Environmental Risk Assessment

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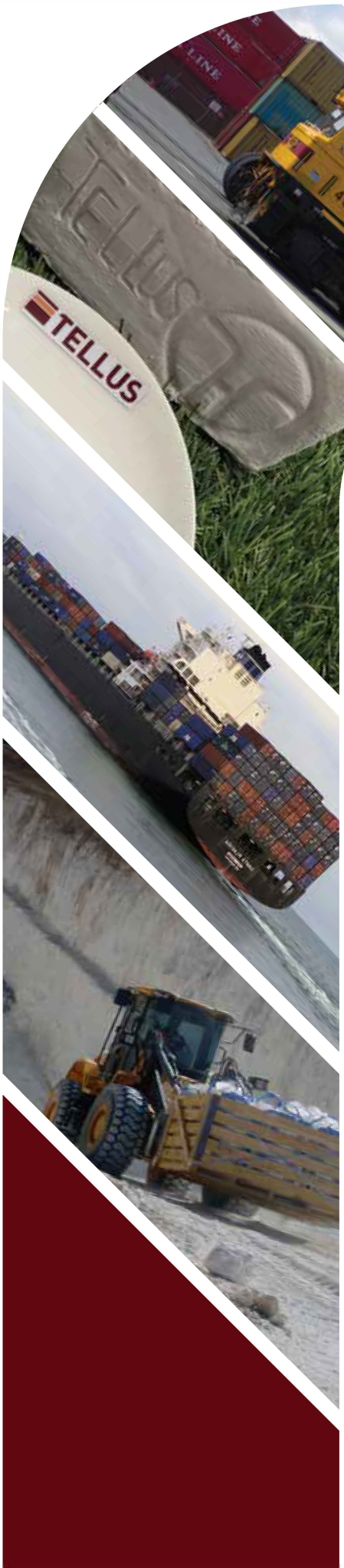

TELLUS

Sandy Ridge Facility
Environmental Risk Assessment

June 2016

SANDY RIDGE FACILITY ENVIRONMENTAL RISK ASSESSMENT

Draft Report | June 2016

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DISTRIBUTION

Report File Name	Report Status	Author	Date	Distribution
Environmental Risk Assessment –V0.1	V0.1 (Draft)	Aurora Environmental	15 February 2016	Tellus Holdings Ltd
Environmental Risk Assessment –V0.2	V0.2 (Draft)	Aurora Environmental	12 April 2016	Tellus Holdings Ltd
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ABBREVIATIONS

ADT	Articulated dump truck
Bq/g	Bequerels per gram
DotE	Department of the Environment (Cwlth)
DG	Dangerous goods
DPAW	Department of Parks and Wildlife (WA)
EMS	Environmental Management System
EP Act	*Environmental Protection Act 1986* (WA)
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Cwlth)
JSA	Job safety analysis
mm	millimetre
PEC	Priority Ecological Community
PER	Public Environmental Review
PPE	personal protective equipment
QA	quality assurance
QC	quality control
TEC	Threatened Ecological Community

1 INTRODUCTION

Tellus Holdings Limited (Tellus) proposes to construct and operate the Sandy Ridge Project. The details of the Sandy Ridge Project are provided in the *Sandy Ridge Project Public Environmental Review* (PER) (Tellus, 2016).

The environmental risks associated with the operational aspects of the project have been assessed by the project team at a workshop. The outcomes of the workshop are documented in this report.

Risks associated with closure were addressed at a separate workshop. The outcomes of that workshop are presented in the Mine Closure Plan and Waste Facility Decommissioning and Closure Plan. These plans are appended to the PER.

2 METHODOLOGY

Tellus adopted the international (*ISO 31000:2009*) and national (*AS/NZS ISO 31000:2009*) (SAI Global, 2009) standard processes for managing environment–related risks. An environmental risk assessment has been undertaken for all operational aspects of the project, in accordance with the procedures outlined in *AS/NZS ISO 31000:2009 Risk Management–Principles and Guidelines* and the handbook *HB 203:2012 Managing Environment–Related Risk* (SAI Global, 2012), using Tellus' Risk Assessment Matrix (AppendixA.1). The risk assessment process is illustrated in Figure 2–1.

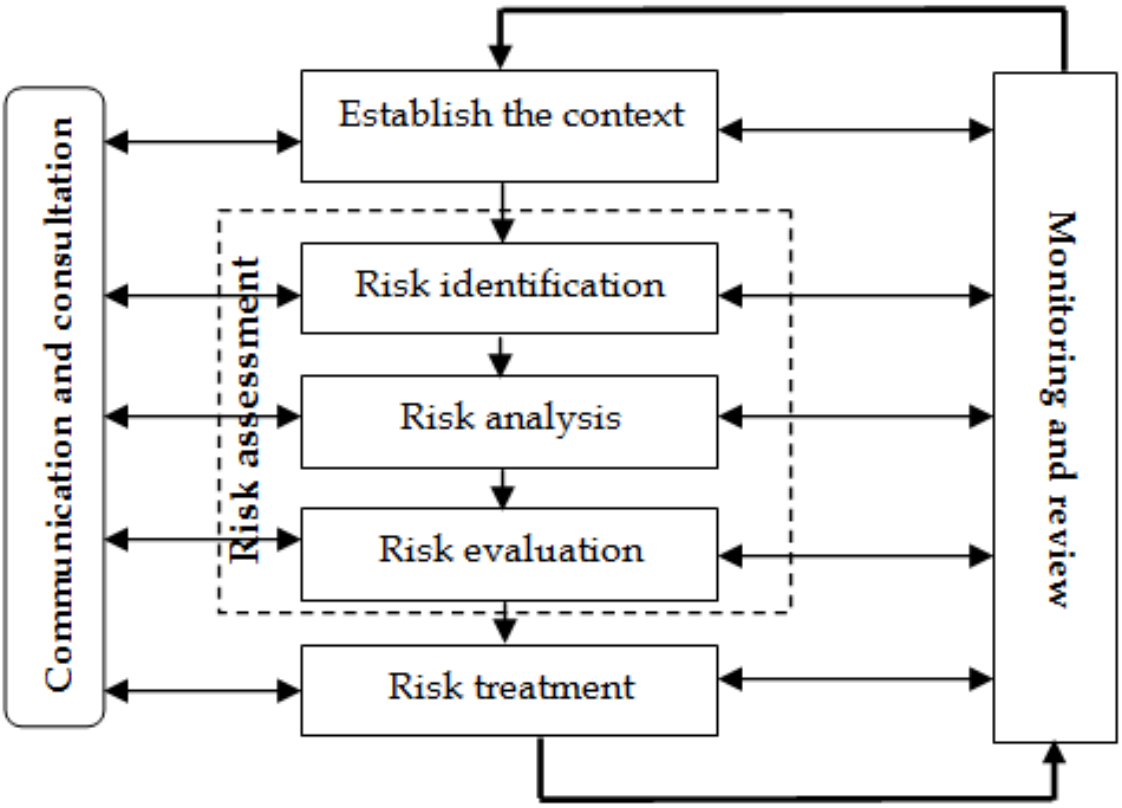

Figure 2–1 Risk assessment process as outlined in HB 203:2012

Each step of the process is described below.

3 ESTABLISH THE CONTEXT

As the project is proposed to be located within Western Australia, the definition of 'environment' for the purpose of the environmental risk assessment was the definition provided under the Western Australian *Environmental Protection Act 1986* (EP Act):

***environment**, subject to subsection (2), means living things, their physical, biological and social surroundings, and interactions between all of these (*Part 1, section 3, subsection 1).

For the purposes of the definition of environment in subsection (1), the social surroundings of man are his aesthetic, cultural, economic and social surroundings to the extent that those surroundings directly affect or are affected by his physical or biological surroundings (Part 1, section 3, subsection 2).

The project is also being assessed by the Commonwealth Department of the Environment (DotE) under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Section 528 of the EPBC Act defines environment to include:

(a) ecosystems and their constituent parts, including people and communities; and

(b) natural and physical resources; and

(c) the qualities and characteristics of locations, places and areas; and

(d) Heritage values of places; and

(e) the social, economic and cultural aspects of a thing mentioned in paragraph (a), (b), or (c).

The EPBC Act's definition for environment was also considered in establishing the context of the risk assessment.

The glossary of other terminology used during the environmental risk assessment was as per *HB 203:2012 Managing Environment–Related Risk* as listed below:

Consequence	includes cascade effects and impacts to the organization's business and activities arising from environmental-related issues (e.g. regulatory fines, clean-up costs, and damaged reputation as well as enhanced reputation, continued licence to operate, and regulatory approvals).
Environmental Aspect	element of an organization's activities, products or services that can interact with the environment.
Environmental impact	any change to the environment, whether adverse or beneficial, wholly or partially resulting from an organization's activities, products or services.
Hazard	source of potential harm.

Likelihood	chance of something happening, whether defined, measured or determined objectively or subjectively, qualitatively or quantitatively, and described using general terms or mathematically.
Risk	the effect of uncertainty on objectives.
Risk Source	a tangible or intangible element that alone or in combination has the intrinsic potential to give rise to risk.

4 RISK ASSESSMENT

4.1 Risk identification

The sources of risks, environmental aspects and potential environmental impacts, as defined by *HB 203:2012* were identified in a workshop attended by the Tellus Project Leader, Tellus Environment and Approvals Manager, Tellus Engineer, and Aurora Environmental representatives. The identified environmental aspects were categorised into 'planned' that is those aspects which Tellus know will occur during the project, and those that are 'unplanned' and may credibly occur during the project, but which Tellus has no control over the frequency of occurrence. The identified potential environmental impact is based on the 'worst–case' credible impact.

4.2 Risk analysis

Qualitative risk analysis was used to evaluate the significance of the likelihood of the consequence (Table 4–1). Analysis of the inherent risk was undertaken assuming no management/mitigation controls were in place. The group then discussed appropriate management and mitigation measures that would be implemented to reduce the likelihood or consequence, and then analysed the final residual risk.

Table 4–1 Environmental risk register

Risk Number	Environmental Aspect	Sources of Risk (Hazard)	Potential Environmental Impact (Worst case)	Pre–management risk	Management and Mitigation Measures	Post–management Risk		Residual risk
						Likelihood	Consequence	
1	**Transport of hazardous/intractable waste.**	Chemical spill (40 t) from the shipping container. Chemical spill onto roads.	Death and/or acute or chronic illness in humans and biota exposed to the spill.	Extreme	Waste packaged in bulka bags/drums. Bulka bags/drums transported inside shipping container. Shipping container securely fastened to truck. Dangerous goods (DG) rated trucks (e.g. better brakes, rollover systems) are used only. Trucks travel on sealed roads or controlled site access roads. Transport contractor on Tellus Register of Approved Transporters. Audits of transport contractor's procedural controls. For high risk loads (e.g. arsenic trioxide) individual risk assessment and transport management plan. Emergency Response and Management Plan.	Rare	Catastrophic	High
2	**Explosions.**	Fuel storage facility, storage and use of gas. Diesel fuel tank and piping reticulation. Explosives magazine.	Degradation of air quality (localised). Death/injury of humans and biota within the vicinity of the blast zone or in the path of the fire. Creates bushfire.	Extreme	Fuel storage facilities and systems designed to meet relevant Code. Inspection to ensure compliance including maintenance. Firebreaks. Firefighting equipment. Operational procedures. Hot work permits. Restricted access to the explosives store (i.e. must hold shot firer licence).	Rare	Major	High
3	**Transport of hazardous/intractable waste.**	Truck crash.	Death and injury to humans.	High	Trucks travel on sealed main roads only. Transport contractor on Tellus Register of Approved Transporters. Well maintained trucks. Approved, experienced and licensed drivers. Audits of transport contractor's procedural controls. Emergency Response and Management Plan. Police, emergency services.	Rare	Catastrophic	High
4	**Transport of hazardous/intractable waste.**	Chemical spill (e.g. flyash/ SPL) on the road, into surrounding environment (e.g. river).	Death and/or injury to fauna and flora.	High	Waste packaged as appropriate to level of hazard. Bulka bags/drums transported inside shipping container. Shipping container securely fastened to truck. DG rated trucks (e.g. better brakes, rollover systems) are used only. Trucks travel on sealed roads or	Possible	Moderate	High

Risk Number	Environmental Aspect	Sources of Risk (Hazard)	Potential Environmental Impact (Worst case)	Pre–management risk	Management and Mitigation Measures	Post–management Risk Likelihood	Post–management Risk Consequence	Residual risk
					controlled site access roads. Transport contractor on Tellus Register of Approved Transporters. Audits of transport contractor's procedural controls. For high risk loads (e.g. arsenic trioxide) individual risk assessment and transport management plan. Emergency Response and Management Plan.			
5	**Transport of hazardous/intractable waste.**	Collision with native fauna.	Road kill of Threatened/Priority fauna.	High	Trucks travel on sealed main roads only. Transport contractor on Tellus Register of Approved Transporters. Well maintained trucks. Approved, experienced and licensed drivers. Audits of transport contractor's procedural controls. Report to DPAW and DotE. Where feasible control speed and use headlights.	Possible	Moderate	High
6	**Creation of mine pits.**	Clearing native vegetation.	Loss of native vegetation.	High	Avoid Priority species. Engineering design to minimise amount of vegetation to be cleared. Supervision of clearing. Operational Procedure. Regular toolbox meeting. Training of Operators.	Almost Certain	Insignificant	High
7	**Creation of firebreak.**	Clearing native vegetation.	Opportunity for weeds to establish.	High	Weed monitoring and removal.	Almost Certain	Insignificant	High
8	**Transport of radioactive waste.**	Radioactive waste spill (200L drum).	Humans within the vicinity of the spill will receive a one off higher dose of radiation above background levels.	High	Small quantities received on average annually. Drums transported inside shipping container. Shipping container securely fastened to truck. Priority given to transporting on heavy haulage routes. For all radioactive waste an individual risk assessment is completed. Disposal permit issued by government. Transport contractor on Tellus Register of Approved Transporters. Audits of transport contractor's procedural controls. Emergency Response and Management Plan. Inform Radiation Health Branch WA.	Unlikely	Moderate	Moderate
9	**Presence of infrastructure (e.g. turkeys nest, landfill, mine voids).**	Attraction of birds, mammals, vermin and feral animals to water source. Fauna falling into pit/cell.	Injury or death of Threatened/Priority fauna.	High	Fencing of contaminated water pond. Fencing around landfill. Covering of landfill once the trench is	Unlikely	Moderate	Moderate

Risk Number	Environmental Aspect	Sources of Risk (Hazard)	Potential Environmental Impact (Worst case)	Pre–management risk	Management and Mitigation Measures	Post–management Risk Likelihood	Post–management Risk Consequence	Residual risk
		Presence of vermin carrying disease at landfill, being eaten by predators.			full. Weekly litter inspection and clean-up. Weekly toolbox meeting. Training of operators. Operational bunding around cell. Ramps into and out of cell. Daily inspection of water ponds for trapped/injured fauna. Daily inspections of access roads for roadkill.			
10	**Naturally occurring events.**	Bushfire.	Injury of workers and site visitors. Toxic smoke plume. Contaminated fire water. Soil contamination.	High	Emergency Response and Management Plan. Low fuel load in woodlands. Firebreaks. Firefighting facilities onsite. Minimal flammable waste, facilities and goods onsite.	Rare	Moderate	Moderate
11	**Introduction of weeds.**	Incoming waste carriers. Incoming supply vehicles and 4wds. Incoming site visitors, staff vehicles. Bird poo.	Establishment of weeds on the site and competition for resources (e.g. water) with native vegetation.	High	Weed monitoring procedures. Inspections of light vehicles and brush downs. Mining plant wash down before its used onsite. Weed removal where necessary.	Likely	Insignificant	Moderate
12	**Accidental fire within infrastructure.**	Flammable goods packed into shipping container. Vehicle fire in cell. Fire in buildings.	Release of toxic gas, adverse health impacts to workers/public/fauna.	High	Equipment maintenance. Fire detection/ suppression systems. Design codes for waste storage. Operational procedures. Regular toolbox meetings. Training of operators. Chemical wastes stored in shipping containers. Use of diesel engines instead of petrol in storage areas. Multiple waste storages areas in container hardstand.	Rare	Moderate	Moderate
13	**Handling of hazardous/intractable waste.**	Chemical spill during offloading of waste from ADT into cell. Chemical spill during manoeuvring of waste package into place in the cell.	Death of worker in the cell.	Extreme	PPE. Training of operators. Regular toolbox meetings. Operating procedures. Restricted access to the cell. Recirculating air throughout cabs. JSAs specific to waste being handled. Equipment maintained. Secondary egress from cell. Everyone in the cell immediately evacuates.	Unlikely	Minor	Low
14	**Creation of cell and waste disposal progressing.**	Surface water runoff into cell.	Generation of leachate and degradation of groundwater.	Extreme	Roof canopy over open cell. Operational bunding around cell, drains into V drain and sump. Levees to divert surface water flow. Backfill around waste packages with high matric suction potential.	Rare	Insignificant	Low

Risk Number	Environmental Aspect	Sources of Risk (Hazard)	Potential Environmental Impact (Worst case)	Pre–management risk	Management and Mitigation Measures	Post–management Risk Likelihood	Post–management Risk Consequence	Residual risk
					Primary containment in place in each waste package (e.g. liner in bulka bag).			
15	**Handling of hazardous/intractable waste.**	Chemical spill during unloading/reloading of waste from/into shipping container in Waste Inspection Shed. Chemical spill during sampling and testing of waste package in laboratory.	Death and/or acute or chronic illness in humans exposed to the spill.	High	Operating procedures. Training of operators. Regular toolbox meetings. PPE. Regular equipment maintenance. Visual assessment. Safety shower. Spill kits. First aiders/first aid kit. Evacuation procedure.	Rare	Minor	Low
16	**Handling of hazardous/intractable waste.**	Vehicle collision with ADT. Loss of containment from shipping container subsequent spill of solids.	Localised soil contamination. Damage to vegetation. Toxic dust dispersal affecting vegetation/fauna off the development envelope.	High	Operating procedures. Training of operators. Regular toolbox meetings. Onsite traffic management. Speed limits. Two-way communications. Regular equipment maintenance. Visual assessment. Spill kit.	Rare	Minor	Low
17	**Handling of radioactive waste.**	NORMs spill during unloading/reloading of waste from/into shipping container in Waste Inspection Shed.	Humans within the vicinity of the spill will receive a one off higher dose of radiation above background levels.	High	Operating procedures. Training of operators. Regular toolbox meetings. PPE. Regular equipment maintenance. Visual assessment. Safety shower. Spill kits. First aiders/first aid kit. Dose meters on workers. Radiation measurements.	Rare	Minor	Low
18	**Handling of radioactive waste.**	Gamma exposure during offloading of waste from ADT into shaft.	Humans within the vicinity of the shaft above with higher dose of radiation above background levels or chemical exposure.	High	Operating procedures. Training of operators. Regular toolbox meetings. Engineering design. Dose meters. Radiation measurements. Exclusion zones.	Rare	Insignificant	Low
19	**Wash down of shipping containers.**	Contaminated wash water washes off the wash down pad. Dust on hardstand from, residual of wash down. Containment overflows during extreme rainfall event. Liner faulty/fails.	Soil contamination.	High	Operating procedures. QA/QC testing on liner. Engineering design (500mm freeboard, ponds sufficient capacity). Shallow monitoring bores. Contain the overflow through secondary sump. Clean-up/disposal of contaminated soil.	Unlikely	Minor	Low

Risk Number	Environmental Aspect	Sources of Risk (Hazard)	Potential Environmental Impact (Worst case)	Pre–management risk	Management and Mitigation Measures	Post–management Risk		Residual risk
						Likelihood	Consequence	
20	**Creation of mine pits.**	Blasting. Physical removal of topsoil, subsoil and kaolin.	Dust emissions affecting workers. Dust emissions settling on plant leaves, affecting photosynthesis and potentially killing plants. Noise emissions affecting workers. Noise emissions temporarily or permanently damaging the hearing of fauna in the vicinity of the blast.	High	Operating procedures. Blasting conducted once per year, duration of a few seconds. PPE for workers.	Unlikely	Insignificant	Low
21	**Construction and operation of water pipeline.**	Leak/spill of saline water.	Death of vegetation through osmosis of saline water.	High	Design controls to monitor flow through pipeline, any loss will immediately trigger an alarm in the process control unit. Close isolation valves. Cease pumping water. Inspect water pipeline and repair damaged section.	Unlikely	Minor	Low
22	**Use of saline water for dust suppression**	Watering of native vegetation along roadsides.	Uptake of saline/brackish water and death of vegetation.	High	Use a dribble bar on the back of the water cart instead of a spray bar. Equipment maintenance. Operational procedures.	Unlikely	Minor	Low
23	**Fencing of the waste cells.**	Exclusion of fauna from potential habitat.	Forced translocation of fauna into other habitat and increased predation in new habitat. Potential for injury/death of Threatened/Priority fauna.	High	Fences to be removed following revegetation of cells.	Rare	Insignificant	Low
24	**Waste Laboratory.**	Minor spill of sample during testing of waste.	Radiation exposure of workers. Injury (e.g. chemical burn) to workers.	High	Building enclosed and contains fume hoods. PPE. Operational procedures for waste testing. Training of operators. Regular toolbox meetings.	Unlikely	Minor	Low
25	**Water retention ponds.**	Leak/crack in pond liners.	Release of contaminated water to underlying and surrounding soils and potentially damage vegetation associated with those soils.	High	Shallow monitoring bores. Low hydraulic conductivity means water will not move far from the spill site. Contain and clean-up the spill. Operational procedure for management of contaminated soils.	Unlikely	Insignificant	Low
26	**Naturally occurring events.**	Earthquakes (size 3)	Slight subsidence of cell, consolidates backfill and potential creates a void.	High	Post event inspection and records kept. Repair cap if needed. Subsidence monitoring.	Possible	Insignificant	Low
27	**Naturally occurring events.**	Cyclones/flood	Increased rainfall at the site, overflow of contaminated water ponds which may impact surrounding soils, cause widespread flooding of contaminated surface water and injure/kill biota. Cell fills with water and leachate generated and then overflows to surrounding environment.	High	Small quantities of water. 24 hour duration. Pumping out of ponds prior to cyclone. Roof canopy over open cell. Operational bunds around cells. Waste still in shipping containers. Waste disposal halted if cyclone expected.	Unlikely	Insignificant	Low

Risk Number	Environmental Aspect	Sources of Risk (Hazard)	Potential Environmental Impact (Worst case)	Pre–management risk	Management and Mitigation Measures	Post–management Risk Likelihood	Post–management Risk Consequence	Residual risk
28	**Aboriginal heritage.**	Destruction of aboriginal heritage site and/or cultural association. E.g. clearing native vegetation of significance, excavating land of significance, and storing waste on significant land.	Degradation of heritage value of the local area.	High	Aboriginal heritage pre-construction survey. Operational procedure for encountering aboriginal cultural material. Contact WA Police if skeletal material is uncovered.	Rare	Minor	Low
29	**Malleefowl mound.**	Construction of pipeline. Construction of road and plant.	Removal or damage to an active nesting mound.	High	Malleefowl survey pre-construction to identify new active mounds. Re-design pipeline route to avoid mound. Report disturbance to an active mound to DPAW and DotE.	Rare	Insignificant	Low
30	**Landform.**	Change in landform by placing domed caps up to 5m higher than the landscape.	Ponding around the toe of the landform. Erosion.	Moderate	Engineering design. Engineering design as constructed plans demonstrated cell backfilling/capping competently constructed. Long term erosion modelling. Revegetation present.	Unlikely	Insignificant	Low
31	**Transport of chemical and radioactive waste.**	Leak of liquid material (e.g. NORM and/or hydrocarbons) from shipping container.	Humans within the vicinity of the leaked material may receive a one off higher dose of radiation above background levels or chemical exposure.	Low	Waste packaged as appropriate to level of hazard. Trucks travel on sealed roads or controlled site access roads. Transport contractor on Tellus Register of Approved Transporters. DG rated trucks (e.g. carry clean-up equipment and drivers are trained to manage a leak). Audits of transport contractor's procedural controls. Truck parked up. Source of the leak is investigated and contained. Clean-up undertaken. Emergency Response and Management Plan.	Rare	Insignificant	Low
32	**Subsurface waste disposal**	Permanent isolation of waste over geological time.	Gamma radiation exposure at the surface on surrounding humans, soils, flora and vegetation and fauna.	Low	Safety Case and Safety Assessment. Baseline radiation survey. Engineering design - depth of burial in shaft and materials used in construction. Institutional control period.	Rare	Insignificant	Low
33	**Creation of mine pits**	Alteration to surface water runoff.	Changes hydrology (quality and quantity) and effects on downstream vegetation.	Low	High infiltration rate (500mm/day). High evaporation rate (2400mm/year). Vegetation likely to be dependent only on landing rainfall, not runoff. Vegetation adapted to low rainfall (<250mm/year).	Rare	Insignificant	Low
34	**Kaolin Process Plant**	Operation of the plant. Incorrect disposal of wastes (e.g. waste oil, oily rags)	Dust emissions affecting workers. Dust emissions settling on plant leaves, affecting photosynthesis and potentially killing	Low	Wet process. Building enclosed and contains dust extraction system (e.g. baghouse).	Rare	Insignificant	Low

Risk Number	Environmental Aspect	Sources of Risk (Hazard)	Potential Environmental Impact (Worst case)	Pre–management risk	Management and Mitigation Measures	Post–management Risk Likelihood	Post–management Risk Consequence	Residual risk
			plants. Noise emissions affecting workers. Noise emissions temporarily or permanently damaging the hearing of fauna in the vicinity. Hydrocarbon contamination of soils.		PPE. Noise levels monitored to comply with OHS Regulations. Operational procedures. Training of operators. Regular toolbox meetings. Oily waste disposed offsite.			
35	**Water abstraction from Carina pit**	Create a cone of depression within the Carina pit.	Change to groundwater aquifer (quality and quantity) at Carina pit	Low	Measurements of quality and drawdown of the water within the pit. Monitor abstraction volumes. Groundwater modelling to confirm cone of depression.	Unlikely	Insignificant	Low
36	**Failure of waste cell containment, cell instability/collapse during operations.**	Placement of liquid/gas waste packages into the cell. Over time voids are created in the cell. Generation of leachate as water infiltrates the cell. Failure of cell wall and/or cap. Faulty design. Faulty construction - waste package placement/backfill. Differential settlement. Earthquake. Intentional disturbance to the cell to retrieve radioactive material.	Degradation of groundwater quality.	Low	Seepage rate low. High evaporation rate. High evapotranspiration rates. High energy hydrological environment. Large unsaturated zone and storage capacity beneath each cell. Backfill material is unsaturated and can store water. No aquifer within weathered granite. No groundwater dependent vegetation, Threatened species or TECs/PECs. Engineering design/site selection based on international best practice for near surface geological repositories. Operational procedures for appropriate wastes and waste acceptance criteria. Training of operators. Subsidence monitoring of cap. Groundwater monitoring.	Rare	Insignificant	Low
37	**Waste package comprising a sealed source arrives with an activity concentration >3,700 Bq/g arrives at the site.**	The waste package exceeds the waste acceptance criteria and will not be <370 Bq/g at the end of the institutional control period (300 years).	Potential exposure of workers during handling of the waste package.	Low	Disposal permit issued. Proforma issued. Inspection and measurement of all sealed sources on arrival at site. Dose meters attached to workers.	Rare	Minor	Low
38	**Waste package comprising a sealed source arrives with a half-life greater than 30 years and is placed in the cell.**	The waste package exceeds the waste acceptance criteria and will not be <370 Bq/g at the end of the institutional control period (300 years).	Acute or chronic radiation exposure possible to the public utilising the land in 300 years' time.	Low	Disposal permit issued. Proforma issued. Inspection and measurement of all sealed sources on arrival at site. Depth of burial. Operational procedures.	Rare	Insignificant	Low
39	**Erection of buildings**	Kaolin processing plant will be the tallest building. Tourists will not be allowed to enter the mine site.	Change to visual amenity of people conducting nature based tourism activities in Mount Manning Range Nature Reserve, Mount Manning - Helena - Aurora Ranges Conservation Park.	Low	Normal travel routes on existing roads will not be affected by Tellus operations. 10 km distance from nearest existing reserve (Mount Manning Range) and unlikely the kaolin processing plant	Rare	Insignificant	Low

Risk Number	Environmental Aspect	Sources of Risk (Hazard)	Potential Environmental Impact (Worst case)	Pre–management risk	Management and Mitigation Measures	Post–management Risk Likelihood	Post–management Risk Consequence	Residual risk
			Interference with scientific studies in existing and proposed reserve system.		will be visible from this distance. There is not expected to be an encounter with scientists within ex-Jaurdi Pastoral Lease, given operations will be outside of the Lease area.			
40	**Surface water**	Leak or spill from a waste package.	Degradation of water quality.	Low	Minimal volumes of surface water that will be present at the time of a spill/leak (i.e. surface water flows only in extreme rainfall events). Various barriers around, and integrity of, the waste package itself. Factors that affect leachability of solid waste. Unloading of waste packages within enclosed warehouses with bunded concrete floors. Distance to nearest receptor (48 km away).	Rare	Insignificant	Low

4.3 Risk evaluation

The outcome of the risk assessment included the identification of 40 credible risks, of these 28 are planned (i.e. elements of Tellus activities that will interact with the environment) and 12 are unplanned (unexpected interactions with the environment). With the implementation of management and mitigation measures, the division of the residual risks for the project were:

- 7 – High residual risks.
- 5 – Moderate residual risks.
- 28 – Low residual risks.

The residual risks were evaluated using the Tellus risk criteria (Table 4–2).

Table 4–2 Risk criteria

	Extreme	**Unacceptable** further management review required to reduce risk.
	High	**Tolerable** if management determine and accepts risk has been reduced to as low as reasonably practicable.
	Moderate	**Acceptable** with management review for continuous improvement.
	Low	**Acceptable** no further management required.

As stated in *HB 203:2012 Managing Environment–Related Risk:*

'Tolerable' refers to the willingness to live with a risk to secure benefits, on the understanding that it is being properly controlled. 'Tolerability' does not mean 'acceptability'. Tolerating a risk does not mean that it is regarded as negligible, or something that can be ignored, but rather as something that should be kept under review such that if and when feasible and appropriate it can be reduced still further.

'Acceptable' relates to risks that do not need further treatment at this stage. The expression acceptable level of risk refers to the level at which it is decided that further action is not worthwhile, e.g. additional effort will not result in significant reductions in risk levels.

5 RISK TREATMENT

The purpose of risk treatment is to achieve objectives by managing uncertainty as effectively as possible. As no 'Extreme' risks have been identified, and the residual risk levels for all hazards have been evaluated as **Tolerable** or **Acceptable** it is considered no further treatment of risks is required at this stage.

In future environmental risk assessments, if the risk profile is elevated to 'Extreme' risk treatment will be undertaken by Tellus.

6 MONITORING AND REVIEW

Monitoring and review of the environmental risks associated with the project will be conducted using the following methods:

1. Monitor the environment itself – monitoring requirements specified in the PER and the Environmental Management System (EMS) will be undertaken. The outcomes of the monitoring, and any new risks identified will be outlined in future risk assessments.
2. Monitor and respond to losses and incidents – incidents which occur during the construction and operations phase, that potentially lead to environmental harm, will be documented and reviewed.
3. Monitor the implementation of the Emergency Response and Management Plan and where possible continuously improve the procedures outlined in the plan.
4. Use internal and external audits in accordance with EMS requirements.

7 REFERENCES

SAI Global, 2009, *AS/NZS ISO 31000:2009 Risk Management–Principles and Guidelines,* available at: http://infostore.saiglobal.com/store/details.aspx?ProductID=1378670

SAI Global, 2012, *HB 203:2012 Managing Environment–Related Risk,* available at: http://infostore.saiglobal.com/store/details.aspx?ProductID=1516912

APPENDIX

A.1 **Risk matrix**

Consequence descriptors

Consequences	Insignificant	Minor	Moderate	Major	Catastrophic
Safety and Health	Near miss / hazard.	First aid treatment required.	Medical treatment required, no lost time.	Lost time injury(s) (LTIs).	Potential fatality / multiple LTIs.
Regulatory	No breach of works approval/licence/approval condition	Breach of one works approval/licence/approval condition.	Injunction under the EPBC Act. Infringement notice issued under the EP Act. Breach of several licence conditions/ministerial statement conditions/proponent commitment.	Directed environmental audits under the EPBC Act. Environmental Field Notice, Caution Notice, Management Letter or Non Compliance Notice issued under the EP Act.	Civil and criminal penalties under the EPBC Act and EP Act. Suspension or revocation of works approval/licence.
Pollution	No noise emitted from operation. Minor spill cleaned up in hours to days. No residual contamination following clean-up, no effect on watercourses, water bodies or aquifers.	Low level of noise emitted but not received at noise sensitive premise. Contamination of a watercourse, water body and/or aquifer, cleaned up in days to months.	Moderate level of noise emitted but expected to be below Noise Regulation limits at noise sensitive premises. Massive contamination of a watercourse, water body or aquifer, with clean-up over months to years.	High level of noise emitted and expected to be above the Noise Regulation limits at noise sensitive premises. Massive irreverable contamination of a watercourse, water body or aquifer.	Noise emitted causes temporary or permanent hearing loss. Toxic release off site with massive detrimental effect. Massive pollution with significant remedial work required. Global media interest.
Flora / Fauna	Damage to flora. Death or Injury of individual fauna.	Damage to priority flora. Death or injury of individual priority fauna. Destruction of fauna habitat.	Damage to Threatened/declared rare flora. Destruction of priority flora species. Death of priority fauna species. Death or injury of individual Threatened or Migratory fauna. Damage of critical fauna habitat.	Damage to critically endangered flora. Destruction of Threatened/declared rare flora species. Destruction of critical fauna habitat. Death or injury of individual critically endangered fauna.	Extinction of fauna species. Extinction of flora species. Destruction of critical habitat.

Consequences	Insignificant	Minor	Moderate	Major	Catastrophic
Socio / Political	Localised temporary impact	Localised, short term impact, closure of access roads, temporary loss of amenity.	Localised, long term impact but manageable. Evacuation of site and closure of neighbouring operations.	Localised, long term impact with unmanageable outcomes. Evacuation of site, and people within 200 km of the site, closure of major highway.	Long term regional or national impact, permanent isolation from the site and region.
Heritage	Damage or disturbance occurring near to (but not at) an Aboriginal Site. Access to an Aboriginal Site lost for up to two weeks.	Unauthorised access to or interference with an Aboriginal Site (e.g. movement of an artefact) without causing damage. Access to an Aboriginal Site lost for up to one month.	Minor damage to an Aboriginal Site or to an artefact at an Aboriginal Site. Access to Aboriginal Site lost for up to three months.	Major damage to an Aboriginal Site or to an artefact at an Aboriginal Site. Access to Aboriginal Site lost for up to six months.	Destruction of an Aboriginal Site or an artefact at an Aboriginal Site. Permanent loss of access to an Aboriginal Site.
Financial / Legal	<$50,000	$50,000 - 250,000	$250,000 - 400,000	$400,000 - 10M	>$10m

Likelihood descriptors

Rare	Unlikely	Possible	Likely	Almost Certain
5%	20%	50%	80%	95%
Highly unlikely to occur on this project	Given current practices and procedures, this incident is unlikely to occur on this project	Incident has occurred on a similar project	Incident is likely to occur on this project	Incident is very likely to occur on this project, possibly several times

Risk matrix				Consequence				
				Insignificant	Minor	Moderate	Major	Catastrophic
				1	2	3	4	5
Likelihood	A	Almost Certain	95%					
	B	Likely	80%					
	C	Possible	50%					
	D	Unlikely	20%					
	E	Rare	5%					

Risk criteria

	Extreme	**Unacceptable** further management review required to reduce risk.
	High	**Tolerable** if management determine and accepts risk has been reduced to as low as reasonably practicable.
	Moderate	**Acceptable** with management review for continuous improvement.
	Low	**Acceptable** no further management required.