000 mg/L TDS). Salinity increases with depth, with the upper tertiary detritals having a salinity of 1,000 to 2,000 mg/L TDS, Marra Mamba Formation reaching up to 6,000 mg/L TDS and the deeper Lower Marra Mamba and Wittenoom Formations having a salinity of 5,000 to 11,000 mg/L TDS. The Oakover Formation to the south of the resource area has monitored TDS of up to 150,000 mg/L (Report 1429).

Meteorology
The climate of the Pilbara is arid tropical, characterised by low and variable rainfall, high daily temperatures, high diurnal temperatures and high evaporation rates. The estimated average rainfall at the Premises is 459 millimetres (mm) and the average annual evaporation is estimated at 3,300 mm. The 1 in 100 year Average Recurrence Interval (ARI), 72-hour storm event for the mine area is approximately 4.8 mm per hour, or a 345 mm event.

Clearing
Ministerial Statement (MS) 1033 for the Pilbara Iron Ore and Infrastructure Project (Christmas Creek Mine, East-West Railway and Mindy Mine) – Revised Proposal approves the clearing of 17,956 ha of vegetation within a 34,009 ha mine development area.

Part IV of the EP Act
Development of Christmas Creek was authorised by the Minister for Environment under Part IV of the EP Act upon issue of MS 707 on 16 December 2005. The Christmas Creek Water Management Scheme (CCWMS) project was referred to the EPA in 2010 and involved an expansion of the

dewatering and reinjection scheme at Christmas Creek to allow access to ore below the water table. The CCWMS was approved under MS 871 on 8 August 2011.

The Christmas Creek Iron Ore Mine Expansion was referred to the EPA on 5 November 2013 and involves an expansion to the existing mining footprint, permanent waste landforms, tailings disposal, conveyors, roads, drainage and other associated mine infrastructure. The expansion project was approved under MS 1033 (Pilbara Iron Ore and Infrastructure Project (Christmas Creek Mine, East-West Railway and Mindy Mine) – Revised Proposal) on 8 August 2016. MS 1033 specifies that the implementation conditions in MS 707 and MS 871 no longer apply in relation to the proposal from the date of issue of MS 1033.

The Christmas Creek Iron Ore Mine Expansion, approved by the EPA under MS 1033, allows the abstraction and injection of no more than 110 GLpa of groundwater. The Delegated Officer notes that the approved production capacity for Category 6 currently imposed through this Licence will need to be increased prior to the Licensee increasing the rate of mine dewatering as approved under MS 1033.

The EPA's recommendation to the Minister for Environment with respect to the Christmas Creek Iron Ore Mine Expansion were documented in *Report 1567*, which resulted in the issue of MS 1033.

The EPA identified the following factors as the key environmental factors during the course of its assessment of the proposal:

1. Hydrological processes/inland waters environmental quality (impacts from drawdown and mounding of groundwater, potential changes in surface flow regimes and potential changes in water quality);
2. Flora and vegetation (direct impacts from clearing and indirect impacts from groundwater drawdown and mounding, and change to surface water flows);
3. Subterranean fauna (potential impacts from loss of habitat due to dewatering and excavation of mine pits);
4. Terrestrial fauna (potential impacts from loss of habitat for conservation significant fauna species from clearing of vegetation);
5. Rehabilitation and decommissioning (potential long-term impacts to vegetation and fauna habitat if rehabilitation is unsuccessful, and potential long-term impacts to aquifer water quality once dewatering and reinjection ceases); and
6. Offsets (to counterbalance the significant residual impacts to native vegetation and vegetation in the proposed Fortescue Marsh Conservation Reserve and Fortescue Marsh management zone 1a).

Other approvals

Iron Ore (FMG Chichester Pty Ltd) Agreement Act 2006

The Premises is subject to the *Iron Ore (FMG Chichester Pty Ltd) Agreement Act 2006,* which ratifies and authorises the development of mining of iron ore by the Licensee within a defined area of the Chichester Ranges, and defines the assistance to be provided by the State government. The Department of Jobs, Tourism, Science and Innovation is responsible for administering this Act.

EPBC Act

On 13 November 2013, the Christmas Creek Iron Ore Mine Expansion project was determined to be a controlled action under the EPBC Act due to potential impact on Matters of National Environmental Significance; listed threatened specifies and communities, and listed migratory species. The proposal was assessed according to the Bilateral Agreement between the Commonwealth and Western Australian governments. The Christmas Creek Iron Ore Mine Expansion was approved under the EPBC Act on 3 January 2017 (EPBC 2013/7055).

Rights in Water and Irrigation Act 1914 (RIWI Act)
Groundwater abstraction is undertaken to enable mining below the water table and provide mine site water supply. Groundwater is abstracted in accordance with Section 5C licences issued pursuant to the RIWI Act. In accordance with the requirements of the Section 5C licence, the Licensee has developed the Christmas Creek Groundwater Operating Strategy (CC-PH-HY-0002, Revision 6, April 2016). This strategy documents the operation of the dewatering, injection and process water supply systems and the management systems to be implemented to monitor and mitigate potential impacts. The Groundwater Operating Strategy requires quarterly and annual monitoring summary reports, and a triennial groundwater monitoring review to be submitted.

Amendment Notice 1
Amendment Notice 1 for Licence L8454/2010/2 was issued 28 February 2017 and approved the construction and operation of the Flinders IPTSF (below and above water table tailings deposition) and a number of other changes to the conditions of Licence L8454/2010/2, including:

- Changes to the Vasse and Windich TSF groundwater monitoring bore locations;
- Updates to the visual monitoring requirements for the TSF embankment freeboard;
- Removal of the requirements for sewage pipelines to be equipped with specific controls;
- Updates to the containment infrastructure requirements;
- Updates to the tyre storage requirements;
- Emissions to land monitoring requirements (inclusion of TDS for emission point L1);
- Removal of condition 4.1.2 relating to implementation of improvement IR3 which required a review of the TSF groundwater monitoring network; and
- Minor administrative updates to condition 5.1.2 (Annual Audit Compliance Report reporting requirements) and definitions.

Licence amendment – 14 July 2017
On 9 March 2017 the Licensee submitted an application for an amendment to the Christmas Creek licence under section 59B of the EP Act. The Licensee has applied to make the following changes:

- Condition 1.2.2 (Table 1.2.1) -
  - Updates to remove references to individual TSFs, settlement and transfer ponds. The Delegated Officer has determined not to implement this change as for compliance and enforcement purposes individual storage locations should be identified;
  - Specify that a supernatant water collection and return system be used only when a recoverable volume of water is present; and
  - Remove the containment infrastructure requirements specified for the Flinders IPTSF (imposed via Amendment Notice 1 issued 28 February 2017);
- Condition 1.2.5 (Table 1.2.3) – Remove “clean fill” as a waste type and include a provision to allow for clean fill to be used as cover to cap landfill trenches;
- Condition 1.2.8 – Remove condition 1.2.8 and reference to the “Mobile Crushing and Screening Environmental Management Procedure”;
- Condition 1.2.10 (Table 1.2.6)
  - Remove the design and construction specifications for the Karntama Village Sludge Unit as the facility has been constructed; and
  - Include design and construction specifications for a new mine dewater settlement pond to be constructed;
- Condition 1.2.11 – Remove the specification relating to the Flinders IPTSF which allows

tailings to only be deposited to no more than 2 m below the pre-mining groundwater level (imposed via Amendment Notice 1 issued 28 February 2017);

- Condition 3.2 – Remove the point source air emissions monitoring requirements associated with the power station;
- Condition 3.4.1 (Table 3.4.1) – Remove volumetric flow rate from the saline and brackish reinjection monitoring requirements specified in Table 3.4.1;
- Condition 3.6.1 (Table 3.6.1) – Remove the requirements to sample for Benzene, Toluene, Ethyl benzene and Xylene (BTEX) in water from the CCY1 and CCY2 treatment used for dust suppression;
- Condition 3.7.1 (Table 3.7.1) – Inclusion of a footnote on Table 3.7.1 specifying *"No sample required if bore is dry"* to avoid potential non-compliances if the TSF monitoring bores are dry due to mine dewatering in the area and change monitoring frequency to six monthly;
- Condition 5.2.1 (Table 5.2.1)
  - Update the reference to the telemetric controls on the saline reinjection infrastructure as the Licensee is currently trialling the use of improved technologies; and
  - Remove the requirement to report the average percentage of sulfur content of diesel fuel used; and
- Condition 5.3.1 (Table 5.3.1) – Remove the requirement to verify the permeability of the pit wall, as imposed via Amendment Notice 1. Details of the pit wall were provided in the first compliance document for the Flinders IPTSF, submitted to the former Department of Environment Regulation on 1 March 2017.

Licence amendment – 16 July 2018
A licence amendment application was submitted by the Licensee on 26 February 2018 to make the following changes:

- Combination of two existing TSFs at Flinders, being the Flinders Strip 12 TSF and the Flinders IPTSF into one consolidated landform called the Flinders IPTSF Complex; and
- Removal of monitoring location (CCSP0011) and addition of CCSP0024 for the monitoring of point source emissions to groundwater.

This Licence amendment – January 2019
A licence amendment application was submitted by the Licensee on 12 October 2018 (FMG 2018c) and 16 November 2018 (FMG 2018d) for the following:

- Disposal of RO reject water into the existing Construction Camp irrigation area;
- Construction of the Lefroy Turkey's nest; and
- Installation and operation of 11 new saline injection bores in the saline injection borefield at the Premises.

During this amendment the following changes have been made to the Licence:

- Table 1.2.1 updated to include the Lefroy Turkey's Nest as a containment infrastructure;
- Table 1.2.6 updated to remove some of the construction requirements for the Flinders IPTSF for the tailings deposition pipeline;
- Inclusion of construction requirements to Table 1.2.6 for the Lefroy's Turkey's Nest and saline injection bores;
- Conditions 1.2.9, 1.2.10 and 4.3.1 updated to include the Lefroy's Turkey's Nest and saline injection bores;
- Table 2.3.1 updated to include 11 proposed saline injection bores;
- Table 2.4.1 updated to specify RO reject water as a source for the Construction Camp irrigation area;

- Table 3.3.1 updated to specify the outflow line associated with the two saline monitoring points;
- Removal of footnote 'Note 2' from Table 3.4.1;
- Chlorine has been removed from Table 3.6.1 for mine dewater reinjection and replaced with chloride;
- The requirement to submit the TSF annual water balance associated with condition 1.2.4 within the Annual Environmental Report (AER) has been included to Table 4.2.1; and
- Map of containment infrastructure and map of emission points for Table 2.3.1 updated in Schedule 1.

DWER's assessment and decision making with respect to emissions and discharges associated with the operation of the Premises are described in section 4 of this document.

4 Decision table

All applications are assessed in line with the EP Act, the EP Regulations and *Guidance Statements*: *Decision Making* and *Risk Assessments*. Where other references have been used in making the decision they are detailed in the Decision Document.

DECISION TABLE			
Licence section	**Condition number**	**Justification (including risk description & decision methodology where relevant)**	**Reference documents**
General conditions	Conditions 1.1.1 - 1.1.4.	Definitions for terms used in the Licence are specified under condition 1.1.1 and 1.1.2. Conditions 1.1.3 and 1.1.4 refers to references made to Australian or other standards and codes of practice meaning the relevant parts and version of that standard, guideline or code of practice.	General provisions of the *Environmental Protection Act 1986.* *Environmental Protection (Unauthorised Discharges) Regulations 2004.*
Premises operation	Conditions 1.2.1 - 1.2.10.	The OPFs and TSFs at the Premises meet the description and production or design capacity of a Category 5 prescribed premises, as described in Schedule 1 of the EP Regulations. Dust and noise emissions associated with the OPFs have been assessed in the relevant sections of this document. The Licensee also operates a number of facilities, ancillary to the primary activity of mining and ore processing, that meet the description and production or design capacity of Categories of prescribed premises, as described in Schedule 1 of the EP Regulations. The location of DWER's assessment and decision making on the operation of these facilities is shown below: • Category 5: TSFs as detailed in Appendix A (Premises operation); • Category 6: Mine dewatering as detailed in Appendix C (Point source emissions to surface water) and Appendix D (Point source emissions to groundwater);	General provisions of the *Environmental Protection Act 1986.* *Environmental Protection (Unauthorised Discharges) Regulations 2004.* MS 1033.

DECISION TABLE			
Licence section	**Condition number**	**Justification (including risk description & decision methodology where relevant)**	**Reference documents**
		• Category 52: Christmas Creek power station as detailed in Appendix B (Point sources emissions to air); • Category 54: WWTPs as detailed in Appendix E (emissions to land); • Category 64: putrescible and inert landfills as detailed in Appendix A (Premises operation); and • Category 73: bulk and satellite fuel facilities as detailed in Appendix A (Premises operation). Stormwater management at the Premises, is detailed and assessed in Appendix A.	
Point source emissions to air including monitoring	Condition 2.1.1.	DWER's assessment and decision making with respect to air emissions associated with the Christmas Creek power station are detailed in Appendix B.	National *Environmental Protection (Ambient Air Quality) Measure*. FMG 2018b.
Point source emissions to surface water including monitoring	Conditions 2.2.1 and 3.2.1.	DWER's assessment and decision making with respect to the contingency discharge of dewatering water to creek lines are detailed in Appendix C.	General provisions of the *Environmental Protection Act 1986.* *Environmental Protection (Unauthorised Discharges) Regulations 2004.* *Dewatering Contingency Discharge Procedure*. Australian Standard AS/NZS 5667.1.

DECISION TABLE			
Licence section	**Condition number**	**Justification (including risk description & decision methodology where relevant)**	**Reference documents**
			Australian Standard AS/NZS 5667.6.
Point source emissions to groundwater including monitoring	Conditions 2.3.1 and 3.3.1.	DWER's assessment and decision making with respect to the reinjection of dewatering water at the Premises are detailed in Appendix D.	*Cloudbreak Groundwater Operating Strategy* (CB-PH-HY-0009). *Cloudbreak Water Management Scheme* (FMG, Rev 9, December 2015). General provisions of the *Environmental Protection Act 1986.* *Environmental Protection (Unauthorised Discharges) Regulations 2004.* Australian Standard AS/NZS 5667.1. Australian Standard AS/NZS 5667.11. MS 1033.
Emissions to land including monitoring	Conditions 2.4.1 and 3.4.1.	DWER's assessment and decision making with respect to the discharge of treated wastewater and RO reject water to land at two separate irrigation areas is detailed in Appendix E.	General provisions of the *Environmental Protection Act 1986.* *Environmental Protection (Unauthorised Discharges) Regulations 2004.*

DECISION TABLE			
Licence section	**Condition number**	**Justification (including risk description & decision methodology where relevant)**	**Reference documents**
			Australian Standard AS/NZS 5667.1. Australian Standard AS/NZS5667.10. FMG 2018c.
Fugitive emissions	N/A.	DWER's assessment and decision making with respect to fugitive dust and light emissions are detailed in Appendix F.	General provisions of the *Environmental Protection Act 1986.* *Conservation Significant Fauna Management Plan* (100-PL-EN-0022).
Odour	N/A.	There are no significant odour emissions associated with the emissions undertaken at the Premises. The Delegated Officer notes that minor odour emissions may occur from the operation of the putrescible landfill and WWTPs; and that the nearest potential sensitive receptor is Roy Hill Station located approximately 30 km from the Premises. This is considered a sufficient buffer distance to prevent odour impacting on Roy Hill Station. In accordance with the *Guidance Statement: Risk Assessments*, the Delegated Officer has not undertaken an assessment of odour emissions from the Premises as there is not considered to be a receptor at risk of being impacted by odour emissions from the Premises. As previously noted, the onsite accommodation camps are not considered by DWER to be sensitive receptors for the purpose of assessing emissions and discharges from the activities undertaken on the Premises.	*Guidance Statement: Risk Assessments*. General provisions of the *Environmental Protection Act 1986.*

DECISION TABLE			
Licence section	**Condition number**	**Justification (including risk description & decision methodology where relevant)**	**Reference documents**
Noise	N/A.	DWER's assessment and decision making with respect to noise emissions are detailed below. Emission description *Emission:* Noise and vibrations from operation of equipment and vehicles. *Impact:* Impacts to amenity of sensitive receptors. Noise and vibrations may force terrestrial fauna away from existing habitats into new areas increasing risk of predation or causing conflict with existing fauna assemblages. *Controls:* The Premises is located approximately 30 km from the nearest pastoral homestead, which the Delegated Officer considers to be a sufficient buffer to prevent noise impacting the amenity of the homestead residents. Noise modelling was conducted as part of the Public Environmental Review assessment for Christmas Creek and showed noise emissions significantly below the *Environmental Protection (Noise) Regulations 1997*. Low-noise plant and equipment is used where practicable. Noise emissions from the mobile crushing and screening plants are minimised with the use of protection shields around motors, and rubber lines and protective barriers. Inspections and maintenance of exhaust and silencing systems on machinery, equipment and vehicles is conducted as required. Condition 8-3 of MS 1033 requires the Licensee to continue to implement the *Conservation Significant Fauna Management Plan* (100-PL-EN-0022), until the CEO of the EPA has confirmed in writing that the revised management plan required under MS 1033 meets the environmental objective for fauna management.	General provisions of the *Environmental Protection Act 1986.* *Guidance Statement: Risk Assessments.* *Environmental Protection (Noise) Regulations 1997.* *Conservation Significant Fauna Management Plan* (100-PL-EN-0022). *Chichester Operations Noise and Vibration Management Plan* (CB-PL-EN-0007). MS 1033.

DECISION TABLE			
Licence section	**Condition number**	**Justification (including risk description & decision methodology where relevant)**	**Reference documents**
		The *Conservation Significant Fauna Management Plan* specifies key management actions for conservation significant fauna management, including strategies to minimise the potential impacts from noise and vibrations. Where noise emissions may result in significant impacts to conservation significant fauna, mitigation measures will be incorporated into planned activities in accordance with the *Chichester Operations Noise and Vibration Management Plan* (CB-PL-EN-0007). Risk assessment: *Consequence:* The closest sensitive human receptor to the Premises is a pastoral homestead located approximately 30 km away. Impacts to the amenity of this receptor from noise and vibrations are not expected. Mid-level on-site impacts and low level off-site impacts at a local scale to fauna could occur from noise and vibrations. Therefore, the consequence is moderate. *Likelihood:* Based on the size and extent of the machinery in use (24 hours per day) an impact to fauna species from noise and vibration could occur at some time. Therefore, the likelihood of the consequence is possible. *Risk rating:* Comparison of the consequence and likelihood ratings described above with the risk rating matrix (Table 2) determines the overall rating of risk for noise emissions and vibrations to be **medium**. Regulatory controls Noise and vibration impacts to conservation significant fauna species are addressed under the management plans currently implemented under MS 1033, pursuant to Part IV of the EP Act. Conditions relating to the management of noise and vibration to minimise potential impacts to fauna	

DECISION TABLE			
Licence section	**Condition number**	**Justification (including risk description & decision methodology where relevant)**	**Reference documents**
		have not been applied to the Licence as sufficient regulation is provided under Part IV of the EP Act. The Delegated Officer notes that the *Environmental Protection (Noise) Regulations 1997*, as well as the general provisions of the EP Act with respect to the causing of pollution and environmental harm apply. <u>Residual risk assessment:</u> *Consequence:* Moderate *Likelihood:* Possible *Risk rating:* Medium	
Monitoring general	Conditions 3.1.1 - 3.1.4.	General monitoring conditions are included in this Licence to ensure monitoring is carried out in accordance with the relevant standards, at appropriate intervals and submitted to and tested by a NATA accredited laboratory for analysis; and that monitoring equipment is appropriately maintained and calibrated.	Australian Standard AS/NZS 5667.1. *Guidance Statement: Setting Conditions.*
Process monitoring	Condition 3.5.1.	**Dust suppression** Treated wastewater from the CCY1 and CCY2 storage ponds is used on site for dust suppression. The Licensee also sources bore water for use in dust suppression. DWER's assessment and decision making with respect to the use of treated wastewater and bore water for dust suppression is detailed below. <u>Emission description</u> *Emission:* Saline and potentially hydrocarbon contaminated treated wastewater discharged to land when used for dust suppression. In 2017, TDS in reuse water from the treated wastewater ponds ranged from 2,200 mg/L to 36,000 mg/L (2017 AER), which is considered of saline to highly saline quality (Understanding salinity).	General provisions of the *Environmental Protection Act 1986.* 2017 AER. Report 1429. MS 1033.

DECISION TABLE			
Licence section	**Condition number**	**Justification (including risk description & decision methodology where relevant)**	**Reference documents**
		Brackish/saline bore water is also used for dust suppression. In 2016, 2,789,956 kL of groundwater was used for dust suppression at the Premises. *Impact:* Treated wastewater from the CCY1 and CCY2 is of saline to highly saline quality and could contain elevated levels of hydrocarbons which could contaminate surface water, groundwater and/or terrestrial environments, adverse impacts on flora, fauna and aquatic biota. Overspray and runoff of saline groundwater used for dust suppressions may impact on the health of vegetation adjacent to mine access and haul roads. *Controls:* *Treated wastewater ponds* Monthly monitoring of water from the CCY1 and CCY2 final treatment ponds is undertaken for total recoverable hydrocarbons (TRH) and TDS. Results provided in the *2017 AER* submitted in accordance with the reporting requirements of this Licence, indicate the TRH in discharge water were less than 0.25 mg/L. TDS in water ranged from 2,200 mg/L to 36,000 mg/L. Water from the two ponds is used for dust suppression on and around the disturbed land of the active mining areas. *Groundwater used for dust suppression* The Cloudbreak Iron Ore Mine is located adjacent to the Premises, and is also owned and operated by the Licensee. The Delegated Officer notes that the environmental setting, including the regional hydrology, topography, vegetation and flora, is relatively consistent between the two premises. Noting this, the Delegated Officer has made reference to	

DECISION TABLE			
Licence section	**Condition number**	**Justification (including risk description & decision methodology where relevant)**	**Reference documents**
		Report 1429 and studies undertaken for Cloudbreak Mine relating to the use of saline water for dust suppression. In *Report 1429*, the EPA acknowledged the potential impacts to vegetation associated with the use of saline water for dust suppression. The EPA also noted that a study was undertaken to characterise the salt balance relating to dust suppression, the pathways by which salt may enter the surrounding environment and the sensitivity of environmental receptors of the salt loading. The Licensee has advised that two studies have been undertaken regarding saline water used for dust suppression. The *Assessment of Salt Movement from Saline Water Dust Suppression Areas – Cloudbreak (Astron 2012)* determined the baseline salt in the landscape. The study found that the natural level of salt present in the landscape is low in areas of mulga vegetation. Worley Parsons investigated the impacts to surface water and found that low rainfall events sufficient to induce small volumes of saline road runoff (but not significant catchment runoff), are likely to pose the greatest risk to sheet-flow dependant on mulga, shallow rooted vegetation or ecological communities associated with creeks (Worley Parsons 2011). In correspondence dated 12 August 2016 regarding the compliance assessment of the Christmas Creek 2015 AER, the Licensee advised that vegetation health monitoring required by approvals issued under Part IV of the EP Act is not indicating any adverse impacts to vegetation as a result of the reuse of water onsite for dust suppression. Further to this, the Licensee advised that where saline or hypersaline water is proposed to be used on site, risk assessments are undertaken to ensure where saline	

DECISION TABLE			
Licence section	**Condition number**	**Justification (including risk description & decision methodology where relevant)**	**Reference documents**
		water is used for dust suppression it is managed so that saline water does not enter vegetation. Specific controls include the preferential use of brackish water for dust suppression, with higher EC water used in active mining pits, roads accessing these mining pits and major haul roads accessed by heavy vehicles. These areas do not have surrounding or adjacent vegetation. Lower EC water is used on other access roads, which are commonly accessed by light vehicles. The Licensee has advised that irrigation spray contact with vegetation is minimised via the presence of windrows on the side of the major haul roads. <u>Risk assessment</u> *Consequence:* Considering the volume of water being used for dust suppression, low level on site impacts and minimal offsite impacts at a local scale to vegetation could occur from the reuse of treated wastewater and use of saline/hypersaline groundwater for dust suppression. Therefore, the consequence is minor. *Likelihood:* Based on the Licensee's controls in place to manage the overspray of saline water on mine access and haul roads and use of treated wastewater in active mining areas, the consequence will not occur in most circumstances. Therefore, the likelihood of the consequence is unlikely. *Risk rating:* Comparison of the consequence and likelihood ratings described above with the risk rating matrix (Table 2) determines the overall rating of risk for treated wastewater and saline groundwater used for dust suppression to be **medium.**	

DECISION TABLE			
Licence section	**Condition number**	**Justification (including risk description & decision methodology where relevant)**	**Reference documents**
		Regulatory controls The Delegated Officer notes that existing condition 3.5.1 requires the monthly monitoring of treated wastewater used for dust suppression from CCY1 and CCY2. Volumetric flow rate, TRH and TDS is monitored, with results reported in the AER. The Delegated Officer notes that vegetation health from salt accumulation is also managed under Part IV of the EP Act; and the Licensee has developed and implements the *Vegetation Health Monitoring and Management Plan* to meet these obligations. Residual risk assessment *Consequence:* Minor *Likelihood:* Unlikely *Risk rating:* Medium	
Ambient quality monitoring	Condition 3.6.1.	Condition 3.6.1 specifies the ambient environmental quality monitoring requirements for the Premises. Ambient groundwater monitoring has been imposed to identify potential impacts to groundwater as a result of the operation of the landfill, TSFs and the reinjection of mine dewater. DWER's assessment and decision making with respect to the operation of the TSFs and landfill is detailed in Appendix A (Premises operation), which includes further discussion regarding the ambient groundwater monitoring requirements. DWER's assessment and decision making with respect to the reinjection of mine dewater is detailed in Appendix C (Point source emissions to groundwater including monitoring), which includes further discussion regarding the ambient groundwater monitoring requirements.	Australian Standard AS/NZS 5667.1. Australian Standard AS/NZS 5667.11. *Chichester Groundwater Quality – Operational Tailings Storage Facilities Review*.
Meteorological monitoring	N/A.	No specified conditions relating to meteorological monitoring are included in this Licence.	N/A.
Improvements	N/A.	No specified conditions relating to improvements are included in this Licence.	N/A.

DECISION TABLE			
Licence section	**Condition number**	**Justification (including risk description & decision methodology where relevant)**	**Reference documents**
Information	Conditions 4.1.1 to 4.1.3. Conditions 4.2.1 and 4.2.2. Condition 4.3.1.	Conditions 4.1.1, 4.1.2 and 4.1.3 have been applied to the Licence and require the appropriate management of records and information, submission of an Annual Audit Compliance Report and implementation of a complaints management system. Conditions 4.2.1 has been applied to the Licence to require the submission of an AER, including the information specified in Table 4.2.1. During this amendment (January 2019) the requirement to submit the TSF annual water balance associated with condition 1.2.4 within the AER has been included to Table 4.2.1. Condition 4.2.2 requires a comparison of results against previous monitoring results and Licence limits. Condition 4.3.1 specifies notification requirements, specifically relating to limit breaches, contingency discharge events and submission of compliance documentation for works approved and constructed under this Licence. During this amendment (January 2019) condition 4.3.1 has been updated to include the requirement to submit a compliance document for the Lefroy Turkey's Nest and saline injection bores.	General provisions of the *Environmental Protection Act 1986.*
Licence Duration	N/A.	Licence L8454/2010/2 expires 23 August 2036.	Notice of Amendment of Licence Expiry Dates, 29 April 2016.

5 Advertisement and consultation table

Date	Event	Comments received/Notes	How comments were taken into consideration
04/01/2019	Licensee provided with draft licence and decision document for comment.	The Licensee provided comment on 8 January 2019 (FMG 2019) requesting that the proposed requirement under Table 4.3.1 to submit bore logs for the 11 saline injection bores, within 30 days of construction be removed as the submission of the bore logs are already managed under the 26D licence to construct or alter a well under Section 26E of the RIWI Act.	DWER has removed the requirement under condition 4.3.1 for Table 2.3.1 for the submission of the bore logs as requested by the Licensee. DWER has updated conditions 1.2.9, 1.2.10 and 4.3.1 to include construction and compliance requirements for the 11 saline injection bores following construction. This notification requirement for the saline injection bores is so that Part V are advised as to when the installation of the bores are completed; that they had been constructed as per the Licensee's commitments; and that they were now ready to be used for injection into the saline borefield.

6 Risk Assessment

Note: This matrix is taken from the Guidance Statement: Risk Assessments.

Table 2: Risk rating matrix

Likelihood	Consequence				
	Slight	Minor	Moderate	Major	Severe
Almost Certain	Medium	High	High	Extreme	Extreme
Likely	Medium	Medium	High	High	Extreme
Possible	Low	Medium	Medium	High	Extreme
Unlikely	Low	Medium	Medium	Medium	High
Rare	Low	Low	Medium	Medium	High

Appendix A

Premises operation

Stormwater management
Emission description
Emission: Potentially contaminated and sediment laden stormwater from operational areas (landfill, bioremediation facility, treated wastewater irrigation areas, works areas (ROM, OPFs, workshops, mobile crushing and screening facilities) and fuel storage areas).

Impact: Contamination of surrounding land and surface water drainage systems. Potential impacts on ecology of surface water from the addition of nutrients, heavy metals and/or hydrocarbons. Increased turbidity and downstream sedimentation impacting aquatic biota and ecosystems.

Stormwater drainage from the Premises flows south to the Fortescue Marsh, a highly conservation significant wetland. The Fortescue Marsh is a listed Priority 1, PEC by the Department of Biodiversity, Conservation and Attractions. This means that the Marsh is currently poorly surveyed and is a Priority 1 (with 1 being the highest priority from 1-4) for biological survey, given the community is ecologically significant and possibly threatened.

The Premises is subject to high seasonal rainfall, particularly during the January – March cyclone season, where significant amounts of stormwater will flow through the ephemeral creeks as channel flow and overland as sheet flow, resulting in inundation of the Marsh. During periods of lower rainfall, runoff migrates towards the Marsh via the ephemeral creeks.

The vegetation most likely to be affected by contaminated stormwater is the Samphire species, which relies on surface water flows in the Marsh. Secondary impacts to bird and other fauna species that utilise the Marsh may result.

Controls: A drainage swale at OPF1 captures surface flow before intercepting the OPF. From the swale, captured stormwater is diverted to a settling pond prior to discharge.

All major fuel storages (CCY1, CCY2, heavy vehicle workshop and the bulk diesel fuel facility) are concrete bunded according to the requirements of AS1940:2004 *'The storage and handling of flammable and combustible liquids'*. Satellite fuel facilities are earthen bunded with HDPE lining to isolate potential spills from stormwater. Of the 7 satellite fuel facilities, 3 (Mokare, Flinders and Windich) have HDPE lined sumps to collect any potentially contaminated stormwater. The heavy vehicle and light vehicle wash bays have ramps and containment bunds installed at the entry and exit to ensure that wash-down water is directed back into the facilities for treatment.

Diversion channels and embankment bunds have been constructed to divert surface water away from the landfill facility. Chemicals and hydrocarbons are stored in lined bunds. These measures will help to prevent stormwater contamination occurring at the landfill.

No infrastructure is located in the ephemeral creeks and design and location of new infrastructure aims to mitigate impacts to sheet flow. Internal design procedures require a risk assessment to be completed to demonstrate that the location minimises impacts to vegetation, sheet flow, and that creeks are conserved.

The EPA identified hydrological processes/inland waters environmental quality as key environmental factors during their assessment of the Christmas Creek Expansion Project (Report 1567). The EPA did not recommend any separate conditions relating to hydrological processes (surface water) during operations, however condition 7-3 of MS 1033 requires the management plan required under

condition 5-1 to address impacts on conservation significant flora and vegetation health including from, but not limited to, changes to groundwater levels and groundwater quality, changes to surface flows, dust and weeds.

The Delegated Officer notes that condition 7-4 of MS 1033 requires the Licensee to continue to implement the *Surface Water Management Plan* until the Chief Executive Officer (CEO) of the EPA is satisfied that the management plans required under MS 1033 satisfies the requirements of that approval. The objective and scope of the existing *Surface Water Management Plan* is to:

- Identify key environmental activities that have the potential to cause impacts to surface water;
- Identify potential impacts to surface water caused by contamination, excessive erosion and downstream sedimentation resulting from activities on the premises and direct and indirect impacts on flora, fauna and vegetation during all stages of Chichester Metals operations;
- Provide guidance to facilitate robust and consistent use and design of drainage infrastructure; Provide guidance for site specific monitoring and reporting of water quality, flow and drainage infrastructure; and
- Describe the management actions that when implemented, will minimise environmental impacts on surface water.

The *Surface Water Management Plan* identifies vegetation clearing, ground disturbance, construction of infrastructure, open pit mining, ore processing, stockpiling and waste rock dumps and waste disposal as the key activities which have the potential to impact on surface water flow regimes and water quality across the operations. It documents a number of key management actions for surface water management for the key activities, including but not limited to:

- Minimisation of clearing and vegetation disturbance;
- Conducting a risk assessment to determine the likelihood of a change to the surface water regime that may lead to unacceptable environmental impacts;
- Locate, design, construct and operate drainage infrastructure to design specifications that reflect risk assessment outcomes;
- Bunding of iron ore stockpiles designed to minimise impact to surface water flow volume, flow regimes and turbidity;
- Use erosion minimisation strategies, such as sediment basins, bunding and vegetated batters to control surface water sediment and water quality from ore stockpiles;
- Management of chemicals and hydrocarbons in accordance with the *Chemical and Hydrocarbon Management Plan*;
- Provide hydrocarbon and chemical spill control training and equipment to appropriate staff and contractors; and
- Keep clean and potentially contaminated stormwater separate, managing contaminated stormwater prior to release to the environment.

Risk Assessment

Consequence: The Fortescue Marsh is located between 1 to 10 km from the Premises. An impact from discharges of contaminated and/or sediment laden stormwater could result in short term impacts to the Fortescue Marsh; an area of high conservation value. Therefore, the consequence is major.

Likelihood: Based on the Licensee controls (infrastructure located above the 100 ARI flood level, stormwater diversion infrastructure and water treatment systems) an impact to sensitive receptors from the discharge of contaminated and/or sediment laden stormwater will probably not occur in most circumstances. Therefore, the likelihood of the consequence is unlikely.

Risk Rating: Comparison of the consequence and likelihood ratings described above with the risk rating matrix (Table 2) determines the overall rating of risk for discharges of contaminated and/or sediment laden stormwater to the environment to be **medium**.

Regulatory Controls
The Delegated Officer notes that surface water, including stormwater management, is managed by the Licensee in accordance with the *Surface Water Management Plan,* currently implemented under conditions of MS 1033. The new plan required under condition 5-1 of MS 1033 must also address impacts on conservation significant flora and vegetation health from changes to surface flows.

The Delegated Officer has not imposed conditions relating to the management of stormwater as potential impacts are addressed and managed under the Ministerial approvals issued under Part IV of the EP Act.

The Delegated Officer notes the general provisions of the EP Act with respect to the causing of pollution and environmental harm apply, as will the provisions of relevant subsidiary legislation, including the *Environmental Protection (Unauthorised Discharges) Regulations 2004*.

Residual Risk Assessment
Consequence: Major
Likelihood: Unlikely
Risk Rating: Medium

Bulk and satellite fuel facilities
Emission description
Emission: Seepage of hydrocarbons to soil or groundwater from leaking bulk and satellite fuel facilities. Hydrocarbon spills outside of containment infrastructure during refuelling and fuel transfer activities.

Impact: Contamination of soil and/or groundwater, impacting the health of ecosystems receiving groundwater in the area.

Controls: The bulk fuel facility comprises of self-bunded tanks, located within a concrete bunded hardstand to capture any spills or leaks. The facility is controlled by a Programmable Logic Controller and HMI (human machine interface) which monitor and manage the fuel facility. Fuel unloading facilities are contained within a bunded area with breakaway couplings and dry brake fittings installed at each service vehicle refuelling point. The duty tank for unloading is indicated by a flashing beacon that enables the tanker driver to readily identify which tank is receiving fuel. All tanks and pipelines are located above ground.

Concrete bunding compliant with AS1940:2004 has been constructed at the CCY1 and at the Heavy Vehicle Workshop. A buried HDPE liner covered by earthen bunding is in place at the satellite fuel facilities: Windich, Mokare and Flinders. All tanks are fitted with overflow warning alarms to prevent accidental spillage.

Contaminated runoff at the CCY1 and CCY2 is directed via a sump to an oil/water separator (OWS). Treated oily water from the CCY1 and CCY2 OWSs is directed to a series of treatment ponds. Final treated wastewater is reused onsite for dust suppression.

Management measures in place to reduce hydrocarbon incidents include training personnel in chemical management and spill response. The Licensee has developed the *Chemical and Hydrocarbon Management Plan* to meet the requirements of MS 690 (Anderson Point Port and North-South rail) and MS 707 (East-West Rail and Christmas Creek Mine). The *Chemical and Hydrocarbon Management Plan* identifies potential direct and indirect impacts of chemical and hydrocarbons and develops management measures to minimise potential environmental impacts associated with chemical and hydrocarbons transport, storage, handling and disposal.

Risk Assessment
Consequence: The impact from spills/leaks of hydrocarbons from bulk and satellite storage areas could result in mid-level onsite impacts and low-level offsite impacts at a local scale. Therefore, the consequence is moderate.

Likelihood: Based on the frequent use, size and number of fuel storage facilities at the Premises an environmental impact from spills/leaks from hydrocarbon storage areas could occur at some time. Therefore, the likelihood of the consequence is possible.

Risk Rating: Comparison of the consequence and likelihood ratings described above with the risk rating matrix (Table 2) determines the overall rating of risk for leaks/spills of hydrocarbons to the environment from fuel storage areas to be **medium**.

Regulatory Controls
The Delegated Officer notes that the Licensee has developed and implements the *Chemical and Hydrocarbon Management Plan*, in accordance with MS 707 issued under Part IV of the EP Act. The *Dangerous Goods Safety Act 2004* provides for the safe storage, handling and transport of dangerous goods; and applies to the fuel storage facilities located at the Premises.

The Delegated Officer is not imposing any specified conditions for the management of hydrocarbons, as sufficient regulatory control is currently imposed through approvals issued pursuant to Part IV of the EP Act, as well as the *Dangerous Goods Safety Act 2004*, administered by the Department of Mines, Industry Regulation and Safety.

Fuel storage areas at the Premises will be subject to DWER inspections, during which the management measures in place to minimise potential environmental impacts associated with chemical and hydrocarbons transport, storage, handling and disposal will be considered. The general provisions of the EP Act with respect to the causing of pollution and environmental harm apply, and discharges of hydrocarbons may be subject to the *Environmental Protection (Unauthorised Discharges) Regulations 2004*.

Residual Risk Assessment
Consequence: Moderate
Likelihood: Possible
Risk Rating: Medium

TSFs
Tailings produced from the OPF1 and OPF2 desand plants are currently deposited into the existing Windich TSF, Flinders Strip 12 TSF and/or Flinders IPTSF. Flinders Strip 12 TSF receives tailings from OPF1 and Windich TSF receives tailings from OPF2. Flinders IPTSF is partially constructed and is currently only receiving tailings from OPF1, however on completion of works will also receive tailings from OPF2. Deposition into the Vasse TSF has ceased as the facility has reached its storage capacity.

Tailings delivery pipelines convey tailings from the OPFs to the respective TSF. Spigots located along the TSFs crest walls deposit tailings into the mined out voids. Mobile water pumps, floating suction lines and return water pipelines have been installed on the TSFs to convey supernatant water from the TSFs to turkey's nests at the OPFs for reuse in the OPF process water circuit.

Windich TSF
Tailings deposition initially commenced into mined out pit voids being Windich TSF 1 (mining strips 8 and 9) and Windich TSF 2 (mining strips 10-13). The two facilities were subsequently incorporated into one above ground TSF by constructing an embankment wall along the western and southern

boundaries of the two facilities. The Windich Above-Ground TSF was approved via an amendment to this Licence, issued 7 July 2016. The works are being implemented in two stages:

- Stage 1 – waste rock backfill in the adjacent pit used to raise the embankment wall at the western end of TSF 1 by 7 m to provide capacity for approximately 6 months of tailings production; and
- Stage 2 - further extension of the western embankment wall adjacent to Windich TSF 2 and an additional embankment wall along the southern boundary of TSF 2. Stage 2 will be undertaken in two phases:
    - Phase 1 – raise TSF 2 embankment walls by 6 m utilising mine pit backfill in the downstream Windich mining strips; and
    - Phase 2 – a further raise of the embankment walls by 7 m.

The Windich Above-Ground TSF has capacity for approximately 3 years of tailings production.

Condition 1.2.9 of the Existing Licence has requirements for the construction of the Windich Above-Ground TSF. The Licensee has submitted compliance documentation, confirming the implementation of Stage 1. Further compliance documentation will be required following completion of Stage 2.

Flinders Strip 12 TSF

The Flinders Strip 12 TSF has been used as a satellite IPTSF in the mined out pit void at Flinders Pit Strip 12. Prior to the commencement of tailings deposition, the void was backfilled to above the pre-mining water table. The TSF is bound to the north, west and east by backfill mineral waste. The southern boundary is the pit wall. The Flinders Strip 12 TSF has an estimated capacity of 6.9 Mt and an operational life of 16-17 months.

Flinders IPTSF (below water table tailings storage)

Traditionally, the Licensee has backfilled pits with waste rock to pre-mining groundwater levels (410 m Australian Height Datum (AHD)) and then commenced tailings deposition above the pre-mining groundwater level. The Flinders IPTSF will be completely backfilled with tailings, as opposed to backfilling with waste rock to the pre-mining groundwater level. Essentially, this will result in a portion of the tailings being situated below the water table once mine dewatering in the vicinity ceases and groundwater levels recover. The Flinders mined out pit has been excavated to Relative Level (RL) 374 m Australian Height Datum (AHD) at its lowest point. The pre-mining water table is at 410 mAHD, being approximately 36 m higher than the lowest point of the mined out pit.

The Flinders IPTSF was approved for construction under an amendment to this Licence issued, 28 February 2017.

The Flinders IPTSF will receive tailings produced at both OPF1 and OPF2; providing storage for more than five years of tailings at current rates. Tailings deposition occurs at a rate of approximately 270,000 dry tonnes per month.

Amendment Notice 1 was issued on 28 February 2017, which approved the construction of the Flinders IPTSF. Based on the outcome of the risk assessment undertaken for the operation of the TSF, a limit was imposed under Amendment Notice 1 to restrict tailings deposition to at least two metres below the pre-mining water table; ensuring the TSF would function as an evaporative sink thereby mitigating the risk of groundwater flow through the tailings potentially transporting soluble contaminants to sensitive receptors.

In the amendment application submitted on 9 March 2017, the Licensee requested the tailings deposition limit be removed from the Licence. The Licensee submitted the *Christmas Creek Triennial Groundwater Monitoring Review* report for review in order to determine the extent to which groundwater flow from the pit would have the potential to affect environmental receptors.

16 July 2018 amendment (FMG 2018a, SRK 2017 and FMG 2018b)

The Licensee proposed to combine the Flinders Strip 12 TSF and the Flinders IPTSF into one consolidated landform called the Flinders IPTSF Complex. Figure 4 shows the layout of the two TSFs at the Premises.

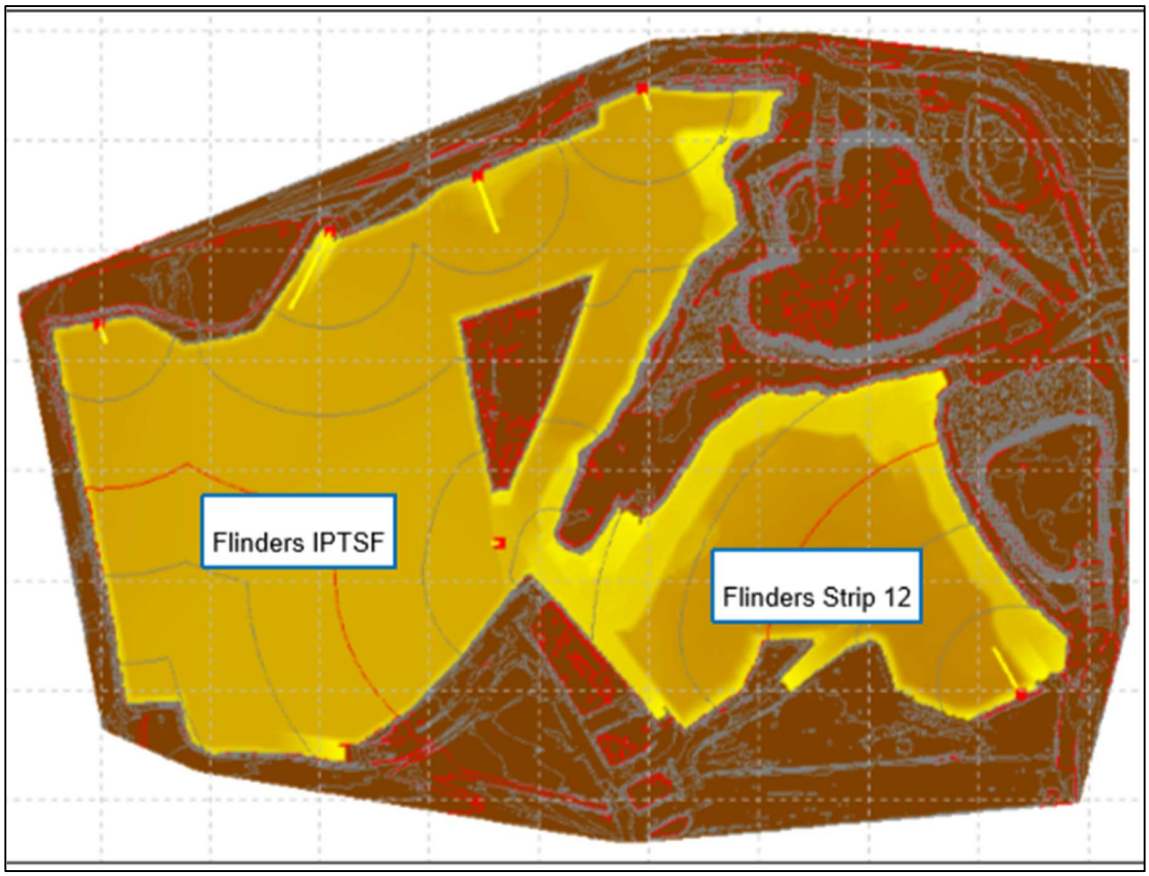

Figure 4: Layout of the Flinders TSFs

The Flinders IPTSF original design specified that the facility was to be filled in two stages; Stage 1 to RL 416 m and Stage 2 to RL 430.5 m. The existing Stage 1 and Stage 2 design limited deposition to within the Flinders IPTSF basin only, with a waste dump extension constructed during the Stage 2 development to stop overflow into the adjacent Flinders Strip 12 TSF basin.

Deposition into Flinders Strip 12 TSF ceased with the switching of deposition to the Flinders IPTSF. The Flinders Strip 12 TSF has remaining storage up to the permitted RL 420 m and also a higher containment elevation (approximately RL 435 m).

The combination of the two facilities involves raising the maximum tailings elevation within the Flinders Strip 12 TSF to allow tailings to flow through the gap connecting the two TSFs.

The landform development is presented at different key stages in Figure 5 (a to f). The Flinders Strip 12 pond is expected to flow into the Flinders IPTSF once the gap between the two pits is overtopped. This is expected to occur between the end of Year 1 and the beginning of Year 2 (SRK 2017). Figure 6 provides the Flinders IPTSF Complex layout.

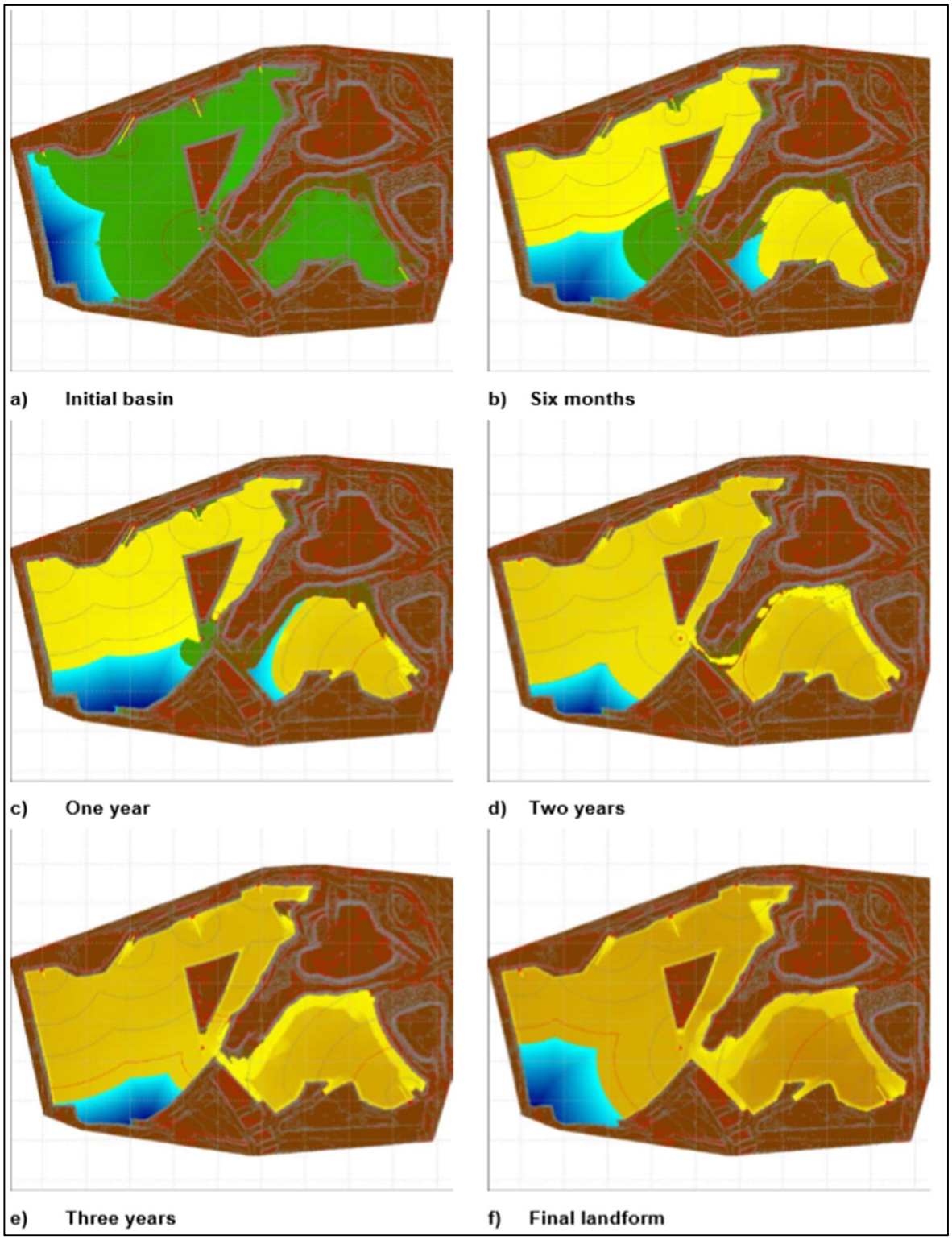

Figure 5: Tailings deposition modelling results

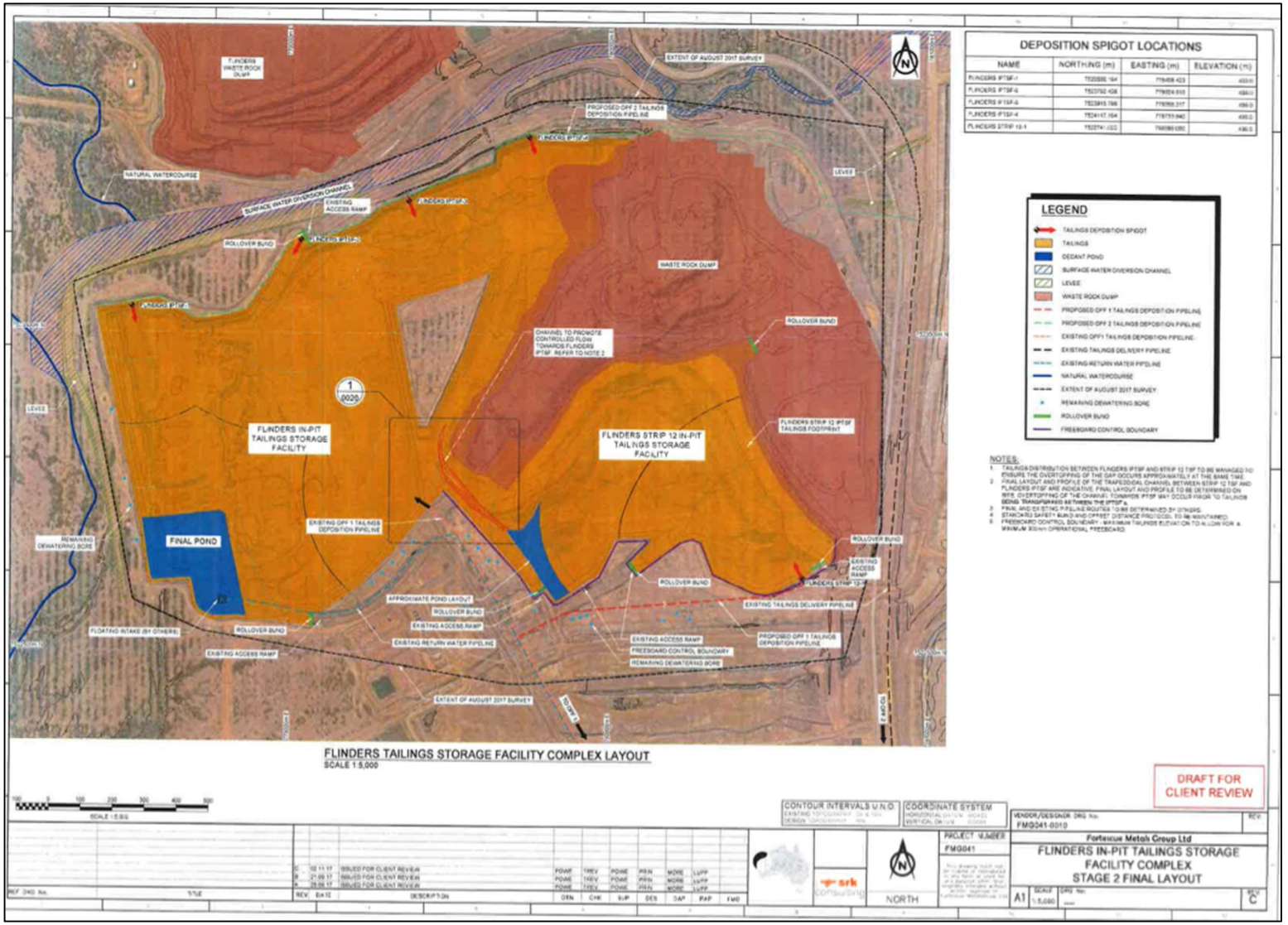

Figure 6: Flinders IPTSF Complex layout

Embankment walls
No embankment walls are required for Flinders Strip 12 TSF to render the TSF suitable for the Flinders IPTSF Complex, though it is necessary to raise the maximum tailings elevation within the Flinders Strip 12 TSF to allow tailings to flow through the gap connecting the two TSFs.

Supernatant collection pond
A supernatant collection pond will be located temporarily on the south-western corner of the Flinders Strip 12 TSF prior to the overflow into the Flinders IPTSF. To manage this overflow an excavated channel from the Flinders Strip 12 TSF to the Flinders IPTSF will be constructed, resulting in a single pond collection point. The supernatant collection pond is included under condition 1.2.9 of the Licence for construction requirements.

Tailings delivery pipeline
The pipework proposed to combine the Flinders Strip 12 TSF and the Flinders IPTSF into the Flinders IPTSF Complex includes the following requirements:

- The OPF1 pipeline will be extended to the south-eastern corner of the Flinders Strip 12 TSF;
- A new spigot located in the south-eastern corner of Flinders Strip 12 TSF and an additional emergency spigot near the south-western corner of the Flinders Strip 12 TSF will be installed;
- Flow meters will be installed near the start and end (or as close to the end of the pipeline as operationally possible) for the deposition pipelines, with appropriate infrastructure installed to alert the OPF control room of a leak or failure; and
- Pressure sensors will be installed along deposition pipelines to detect any loss of pressure or potential obstructions.

The Licensee submitted compliance documentation on 19 July 2018 and 11 October 2018 (*Partial Compliance Document #1 and #2*) to certify that the following had been constructed:

- Additional emergency spigot near the south-western corner of Flinders Strip 12 TSF;
- Pipelines around the crest of the Flinders IPTSF Complex constructed of high density polyethylene piping;
- Four spigots discharge into the Flinders IPTSF Complex from the northern pit crest;
- Flow meter installed at the beginning of the tailings pipeline at OPF 2;
- Flow meter installed in the tailings pipeline at the Flinders IPTSF Complex;
- Telemetry installed on the flow meters to alert the OPF control room of a leak or failure; and
- Pressure sensors installed along the tailing deposition pipeline.

During this amendment (January 2019) condition 1.2.9 has been updated to remove the words shown in strikethrough below for the Flinders IPTSF Complex construction requirements for the Tailings deposition pipeline.

1.2.9 The Licensee shall construct the Windich Above-Ground TSF and Flinders In-Pit TSF Complex in accordance with the documentation and specifications detailed in Table 1.2.6. The Licensee must not depart from the design and construction requirements specified in Table 1.2.6 except:

(a) where such departure is minor in nature and does not materially change or affect the infrastructure; or

(b) where such departure improves the functionality of the infrastructure and does not increase risks to public health, public amenity or the environment;

and all other conditions in this Licence are still satisfied.

Table 1.2.6: Infrastructure to be constructed [1]	
Infrastructure	**Specifications (design and construction)**
Flinders In-Pit TSF Complex as depicted on the map in Schedule 1	
Tailings deposition pipeline	~~• Pipelines around crest of the Flinders Pit constructed of HDPE piping~~ ~~• Four spigots on the northern pit crest~~ ~~• Flow meters installed near the start and end of the deposition pipelines with appropriate infrastructure installed to alert the ore processing facility control room of a leak or failure~~ ~~• Pressure sensors installed along deposition pipelines to detect any loss of pressure or potential obstructions~~ • Extension of OPF 1 pipeline to the south-eastern corner of the Flinders Strip 12 TSF • One spigot located in the south-eastern corner of the Flinders Strip 12 TSF~~, and an additional emergency spigot near the south-western corner of Flinders Strip 12 TSF~~

Note 1: Where the details and commitments of the documents listed in Condition 1.2.9 are inconsistent with any other condition of this Licence, the conditions of this Licence shall prevail.

Risk Assessment

The Flinders Strip 12 TSF and Flinders IPTSF have previously been assessed (FMG 2016a and FMG 2016b). As the Flinders IPTSF Complex is a combination of the two existing TSFs the risk assessment below for normal and abnormal operations in association with the Windich TSF remains largely unchanged.

Normal operation (above and below the water table storage, all facilities)

Emission description

Emission: Tailings produced through the beneficiation of iron ore deposited into the TSFs. Seepage from the TSF into surrounding groundwater. Acidic and/or metalliferous drainage from embankment construction materials and tailings could occur.

The fresh groundwater that rides over the diffuse saline water interface near the Fortescue Marsh discharges to the surface, which is a potential groundwater pathway to transmit chemical constituents into the Fortescue Marsh. It is acknowledged that the water is lost by evaporation so a distinct seepage face will not appear at the surface. Similarly, brine beneath the marsh area is also recirculating and also discharges to the surface near the edge of the marsh, bringing nutrients and other chemical constituents to the surface within the wetland.

While there is a potential pathway to the Fortescue Marsh, the rate of transmission is likely to be very slow due to the low permeability of the sediments that underlie the marsh and the very slow rate of groundwater flow and hypersaline water recirculation.

Impact: Increasing the water table from seepage may impact on local vegetation, if it results in the growth medium becoming water logged. Mulga (*Acacia aneura*) is widespread in the surrounding mine site area and particularly prone to impacts from groundwater mounding. Seepage may impact on groundwater quality by changing the salinity of the aquifer or increasing metals' concentration in underlying soils or groundwater. Impacts to beneficial groundwater uses, including use of groundwater for livestock watering. It is noted that the nearest pastoral bore is located approximately 3 km from the Windich TSF.

Controls: The TSFs have been designed to meet ANCOLD and Department of Mines, Industry Regulation and Safety requirements, with a tailings beach formed to reduce seepage during operations. Supernatant water is recovered from the TSFs and directed to the OPFs for reuse in

processing. Approximately 40% of seepage is expected to occur during the first three months of the TSF operation before the floor has been covered by the tailings in its entirety.

The Licensee has undertaken sampling and analysis of 189 samples of tailings material from the Premises, with results indicating that the tailings have no likelihood of generating acid. The tailings geochemical characterisation assessment indicates there is a low likelihood of leaching of some metals including aluminium, barium, chromium, copper and zinc.
Analysis of tailings supernatant water indicated a high likelihood of cadmium, chromium, mercury and zinc, with a low likelihood of boron, rubidium and uranium occurring in any seepage, at low concentrations.

The Delegated Officer acknowledges that under geochemically reducing conditions; cadmium, zinc, cobalt, mercury, nickel, antimony, selenium and thallium are elements of potential environmental concern that could have elevated concentrations in leachate after a prolonged period of leaching. Solubility is likely to be enhanced under hypersaline conditions due to the formation of highly soluble metal/metalloid chloride complexes. The Delegated Officer understands that the potential leaching of these elements has been tested, with the exception of thallium. Thallium is known to be highly toxic to a range of environmental receptors, including livestock, and is included in the analytical suite monitored in groundwater at the TSFs.

Selenium has been identified in groundwater samples and is elevated in bores directly down gradient of the existing TSFs. It is likely a result of seepage, but does not appear to be considerably mobile and has not been identified in bores further down gradient. Following a review of the *Chichester Groundwater Quality – Operational Tailings Storage Facilities Review*, the Delegated Officer accepts that selenium is unlikely to cause adverse environmental impacts, due to the lack of a substantial groundwater pathway to transmit the contaminant to environmental receptors.

The Licensee has advised that the natural groundwater regime of the region has been significantly altered due to the dewatering and reinjection activities and a cone of depression has been created by mine dewatering which forces groundwater to flow in the opposite direction; back towards the mining area as opposed to towards the Fortescue Marsh. The Delegated Officer notes that a potential groundwater pathway to transmit chemical constituents into the Fortescue Marsh exists, although it is severely interrupted by the current mine dewatering operations and the rate of transmission is likely to be limited, whilst operations continue.

Following a review of the *Christmas Creek Triennial Groundwater Monitoring Review*, the Delegated Officer acknowledges that it is unlikely that any contamination from the mine site in the shallow aquifer would have a significant impact on environmental receptors in the Fortescue Marsh due to the generally clayey nature of sediments in this aquifer, the long travel times and the lack of direct hydraulic interconnection between this aquifer and the surface water flow system in the marshes. Similarly, it is likely that there is negligible discharge of groundwater from the underlying deeper aquifers into the Fortescue Marsh because upward leakage of groundwater would be impeded by the presence of a significant clayey aquitard that overlies the Oakover Formation.

With respect to the operation of the Flinders IPTSF (below and above water table deposition of tailings), SRK Consulting undertook a groundwater impact assessment, which reports that the impacts to groundwater from backfilling with tailings are indistinguishable from the current method of tailings disposal, whereby pits are backfilled with waste rock prior to the commencement of tailings deposition.

The Licensee's hydraulic model provided with the application for the Flinders IPTSF (FMG 2016b) assumed that the blast damaged rock within the pit wall would provide a pervious layer and divert groundwater flow around the tailings mass, thereby decreasing groundwater flow through the tailings

and potential transport of soluble contaminants to sensitive receptors. In the partial compliance documentation submitted on 1 March 2017 (FMG 2017a), the Licensee confirmed that the pit walls are at least four orders of magnitude more permeable than the tailings material. The Delegated Officers notes that this should assist in groundwater being channelled around the tailings, as opposed to through it.

Groundwater is expected to continue to flow towards the Flinders pit after mine closure due to the effects of evaporation. Therefore, it is considered that there would be negligible risk of soluble contaminants within the Flinders IPTSF causing offsite environmental impacts from groundwater discharge. It is also considered that the risks of offsite impacts would not change significantly if tailings deposition were to take place at a higher elevation than 2 m below the pre-mining water table elevation.

As iron-ore tailings contain no sulfide minerals, it is often assumed that these materials will produce leachate that is environmentally benign. However, this is not necessarily the case because of chemical reactions that can take place on the surfaces of many iron oxide mineral particles, particularly when these surfaces are relatively fresh having been subject to crushing associated with mining processes. Many iron oxide minerals have a large specific surface area and are capable of adsorbing a wide range of metals, metalloids and inorganic anions under a range of pH and oxidation-reduction conditions. If these conditions change through processes such as through the deposition of tailings sub-aerially from materials excavated from below the water table (or vice versa), some adsorbed chemical constituents can be released into leachate from tailings materials, potentially causing adverse impacts on groundwater or soil pore-water quality, even under near-neutral pH conditions (Wong and Tam, 1977; Wilken, 2012).

A potential source of chemical constituents that have the potential to cause groundwater contamination near iron-ore waste rock dumps and TSFs are residues of explosives that are used in mining, particularly nitrate and ammonium ions (Morin and Hutt, 2009) and, to a lesser extent, perchlorates (Bailey et al., 2012). At some sites, perchlorate concentrations in groundwater from explosives residues have the potential to reach levels that are unsuitable for livestock water supplies. Therefore this chemical constituent should generally be included in analytical suites for groundwater monitoring near iron-ore waste rock dumps and TSFs in the Pilbara region.

Risk Assessment

Consequence: The findings of the TSF groundwater review conducted at the Premises demonstrates there is not a substantial groundwater pathway to transmit contaminants to environmental receptors, so low level onsite impacts and minimal offsite impacts at a local scale will occur from TSF seepage. Therefore the consequence is minor.

The Delegated Officer notes that the salinity and pH of supernatant water is similar to background water quality; and that it will be removed as required to encourage the consolidation of tailings to minimise seepage. It is also noted that studies conducted by the Licensee have demonstrated a low risk of generation of acidic and/or metalliferous drainage from the embankment construction materials and tailings.

In regards to residues of explosives that are used in mining, the Delegated Officer notes that the Licensee has stated (FMG 2018f) the following:

- That they have never used explosives at the Premises that contain Perchlorate, therefore there is no source of this substance as a result of Fortescue activities. Since 2013, blasting activities at the Premises have been undertaken by Orica who use emulsion products including Fortan, Fortis and ANFO. The Safety Data Sheets show that Perchlorates are not used in these products and Orica does not use any packaged explosives or additives containing Perchlorate;

- Between 2009 and 2013 Downer Blasting Services (DBS) were contracted to undertake blasting activities at the Premises. DBS used emulsion products manufactured from the HEAT Emulsion Series and ANFO; and
- Both Orica and DBS have confirmed via correspondence that no perchlorate containing substances have ever been present in any of their products used at Fortescue sites.

Likelihood: An environmental impact due to TSF seepage will probably not occur in most circumstances. Therefore, the likelihood of the consequence is unlikely.

Risk Rating: Comparison of the consequence and likelihood ratings described above with the risk rating matrix (Table 2) determines the overall rating of risk for TSF seepage to the environment to be **medium**.

Regulatory Controls
The Delegated Officer has imposed ambient groundwater monitoring requirements through condition 3.6.1, to ensure that changes to groundwater quality and levels as a result of seepage from the TSF are identified. The Licensee is required to report monitoring results annually as part of the AER, required under reporting condition 4.2.1.

During this amendment (January 2019) the requirement to monitor for alkalinity, nitrate and ammonia has been added to condition 3.6.1 for the Flinders IPTSF Complex.

Residual Risk Assessment
Consequence: Minor
Likelihood: Unlikely
Risk Rating: Medium

Abnormal operation/emergency situation
Emission description
Emission: Overtopping of the TSFs, rupture of the tailings and return water pipelines, releasing tailings or return water into the surrounding environment.

Impact: Deterioration of surface water, soil and groundwater quality. A spill of tailings may impact on surrounding vegetation, dependant on location and volume of waste discharged.

Controls: TSFs are designed to accommodate rainfall from a 1 in 100 year ARI, 72-hour duration storm event, in addition to the normal operating freeboard of 0.5 m.
Removal of supernatant water is carried out as required. Regular visual inspections of tailings pipelines and TSFs to monitor freeboard.
The Licensee has committed to the monitoring of embankments for stability including freeboard.

Risk Assessment
Consequence: Based on the geochemical characterisation of the tailings/return water and location of infrastructure in already disturbed areas an environmental impact from discharge of tailings or return water could result in low level onsite impacts and minimal off site impacts at a local scale. Therefore, the consequence is minor.

Likelihood: Based on the location of the TSF infrastructure an environmental impact due to tailings and return water discharges will probably not occur in most circumstances. Therefore, the likelihood of the consequence is unlikely.

Risk Rating: Comparison of the consequence and likelihood ratings described above with the risk rating matrix (Table 2) determines the overall rating of risk for tailings and return water discharging to the environment to be **medium**.

Regulatory Controls
The Delegated Officer has applied condition 1.2.1 to ensure systems are in place to monitor and isolate pipelines transferring tailings and return water. Conditions 1.2.2 and 1.2.3 specify the Licensee's controls with respect to maintaining adequate freeboard on the TSFs and conducting daily visual integrity inspections of tailings pipelines, water return lines and the TSFs embankment freeboard. Condition 1.2.4 requires annual water balances to be undertaken for the TSFs, which is reported as part of the AER under condition 4.2.1.

Residual Risk Assessment
Consequence: Minor
Likelihood: Rare
Risk Rating: Low

Saline water pipelines
Emission description
Groundwater abstracted to facilitate mining below the water table is transferred to the bore reinjection system via a network of pipelines, which are raised or buried at regular intervals to allow the flow of surface water and aid in the movement of fauna.

Emission: Spill of saline water from above ground pipelines.

Impact: A spill of saline water may impact on conservation significant Mulga vegetation health dependant on location.

Controls: All water conveyance infrastructure is inspected daily by maintenance personnel, checking for water leaks, controls and condition of containment dams.

The Licensee has undertaken improvements to the saline conveyance infrastructure at the Premises to improve the management of the potential risks associated with the uncontrolled release of saline water to the environment. The Licensee has identified environmentally sensitive areas (Figure 7) where telemetry infrastructure has been installed on existing water pipelines, with the aim of improving the detection of uncontrolled releases to accelerate the Licensee's response, thereby minimising environmental impacts.

Flow meters and pressure gauges are located at key locations on transfer pipelines, approximately every 1 km, to allow the Licensee to undertake water balance calculations and identify if there are any losses from the system. A notification message (SMS) is sent when the flow meters detect any unplanned reduction in flow so corrective management actions can be implemented. If leaks are detected, the location is isolated and repaired. Flow meters on all bores are tested for accuracy and calibrated by in-situ validation, twice a year or as per manufacturer specifications.
Valves are regularly installed along bulk lines to allow for isolation of sections should damage occur, or for maintenance activities.

On 31 December 2015, the Licensee submitted the *Saline Water Infrastructure Environmental Improvement Assessment* which identified environmentally sensitive areas containing Mulga (*Acacia aneura*) or Phreatophytic (*Eucalyptus camaldulensis* and *Eucalyptus victrix*) dominated vegetation units in areas that are not scheduled for mining or other ground disturbing activities within the current five year mine plan.

A leak detection system has been implemented at the Premises using telemetry infrastructure on the pipelines in the environmentally sensitive areas potentially at risk of being impacted by unplanned discharges of saline/hypersaline water. The method for leak identification is via automated Volume Flow Balance (VFB) analysis using data based algorithms and rules. The *Chichester Saline Water Leak Detection System Summary of Commissioned Works* states "*This solution provides for a combination of optimal leak detection capabilities with practical engineering incorporation into existing operations and will facilitate a basis for effective response in the event of a detected leak*".

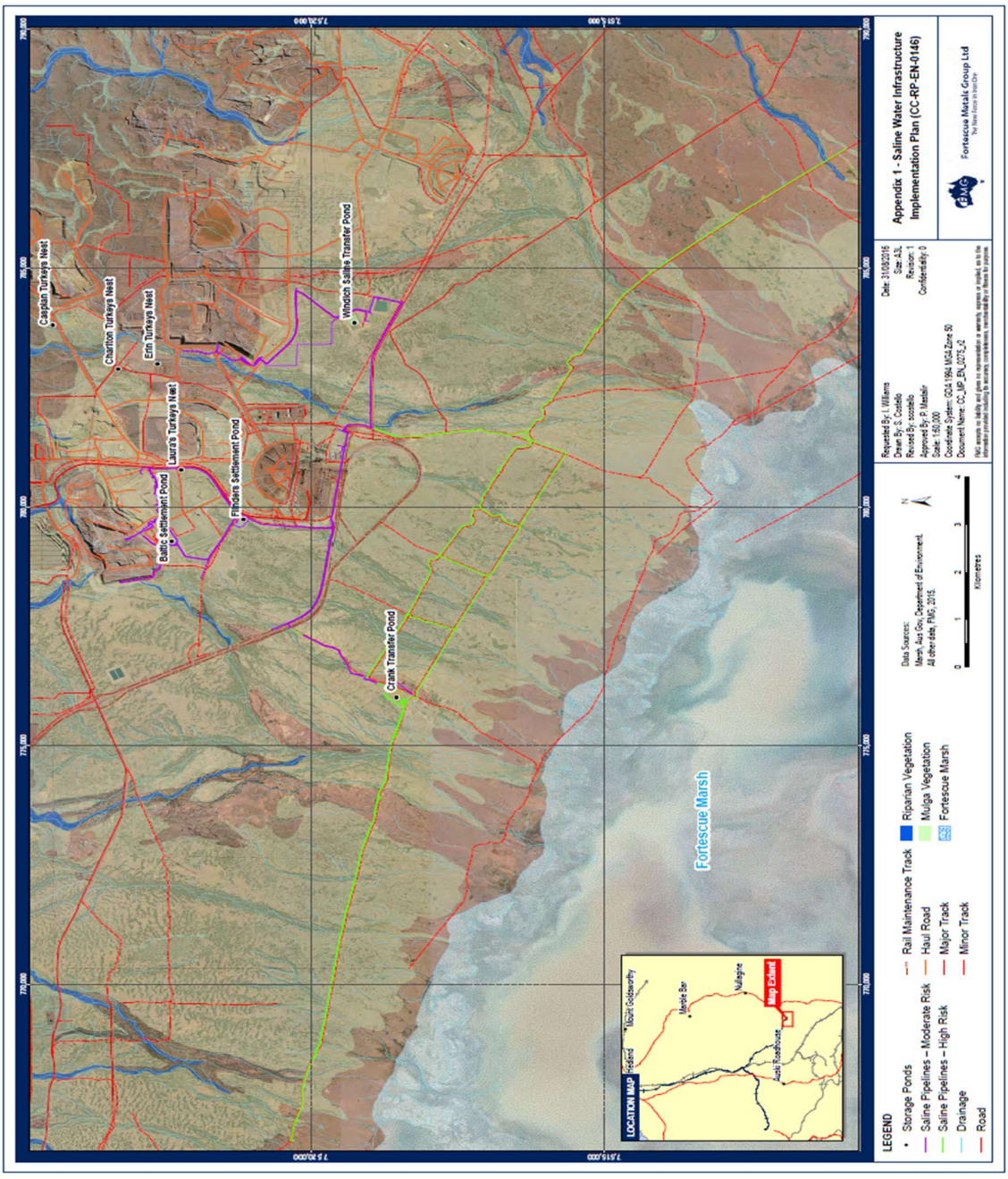

Figure 7: Map of environmentally sensitive areas

Risk Assessment
Consequence: Based on previous incidents involving unplanned discharges of saline water at the Licensee's neighbouring Cloudbreak Iron Ore Mine and that significant volumes of saline/hypersaline water is conveyed across the Premises (43 GLpa). Discharges of saline/hypersaline water could result in midlevel onsite impacts to Mulga and/or Phreatophytic vegetation exposed. Therefore, the consequence is moderate.

Likelihood: Based on the Licensee's controls (daily visual inspections and telemetry system on pipelines in environmentally sensitive areas) and previous incidents on similar premises an impact to vegetation from the discharge of saline/hypersaline water could occur at some time. Therefore, the likelihood of the consequence is possible.

Risk Rating: Comparison of the consequence and likelihood ratings described above with the risk rating matrix (Table 2) determines the overall rating of risk for discharges of saline water from pipelines during operation to be **medium**.

Regulatory Controls
To ensure that pipeline leaks, ruptures and/or spills are identified and responded to quickly, condition 1.2.3 requires daily visual inspections of saline water infrastructure, including saline pipelines, consistent with the Licensee's existing controls.

Residual Risk Assessment
Consequence: Moderate
Likelihood: Unlikely
Risk Rating: Medium

Transfer and settlement ponds
Groundwater abstracted to facilitate mining below the water table is transferred to the bore re-injection system via a network of pipelines. The saline re-injection infrastructure consists of a complicated network of numerous paths and nodes including bores, pipelines, pumps, and transfer ponds. Saline water is pumped from saline transfer ponds via the saline re-injection pipeline network and headers which facilitate its transfer to saline re-injection bores.

During this amendment (January 2019) the Licensee is proposing to construct the Lefroy Turkey's Nest and associated pipework. The Lefroy Turkey's Nest will contain saline water and pipework will connect the turkey's nest to the dewatering network and to the existing conveyance pipeline corridors.

Emission description
Emission: Spill of saline water from overtopping of transfer and settlement ponds.

Impact: A spill of saline water may impact on vegetation health dependant on location.

Controls: Leak detection is undertaken via regular visual inspections of pipework, ponds and fittings. Information collected on the saline transfer ponds, via telemetry includes water level, distance to overflow and water level trends. This information is displayed as live data, displayed remotely and SMS messages are sent for any breaches in pre-set levels. There is also the ability to control pumps remotely. A 200 mm vertical freeboard is maintained on all transfer and settlement ponds.

Risk Assessment
Consequence: The environmental impact from discharges of saline/hypersaline water from ponds to the environment could result in low level onsite impacts. Therefore, the consequence is minor.

Likelihood: Based on the Licensee's controls (daily visual inspections and telemetry systems) an impact to vegetation from the discharge of saline/hypersaline water from the overtopping of saline ponds will not occur in most circumstances. Therefore, the likelihood of the consequence is unlikely.

Risk Rating: Comparison of the consequence and likelihood ratings described above with the risk rating matrix (Table 2) determines the overall rating of risk for discharges of saline water from the overtopping of saline ponds during operation to be **medium**.

Regulatory Controls
The Delegated Officer has given regard to the Licensee's controls and considers that daily visual inspections and the use of telemetry infrastructure lower the likelihood of an environmental impact occurring.

Condition 1.2.2 specifies waste containment infrastructure utilised at the Premises, including the saline water ponds, and the requirements to be maintained on this infrastructure to ensure a sufficient level of environmental protection is achieved, including the maintenance of a minimum vertical freeboard to prevent overtopping and a HDPE liner.

During this amendment (January 2019) the following changes have been made to the licence conditions:

- Lefroy Turkey's Nest has been added to condition 1.2.2;
- The Licensee's controls for the construction of the Lefroy Turkey's Nest and associated pipeworks have been conditioned through condition 1.2.9 and were derived from the Licensee's obligations within FMG 2018c; and
- Condition 1.2.10 has been updated to allow the operation of the Lefroy Turkey's Nest following submission of a compliance document required under condition 4.3.1.

Residual Risk Assessment
Consequence: Minor
Likelihood: Rare
Risk Rating: Low

Landfill
The Christmas Creek putrescible landfill is a trench type facility which accepts up to 5,000 tonnes per annum of waste. The maximum dimensions of each trench is 30 m in length, 5 m in width and 4 m in depth and are excavated to a maximum depth of 3 m below ground level (bgl). Only one trench is open and used at a time. Approximately 230 trenches will be accommodated at capacity. The maximum tipping area open at any time will be no greater than 30 m in length and 2 m above ground in height. The tipping area is enclosed with a stock proof fence.

The Licensee also disposes of used tyres, pipelines concrete and untreated wood in mining pits and waste rock dumps.
In aggregate, up to 10,000 tonnes per annum of waste is disposed of to the putrescible and inert landfills.

Emission description
The Licensee operates a landfill for disposal of up to 10,000 tonnes of putrescible and inert waste per annum. Inert materials (tyres, disused pipelines and concrete) and untreated wood is disposed of in mining pits and waste rock dumps.

Emission: Potential leachate generation from inert and putrescible landfills.

Impact: Contamination of soil and groundwater, impacts to ecosystems receiving groundwater discharge from the addition of hydrocarbons, nutrients and heavy metals. Impacts to pastoral groundwater uses in the area.

Controls: Depth to groundwater at the putrescible landfill is 25 mbgl (pre-mining level) and generally flows in a southerly direction towards the Fortescue Marsh, located approximately 4 km from the landfill. There is no potable drinking water supply bores located down gradient of the landfill. The nearest pastoral bore to the putrescible landfill is 22 Mile bore; located approximately 9 km from the landfill.

Site controls on the types of waste deposited to landfill and restrictions on access (the landfill is fenced) are in place; and management of the landfill requires weekly coverage of landfill trenches with at least 300 mm of inert material. No clinical or asbestos waste is disposed of to the putrescible landfill and chemical and hydrocarbons are stored in lined bunds and/or mobile spill pallets, and removed from site by a licensed contractor for disposal at an appropriately licensing facility.

Diversion channels and embankment bunds have been constructed to divert surface water away from the landfill facility. Groundwater in the area of the landfill is subject to drawdown from the mine dewatering activities being conducted to access the ore bodies, and hence the depth to groundwater is increased and the impact of leachate mitigated. A groundwater monitoring bore has been established adjacent to the putrescible landfill to monitor standing water level on a biannual basis. Monitoring results since May 2016 show the bore being dry, indicating that the aquifer has been depleted in the landfill area due to dewatering in the adjacent mining pits.

Risk Assessment
Consequence: The environmental impact associated with landfill leachate could result in midlevel onsite impacts and low level offsite impacts at a local scale. Therefore, the consequence is moderate.

Likelihood: Based on the depth to groundwater (25 m), surface water management (diversion channels and embankment bunds) and distance to the closest water course (80 m) an impact to groundwater and aquatic ecosystems could occur at some time. Therefore, the likelihood of the consequence is possible.

Risk Rating: Comparison of the consequence and likelihood ratings described above with the risk rating matrix (Table 2) determines the overall rating of risk for leachate from the landfill during operation to be **medium**.

Regulatory Controls
The Delegated Officer has specified waste management requirements under condition 1.2.5 and landfill cover requirements under condition 1.2.6. These conditions ensure appropriate waste acceptance and management is implemented on site, consistent with the assessed design capacity of the landfill.

The Licensee has advised (FMG 2017c) that the groundwater monitoring bore adjacent to the landfill is dry. The Delegated Officer accepts that this is an indication that the aquifer in the vicinity of the landfill has been depleted as a result of dewatering activities in the adjacent mine pit. Therefore, the Delegated Officer has not imposed groundwater monitoring requirements at this stage. However following the cessation of mine dewatering in the vicinity of the landfill and the recovery of the groundwater levels, an assessment will be required to determine if further regulatory controls (e.g. groundwater monitoring) is required.

Residual Risk Assessment
Consequence: Moderate

Likelihood: Unlikely
Risk Rating: Medium

Bioremediation facility
Emission description
Emission: Runoff from the bioremediation treatment cells containing elevated concentrations of hydrocarbons and heavy metals.

Impact: Contamination of soil, surface water and groundwater in the area, impacts to fauna and ecosystem disruption. Potential impacts to the Fortescue Marsh, which receives groundwater and surface water from the project area.

Controls: The facility consists of three pads approximately 25 m in length and width and lined with HDPE liner to act as a barrier to underlying soil and groundwater. It is anticipated that only one pad will be used during the life of the facility. The depth to groundwater is approximately 20 to 25 m below the facility (maximum wet season level). The site is located on flat terrain and at least 100 m from any water course. It is predicted that the facility will process approximately 750 tonnes of contaminated soil per year.

The contaminants in the soil to be remediated are hydrocarbons, primarily diesel, hydraulic oil and engine oil. Sampling and analysis is conducted once the soil has reached the final cell in the bioremediation pad. The quality of the end use soil will meet with the Health Investigation Levels for Total Petroleum Hydrocarbons for commercial and industrial premises. It is then to be used in the rehabilitation of backfill mined pits.

Stormwater is managed with the use of earthen bunding to divert stormwater discharges away from bioremediation areas.

The bioremediation pad in use is monitored weekly to ensure it is being managed appropriately. The pad is sprayed with water weekly, tilled/turned monthly and chemically treated quarterly, or as required. A Bioremediation Log Book is maintained which records the date, volume, origin and known or likely contaminant material.

With respect to the reuse of bioremediation soils, the Licensee will need to ensure that the Soil Ecological Screening Levels and Health Screening Levels outlined in *Assessment of Site Contamination NEPM* are met; and will also need to develop site-specific Ecological Investigation Levels that protect groundwater quality and aquatic ecosystems from potential soil leachate in accordance with Appendix B of Schedule B5b of the *Assessment of Site Contamination NEPM*. The Delegated Officer notes the Licensee's responsibility under the *Contaminated Sites Act 2003* to report known or suspected contaminated sites to DWER.

Risk Assessment
Consequence: Based on the distance to the nearest drainage line (at least 100 m) and depth to groundwater (approximately 25 mbgl) contaminated runoff will result in minimal onsite impacts. Therefore, the consequence is slight.

Likelihood: Based on the cell design, incorporating HDPE liner and earthen bunding to divert stormwater, an impact to groundwater and aquatic ecosystems will probably not occur in most circumstances. Therefore, the likelihood of the consequence is unlikely.

Risk Rating: Comparison of the consequence and likelihood ratings described above with the risk rating matrix (Table 2) determines the overall rating of risk for leachate from the landfill during operation to be **low**.

Regulatory Controls
The Delegated Officer notes the general provisions of the EP Act, with respect to the causing of pollution and environmental harm apply, as will the provisions of relevant subsidiary legislation, including the *Environmental Protection (Unauthorised Discharges) Regulations 2004*.

The Delegated Officer notes that the provisions of the *Contaminated Sites Act 2003* also apply.

Residual Risk Assessment
Consequence: Slight
Likelihood: Unlikely
Risk Rating: Low

Appendix B

Point source emissions to air including monitoring

Point source emissions to air are generated from the Christmas Creek power station which comprises a series of 27 x 2 MW Cummins QSK78-G9 diesel fired generators. The installation of these gensets occurred in two stages and was subject to two works approvals:

- W4643/2010/1 – first stage installation of 14 diesel gensets; and
- W5001/2011/1 - installation of additional 13 diesel gensets.

Each 2 MW unit has an exhaust duct, which emits to air. Key emissions are products of diesel combustion: particulates (PM), carbon monoxide (CO), sulphur dioxide (SO_x) and oxides of nitrogen (NO_x). The Licensee has modelled the potential effects on air quality from emissions to air using TAPM and Ausplume which are accepted by DWER as suitable models.

The Licensee supplied design criteria for the Cummins 2 MW diesel gensets as follows in Table 3:

Table 3: Point source emission rates for Cummins QSK78-G9 generator

Emission Type	Modelled Emissions (mg/Nm^3)
NO_x	3,252
SO_x	47
CO	4,049
Hydrocarbons	472

The results of modelling of the power station is presented in the Table 4 below and represent the maximum ground level concentrations predicted by the dispersion modelling at Marillana Station, as compared to the *Ambient Air NEPM*.

Table 4: Ambient concentrations of air pollutants compared to the Ambient Air NEPM

Emission Type	Averaging period	Maximum at receptor ($\mu g/m^3$)	Ambient Air NEPM criteria ($\mu g/m^3$)	Percentage of guideline
NO_x	1 hour	145	247	59%
	Annual	5.6	62	9%
SO_x	1 hour	8.0	572	1.4%
	24 hours	1.8	229	0.8%
CO	8 hours	1,101	11,254	9.8%
PM_{10}	24 hours	38	50	75%
$PM_{2.5}$	24 hours	27	25	107%

Emission description

Emission: Combustion gases (CO, NOx, SOx, BTEX) and particulates from diesel generators (normal operation).

Impact: Reduced local air quality at the nearest sensitive receptors. Emissions modelling demonstrated the emission may cause a breach of the *Ambient Air NEPM* standards for $PM_{2.5}$ at the Marillana homestead (41 km from the premises) for one 24 hour period per annum. However, this modelling was conservative, as the modelled condition assumed all gensets are operating at full load under adverse meteorological conditions.

Controls: The nearest sensitive land uses include Roy Hill Station and Marillana Homestead, located 30 km and 41 km respectively from the Christmas Creek power station.

Despite modelling indicating a potential exceedance of $PM_{2.5}$ at Marillana Homestead, the likelihood of this exceedance occurring is expected to be minimal as modelling of ambient air emissions have been based on conservative emission estimates. The Licensee indicated that the estimated emissions are based on a worst case scenario of all generators operating simultaneously. The Delegated Officer accepts that all of the turbines will not be operated at any one time and therefore $PM_{2.5}$ emissions will most likely be less than those predicted.

Additionally, $PM_{2.5}$ concentrations modelled were based on manufacturer specifications which combine PM_{10} and $PM_{2.5}$. It is estimated that the actual $PM_{2.5}$ emissions are 80% of that modelled resulting in an overestimation by 20%. The Delegated Officer notes that given this conservative modelling it is anticipated that the emissions from the expanded power will be within the Ambient Air NEPM guidelines.

Risk Assessment
Consequence: The nearest human receptors are Roy Hill Station and Marillana Homestead, located approximately 30 km and 41 km respectively from the Premises. The Delegated Officer considers this a sufficient buffer, and there will be minimal impacts to the health and amenity of this receptor. Therefore, the consequence is slight.

Likelihood: An impact to sensitive receptors would only occur in exceptional circumstances. Abatement and maintenance procedures are in place. With respect to the modelled ambient $PM_{2.5}$ concentrations at Marillana Station, the Delegated Officer notes that modelling was conservative and actual concentrations are likely to be 20% less than those modelled. Therefore, the likelihood of the consequence is rare.

Risk Rating: Comparison of the consequence and likelihood ratings described above with the risk rating matrix (Table 2) determines the overall rating of risk for air emissions during operation to be **low**.

Regulatory Controls
The Delegated Officer has specified the point source air emission locations under condition 2.1.1. The risk associated with point source air emissions has been assessed as low, therefore no further regulatory controls are being applied to the Licence.

The Licensee will be required to report air emissions to DWER annually through the annual fee application process. The Licensee will be required to include the air emission calculations as part of the annual fee submission, based on an appropriate emission estimation technique, for example monitoring data, National Pollution Inventory guides or emission factors.

Residual Risk Assessment
Consequence: Slight
Likelihood: Rare
Risk Rating: Low

Appendix C

Point source emissions to surface water including monitoring

Emission description
Emission: In the event that it is not able to be managed through reuse, bore reinjection or in pit disposal or temporary storage, excess mine dewater may be discharged via 4 discharge points to ephemeral creeks, draining south towards the Fortescue Marsh.

Impact: Impacts to the riparian vegetation communities in the ephemeral creeks.

Discharges of excess mine dewater has the potential to impact on the natural surface flow regime of the Fortescue Marsh, impact on vegetation (in particular Samphire) and habitat for species of national significance.

The Fortescue Marsh is the largest ephemeral wetland in the Pilbara and is of high conservation value with species of national significance and is part of a complex array of alluvial aquifers and groundwater systems. The Marsh has been divided into six zones with two each of high environmental significance, medium environmental significance and low environmental significance. Zone 1a, of high environmental significance, is located on the northern side of the Marsh, closest to the contingency discharge points.

Controls: The Licensee has developed the *Dewatering Contingency Discharge Procedure* (CH-PR-RN-00003_Rev4, FMG, December 2014) to ensure that the contingency discharge of groundwater is appropriately managed at the Premises.

Dewatering discharge at designated discharge points is only undertaken as a contingency measure, where levels of Electrical Conductivity (EC) in the water to be discharge is less than 15,000 micro Siemens per centimetre (µS/cm) and where turbidity level in the water to be discharged is less than 100 nephelometric turbidity units (NTU). Water quality is monitored prior to, during and at the cessation of discharge.

Risk Assessment
Consequence: Based on the Licensee's controls which include discharge limits for EC and turbidity; low level onsite impacts and minimal offsite impacts at a local scale could occur from the contingency discharge of mine dewater. Therefore, the consequence is minor.

Likelihood: The impact to sensitive receptors will not occur in most circumstances, as the contingency discharge is used infrequently, only in the event that reuse, reinjection, in pit disposal and temporary storage are not available or been exhausted. Therefore, the likelihood of the consequence is unlikely.

Risk Rating: Comparison of the consequence and likelihood ratings described above with the risk rating matrix (Table 2) determines the overall rating of risk for the contingency discharge of mine dewater to creek lines to be **medium**.

Regulatory Controls
Condition 2.2.1 specifies the four emissions points from which the contingency discharge of mine dewater may occur in the event that reuse, reinjection, in pit disposal and temporary storage are not available or have been exhausted.

Condition 3.2.1 specifies the monitoring requirements for surface water emissions and limits for EC and NTU, consistent with the Licensee's controls specified in the *Dewatering Contingency Discharge Procedure* (CH-PR-RN-00003_Rev4, FMG, December 2014), which were considered by the Delegated Officer in assessing the consequence of the contingency discharge. The Licensee will also be required to monitor the cumulative volume of discharge during contingency discharge events.

Condition 4.3.1 requires the Licensee to report to DWER following a contingency discharge, including the results of the monitoring undertaken during the event.

Residual Risk
Consequence: Minor
Likelihood: Unlikely
Risk Rating: Medium

Appendix D

Point source emissions to groundwater including monitoring

The Delegated Officer notes that impacts to conservation significant vegetation and subterranean fauna (stygofauna and troglofauna) from changes in groundwater levels and quality as a result of reinjecting mine dewater have been assessed by the EPA under Part IV of the EP Act. Conditions have been imposed on MS 1033 to address the potential impacts to vegetation and subterranean fauna associated with the reinjection of mine dewater.

Conservation significant vegetation
Condition 5-1 has been imposed on MS 1033 and requires the development of an Outcome-based Condition Environmental Management Plan to demonstrate that the environmental outcomes specified in condition 7-1 will be met. The environmental outcomes specified under condition 7-1 of MS 1033 relates to maintaining the health of Mulga, Samphire and Coolibah/River Red Gum vegetation; and conservation significant flora within the Christmas Creek Mine Development Envelope. Condition 7-3 requires the Outcome-based Condition Management Plan to address impacts on conservation significant flora and vegetation health including from, but not limited to changes to groundwater levels and groundwater quality, changes to surface flows, dust and weeds. MS 1033 requires the Outcome-based Condition Environmental Management Plan to specify; threshold criteria to demonstrate compliance with the environmental outcomes, trigger criteria that provide an early warning that the threshold criteria may not be met, monitoring, trigger level actions and threshold contingency actions.

The Delegated Officer notes that under condition 7-4 of MS 1033, the Licensee is required to continue to implement the management plans required under MS 871 for the CCWMS until the CEO of the EPA has confirmed that the Outcome-based Condition Environmental Management Plan satisfies the requirements of MS 1033. These plans include the *Vegetation Health Monitoring and Management Plan* (CC0PL-EN-0004), the *Significant Flora and Vegetation Management Plan* (45-PL-EN-0017), the *Fortescue Marshes Management Plan* (45-PL-EN-0009) and the *Surface Water Management Plan* (100-PL-EN-1015).

Subterranean fauna
Condition 9-1 of MS 1033 requires the Licensee to manage the implementation of the proposal to minimise impacts to subterranean fauna species that have been identified through baseline surveys to have potentially restricted distributions or potentially restricted habitat. Under MS 1033, the Licensee is required to undertake further targeted surveys for the proposed expansion. A management-based Condition Environmental Management Plan for potentially restricted subterranean fauna will need to be developed and implemented if surveys indicate that one or more subterranean fauna species has a restricted distribution and/or a restricted habitat.

The Delegated Officer has considered the Part IV of the EP Act approvals issued for Christmas Creek, and with respect to the reinjection of mine dewater has restricted DWER's assessment to potential environmental impacts to changes to groundwater quality, and subsequent impacts to beneficial use of groundwater. The potential environmental impacts to vegetation and subterranean fauna associated with mounding and changes to groundwater quality as a result of reinjection of mine dewater have been addressed under conditions of MS 1033, issued under Part IV of the EP Act.

Emission description

Emission: Groundwater is abstracted from dewatering borefields to enable below water table mining. Water is used for dust suppression, ore processing, earthworks and construction. Excess groundwater abstracted from the dewatering operation is reinjected into suitable aquifers.

Groundwater injection is undertaken with brackish water in areas west of the active mining area and typically targets the Marra Mamba Formation. There is currently no active brackish injection occurring at Cloudbreak.

Saline injection is undertaken between the southern limit of the resource area and the northern limit of the Fortescue Marsh. The Oakover Formation is the target aquifer of the injection. It has a salinity which is typically between 30,000 mg/L and 150,000 mg/L. At each injection location there is generally a flow meter and a down-hole water level sensor. The down-hole and flow sensors are complemented by regular visual inspections of the pipework and fittings and manual recordings of meter readings.

Impact: Changes in groundwater quality as a result of the discharge of higher salinity water into fresh water zones of the aquifer. Impacts to other groundwater users in the area (pastoral bores). Saline water injected into areas with fresh or brackish water quality (less than 6,000 mg/L TDS) has the potential to increase salinity. Salinity above 6,000 mg/L TDS could limit the potential use of the water for stock watering and other beneficial uses.

Controls: The Licensee monitors groundwater levels and field EC monthly at pastoral bores to ensure the water resource is being maintained.

Groundwater abstraction at the Premises is currently regulated pursuant to the RIWI Act. The *Christmas Creek Groundwater Operating Strategy*, prepared as a condition of the 5C licence, outlines the planned operation of dewatering, injection and process water supply systems at the Premises and the management systems that will be employed to monitor and mitigate potential impacts.

Monthly monitoring of the standing water level and EC in pastoral bores is undertaken by the Licensee, in accordance with the *Christmas Creek Groundwater Operating Strategy*. Data is reported quarterly in accordance with conditions of the 5C licence.

The Licensee has implemented an extensive monitoring bore network to measure impacts of groundwater dewatering, reinjection and borefield operations on water resources, the environment and other users. Ambient groundwater monitoring is undertaken twice yearly from a number of locations across the brackish and saline injection areas.

The Delegated Officer also notes that mine dewater is reinjected to compatible aquifers, minimising the likelihood of there being significant impacts to groundwater quality.

Risk Assessment

Consequence: Mid-level onsite impacts and low level offsite impacts at a local scale could occur to sensitive receptors from changes to groundwater quality as a result of reinjection of mine dewater. Therefore, the consequence is moderate.

Likelihood: The impact to sensitive receptors could occur at some time. Therefore, the likelihood of the consequence is possible.

Risk Rating: Comparison of the consequence and likelihood ratings described above with the risk rating matrix (Table 2) determines the overall rating of risk for the reinjection of mine dewater to be **medium**.

Regulatory Controls
Condition 2.3.1 specifies the groundwater emission points, comprising of reinjection bores located in the saline and brackish injection zones.

This amendment – January 2019
The Licensee is proposing to install and operate 11 new saline injection bores in the saline injection borefield at the Premises (FMG 2018d). The bores will be drilled into the Oakover aquifer and approval has been obtained under the RIWI Act. There will be no change to the category 6 capacity limit of 43 GLpa (injected) from the construction and operation of these bores.

During this amendment (January 2019) the following conditions have been updated:

- Condition 1.2.9 to include the construction requirements for the 11 saline injection bores;
- Condition 1.2.10 to allow the operation of the saline injection bores following submission of a compliance document required under condition 4.3.1; and
- Condition 2.3.1 to include the 11 proposed bores.

This amendment – January 2019
Condition 3.3.1 specifies three points along the water conveyance infrastructure from which reinjection water is monitored, one location for the sampling of brackish water and two locations for the sampling of saline water.

The Licensee has requested (FMG 2018c) that the two monitoring points (CCSP0024 and CCSP0015) that are used for the monitoring of point source emissions to groundwater for the Saline Injection Borefield be renamed to accurately describe the monitoring point locations.

CCSP0024 is set up on the outflow line out of the Windich Transfer Pond; and CCSP0015 is set up on the outflow line out of the Crank Transfer Pond. Saline water is reinjected from the Windich and Crank Transfer Ponds intermittently throughout the year due to operational practices. Sampling of the water being injected from these ponds takes place from the monitoring points situated on the active injection lines only, when injection is occurring.

Condition 3.3.1 has been updated to specify the outflow line associated with the two saline monitoring points; and chlorine has been changed to chloride under condition 3.6.1 for the mine dewater reinjection (FMG 2018e).

Condition 3.6.1 includes ambient groundwater monitoring requirements to identify potential impacts to groundwater quality and levels as a result of the reinjection of mine dewater. The monitoring of pastoral bores has not been included as the monthly monitoring of standing water levels and EC is undertaken by the Licensee in accordance with the approved *Christmas Creek Groundwater Operating Strategy*.

Under condition 4.2.1, the Licensee is required to report the results of monitoring to DWER in the AER for review.

Comprehensive regulation of impacts to vegetation is provided for under Part IV of the EP Act, therefore the Delegated Officer considers no further regulation under Part V of the EP Act is required.

Residual Risk Assessment
Consequence: Moderate
Likelihood: Possible
Risk Rating: Medium

Appendix E

Emissions to land including monitoring

Construction Camp WWTP
The process for treating wastewater at the Construction Camp involves an activated sludge WWTP (Stornaway) designed to treat wastewater for a maximum of 500 people.

Raw wastewater is pumped from the pump station to an in-ground bar screen which removes inorganic material from the wastewater and disposes it to the waste bin. The wastewater is then transferred to the balance tank which allows the inflow of wastewater to be controlled, preventing the facility from experiencing load shocks during peak use periods. From the balance tank, wastewater is discharged into the anoxic tanks which are continuously mixed by the anoxic mixer. The wastewater is then gravity fed to the aeration tanks, each with two blowers and associated valves and piping that deliver process air to the aeration tanks. Liquor is fed from the aeration tank into the inlet of the clarifier where solids are provided sufficient time to settle out, before passing through a settling tube and being gravity fed to the final effluent tank.

A sequencing batch reactor (SBR) WWTP (Tristar) also operates at the Construction Camp and utilises the same balance tank, irrigation tank, anaerobic digester, polymer storage tank, geotubes and polyvinyl chloride (PVC) lined bund to contain the geotubes as the activated sludge WWTP. Screened wastewater is stored in the balance tanks which feeds wastewater to both facilities. Wastewater fed into the Tri-Star SBR facility is deposited into the SBR tank for processing. The biological treatment process of oxidation, nitrification, de-nitrification, sedimentation and aerobic sludge digestion takes place at the SBR tank.

Treated effluent from both WWTPs is directed to the 200,000 L irrigation tank prior to being disposed of through a surface irrigation system. The irrigation area is located approximately 11.5 km south of the treatment facility and construction camp, and covers an area of approximately 15 ha.

This amendment – January 2019
The Licensee is proposing (FMG 2018c) to dispose of RO reject water to the final tank at the existing Construction Camp WWTP (refer to Figure 8) where it will be mixed with wastewater effluent prior to disposal via irrigation at the existing Construction Camp Irrigation Area.

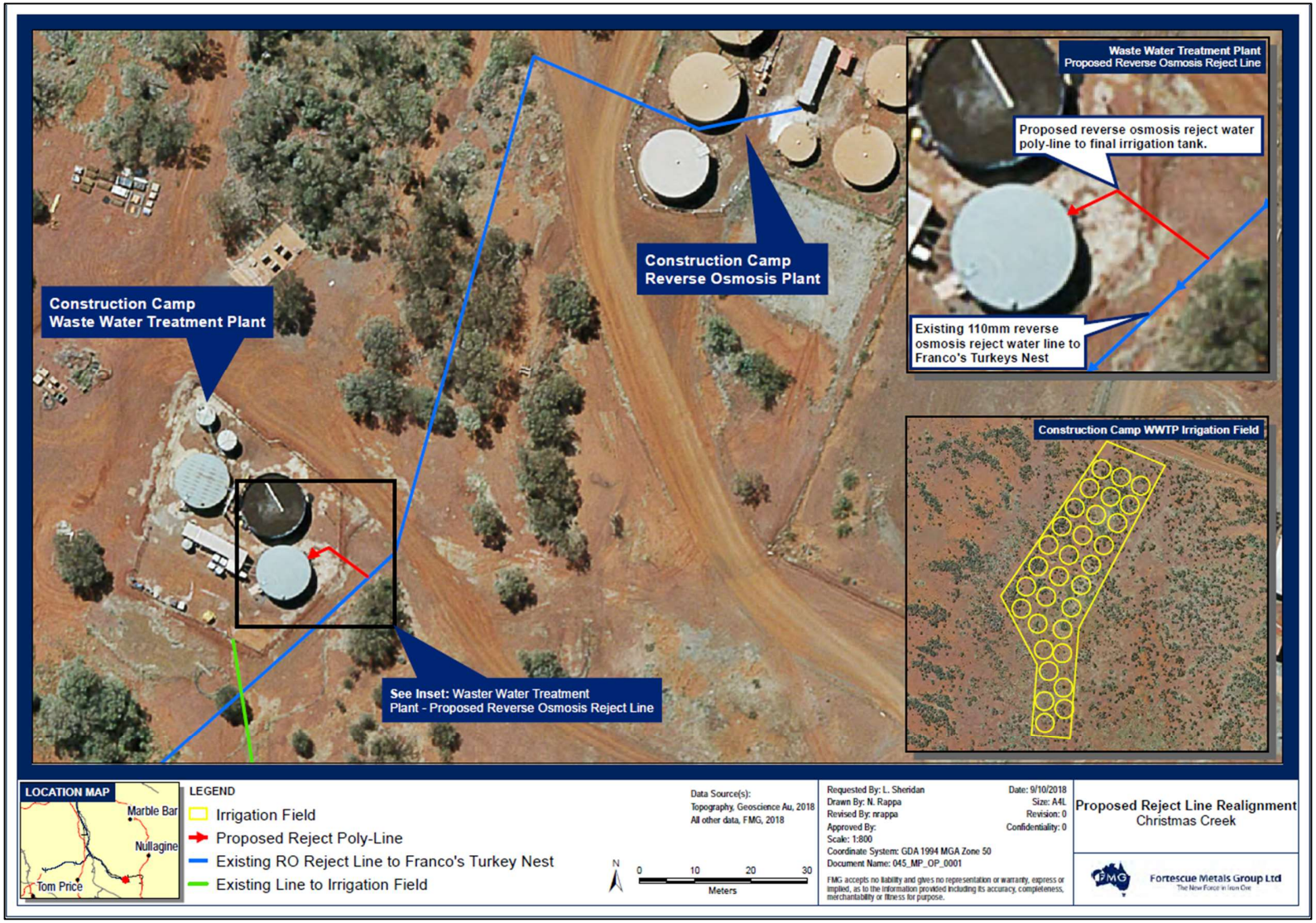

Figure 8: Proposed RO reject line to Construction Camp WWTP

A sample of the RO reject water was taken on 30 July 2018 with the results shown in Table 5.

Table 5: RO reject water sample results

Parameter	Unit	Result
E.Coli	cfu/100 mL	<1
pH	pH units	7.69
Biochemical Oxygen Demand	mg/L	<5
Total Phosphorus	mg/L	3.5
Total Dissolved Solids	mg/L	7,900
Total Suspended Solids	mg/L	<5
Total Nitrogen	mg/L	13

The TDS of the reject water is approximately 7,900 mg/L and the existing effluent output from the WWTP is approximately 850 mg/L TDS. The average daily flow rate of the RO reject water and existing WWTP effluent is 23,429 L (one quarter of the daily flow rate to the irrigation area) and 69,286 L respectively. Therefore, the Licensee has stated that the average TDS of the final combined effluent to the Construction Camp Irrigation Area is approximately 3,341 mg/L (FMG 2018c).

Karntama Camp WWTP

The process for treating wastewater at the Christmas Creek Operations Camp involves a membrane bioreactor (MBR), designed to treat wastewater for a maximum of 1,600 people. Following treatment of the wastewater, treated effluent is to be stored in tanks prior to being disposed of to the irrigation area.

The *2017 AER* states that no WWTP effluent is used for dust suppression. The irrigation area is located approximately 600 m south of the treatment facility and operations camp, and covers an area of approximately 13 ha.

Reject water from the Karntama Camp RO plant is discharged to the Karntama Camp WWTP irrigation area, accounting for 40% of the irrigated wastewater.

Emission description

Emission: Treated effluent and RO reject water from the Construction Camp and Karntama Camp WWTPs discharged to land via irrigation to designated irrigation areas.

Impact: Effluent discharged to land via irrigation has the potential to result in degraded or waterlogged land, with soil or groundwater contamination arising where the effluent is either saline, turbid, nutrient enriched, and/or contaminated with metals. Secondary impacts to vegetation may also result from effluent discharge that is of poor quality or in quantities such that offsite impacts may occur.

Controls: Depth to groundwater is greater than 10 m and the nearest drainage line is located approximately 55 m from the Karntama Camp WWTP irrigation area and 215 m from the Construction Camp WWTP irrigation area.

Pooling of irrigated treated wastewater and surface runoff is unlikely due to vegetation uptake and the high evaporation rate experienced in the region (approximately 3 m per year).

Intermittent discharge of effluent to the irrigation areas occurs to prevent potential ponding and run-off. The irrigation areas have been sized appropriately to ensure acceptable nutrient loading rates are achieved. The irrigation areas are fully fenced and signed to restrict personnel from entering the areas and prevent unauthorised access. The fence is a minimum of 5 m from the sprinkler spray pattern to allow for spray drift. High level alarms have been incorporated into the WWTPs to alert

staff of potential overflows; and automatic shutoff shut off valves are a feature of the SBR facility at the Construction Camp to prevent overspill.

With respect to the inspection, maintenance and monitoring associated with the WWTPs, the Licensee has advised that:

- Weekly inspections and maintenance of the WWTPs and associated infrastructure is undertaken;
- Weekly monitoring and recording of effluent volume and pH is conducted; and
- Monthly monitoring of the treated wastewater quality is undertaken, including biochemical oxygen demand, total suspended solids, total nitrogen, total phosphorus, TDS and coliforms.

The Delegated Officer also notes that a licensed contractor carries out inspections and full services of the WWTPs on a quarterly basis as required by the Department of Health.

The *2017 AER* states that the design specifications for nitrogen at the Karntama Camp WWTP were less than10 mg/L however monitoring conducted during commissioning indicates that the plant will meet on average 33.5 mg/L which is in line with the *Australian Guidelines for Sewage Systems – Effluent Management*. This can be attributable to final effluent being mixed with "RO reject water" (which contains values of 20-30 mg/L NO_3) prior to sample point at the Karntama Camp WWTP. Onsite testing of final effluent is undertaken with Nitrate (NO_3) levels in line with plant specification, with values ranging between 10-14 mg/L recorded monthly.

Risk Assessment

Consequence: Based on the siting of the WWTPs and irrigation areas, the high evaporation rates experienced in the Pilbara region, depth to groundwater and local hydrology (surface and groundwater flows towards the Fortescue Marsh); low level onsite impacts and minimal offsite impacts at a local scale could occur as a result of the irrigation of treated wastewater or tank overflow. Therefore, the consequence is minor.

Likelihood: Based on the Licensee's controls (frequent inspections, appropriately sized irrigation areas) an environmental impact will not occur in most circumstances. Therefore, the likelihood of the consequence is unlikely.

Risk Rating: Comparison of the consequence and likelihood ratings described above with the risk rating matrix (Table 2) determines the overall rating of risk for discharges to land to be **medium**.

Regulatory Controls

Condition 2.4.1 is imposed to specify the emission points to land. During this amendment (January 2019) Table 2.4.1 has been updated to include RO reject water as a source associated with L2 – Construction Camp irrigation area.

The Delegated Officer has imposed condition 3.4.1, requiring the Licensee to monitor water quality on a quarterly basis. Limits for wastewater quality have not been included, however the Licensee will be required to report the quarterly monitoring results in the AER and provide an interpretation of results against the WWTP design specifications.

During this amendment (January 2019) footnote "Note 2" has been removed from Table 3.4.1. The Licensee will be required to monitor TDS quarterly for both WWTPs (Karntama and Construction Camp).

The general provisions of the EP Act with respect to the causing of pollution and environmental harm will apply, as will the provisions of relevant subsidiary legislation, including the *Environmental Protection (Unauthorised Discharges) Regulations 2004*.

Residual Risk Assessment
Consequence: Minor
Likelihood: Unlikely
Risk Rating: Medium

Appendix F

Fugitive emissions

Fugitive dust emissions

Emission description

Emission: There is the potential for dust to be generated from mining related activities such as crushing and screening, stockpiling, machinery loading, train loading and vehicle movement. Dust is also generated during periods of high winds, low rainfall and high evaporation rates. The dust emissions should be relatively inert being predominantly iron ore.

Impact: Human health and amenity impacts. Dust containing particles of less than 10 micrometres in diameter have been associated with diminishing lung function and dust in high volumes does interfere with comfort and amenity for the public.

The Premises is between 1 km to 10 km from the Fortescue Marsh and is partially located within the Northern Flank Management Zone 1a, which is regarded as having high conservation value, and also in Zone 3b which has a low level of conservation significance (Report 1484).

Localised impacts on vegetation from dust deposition can occur due to dust forming a physical barrier, restricting photosynthesis and respiration. Dust can also be abrasive to the leaf surface which may result in decreased productivity and changes to the vegetation structure. Fauna can also be expected to be impacted upon by dust emissions either directly or indirectly as the vegetation is used for habitat or a source of food. Any impact to flora is likely to be reversed during rainfall events during the wet season, thus long term impacts are not likely.

Controls: The closest human receptor is Roy Hill Station located 30 km from the Premises.

At the OPFs, dust is controlled by the use of misting and deluge sprays on ROM hoppers and primary gyrator crusher and grizzly, water sprays on transfer points, dry screens are covered on scrubbers and screens, surge bins and belt feeder and crusher discharge chutes on secondary and tertiary crushers. The moisture content of both ROM and final product is continuously monitored through the use of moisture analysers installed after the primary crusher, prior to the stacker and before the train loader.

The Delegated Officer notes that condition 5-1 of MS 1033 requires the Licensee to develop an Outcome-based Condition Management Plan for Christmas Creek. Condition 7-3 of MS 1033 requires the plan to address impacts on conservation significant flora and vegetation health including from, but not limited to changes to groundwater levels and groundwater quality, changes to surface flows, dust and weeds.

Risk Assessment

Consequence: Based on the distance to the nearest sensitive receptor (approximately 30 km) minimal impacts to the amenity of this receptor will occur. The Delegated Officer has determined that minimal onsite impacts to vegetation will occur. Even in areas most impacted by dust, it is likely that the natural dust tolerance of Pilbara vegetation species will prevent widespread vegetation impacts. Therefore, the consequence is slight.

Likelihood: Based on the Licensee's controls to manage dust adverse impacts to the environment from fugitive dust emissions will not occur in most circumstances. Therefore, the likelihood of the consequence is unlikely.

Risk Rating: Comparison of the consequence and likelihood ratings described above with the risk rating matrix (Table 2) determines the overall rating of risk for fugitive dust emissions to be **low**.

Regulatory Controls
The Delegated Officer is not imposing any specified conditions relating to fugitive dust emissions as the risk has been assessed as low given the location of the Premises relative to the nearest sensitive receptor. Due to the distance to sensitive receptors, the Delegated Officer is satisfied that the general provisions of the EP Act provide sufficient regulatory control for the management of dust.

The Delegated Officer notes that impacts from dust on conservation significant flora and vegetation is addressed under MS 1033.

Residual Risk Assessment
Consequence: Slight
Likelihood: Unlikely
Risk Rating: Low

Fugitive light emissions
Emission description
Emission: Light spillage from operational areas.

Impact: Potential impacts on sensitive fauna species.

Controls: Condition 8-3 of MS 1033 requires the Licensee to continue to implement the *Conservation Significant Fauna Management Plan* (100-PL-EN-0022), until the CEO of the EPA has confirmed in writing that the revised management plan required under MS 1033 meets the environmental objective for fauna management.

The *Conservation Significant Fauna Management Plan* specifies key management actions for conservation significant fauna management, including the directing of lights onto active construction and operational areas to minimise the potential light overspill resulting in fauna disturbance, injuries or death.

Risk Assessment
Consequence: Low level onsite impacts and minimal offsite impacts at a local scale could occur to sensitive fauna. Therefore, the consequence is minor.

Likelihood: The impact to sensitive fauna could occur at some time; the Premises operates 24 hours a day and light spillage from operational areas impacting on fauna during night operations is possible. Therefore, the likelihood of the consequence is possible.

Risk Rating: Comparison of the consequence and likelihood ratings described above with the risk rating matrix (Table 2) determines the overall rating of risk for fugitive light emissions to be **medium**.

Regulatory Controls
The Delegated Officer is not applying specific regulatory controls relating to fugitive light emissions at this time as the *Conservation Significant Fauna Management Plan*, implemented under Part IV of the EP Act includes provisions relating to the protection of sensitive fauna species from light spillage.

Residual Risk Assessment
Consequence: Minor
Likelihood: Possible
Risk Rating: Medium

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3	Annual Environmental Monitoring Report – 2017 (100-RE-EN-9675), FMG, March 2018	2017 AER	DWER records (A1654597)
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5	Application to Amend Licence L8454/2010/2 (UID-77989), FMG, 26 February 2018	FMG 2018a	DWER records (A1624867)
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8	Chichester Groundwater Quality – Operational Tailings Storage Facilities Review (45-SY-EN-0004), FMG, 7 November 2016	Chichester Groundwater Quality – Operational Tailings Storage Facilities Review	DWER records (A1192430)
9	Chichester Saline Water Leak Detection System Summary of Detailed Engineering Works – Chichester Water Management Telemetry and Controls Project (CH-00000-RP-EG-0001, FMG Engineering, 29 September 2017	Chichester Saline Water Leak Detection System Summary of Detailed Engineering Works	DWER records (A1702259)
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15	Cumulative environmental impacts of development in the Pilbara region: Advice of the Environmental Protection Authority to the Minister of the Environment under Section 16(e) of the *Environmental Protection Act 1986*, Environmental Protection Authority, August 2014	Cumulative environmental impacts of development in the Pilbara region	accessed at www.epa.wa.gov.au
16	Environmental and water assessments relating to mining and mining-related activities in the Fortescue Marsh management area: Advice of the Environmental Protection Authority to the Minister of the Environment under Section 16(e) of the *Environmental Protection Act 1986*, Environmental Protection Authority, Report 1484, July 2013	Report 1484	accessed at www.epa.wa.gov.au
17	Flinders In-Pit TSF Stage 2 Design Optimisation report (CC16OP004A-16067-RP-EG-0004), prepared by SRK Consulting (Australasia) Pty Ltd for Fortescue Metals Group Ltd, November 2017	SRK 2017	DWER records (A1624867)
19	FW: Christmas Creek Licence Constructions Conditions – Flinders In-Pit TSF Complex – Partial Compliance Document #1	Partial Compliance Document #2	DWER records A1728538)
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21	Guidance Statement: Environmental Siting, Department of Environment Regulation, November 2016	Guidance Statement: Environmental Siting	

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30	Mine-water leaching of nitrogen species from explosives residues. *Proceedings of GeoHalifax 2009*, Morin, K.A. and Hutt, N.M., 2009. The paper is available from web site http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.520.5390&rep=rep1&type=pdf	Morin and Hutt, 2009	DWER records (A1697300)
31	Ministerial Statement 1033	MS 1033	accessed at www.epa.wa.gov.au
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