Decision Report

Application for Works Approval

Division 3, Part V *Environmental Protection Act 1986*

Works Approval Number	W6159/2018/1
Applicant	Iluka Resources Limited
ACN	008 675 018
File Number	DER2018/001020
Premises	South Capel Mineral Sands Mine & Processing Operations (former) 2833 Bussell Highway CAPEL WA 6271 Legal description – Lot 7 on Diagram 26769, Lot 2039 on Plan 140224 and Lot 3822 on Plan 153828 within Mining tenement M70/63 Lot 73 on Plan 63783 and Lot 100 on Plan 406668 within Mining tenement M70/659
Date of Report	5 November 2019
Status of Report	Final

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1. Definitions of terms and acronyms

In this Decision Report, the terms in Table 1 have the meanings defined.

Table 1: Definitions

Term	Definition
ACN	Australian Company Number
AHD	Australian Height Datum
AMC	AMC Minerals Ltd
Applicant	refers to the applicant, as specified at the front of this Decision Report
Application	refers to the documents and information submitted by the Applicant, as described in section 3.1 and listed in Table 3 of this Decision Report
BGM	Bituminous geomembrane
Category/ Categories	Categories of Prescribed Premises as set out in Schedule 1 of the EP Regulations
CS Act	*Contaminated Sites Act 2003*
Decision Report	refers to this document
Delegated Officer	an officer under section 20 of the EP Act
Department	means the department established under section 35 of the *Public Sector Management Act 1994* and designated as responsible for the administration of Part V, Division 3 of the EP Act
DMIRS	Department of Mines, Industry Regulation and Safety
DWER	Department of Water and Environmental Regulation
EP Act	*Environmental Protection Act 1986 (WA)*
EP Regulations	*Environmental Protection Regulations 1987 (WA)*
GL	gigalitre
HRCF	Hutton Road Containment Facility
mbgl	metres below ground level, with 'ground level' referring to the original (undisturbed) ground level at the particular location
Mining Act	*Mining Act 1978 (WA)*
Minister	the Minister responsible for the EP Act and associated regulations
MSP	Mineral Separation Plant
NORM	Naturally Occurring Radioactive Material
PMP	Probable Maximum Precipitation
Prescribed Premises	has the same meaning given to that term under the EP Act
Premises	refers to the premises to which this Decision Report applies, as specified at the front of this Decision Report
Primary Activities	as defined in Schedule 2 of the Works Approval
RAP	Remediation Action Plan
RCWA	Radiological Council of Western Australia
RGC	Rension Goldfields Consolidated Limited
Risk Event	as described in *Guidance Statement: Risk Assessment*
RIWI Act	*Rights in Water and Irrigation Act 1914 (WA)*

2. Purpose and scope of assessment

Iluka Resources Ltd (the Applicant) proposes to undertake site remediation works at the former South Capel Mineral Sands Mine (South Capel). An application for works approval was submitted by the Applicant under Division 3, Part V of the EP Act on 21 June 2018.

This Decision Report sets out the Delegated Officer's assessment of risks arising from emissions and discharges generated by the Prescribed Activities conducted at the Premises.

3. Background

South Capel is a former mineral sands mine located on the southern Swan Coastal Plain, approximately 25 km south of Bunbury. It was used for mining and mineral processing operations of heavy mineral sands between 1956 and 1999.

Early management of mineral sands processing undertaken at the site, including stockpile management, processing controls and tailings disposal, has resulted in contamination of the site and underlying groundwater system. Historic groundwater assessments indicate there are multiple contamination sources and 'hotspots' across the site, and at least one (or a combination of many) contaminant plumes, some of which extend off-site (Iluka, 2014).

3.1 Application details

The Applicant proposes to undertake remediation works at the site as part of its obligations under the *Contaminated Sites Act 2003* (CS Act) and mine closure requirements under the *Mining Act 1978* (Mining Act).

The proposal involves constructing an extension to the existing residue storage facility at the site, in order to relocate identified contaminant sources that are considered to pose an ongoing risk of groundwater contamination at the site. It is also proposed to use this facility to relocate a quantity of similar material from the former Mineral Separation Plant (MSP) site at Capel, as part of remediation works at that site.

In accordance with DWER's regulatory framework the on-site disposal of processing residues, current or historic, into engineered containment facilities is considered to be a component of mineral sands mining or processing – the works will therefore cause the premises to again become Prescribed Premises. Table 2 describes the Prescribed Premises category that the Application is subject, as defined in Schedule 1 of the EP Regulations.

Table 2: Prescribed Premises Categories

Classification of Premises	Description	Premises design capacity (as per Application)
Category 8	Mineral sands mining or processing: premises on which mineral sands ore is mined, screened, separated or otherwise processed.	467,000 tonnes (total)

Table 3 lists the documents submitted for assessment relating to the proposed works.

Table 3: Documents and information submitted for assessment

Document/information description	Author	Date/version
Application form and supporting document	Iluka Resources	June 2018
South Capel Remediation Project – South Capel Site – Works Approval Application supporting document	Iluka Resources	June 2018
Remedial Action Plan – South Capel Remediation Project – Phase 1 Stored Process By-Product, South Capel, Western Australia	Iluka Resources	May 2018

Remedial Action Plan – South Capel Remediation Project – Phase 1 Stored Process By-Product, Capel Dry Plant, Western Australia	Iluka Resources	May 2018
Conceptual Design Review, South Capel Remediation Project (doc ref. LWC C-06-08 FR002)	Land & Water Consulting Wave International	June 2018
South Capel Remediation Project: Conceptual Design Review – Auditor Review	Australian Environmental Auditors	18 June 2018

4. Overview of South Capel

South Capel was one of the first mineral sands mining and processing operations in the south-west of Western Australia (Fetherston & Searston, 2004), with ownership changing several times throughout its 43 years of production.

Western Titanium NL commenced mining and separation at the site in 1956, later to merge in 1976 with AMC Mineral Sands Ltd (AMC). In 1981, AMC was merged with three other companies to become Renison Goldfields Consolidated Limited (RGC). AMC continued to operate under its name until a change to RGC in 1992 (Duncanson, et. al., 1989). In 1998, RGC merged with Westralian Sands Limited, with the new company named 'Iluka Resources Limited' in 1999.

The site operated at a time when environmental constraints were generally minimal (MMA, 1990), and together with the pioneering nature of mineral separation technology and community and government expectations of the day, meant the waste treatment facilities and waste disposal practices were not always as sophisticated as that required by modern-day standards (Brooks & Nicholls, 1996).

4.1 Historic activities

Processing of mineral sands into a variety of products commenced at the site in conjunction with mining. Initially only ilmenite was produced, however improvements in separation technology and market demands over the years enabled production of the higher grade titanium dioxide products leucoxene and synthetic rutile as well as other mineral sands products, such as zircon and the rare earths monazite and xenotime, at times (Brooks & Nicholls, 1996).

The upgrading process of converting ilmenite to the more valuable high titanium dioxide (TiO_2) product, synthetic rutile, was trialed at the site in the early 1960s and after further development, was recommissioned on a fully commercial basis (Iluka, 2014). This process produced a considerable amount of solid waste residues, which during the 1970s to mid-1980s were deposited into mined out voids in the vicinity of the processing plant areas[1] (RGC, 1996). This practice has caused significant, widespread contamination of shallow groundwater beneath the site (URS, 1998; Iluka, 2014), and represents a significant challenge to achieving site closure aims.

4.1.1 Contaminated groundwater recovery

A contaminated groundwater recovery system has been ongoing at the site since 1991 in an attempt to control the long-term spread of contamination. Initially, the program operated in conjunction with the capping of known residue areas, and involves recovery of groundwater

[1] Residue disposal areas were only lined with synthetic liners during later stages of the mining operation (Iluka, 2014).

and treatment (neutralisation), prior to discharge into the adjacent man-made wetland system[2].

A total of 17 recovery bores have been installed over the years – six along the Bussell Highway as an interception curtain to prevent further downstream (and off-site) movement of groundwater, and the remainder located close to known sources of contamination (Peck, 1998).

The groundwater recovery program has not performed as well as assumed in predictive modelling (Peck, 1998). Due to low abstraction yields, reduced efficiencies and other issues, only four recovery bores remain operational (Iluka, 2014). The Applicant expects the removal of the remaining contaminant sources will limit the potential for further contamination and support the improvement of groundwater quality through natural attenuation processes, such that ongoing groundwater recovery will not be required into the medium-to-long term future.

4.1.2 Hutton Road Containment Facility

In 1997, the Applicant constructed a fully-engineered tailings storage facility on the site, known as the 'Hutton Road Containment Facility' (HRCF), in an attempt to re-stow the bulk of the more contaminated material deposited during the early 1970s to mid-1980s. Approximately 260,000 m^3 of material, predominantly from the 'A-Plant Char Dump' and 'Square Dam' areas, was relocated to the lined facility for long term storage. The facility was capped in mid-2000 with a compacted clay layer, a polyethylene geo-membrane and a 0.5 m sand/topsoil layer to assist with drainage.

4.2 Current activities

The site has remained non-operational since production ceased in 1999, with the exception of removal of iron concentrate for export. Former processing infrastructure was demolished in 2003 and the majority of mined out voids have since been rehabilitated.

The existing HRCF and the proposed extension area (subject to this Application) was identified as a source site and subsequently classified as *contaminated – remediation required* under the CS Act on 22 June 2017, with nearby affected sites classified as *potentially contaminated – investigation required*. The Applicant has submitted a Remediation Action Plan (RAP) to DWER Contaminated Sites, which outlines the proposed remediation works to achieve the cleanup goals of removing and encapsulating the contamination sources from locations where they are impacting surrounding soil and groundwater.

4.3 Proposed activities

The Applicant has identified process residues located in mined out voids across the site that are believed to be the main source of groundwater contamination, and are the focus of removal. Additional material from the former MSP at Capel will also be removed as part of remediation works at that site.

As part of the Applicant's remediation strategy, it is proposed to:

- Construct an extension to the existing HRCF to contain the legacy process residues, referred to herein as the HRCF Extension;
- Relocate process residues from specified voids and consolidation through placement into the HRCF Extension;
- Relocate similar process residues from the former MSP at Capel into the HRCF Extension;
- Construct an engineered cap comprising a bituminous geomembrane and sand cover; and
- Excavate clean fill from areas within the site and the Capel Mine Northern Extension for the abovementioned sand cover.

[2] The 'Capel Wetlands Centre' comprises a series of lakes, swamplands and sumplands that were created from mine voids in 1985 as part of rehabilitation at South Capel.

4.3.1 HRCF Extension

The HRCF Extension is proposed to be located to the northeast of the existing HRCF (Figure 1). The existing voids within the proposed HRCF Extension footprint will remain in place and will not be removed or relocated to other areas within the new facility. The residues in the voids that will remain in place are greater than 1 m above the known maximum winter groundwater level at the site (Golder Associates, 2017).

Figure 1: Location of the proposed HRCF Extension and existing process residue dams.

The HRCF Extension will contain relocated process residues from the following areas:

- Approximately 406,500 m^3 of uncontained process residues at the South Capel site that are considered an ongoing source of contamination to groundwater and potential future land uses; and
- Approximately 60,000 m^3 of process residues from the former MSP at Capel.

The residues generally consist of acid effluent, neutralised acid effluent, non-magnetic fines, char and iron concentrate. HDPE liners remaining from a small number of the exhumed voids will also be disposed within the HRCF Extension, in addition to minor quantities of associated redundant infrastructure (e.g. concrete channels).

4.3.2 Engineering design

It is proposed that the base of the HRCF Extension will be constructed using on-site sourced materials and excluding a low permeability basal liner. The Applicant considers this to be an acceptable approach given the extensive characterisation of the materials, and the primary leachate mitigation mechanism being the cover system, comprising a low infiltration cap and associated water shedding infrastructure (Figure 2).

Figure 2: Design of the proposed HRCF Extension.

Capping system

The capping system for the remediation works will initially include a low permeability bituminous geomembrane liner, covered with 0.5 m of uncontaminated sand fill. The Applicant estimates there may be around 10 years between implementation of the remediation works and final closure of the facility, with the final cap design to be based on the final post-closure land use.

Seepage water from rainfall infiltration into the 0.5 m sand cover layer will be collected with subsurface drain pipes and will discharge along the toe of the facility. The pipe outlets will be covered with small rock/coarse gravel materials. Berms will be placed on the upper surface of the facility to manage erosion and prevent surface water from flowing directly over the batter slopes, by draining to the centre. After construction, the surface will be covered with grass to reduce erosion. This will be removed prior to the construction of the store-and-release cover.

Liner system

The purpose of the remediation cover layer is to prevent infiltration of surface water, thereby preventing mobilisation of contaminants into groundwater beneath the facility. A bituminous geomembrane (BGM) liner system will be used, due to ease of installation and a lower risk of puncture/liner defects (compared to conventional HDPE liner systems).

A BGM is a geomembrane manufactured by impregnating a polyester geotextile with an elastomeric bitumen compound. A BGM cover has been selected above HDPE or other liners as it has high UV resistance, very low hydraulic conductivity (6 x 10^{-14} m/s), high puncture resistance and a lower coefficient of thermal expansion compared to other geomembranes.

Seepage

According to Wave (2018), the estimated seepage rate from the proposed HRCF Extension range between 2,500 m^3/d to less than 1 m^3/d (see section 6.1).

Slope stability

The side slopes of the facility are designed to be between 9° and 14°, with low confining pressures (10 – 34 kN/m^2). The interface between the residues, BGM and capping material (silty sand) therefore has sufficient frictional resistance and the capping layer is not expected to form a weak sliding plane.

Surface water management

A diversion channel is proposed to divert surface water runoff from the eastern catchment around the proposed HRCF Extension, to eliminate the ponding of water against the facility. The diversion channel is sized for the expected worst case PMP storm with a duration of 15 minutes.

Key findings:

The Delegated Officer notes the following:

1. The HRCF Extension will be constructed without a basal liner, with the proposed cover system the primary mechanism to mitigate the potential for leachate generation;
2. Due to a high water table at the site, low areas (i.e. below 18 mAHD) will be filled with clean material such that deposited residues will be placed at least one metre above the peak known groundwater table. This will minimise the potential interaction between the groundwater and residues; and
3. The proposed full capping system, as illustrated in Figure 3, comprises the following two phases:
   - Phase 1 – remediation capping system:
     - 0.5 m sand layer, overlying a bituminous geomembrane liner (see below); and
   - Phase 2 – closure cover layer (final closure design layer, ± 10 years after remediation):
     - 1.5 m store-and-release system.

4.3.3 Site preparation

Initial site works will include clearing of regrowth vegetation, including separation of any entrained process residues and contaminated soil, and general preparation of the foundation of the HRCF Extension (i.e. backfilling). Vegetation is likely to contain some traces of process residues, which will be dried and burned, with the ash placed within the HRCF Extension.

4.3.4 Process residue placement

Residues will be placed in the HRCF Extension at a minimum of 1 m above the groundwater level considered to be representative of local historical groundwater levels. Areas within the HRCF Extension footprint that do not provide the minimum 1 m will be backfilled to the necessary level with uncontaminated fill prior to placement of the residues.

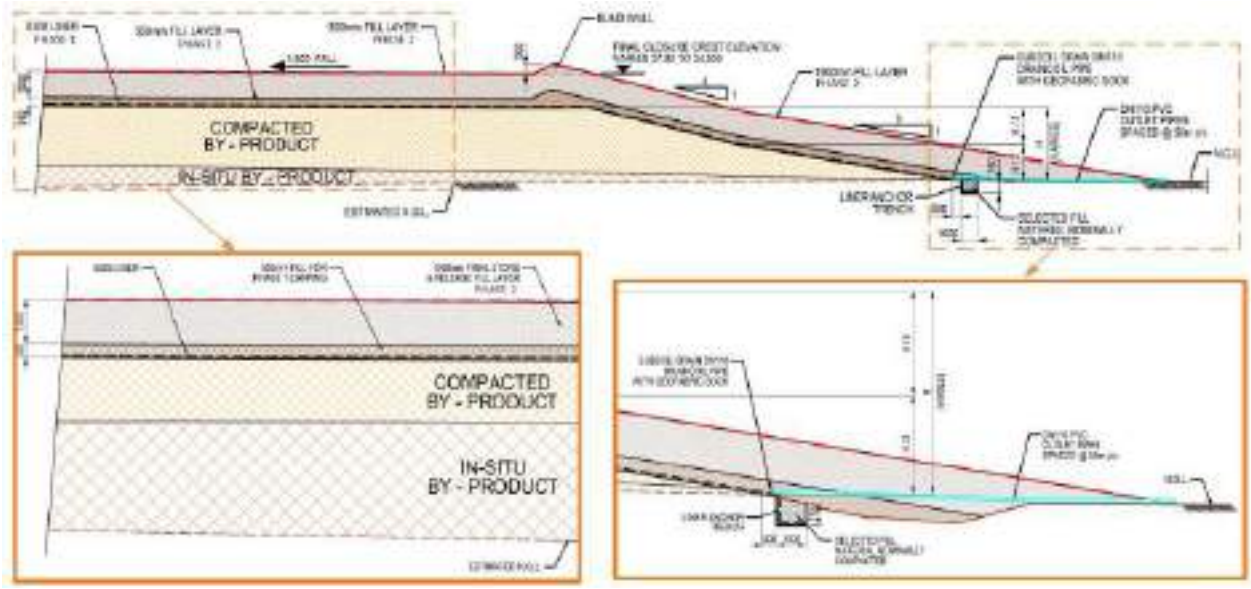

Figure 3: HRCF Extension - typical section.

Existing voids within the HRCF Extension footprint are in excess of 1 m of the groundwater level considered to be representative of local groundwater levels and will remain in situ. Residues will be placed in a manner that will ensure individual product types can be recovered for future beneficial use/sale, and to minimise risks to health and the environment.

4.3.5 Construction

The HRCF Extension will be constructed on already-disturbed land. The hydrology for the proposed engineering design is based on the 1:100, 72 hour Average Recurrence Interval event and probable maximum precipitation falling on the catchment of the facilities and the external (upstream) catchment located to the east.

The surface of the HRCF Extension will be graded to promote surface runoff, and to prevent ponding and infiltration.

4.3.6 Capping

Deposited wastes will be capped with a bituminous geomembrane covered with 0.5 m of uncontaminated sand fill. Approximately 60,000 m^3 of sand will be sourced from the B-plant area and approximately 360,000 m^3 of barren sand will be sourced from the CNME area. Other sand material may be sourced from on-site by-product dam walls where it is demonstrated to be uncontaminated.

4.3.7 Drainage

The top of the HRCF Extension is designed to drain inwards across the surface of the capping layer, and shaped to form a central drainage line running to the northeast with (proposed) maximum slopes of 1:200 V:H to prevent erosion. Berms will be placed on the upper surface and subsurface drain pipes within the sand cover layer, to prevent erosion and to maintain stability. An engineered drop structure will be constructed on the northeast to drain water down to a perimeter surface drain around the HRCF Extension footprint, with rainfall flowing down the outer batter slopes also draining to this perimeter drain.

The perimeter drain comprises an existing (previously constructed) drain and a new drain to be constructed. The existing drain is located to the north and west of the HRCF Extension and will be refurbished to ensure it can accommodate the expected increase in surface water generation from the extension. The new drain will be constructed around the eastern side of

the HRCF Extension which will divert surface water from upstream (off-site) catchments and will tie in to the existing drain located to the north and west.

4.4 Infrastructure

The proposed infrastructure, as it relates to the Category 8 activity, is detailed in Table 4 and with reference to the Site Plan (attached in the Issued Works Approval).

Table 4: South Capel Remediation Project infrastructure

Infrastructure	
Prescribed Activity Category 8	
Construction of a purpose-built containment storage facility for relocating legacy mineral sands processing tailings sitting in uncontained voids	
1	HRCF (existing)
2	HRCF Extension (to be constructed)
3	Existing surface water drainage channel
4	Eastern drainage channel (to be constructed)
Other activities	
1	Groundwater recovery (91,500 kL/a) and treatment plant (lime dosing)

5. Legislative context

Table 5 summarises approvals and statutory requirements relevant to the assessment.

Table 5: Relevant approvals and tenure

Legislation	**Number**	**Approval**
Mining Act 1978 (WA)	Reg ID 75073	A mining proposal is required as the project is considered a change to the approved activities on the tenement
Rights in Water and Irrigation Act 1914 (WA)	GWL 171459	Licensed allocation 91,500 kL/yr from the Busselton-Capel Groundwater Area, Superficial aquifer, for the purpose of contaminant recovery
	GWL 161847 (combined licence across all Iluka South West sites)	Licensed allocation 6.5 GL/yr from the Busselton-Capel Groundwater Area, Yarragadee aquifer, for mining purposes
Contaminated Sites Act 2003 (WA)	DMO 2592	Site classification: *Contaminated – Remediation Required*

5.1 Contaminated sites

In May 2007, the Applicant reported parts of the South Capel site under the *Contaminated Sites Act 2003* (CS Act), with additional areas reported in June 2009. A total of 26 parcels of land were reported based on historical site activities and site use as a mineral sands mine and processing operation, which included below ground storage of by-product residues from synthetic rutile production and an associated contaminated groundwater plume.

In April 2016, all 26 parcels of land were classified by DWER as *possibly contaminated – investigation required* (DER, 2016). It was also concluded that should further investigations confirm off-site impacts from historical activities on the site, then the site would meet the definition of a ‘source site’.

Memorials were subsequently registered against the following Certificates of Title:

- Lot 2039 on Plan 140224 (reference number N330877 ML) (source site);
- Lot 3822 on Plan 153828 (N330877 ML) (two parcels – source site);
- Lot 7 on Diagram 26769 (N330877 ML) (source site);
- Lot 1276 on Plan 105644 (N330875 ML;
- Lot 2722 on Plan 81570 (N330875 ML) (two parcels);
- Lot 1091 on Plan 252618 (N330876 ML);
- Lot 3826 on Plan 159564 (N330875 ML);
- Lot 2678 on Plan 252610 (N330875 ML);
- Lots 229 & 230 on Plan 232739 (N330875 ML);
- Lots 51 – 55 on Plan 18907 (N389400 ML);
- Lot 100 on Plan 406668 (N330877 ML);
- Lot 102 on Plan 406667 (N330875 ML);
- Lot 2 on Diagram 38256 (N330878 ML);
- Lot 1 on Diagram 23754 (N330878 ML);
- Lot 73 on Plan 63783 (N330877 ML);
- Lot 5881 on Plan 18616 (N389400 ML);
- Crown Reserve (Lot 117); and
- Railway Reserve (Parcel 68572).

5.1.1 Known or suspected contamination

Environmental investigations have been ongoing at the site since the late 1990s when monitoring first indicated there was significant acidification of the site and the surrounding surface water catchments due to on-site mining practices. The primary sources of contamination have historically been identified from the leakage of untreated effluent from storage ponds and drainage channels, surface spills and leachate from residue dams. Historically, groundwater contamination has been characterised by low pH and high total dissolved solids, which have been identified across the site and extending as a groundwater plume in a north-westerly direction under the Bussell Highway.

A groundwater risk assessment and modelling report was undertaken in 2014 to assess site-specific groundwater conditions. The assessment identified areas of ‘very high’ vulnerability within the locations of active residue dams. Areas of ‘high’ vulnerability were generally confined to within 1 km of active residue dams, with a thin band existing downstream of the residue dams attributed to a shallow groundwater table in these areas.

The investigations conducted to date have been subject to independent review by an accredited contaminated sites auditor, who has concluded there is a risk to human health and/or the environment posed from soils (by-products) and groundwater beneath, and downgradient of, the site.

5.1.2 Remediation strategy

In mid-2016, the Applicant engaged an accredited contaminated sites auditor to review investigations and provide guidance on the acceptability of proposed site management strategies for the relocation of mining and processing residues. The auditor endorsed a proposal to relocate the residues within an extension to the existing HRCF, and prepared a Voluntary Auditor’s Report (VAR) in preparation for the development of a Sampling and Analysis Quality Plan to detail the proposed geotechnical and chemical investigation and a Remedial Action Plan (RAP) for the HRCF Extension proposal.

Following submission of the VAR, in June 2017 DWER re-classified the 26 parcels of land as *contaminated – remediation required* (DER, 2017). This classification requires remediation of the site to reduce risks to human health, the environment and environmental values to acceptable levels.

The Applicant submitted a RAP to DWER in 2017, which details the scope of the HRCF Extension proposal and sets out the specific remediation objectives, including how the remediation will be carried out and how it will be validated. The auditor has completed an interim audit on the geochemical and chemical investigation that was undertaken in 2017, including the detailed conceptual design and RAP for the processing and by-product storage area. DWER understands the auditor supports the proposed remedial strategy provided a number of conditions are implemented during the construction and emplacement phases, including:

- further testing of the sand to be used as capping;
- preparation of a Construction Environmental Management Plan, to manage potential environmental impacts during construction;
- preparation of a Construction Quality Assurance (CQA) plan by the designer, to form part of the design documentation;
- following the completion of construction, a Construction Quality Assurance Report be prepared to demonstrate that all requirements of the capping technical specifications and CQA have been complied with;
- inspections of the site by the auditor at key times;
- incorporation of the auditor's expert comments into the Technical Specification produced as part of the detailed design; and
- preparation of a site Environmental Management Plan, to manage the interim period between placement of the remediation/rehabilitation cover and the final capping.

5.2 Other relevant approvals

5.2.1 *Mining Act 1978 (WA)*

Tenement holders are required to submit a Mining Proposal, and obtain written approval from DMIRS, prior to undertaking any ground disturbing activity on a lease granted under the Mining Act. The Applicant has submitted a Mining Proposal for the remediation project and it is currently being assessed by DMIRS.

DMIRS also administer the *Mines Safety and Inspection Act 1994*, with respect to the standards for occupational safety and health. The Resources Safety Division administers occupational health legislation for mining operations, and safety legislation and the licensing regime for dangerous goods, including regulation of the State's major hazard facilities. This includes the requirement to lodge and have approved a Project Management Plan, reviewing structural designs and specifications of tailings storage facilities and other engineered mine-related infrastructure, etc.

5.2.2 *Rights in Water and Irrigation Act 1914 (WA)*

Groundwater abstraction in gazetted areas is regulated by DWER under section 5C of the RIWI Act. A Licence to Take Water has previously been issued from the Superficial aquifer (91,500 kL/a) for the purposes of groundwater recovery.

5.2.3 *Radiation Safety Act 1975 (WA)*

Deposits of mineral sands contain levels of naturally occurring radioactive materials (NORM). The radioactive constituents are mostly thorium with smaller amounts of uranium, and their respective decay products. Monazite is the most common radioactive mineral and typically constitutes less than 0.5% of the mined ore; however any operation in which radioactive containing material is extracted from the ground and processed can potentially concentrate NORM in product, by-product or waste streams.

The management of radiological risk (to human health and the environment) from NORM is undertaken jointly by DMIRS and the Radiological Council of WA (RCWA). The Applicant has in place a Radiation Management Plan for its South West operations, and an addendum for the proposed HRCF Extension will be submitted to DMIRS and RCWA for review against

defined requirements before the grant of approval.

5.2.4 Planning approvals

Activities on Mining Act tenure are exempt from development approval under the Shire of Capel Town Planning Scheme No.7.

5.3 Part V of the EP Act

5.3.1 History

South Capel was formerly a prescribed premises during the 1980s and 90s and licensed under L6045/1984/1. A review of DWER's database indicates the licence was not renewed after mining and processing ceased in 1999, which was consistent with departmental policy at the time.

5.3.2 Amendments

In November 2019, the works approval was amended to be less prescriptive, by replacing references to specific amounts of material from each source site with a total amount of material authorised for disposal within the HRCF Extension. The change was requested by the Works Approval Holder to allow for the potential that more material is encountered than originally anticipated at the Capel Dry Plant site. The amendment did not result in any change to the design of the facility, the sources of authorised material, the timeframes over which the facility is to be constructed, or increase the total volume of material originally approved for disposal.

5.3.3 Applicable regulations, standards and guidelines

The overarching legislative framework of this assessment is the EP Act and EP Regulations.

The guidance statements which inform this assessment are listed in Appendix 1.

5.3.4 Clearing of native vegetation

Clearing of native vegetation in Western Australia requires a clearing permit, unless exemptions apply. The Applicant has submitted an application to clear approximately 10 ha of predominantly native regrowth as part of the proposal.

6. Modelling data

6.1 Seepage assessment

The Applicant has conducted a seepage assessment to show the effect of the capping layer and estimated seepage into the deposited residues and foundations (Wave, 2018). The assessment was conducted using 2D finite element analysis software, including associated sensitivity analysis (i.e. assumed liner leakages).

6.1.1 Results

The estimated total daily seepage rates from the entire HRCF Extension footprint using average liner leakage rates most likely to represent the facility if constructed with good QA/QC procedures are presented in Figures 4 and 5. The figures provide seepage rates at the base of the deposited residues.

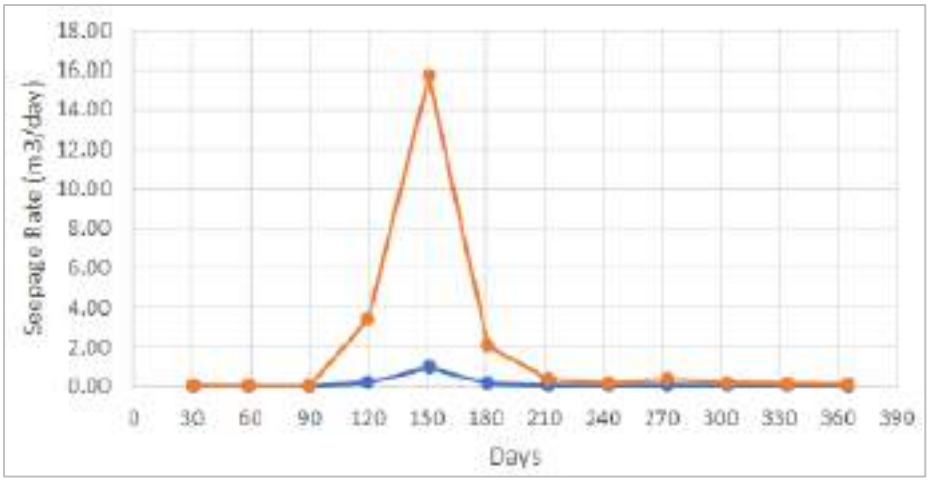

Figure 4: HRCF Extension seepage rates – unsaturated permeability function - with BGM liner leakage (average).

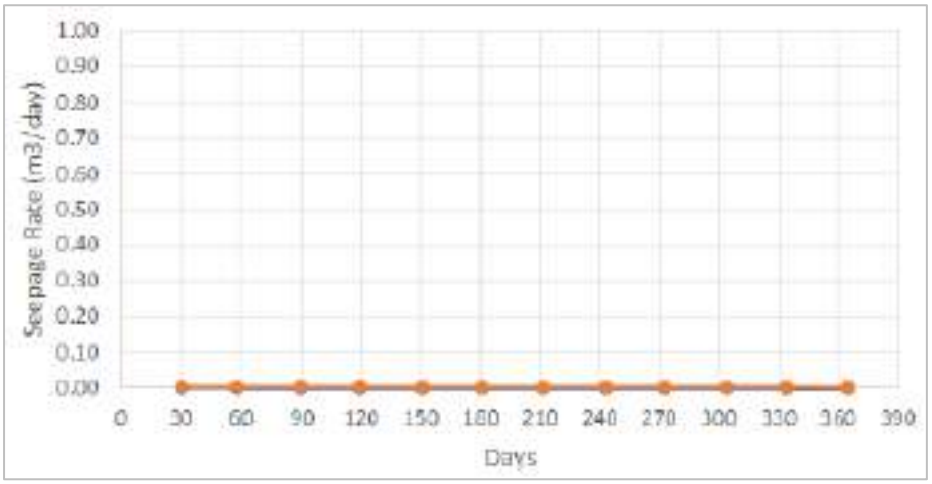

Figure 5: HRCF Extension seepage rates – unsaturated permeability function - no BGM liner leakage.

The results indicate the estimated seepage rate from the proposed HRCF Extension ranges between 16 m^3/d to less than 1 m^3/d, with the higher value being associated with liner leakage. The seepage rates were then used to assess discharge of leachate into a water table 1 metre below the base of the facility – in a worst case scenario, leachate modelling has predicted that impacts to groundwater from chemical substances will not occur beyond 5 metres from the source. Additionally, the leachate modelling indicates that where inundation is assumed (but is considered unlikely), materials are not considered significantly leachable.

Summary

The model predicts that a large portion of the rainfall stored in the cover will be removed via evaporation, with the remainder directed from the cap by lateral drainage (subsurface drains that will discharge along the toe of the facility), which negates the need for a basal liner.

6.1.2 DWER technical review

DWER's review of the *HRCF Extension Engineering Design* report (Wave, 2018) provided as part of the Application identified that:

- The assessment was carried out in an appropriate manner and the model developed for determining potential impacts to groundwater appears to be sound;
- Based on the information available the proposal appears to be acceptable, providing a freeboard of greater than 2 metres exists between the waste body and groundwater, ensuring the waste body remains dry;
- The report does not make reference to ongoing groundwater and surface water monitoring, which is critical for determining the success of the proposed capping system. Consistent with the *South Capel Groundwater Monitoring Plan*, ongoing

monitoring is required to evaluate water quality and determine the integrity of works to address contamination; and

- It is recommended the sandy cover layer be increased from 0.5 to 1.0 metres, to facilitate greater evapotranspiration and an increased growth medium, in addition to ongoing groundwater monitoring.

7. Consultation

The Application was referred to direct interest public authorities. A summary of responses is provided in Table 6.

Table 6: Direct interest stakeholder submissions and DWER consideration

Submitter	Comment
Department of Mines, Industry Regulation and Safety	M70/63 was granted on 16 February 1988 (expires 2030). M70/659 was granted on 23 January 1992 (expires 2034). Both tenements have had a 21 year renewal granted. The Applicant has submitted a mining proposal and a mine closure plan (Reg ID 75073) which is currently under assessment.
Shire of Capel	No response received.

8. Location and siting

8.1 Siting context

The South Capel site is located in the State's South West region, approximately 25 km south of Bunbury. It is defined by two regional physiographic units; the Blackwood Plateau and the Swan Coastal Plain. These units are bounded to the west by Geographe Bay, and to the east by the Darling Plateau.

8.2 Residential and sensitive Premises

The site is predominantly surrounded by farming land to the north and the Capel Nature Reserve to the south and east. The nearest residential receptor is located approximately 200 m south-west of the HRCF, and others 900 m to the south (Table 7).

Table 7: Receptors and distance from activity boundary

Sensitive Land Uses	Distance from Prescribed Activity
Bussell Highway	Runs adjacent along the western and northern boundary, within 150 m
Coolilup Rifle Range[1]	Approx. 200 m south-west of the HRCF
16 Froome Road, Ludlow	Approx. 900 m south of the HRCF
147 Higgins Rd, Capel	Approx. 1.5 km north-west of the HRCF
262 Capel-Tutunup Rd, Ludlow	Approx. 2.7 km south-east of the HRCF
Capel Light Industrial Area	Approx. 3 km north-east of the HRCF

Note 1: Not considered a potential receptor in accordance with DWER's Guidance Statement: Risk Assessments (DER, 2017).

8.3 Environmental setting

8.3.1 Topography

The local topography of much of the site was originally a mosaic of flat, low lying swampy land

with poor drainage in some areas associated with the Guildford Formation interspersed with Bassendean Dunes. The pre-disturbance ground levels were generally between 10 and 20 mAHD. As a result of mining operation, the site has been extensively cut and filled. Approximately 90% of the original land has been returned to the original gently sloping plain terrain following significant rehabilitation.

8.3.2 Climate

The site has a Mediterranean climate characterised by hot, dry summers and cool, wet winters. Mean daytime temperatures range from 31°C in February to 17°C in July. The average yearly rainfall was reported as 640 mm, with most rainfall in June and lowest during the summer months of December to March.

8.3.3 Geology

The site is located on the southern Perth Basin with superficial deposits comprising the Bassendean Dunes, which typically comprise sands with little silt or clay, and the Guildford Formation, which comprises clays, sandy clays and clayey sands with gravels and an estimated maximum thickness of 18 m. An iron-indurated band of sand, colloquially referred to as 'coffee rock', with a maximum thickness of 3 m commonly occurs in the formation near the water table, although this is discontinuous beneath the site.

The superficial deposits are underlain by the Leederville Formation which generally comprises discontinuous sandstones, siltstones and shales overlying the Bunbury Basalt over the Yarragadee Formation at depth.

Due to the former mining operations at the site, there are a number of areas where fill material, mainly comprising mining wastes and residues, have been used to backfill excavated voids as well as the engineered HRCF.

8.3.4 Hydrogeology

The Bassendean Dunes and more permeable layers of the Guildford Formation comprise the superficial, unconfined aquifer beneath the site. Groundwater within this system is directly recharged by rainfall and was expected to be in hydraulic continuity with the underlying Leederville Formation. Groundwater flow within the superficial aquifer was expected to be towards the west-northwest towards Geographe Bay and fluctuates seasonally between 0.5 and 2.0 m.

A multi-layered aquifer system was identified within the Leederville Formation with an average thickness of 200 m and a maximum thickness of 500 m. This formation comprises discontinuous beds of moderately permeable sandstone with relatively low permeable siltstone and shale layers generally less than 5 m thick. Groundwater flow within the Leederville aquifer was expected to be towards the northwest and semi-confined in nature.

A confined aquifer was present within the Yarragadee Aquifer which is generally confined and was also inferred to flow towards the northwest. The Leederville and Yarragadee Aquifers were expected to be in hydraulic continuity.

8.3.5 Hydrology

A number of unlined dams are present within the proposed HRCF extension. Seasonal lakes are also present within the Capel Nature Reserve which is located adjacent to the east.

The natural surface drainage system surrounding South Capel comprises a series of small tributaries and wetlands draining primarily in a west-northwest direction via the Capel, Ludlow and Abba Rivers. These river systems flow into to the Wonnerup Estuary and ultimately discharge into Geographe Bay located approximately 4 km to the northwest.

Naturally occurring surface water features in the vicinity of South Capel include the Banksia Swamp located immediately adjacent to the southeast, McCarley's Swamp located

approximately 250 m west of the Capel Wetland Centre lakes (specifically Tiger Snake Lake), the Capel River approximately 3 km to the northeast and the Ludlow River approximately 10 km to the southwest.

8.3.6 Groundwater use

Previous reports have identified 169 registered and operational groundwater abstraction bores within a 5 km radius of South Capel. Information on the formations intercepted by wells surrounding South Capel was limited, however, the available data indicates that the Leederville Aquifer was primarily targeted for domestic and irrigation purposes. A total of approximately 61 of the 169 abstractions wells are located down hydraulic gradient of the Site which were primarily used for stock-watering purposes.

8.3.7 Areas of environmental value

The Capel Nature Reserve and Settlers Reserve are located adjacent to the east of the proposed HRCF Extension. Banksia Swamp was identified as a conservation significant geomorphic wetland of the Swan Coastal Plain. McCarley's Swamp is a nationally significant wetland due to its ecological and hydrological values, importance as a fauna habitat and its historical/cultural significance. The Tuart Forest National Park is located approximately 400 m to the northwest of the site.

9. Risk assessment

9.1 Determination of emission, pathway and receptor

In undertaking its risk assessment, DWER will identify all potential emissions pathways and potential receptors to establish whether there is a Risk Event which requires detailed risk assessment.

To establish a Risk Event there must be an emission, a receptor which may be exposed to that emission through an identified actual or likely pathway, and a potential adverse effect to the receptor from exposure to that emission. Where there is no actual or likely pathway and/or no receptor, the emission will be screened out and will not be considered as a Risk Event. In addition, where an emission has an actual or likely pathway and a receptor which may be adversely impacted, but that emission is regulated through other mechanisms such as Part IV of the EP Act, that emission will not be risk assessed further and will be screened out through Table 8.

The identification of the sources, pathways and receptors to determine Risk Events are set out in Table 8 below.

Table 8: Identification of emissions, pathway and receptors during construction and filling works

Risk Events						Continue to detailed risk assessment	Reasoning
Sources/Activities		**Potential emissions**	**Potential receptors**	**Potential pathway**	**Potential adverse impacts**		
Construction, filling and capping of HRCF Extension	Clearing of native vegetation Earthworks/ vehicle movements on unsealed roads Excavation and movement of process residues	Noise Fugitive emissions (dust)	Users of the Bussell Highway Rural/residential dwellings >500 m of HRCF Extension Capel Light Industrial Area (3 km north-east)	Air / wind dispersion	Amenity impacts/ health impacts	No	The risk of health/amenity impacts from noise and dust generated during excavation and movement of process residues is considered to be Low due to the short-term nature of the works (~18 months) and sufficient separation to receptors (>500 m).
					Soil contamination, suppression of photosynthetic and respiratory functions of native vegetation, including several Priority flora species within the Premises boundary and immediate surrounds	No	The risk of impacts to native vegetation from dust loading during excavation and movement of process residues is considered to be Low based on the short-term nature of the works (~18 months). Any dust impacts that may occur can be regulated under the provisions of Section 49 of the EP Act.
	Deposition of process residues, including compaction and capping	Noise Fugitive emissions (dust)			Amenity impacts/ health impacts	No No	The risk of health/amenity impacts from noise and dust generated during deposition of process residues is considered to be Low due to separation to receptors (>500 m).
					Soil contamination, etc. (see above)	No	The risk of impacts to native vegetation from dust loading during deposition of process residues is considered to be Low for the reasons stated above. Any dust impacts that may occur can be regulated under the provisions of Section 49 of the EP Act.
		Erosion and sedimentation of cover material	Native vegetation associated with drainage lines, associated surface water or shallow groundwater	Direct discharge	Contamination of drainage lines, nearby wetlands, tributaries of the Capel and Ludlow rivers, inhibiting vegetation growth and survival	Yes	Refer to section 9.4.
		Mobilisation of contaminants within deposited process residues	Bore users within proximity to the Premises Groundwater, wetlands and associated groundwater dependent ecosystems	Through the base of the containment facility (unlined)	Groundwater contamination (exacerbation of existing contamination)	Yes	Refer to section 9.5.
					Groundwater mounding	Yes	Refer to section 9.6.
Other	Groundwater recovery and treatment	Discharge of treated groundwater	Drainage lines, wetlands and associated groundwater dependent ecosystems	Direct discharge	Contamination of drainage lines, nearby wetlands, tributaries of the Capel and Ludlow rivers, inhibiting vegetation growth and survival	Yes	To be assessed following the completion of construction of the HRCF Extension.
	Potential removal of deposited residues following construction and capping	Mobilisation of contaminants within deposited process residues, due to removal of capping layer	Bore users within proximity to the Premises Groundwater, wetlands and associated groundwater dependent ecosystems	Through the base of the containment facility (unlined)	Groundwater contamination (exacerbation of existing contamination)	Yes	To be assessed following the completion of construction of the HRCF Extension.

9.2 Consequence and Likelihood of Risk Events

A risk rating will be determined for risk events in accordance with the Risk Rating Matrix set out in Table 9 below.

Table 9: 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

DWER will undertake an assessment of the consequence and likelihood of the Risk Event in accordance with Table 10 below.

Table 10: Risk Criteria Table

Likelihood		Consequence		
The following criteria has been used to determine the likelihood of the Risk Event occurring.		The following criteria has been used to determine the consequences of a Risk Event occurring:		
			Environment	Public health* and amenity (such as air and water quality, noise, and odour)
Almost Certain	The risk event is expected to occur in most circumstances	Severe	• **onsite impacts**: catastrophic • **offsite impacts local scale**: high level or above • **offsite impacts wider scale:** mid-level or above • Mid to long-term or permanent impact to an area of high conservation value or special significance^ • Specific Consequence Criteria (for environment) are significantly exceeded	• Loss of life • **Adverse health effects:** high level or ongoing medical treatment • Specific Consequence Criteria (for public health) are significantly exceeded • **Local scale impacts:** permanent loss of amenity
Likely	The risk event will probably occur in most circumstances	Major	• **onsite impacts**: high level • **offsite impacts local scale**: mid-level • **offsite impacts wider scale**: low level • Short-term impact to an area of high conservation value or special significance^ • Specific Consequence Criteria (for environment) are exceeded	• **Adverse health effects:** mid-level or frequent medical treatment • Specific Consequence Criteria (for public health) are exceeded • **Local scale impacts**: high level impact to amenity
Possible	The risk event could occur at some time	Moderate	• **onsite impacts**: mid-level • **offsite impacts local scale**: low level • **offsite impacts wider scale**: minimal • Specific Consequence Criteria (for environment) are at risk of not being met	• **Adverse health effects:** low level or occasional medical treatment • Specific Consequence Criteria (for public health) are at risk of not being met • **Local scale impacts:** mid-level impact to amenity
Unlikely	The risk event will probably not occur in most circumstances	Minor	• **onsite impacts**: low level • **offsite impacts local scale**: minimal • **offsite impacts wider scale**: not detectable • Specific Consequence Criteria (for environment) likely to be met	• Specific Consequence Criteria (for public health) are likely to be met • **Local scale impacts:** low level impact to amenity
Rare	The risk event may only occur in exceptional circumstances	Slight	• **onsite impact**: minimal • Specific Consequence Criteria (for environment) met	• **Local scale**: minimal to amenity • Specific Consequence Criteria (for public health) met

^ Determination of areas of high conservation value or special significance should be informed by the *Guidance Statement: Environmental Siting.*

* In applying public health criteria, DWER may have regard to the Department of Health's, *Health Risk Assessment (Scoping) Guidelines* **"on-site"** means within the prescribed premises boundary.

9.3 Acceptability and Treatment of Risk Event

DWER will determine the acceptability and treatment of Risk Events in accordance with the Risk Treatment Table 11 below:

Table 11: Risk Treatment Table

Rating of Risk Event	Acceptability	Treatment
Extreme	Unacceptable.	Risk Event will not be tolerated. DWER may refuse application.
High	May be acceptable. Subject to multiple regulatory controls.	Risk Event may be tolerated and may be subject to multiple regulatory controls. This may include both outcome-based and management conditions.
Medium	Acceptable, generally subject to regulatory controls.	Risk Event is tolerable and is likely to be subject to some regulatory controls. A preference for outcome-based conditions where practical and appropriate will be applied.
Low	Acceptable, generally not controlled	Risk Event is acceptable and will generally not be subject to regulatory controls.

9.4 Risk Assessment – Erosion of the sand cover

9.4.1 Description of risk event

Surface water runoff from the HRCF Extension, causing erosion of the sand cover layer.

9.4.2 Description of potential adverse impact from the risk event

Exposure of the BGM to sunlight, which may impact on the integrity of the BGM, leading to increased seepage and infiltration of water through the deposited residues.

Release of this sand into the nearby drainage lines may lead to increased concentration of suspended sediments (i.e. turbidity) and an increased accumulation of fine sediments, where they are undesirable. Sedimentation has the potential to affect the ecology and functioning of the Capel and Ludlow rivers and associated wetlands, groundwater quality and other environmental values.

9.4.3 Applicant controls

Design of the HRCF Extension incorporates an initial 0.5 m sand cover to protect the BGM from exposure to sunlight. In order to control the potential for erosion of the sand layer from seepage water from rainfall infiltration, the top of the HRCF Extension will be inward draining with surface water flowing to the northeast and through an engineered drop structure (Figures 6 & 7). Water will be collected via subsurface drain pipes and will discharge along the toe of the facility, intersecting with the surface drain infrastructure.

Additional measures to provide protection from surface water erosion and control of sediment may include but are not limited to:

- Matting, such as biodegradable or permanent;
- Sediment fences;
- Temporary drains and diversion; and
- Plastic sheeting.

As part of its commitment to obligations under the CS Act, the Applicant has been required by the contaminated sites auditor to submit an Environmental Management Plan to manage the interim period between placement of the remediation/rehabilitation cover and the final capping. DWER expects this will include details of monitoring and maintenance to be conducted to ensure the ongoing integrity of the capping layer. In addition, ongoing monitoring of ground

and surface waters will be conducted to evaluate water quality and to determine the integrity of the remediation works.

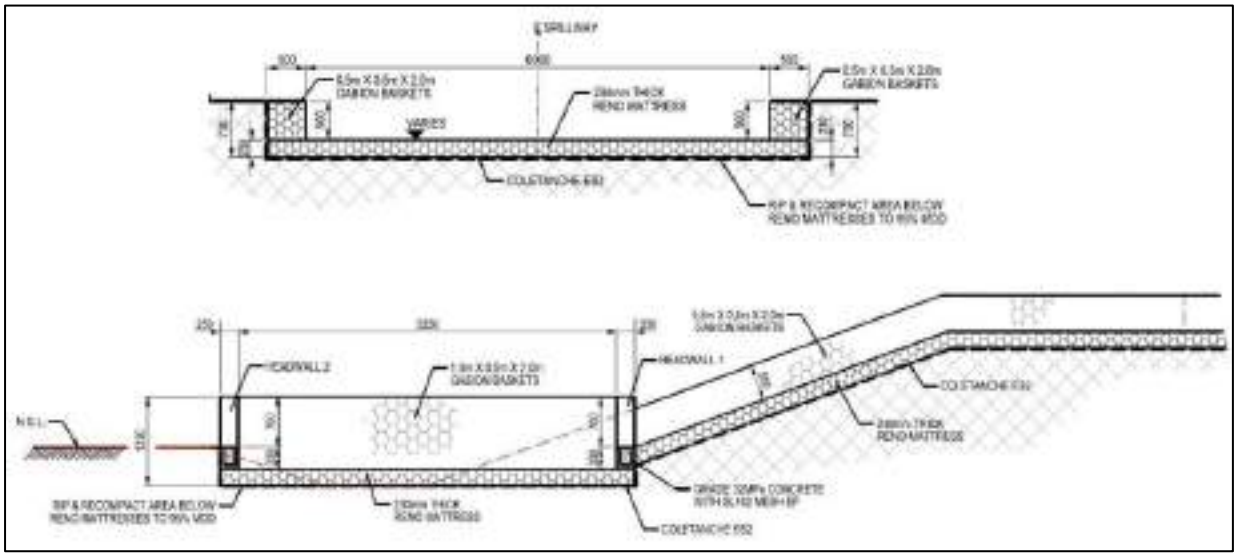

Figure 6: Engineered drop surface (indicative).

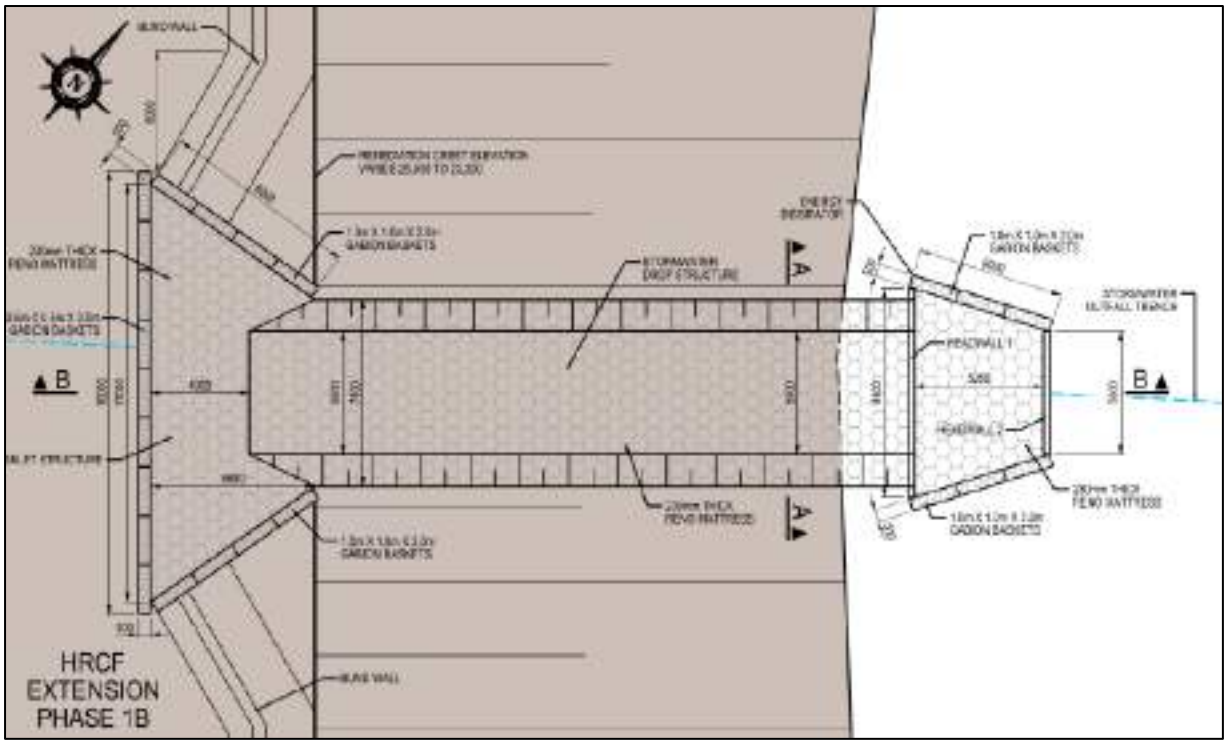

Figure 7: Stormwater drop structure (indicative).

9.4.4 Key findings

The Delegated Officer has reviewed the information regarding the risk of erosion of the Phas 1 cover layer and has found:

1. The engineering design of the HRCF Extension contains a sub-surface water management system that will minimise the potential for erosion of the proposed cover material.
2. In view of the temporary nature of the initial Phase 1 covering layer (first 10 years), the proposal for a 0.5 m thick sand cover is considered to be sufficient, providing that ongoing monitoring and maintenance is conducted to ensure its integrity.
3. DWER understands the contaminated sites auditor supports the proposed remedial

strategy, providing a number of conditions are implemented during the construction and emplacement phases, including ongoing monitoring of ground and surface water and maintenance of the cover layer. These controls are likely to be imposed on the Licence following construction of the facility.

9.4.5 Consequence

Damage to the BGM liner caused by exposure to sunlight may result in increased infiltration of water through the deposited residues, leading to further leachate and may exacerbate groundwater contamination. The Delegated Officer therefore considers the consequence to be **Moderate**.

Surface water erosion of the proposed covering material is likely to result in a medium level of on-site impacts to drainage lines, and potential for off-site impacts at a local scale. The Delegated Officer therefore considers the consequence to be **Moderate**.

9.4.6 Likelihood of Risk Event

It is considered **Unlikely** that impacts would occur under normal circumstances, due to the proposed engineering design that incorporates surface water management controls, and a high likelihood that any erosion would be identified and repaired by the Applicant in a timely manner. The Delegated Officer also notes the existing HRCF incorporates a 0.5 m sand cover layer, and there has been no issues identified in nearly 20 years since its construction.

9.4.7 Overall rating of contaminated surface water runoff

The Delegated Officer has compared the consequence and likelihood ratings described above with the risk rating matrix (Table 9) and determined that the overall rating for the risk of erosion of the sand cover layer is **Medium**.

9.5 Risk Assessment – Groundwater contamination

9.5.1 Description of risk event

Leachate from the deposited process residues, reaching the water table and moving northwards in response to groundwater flow, causing impacts to groundwater, off-site groundwater users and ecological receptors.

9.5.2 Description of potential adverse impact from the risk event

Leachates from the process residues has the potential to affect groundwater quality and other environmental values.

It is noted that groundwater beneath the site is already contaminated, and that the aim of this project is to enable the quality of groundwater to naturally recover by removing known contamination sources and thereby limiting further leachate generation. In addition, the design of the HRCF Extension is such that groundwater is unlikely to come into direct contact with the relocated residues.

The Applicant has undertaken significant work to characterise the process residues and their leachates. Based on historical monitoring data and the potential beneficial uses of groundwater in the vicinity of the site, the contaminants of potential concern comprise:

- Heavy metals and metalloids – aluminium, arsenic, cadmium, chromium, cobalt, copper, iron, mercury, manganese, nickel, lead and zinc;
- Radionuclides (uranium and thorium);
- Ammonia, chloride, sulfate and calcium;
- pH and total dissolved solids.

Polycyclic aromatic hydrocarbons were only identified within the kiln scrubber solids, however this will not intersect groundwater and so has been omitted from the proposal.

9.5.3 Applicant controls

The fully engineered capping layer is the primary mechanism for limiting the potential for leachate generation from the HRCF Extension.

Characterisation of the process residues has indicated the majority to be relatively dry, however any residues that are saturated or high in moisture will be set aside for drying, and prior to placement in the HRCF Extension.

Where process residues are currently located in dams within the HRCF Extension footprint, they will remain *in situ*, as there are additional risks in disturbing these dams, i.e. entrained leachate/pore water may be released upon disturbance. These dams are considered to be largely well consolidated and positioned at a level sufficiently above the natural water table, and the proposed capping layer is considered to minimise the risk of further leachate generation.

A seepage assessment (Wave, 2018) to evaluate the effectiveness of the proposed capping layer in mitigating seepage into the deposited residues, found that the unsaturated models with average liner leakage rates would most likely represent the HRCF Extension, i.e. seepage rates of between 1 m^3/d and 16 m^3/d. On this basis, the Applicant considered the capping to be adequate and that a basal liner was not required to manage contaminants.

The residues will be placed in the HRCF Extension and compacted in approximately 300mm layers to around 90% MDD at optimum moisture content, to reduce any long-term settlement and the hydraulic conductivity. Compacted fill will be placed through the biofilter area to design levels to ensure the residues are placed at least 1 m above the highest known natural groundwater level.

The groundwater recovery system will continue to operate throughout construction of the HRCF Extension. The Applicant anticipates that after the residues have consolidated that the groundwater quality will eventually recover and abstraction would no longer be required.

9.5.4 Key findings

The Delegated Officer has reviewed the information regarding the risk of groundwater contamination from the HRCF Extension and has found:

1. Groundwater beneath the site is already contaminated. The aim of this project is to facilitate the natural recovery of groundwater quality by removing known contamination sources.
2. The HRCF Extension will contain a fully engineered covering system that will minimise seepage water from rainfall infiltration, thereby minimising the potential for leachate generation from the facility.

9.5.5 Consequence

The release of contaminants from process residues within the HRCF Extension may exacerbate existing groundwater contamination beneath the site and extending off-site to nearby receptors. The Delegated Officer therefore considers the consequence to be **Moderate**.

9.5.6 Likelihood of Risk Event

It is considered **Unlikely** that further impacts to groundwater quality beneath the site would occur, due to the proposed engineering design that incorporates controls to minimise the contact of water with the deposited process residues.

9.5.7 Overall rating of groundwater contamination

The Delegated Officer has compared the consequence and likelihood ratings described above with the risk rating matrix (Table 9) and determined that the overall rating for the risk of groundwater contamination from the HRCF Extension is **Medium**.

9.6 Risk Assessment – Groundwater mounding

9.6.1 Description of risk event

Ponding of upstream surface water along the HRCF Extension, causing seepage of surface water and localised mounding of groundwater, causing groundwater to intercept the stored process residues and mobilisation of contaminants.

9.6.2 Description of potential adverse impact from the risk event

Leachates from the process residues has the potential to affect groundwater quality and other environmental values. Potential adverse impacts are discussed in the sections above.

9.6.3 Applicant controls

A diversion channel will be constructed to the east of the HRCF Extension, which is designed to divert surface water runoff from the eastern catchment (i.e. upstream) around the facility, eliminating the ponding of water against the facility.

The diversion channel is sized for the expected worse case PMP storm with a duration of 15 minutes and peak flow of 4.5 m^3/s (flow velocity 1.2 m/s). No erosion protection, other than native grass vegetation, is proposed for the channel due to the low flows.

Surface water modelling indicates the proposed diversion channel will drain flood water from the upstream catchment within 6 hours for the PMP storm event, and within 90 minutes for a 1:100 year storm event.

9.6.4 Key findings

The Delegated Officer has reviewed the information regarding the risk of groundwater mounding and has found:

1. Due to the size and location of the HRCF Extension on the site, there is a risk of surface water ponding against the facility from the upstream catchment, which is likely to cause seepage and grounding mounding.
2. Surface water modelling indicates that construction of an eastern diversion channel around the facility will drain surface water from the upstream catchment and prevent the ponding of surface water against the facility.

9.6.5 Consequence

The ponding and subsequent mounding of groundwater against the facility may cause groundwater mounding, which in turn may lead to mobilisation of contaminants within the stored process residues. The Delegated Officer therefore considers the consequence to be **Moderate**.

9.6.6 Likelihood of Risk Event

It is considered **Unlikely** that groundwater mounding would occur, due to the proposed eastern diversion channel that will divert surface water from the upstream catchment around the proposed facility.

9.6.7 Overall rating of groundwater mounding

The Delegated Officer has compared the consequence and likelihood ratings described above with the risk rating matrix (Table 9) and determined that the overall rating for the risk of groundwater mounding against the HRCF Extension is **Medium**.

9.7 Summary of acceptability and treatment of Risk Events

A summary of the risk assessment and the acceptability or unacceptability of the risk events set out above, with the appropriate treatment and control, are set out in Table 12 below. Controls are described further in section 10.

Table 12: Risk assessment summary

	Description of Risk Event			Applicant controls	Risk rating	Acceptability with controls (conditions on instrument)	Resulting regulatory controls
	Emission	Source	Pathway/ Receptor (Impact)				
1.	Contaminated surface water (process residue leachates)	Runoff from the HRCF Extension	Surface flow to Capel/Ludlow Rivers, adjacent wetlands, groundwater	Construction of capping layer with surface water controls Erosion and sediment controls	**Medium Risk** Moderate consequence Unlikely	Acceptable subject to Applicant controls conditioned	Works Approval to specify: - Construction of surface water drop structure, in accordance with design specifications - Erosion and sedimentation controls, as per design specifications
2.	Mobilisation of contaminants from stored process residues	HRCF Extension	Groundwater contamination	Capping layer designed to limit seepage of rainfall infiltration	**Medium Risk** Moderate consequence Unlikely	Acceptable subject to Applicant controls conditioned	Works Approval to specify: - Minimum requirements specified for lining system - Lining and capping of deposited residues as soon as practicable in accordance with design specifications - Staged sign off as construction and filling progresses, as per sequential staging of project
3.			Groundwater mounding	Construction of eastern diversion channel	**Medium Risk** Moderate consequence Unlikely	Acceptable subject to Applicant controls conditioned	Works Approval to specify: - Construction of the eastern drainage channel in accordance with design specifications

10. Regulatory controls

DWER will determine regulatory controls having regard to the adequacy of controls proposed by the Applicant. The conditions of the Works Approval and Licence will be set to give effect to the determined regulatory controls.

10.1 Works Approval controls

10.1.1 Infrastructure

The infrastructure authorised for construction has been specified in Table 2 of the Works Approval. Following construction, a report is required to be submitted from a suitably qualified professional geotechnical engineer certifying that each component has been constructed with no material defects and to design requirements.

Conditions 2 and 4 provide for minor departures from design requirements, where it can be justified.

Note: *The requirements specified in Table 2 of the Works Approval are required where a potential risk identified in this Decision Report has been determined based on implementation of Applicant control measures.*

Condition 5 specifies the maximum layer thickness and minimum compaction rates, as per the design requirements, in order to minimise the permeability of the deposited solid waste residues.

Condition 6 requires the progressive installation of the lining system and capping layer, in order to minimise the amount of uncapped residue within the HRCF at any one time.

Grounds: *The design and construction requirements of the HRCF Extension are required to be constructed in accordance with the relevant engineering drawings as submitted with the Application.*

10.1.2 Emissions from construction works

A control has been imposed (Condition 8) for specified emissions and general emissions which may arise from the undertaking of the works.

10.1.3 Reporting and record keeping

Due to the nature of the proposed works, which involves the progressive filling of the facility as it is being constructed, a reporting condition has been added to require 6-monthly construction quality assurance reports. This is mainly to provide assurance to DWER that certification is completed at several stages of the process, to enable early identification of potential deviations from design specifications. The proposed conditions essentially align with the Applicant's proposed internal QA/QC procedures and therefore the additional reporting, i.e. holding current certification from the civil engineering association of Australia (Institution of Engineers Australia).

A number of conditions have also been applied to the Works Approval (Conditions 10 and 11 to prescribe the minimum record keeping requirements. They relate to the standards for book-keeping and the requirement to produce records to the CEO upon request.

Grounds: *The requirements specified above are necessary to demonstrate compliance with other requirements of the Works Approval.*

10.2 Licence controls

A Licence will be issued following the completion of construction and capping works, and will regulate post-construction management of the HRCF Extension, e.g. erosion and surface water

management, groundwater monitoring, etc. Ongoing monitoring of the cover layer will be required, given this is the primary mechanism to mitigate the potential for generation of leachates.

DWER notes that existing groundwater management activities are being conducted on the site, including groundwater recovery, treatment and discharge, and groundwater monitoring. These activities do not form part of the Application and therefore have not been assessed at this stage, however a full review of the Premises will be conducted in accordance with DWER's current regulatory framework in conjunction with the licence application, following the completion of works.

11. Applicant's comments

The Applicant was provided with drafts of the Decision Report and Works Approval on 10 October 2018 and 26 February 2019. A summary of the issues raised and DWER's response is provided in Appendix 2.

12. Conclusion

This assessment of the risks of activities on the Premises has been undertaken with due consideration of a number of factors, including the documents and policies specified in this Decision Report (summarised in Appendix 1).

Based on this assessment, it has been determined that the Issued Works Approval will be granted subject to conditions commensurate with the determined controls and necessary for administration and reporting requirements.

Tim Gentle
MANAGER RESOURCE INDUSTRIES
REGULATORY SERVICES

Delegated Officer
under section 20 of the *Environmental Protection Act 1986*

Appendix 1: Key documents

	Document title	In text ref	Availability
1.	South Capel Remediation Project – Works Approval Application. Iluka Resources, Perth.	Application	DWER records (A1711027)
2.	Brooks, D. R. & Nicholls, F. M., 1996. Environmental Management and Wetlands Development at Capel in Southwest Western Australia, *Environmental Management in the Australian Minerals and Energy Industries – Principles and Practices*. Edited by David R. Mulligan, University of New South Wales Press Sydney, Australia in association with Australian Minerals and Energy Environment Foundation. pp 557-569	Brooks & Nicholls, 1996	accessed at: books.google.com.au
3.	DER, July 2015. *Guidance Statement: Regulatory principles.* Department of Environment Regulation, Perth.	DER, 2015a	accessed at: www.dwer.wa.gov.au
4.	DER, October 2015. *Guidance Statement: Setting Conditions.* Department of Environment Regulation, Perth.	DER, 2015b	
5.	DER, November 2016. *Guidance Statement: Environmental Siting*. Department of Environment Regulation, Perth.	DER, 2016a	
6.	DER, February 2017. *Guidance Statement: Risk Assessments*. Department of Environment Regulation, Perth.	DER, 2017a	
7.	DER, February 2017. *Guidance Statement: Decision Making*. Department of Environment Regulation, Perth.	DER, 2017b	
8.	DER, November 2016. *Notice of a classification of a known or suspected contaminated site given under section 15 of the Contaminated Sites Act 2003*	DER, 2016b	DWER records (DMO 2592)
9.	DER, June 2017. *Notice of a classification of a known or suspected contaminated site given under section 15 of the Contaminated Sites Act 2003*	DER, 2017c	
10.	Duncanson, M.W., Pope, J.I., and Selvanathan, E.A., May 1989. An economic evaluation of the mineral sands industry in Western Australia. Department of Economics, The University of Western Australia, Discussion Paper 89.09.	Duncanson, et.al., 1989	accessed at: ecompapers.biz.uwa.edu.au
11.	DMP, October 2015. *Mining Act Guidelines – Basic Provisions*. Department of Mines and Petroleum, Perth.	DMP, 2015	accessed at: www.dmp.wa.gov.au

12.	Fetherston, J.M., and Searston, S.M., 2004. Industrial minerals in Western Australia: the situation in 2004. Western Australia Geological Survey, Record 2004/21.	Fetherston & Searston, 2004	accessed at: books.google.com.au
13.	Golder Associates, November 2017. Combined Geotechnical and Chemical Investigation Report – South Capel Remediation Project. Prepared by Golder Associates for Iluka Resources Ltd	Golder Associates, 2017	DWER records (A1720215)
14.	Iluka, November 2014. South Capel – Hydrogeological characterisation and risk-based contaminated groundwater management assessment. Prepared by Iluka Resources Ltd	Iluka, 2014	DWER records (A1001845)
15.	MMA, March 1990. AMC Mineral Sands Limited – Capel Works – Assessment of Groundwater Contamination and Proposed Management Strategy. Prepared for AMC Mineral Sands by Mackie Martin & Associates	MMA, 1990	DWER records (A1720210)
16.	Peck, February 1998. RGC Mineral Sands Limited – Capel Operations – Brief Report on Groundwater Contamination. Prepared for RGC Mineral Sands by A.J. Peck & Associates	Peck, 1998	DWER records (A1720213)
17.	RGC, October 1996. Hutton Road Containment Facility – Notice of Intent. Study Report submitted to Department of Minerals & Energy by RGC Mineral Sands Limited	RGC, 1996	DWER records (A1720222)
18.	URS, 2003. South Capel Groundwater Receptor Preliminary Evaluation. Draft Report prepared for Iluka Resources Ltd by URS Australia Pty Ltd	URS, 1998	DWER records (A1720215)
19.	Wave, March 2018. South Capel Remediation Project – HRCF Extension Engineering Design. Prepared for Iluka Resources Ltd by Wave International	Wave, 2018	DWER records (A1711835)

Appendix 2: Summary of application's comments on risk assessment and draft conditions

Condition	Justification	DWER response
Table 2: Capping layer – 1.0 m thick sandy fill layer	An interim cover of 0.5 m is preferred by Iluka over a 1.0 m cover, on the grounds it will allow establishment of a grassy-herbaceous plant cover instead of deep-rooted trees which would pose a risk to the integrity of the geomembrane. In addition the existing HRCF demonstrates that a 0.5 m cover layer with an established grassy-herbaceous plant cover is successful in creating a stable surface and preventing erosion.	Given the temporary nature of the sand cover layer (10 years), a 0.5 m thick sand cover is considered to be sufficient, providing that ongoing monitoring and maintenance is conducted to ensure its integrity.
Table 3: Exact amount of materials specified	The RAP includes contingency measures that includes provision for increases in material volumes that require remediation, therefore some flexibility is required should excess material be encountered.	The Works Approval references the design capacity of the HRCF Extension, as per the documents submitted with the Application. Increases in material volumes above the design capacity of the facility have not been assessed by DWER.
6.2.1: Freeboard of greater than 2m between the residue and water table	The design review, based on a conservative 1 m freeboard, concluded there would be no significant impact to groundwater associated with the proposal.	DWER notes the modelling adopted a conservative freeboard of 1 m, however the report concludes that in most cases the likely separation distance between the cell and groundwater is likely to be more than 2 m, which should be maintained where possible.

Attachment 1: Issued Works Approval W6159