

GRANTS LITHIUM PROJECT

Environmental Impact Statement

Additional Information

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1 INTRODUCTION

Following submission of the Grants Lithium Project Supplement, the NT EPA has requested additional information from Core Lithium (Core) in relation to modifications made to the project proposal since the Draft EIS was submitted in November 2018. Specifically, the NT EPA has requested clarification about the effect of the changes on the environment. This document has been compiled to respond to each comment, and where relevant, provide additional information to facilitate further examination of the EIS by the NT EPA.

2 PROJECT MODIFICATIONS

Section 2 of the Supplement summarised modifications to the proposal that have occurred since submission of the Draft EIS in November 2018. These changes are a result of the increased Mineral Resource Estimate prepared for Grants following finalisation of the exploration drilling program in 2018, and subsequent re-optimisation of the pit shell to allow for mining of the additional ore resource. From the outset of the environmental approvals process, Core has been open with the NT EPA about its ongoing exploration program at Grants and other nearby leases, and this information has been shared in briefings conducted at key stages of the assessment process. Core would therefore like to re-iterate that the updates to the project presented in the Supplement, are a result of the exploration success that Core has achieved and subsequent evolution of the project to maximise exploitation of the mineral resources that are present.

Comment #9 received from the NT EPA requested a detailed table of the proposal changes between the Draft EIS and Supplement. To assist the NT EPA with assessing whether or not the modifications alter the significance of potential impacts assessed in the EIS, Table 2-1 provides this information. In summary the following changes have occurred:

- Total ore mined increased by 21%
- Total waste rock increased by 55%
- Pit depth increased by 20 m
- Disturbance footprint increased by 70 ha (or 38%)
- Life of mine extended by 10 months.
- Greenhouse gas emissions over life of mine increased by 32%, as a result of additional land clearing and an additional 10 months of emissions from power generation and transport associated with the extended mine life.

The changes will result in increased economic and employment benefits. There will be an additional \$6.3 million in royalties estimated to be paid to NT Government and an additional 10 months of employment opportunities.

Table 2-1. Summary of modifications to the proposal scope between Draft EIS and Supplement

PROJECT ASPECT		SCOPE IN DRAFT EIS	SCOPE IN SUPPLEMENT	CHANGE
Material volumes	Ore mined	644,306bcm	782,978bcm	Increased by 21%
	Waste mined	8,920,762bcm	13,887,008bcm	Increased by 55%
Schedule	Life of Mine	25 months	35 months	Extended by 10 months
Project footprint	Open pit footprint	17.6ha	24.3ha	Increased by 6.7ha
	WRD/TSF footprint	60ha	88.9ha	Increased by 28.9ha
	Topsoil stockpile	17ha	20.6ha	Increased by 3.6ha
	Inundation bund	7.2ha	7.5ha	Increased by 0.3ha
	Raw Water Dam	0.5ha	2.1ha	Increased by 1.6ha
	Other components	44.7ha	73.6ha	Increased by 28.9ha
	Total mine	147ha	217ha	Increased by 70ha
	Water supply	38ha	38ha	No change
Pit depth	Pit depth	180m	200m	Increased by 20m
	Mining method	Open pit drill and blast		No change

PROJECT ASPECT		SCOPE IN DRAFT EIS	SCOPE IN SUPPLEMENT	CHANGE
Mining operations	Operating hours	24 hours, 7 days/week		No change
	Processing	Crushing, screening and Dense Media Separation		No change
Transport	Haulage	10 quad road train loads to port each day. Total of 20 truck trips along haul route.		No change
	Route	Cox Peninsula Rd, through to the Stuart Hwy, along the Stuart Hwy to Tiger Brennan Drive and then Berrimah Rd, to the East Arm Port		No change
Greenhouse gas emissions	Transport emissions	45,769.2tCO _{2-e}	55,664 tCO _{2-e}	Increased by 9,895 tCO _{2-e}
	Stationary emissions	3,279.5tCO _{2-e}	4,489 tCO _{2-e}	Increased by 1,210 tCO _{2-e}
	Land clearing	10,147tCO _{2-e}	18,323 tCO _{2-e}	Increased by 8,176 tCO _{2-e}
	Portion of NT annual emissions	0.4%	0.47%	Increased by 0.07%
Water use and management	Water demand	2,018 kL/day		No change
	Sources	Make-up water to be supplied from Observation Hill Dam and Mine Site Dam		No change
	Discharge requirements	Off-site discharge of water excess to requirements in November to March each year of operations.		No change
Workforce	Construction	100-150	200-250	Increased by 100
	Operations	90	90	No change
Economic scale	Capital cost	\$53.5 million	\$73 million	Increased by \$19.5M
	Net Present Value	\$87 million	\$97 million	Increased by \$10M
	Tax contribution	\$53 million	\$37.5 million	Decreased by \$15.5 ¹
	Royalties paid to NT	\$26 million	\$32.3 million	Increased by \$6.3M
Closure and rehabilitation	Open pit	Stabilised, secured and left to form a pit lake		No change
	WRD/TSF	Re-profiled to create a stable, non-polluting landform		No change
	Infrastructure	All above-ground infrastructure will be removed		No change
	Rehabilitation	Disturbed areas revegetated with local native species		No change
	Public safety	Abandonment bund and signage in place to protect public safety		No change

The subsequent sections of this document provide additional information in relation to how these changes impact on each of the environmental factors/objectives assessed in the Draft EIS.

¹ Tax liabilities have decreased as a result of the increased capital cost and movement in the lithium price.

3 TERRESTRIAL ENVIRONMENTAL QUALITY

Potential impacts to Terrestrial Environmental Quality were described in Chapter 6 of the Draft EIS. This section provides supplementary information in response to the NT EPA's request for further information in relation to potential sulfur and heavy metals concentrations in the waste rock associated with the larger disturbance footprint and mine closure strategies and criteria.

3.1 Waste rock characterisation

3.1.1 NT EPA Comment # 1

The increase in pit depth from 180 m to 200 m and associated changes to the significance of impacts, especially on Terrestrial Environment Quality and Inland Water Environment Quality, have not been sufficiently addressed in the Supplement. No further information or discussion about the additional waste rock (56% increase in volume) characteristics was provided to assess the significance of the pit extension.

156 waste rock samples have undergone geochemical characterisation. The Western Australian Draft Guidance Materials Characterisation Baseline Data Requirements for Mining Proposals (DMP 2016) recommends a 'few hundred' samples for waste rock volume >10,000 cubic metres.

From the data presented in the Draft EIS, it is unclear where drilling samples have been undertaken and how the results correlate with the expanded pit shell and data provided in the Supplement.

3.1.2 Further Information Required:

- Provide information to justify that the waste rock geochemical characterisation is consistent with relevant guidelines for the characterisation of acid, metalliferous and/or saline drainage, and discuss the scientific confidence in the findings.
- Provide information about the location of each drill bore number in relation to the extended pit shell, preferably in 3D.

3.1.3 Response

Figure 3-1 depicts the original pit shell (green) and the expanded pit shell (aqua), showing that most of the pit expansion occurs to the south. The image illustrates that in some areas, in particular the northern and western portions of the pit, the wall of the extended pit shell sits inside the wall of the original pit shell.

The increase in the pit disturbance footprint does not alter the risks associated with acid, metalliferous or saline drainage (AMD), as the geological domains encountered in the extended pit shell are consistent with those documented and characterised in the Materials Characterisation Report provided as Appendix E of the Draft EIS. The volumes of each rock-type domain in the original pit were calculated using wireframes defined by geological logging of drill core or RC chips (refer section 2.7 of the Waste Characterisation Report). For comparison, Table 3-1 below presents these original figures alongside the volumes of each rock-type encountered in the expanded pit. The geological data compiled from the drilling database illustrates that the expanded pit encompasses larger volumes of the same rock-types. No new rock types are encountered and therefore the waste characterisation work undertaken to date is considered to be representative of the waste materials that will comprise the expanded waste rock dump.

Table 3-1. Rock types encountered in original pit (Draft EIS) and expanded pit (Supplement)

Weathering category	Rock-type	Original pit		Expanded pit	
		Volume m ³	% of total volume	Volume m ³	% of total volume
Surface zone weathered	Soil/Laterite	85,000	1%	100,611	0.68%
Weathered Oxide zone 30-60m thick	Phyllite	4,230,000	49.66%	6,749,892	45.7%
	Quartz veins	8,000	0.09%	12,766	0.09%
	Pegmatite	300,000	3.52%	478,716	3.24%
Transitional zone 1-20m thick	Phyllite	950,000	11.14%	1,402,698	9.5%
	Quartz veins	1,500	0.02%	2,215	0.01%
	Pegmatite	6,000	0.07%	8,859	0.06%
Fresh zone	Phyllite	2,410,000	28.26%	5,221,031	35.35%
	Quartz veins	5,000	0.06%	10,832	0.07%
	Pegmatite	530,000	6.18%	782,977	5.3%

Geochemistry of waste rock in expanded pit

The red lines on Figure 3-1 depict drill holes from which samples were collected for waste characterisation, from the hole collar at the surface, down to the deepest point from which a sample was collected. The holes are drilled on an angle from the outer edges of the pit shell towards the mineral resource, which is vertical and runs along a north-south axis through the centre of the pit (refer Figure 3-1). The holes have not been labelled on the image as it is difficult to clearly illustrate these 3D data in 2D format; however, Core would be happy to provide an on-screen 3D presentation to the relevant NT EPA and/or DPIR staff if required.

In the southern portion of the pit, Figure 3-1 shows a number of drill holes that extend into the expanded pit shell. Waste characterisation samples were collected from six of these holes as part of the routine sample collection undertaken during the last round of exploration drilling in late 2018. The samples are from downhole depths between 38 m and 136 m. Whilst none of these samples are from the deeper parts of the extended pit shell, the waste characterisation program did characterise six samples collected from downhole depths greater than 180 m. Table 3-2 provides details of the sample locations and geochemistry for waste characterisation samples that, given the homogeneity of the geology, should be indicative of the characteristics of the waste rock in the expanded pit shell.

Of the six samples analysed from the expanded area of the pit, one (FRC152-125) had sulfur concentration that exceeds the guideline trigger value (0.05%). ABA results for this sample indicate the presence of PAF material.

Of the five samples analysed from downhole depths >180m, two of these samples had sulfur concentrations greater or equal to the guideline trigger value. ABA results for these samples indicate they are NAF. All other samples had sulfur concentrations below the guideline trigger value.

Analysis of the % sulfur data for all 156 samples, reveals 16 samples, or 10% of the total samples, have concentrations in excess of the 0.05% S trigger value. Of these, ABA results indicate the presence of PAF material in one sample and an uncertain result (potentially PAF) for two further samples. Further analysis of the distribution of the samples with >0.05% Sulfur (refer Figure 3-2), indicates that these materials occur throughout the pit shell and not in any particular zone.

Whilst only a limited number of samples have been analysed from within the extended portion of the pit shell, the largely benign geochemical characteristics of these samples, combined with the knowledge from the drill core

database that the rock types demonstrate a high degree of homogeneity², indicate that mining is unlikely to encounter large volumes of PAF material. On this basis, Core is confident that the conclusions of the waste rock characterisation prepared for the original pit, hold true for the extended pit. Waste rocks that classify as PAF will be limited in volume and are not confined to a specific area within the pit shell. These rocks will be excavated with large volumes of NAF materials and placed in the waste rock dump surrounded and underlain by materials that have sufficient Acid Neutralising Capacity to offset any potential acid generation.

Further analysis of available drill core would increase the scientific confidence of this prediction. Core is committed to working with DPIR to ensure the level of scientific certainty provided in the Mining Management Plan (MMP) is commensurate with the level of risk posed by the proposal. Core has also made a commitment to ongoing sampling of waste rock during mining to identify PAF. This sampling will ensure that any potentially problematic materials are adequately characterised and effectively managed by co-disposal with sufficient volumes of NAF materials to offset any acid generation. The MMP will provide estimates of the volumes of PAF likely to be encountered in each depth horizon, and demonstrate the capacity to manage these materials within each stage of the WRD.

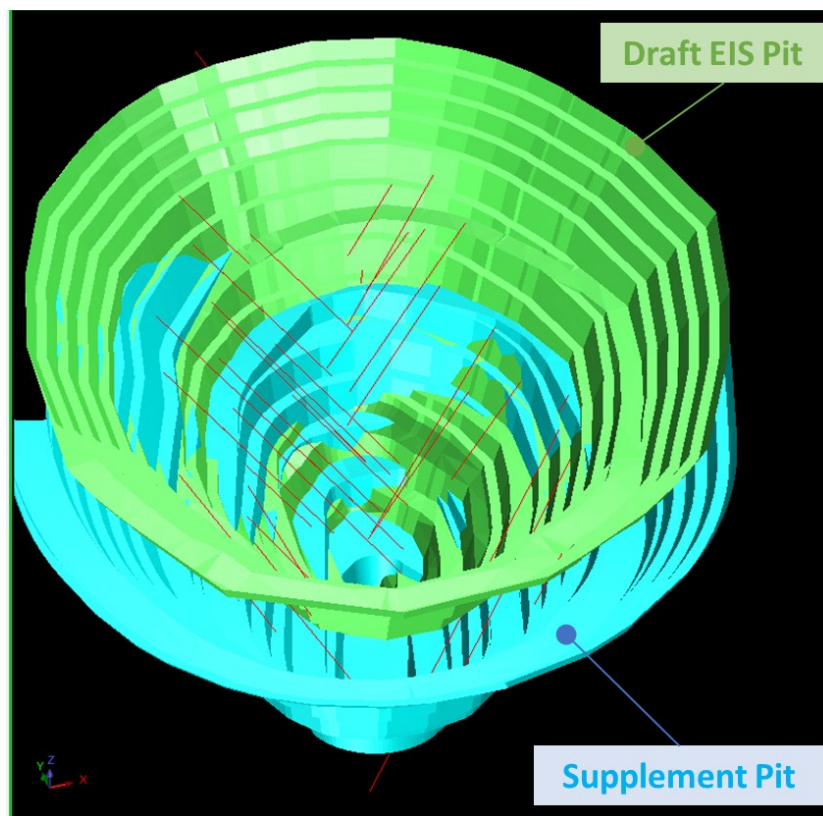


Figure 3-1. Location of waste characterisation drill holes in relation to original pit and extended pit

² The geological domains described in Draft EIS Chapter 2 Section 2.9, demonstrate a high degree of homogeneity and are inherently unlikely to be PAF, due to the generally low concentrations of sulfur associated with the sedimentary environment in which they were deposited. This is supported by the drill core data, which shows pyrite identified in trace concentrations over six intervals, totalling 4.44 m of the total 2,465 m of logged drilling cores (0.18%).

Table 3-2. Results of geochemical analysis for samples taken in expanded pit and at downhole depths greater than 180 m

Hole	Depth m	Lithology	pH	Sulfur - Total S (LECO)	Maximum Potential Acidity	Net Acid Production Potential	
			pH unit	%	kg H ₂ SO ₄ /t		
			Trigger 5.5	Trigger 0.05			
Samples from expanded section of pit shell							
FRC152	125		8.7	1.88	57.5	49.5	
FRC153	38		8.7	0.02	0.6	-	
FRC156	100		9.2	<0.01	-	-	
FRC157	72		7.6	<0.01	-	-	
FRC158	80		8.8	<0.01	-	-1.7	
FRC159	136		9.5	0.03	0.9	-10.1	
Samples from downhole depth >180m							
FRC038	191	Phyllite	9.2	0.04	1.2	-6.4	
FRC041	215	Phyllite	9.4	0.05	1.5	-7.1	
FRCD005	185	Phyllite	9.6	0.02	0.6	-6.2	
FRC151	191	Pegmatite	9.3	0.02	0.6	-	
FRC151	208	Pegmatite	9.7	<0.01	-	-	

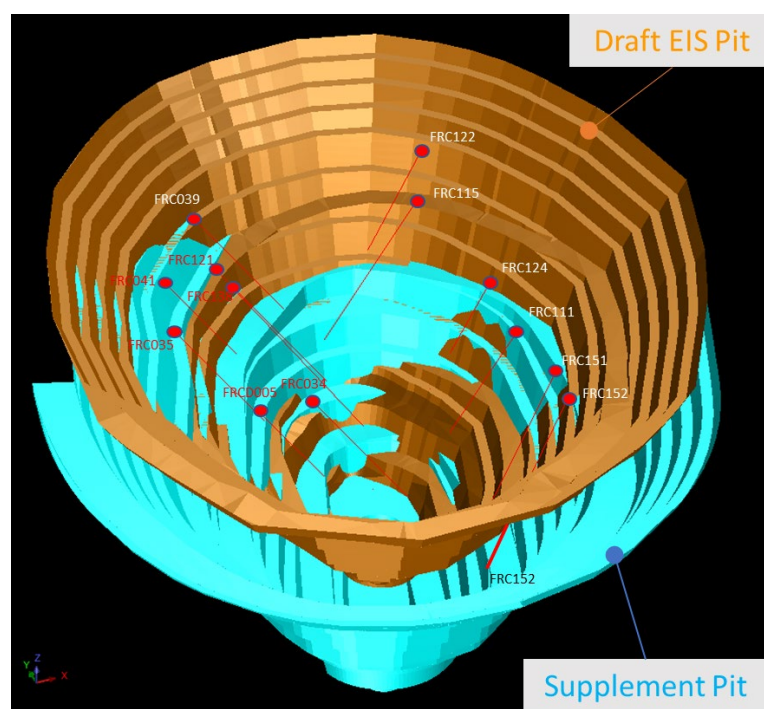


Figure 3-2. Location of samples with >0.05% Sulfur

Adequacy of sampling effort

As indicated in the comments received from the NT EPA, the WA guidelines suggest that operations removing more than 10 million tonnes of material require up to a few hundred samples (WA, DMP 2016) (Table 3-3). This is a guide on the number of samples required based on tonnage, when sampled without prior information. The exploration drilling program undertaken at the Grants deposit, by a qualified and experienced geologist, provided prior information that was used to design the sampling program. The drill core database for Grants deposit indicates that the geological domains exhibit a high degree of homogeneity, and based on the geological characteristics, have an inherently low likelihood of PAF being present. Accordingly, using a risk-based approach, the minimum number of samples required to adequately characterise the waste material would be toward the mid to lower end of the range suggested in the WA guidelines.

Table 3-3. Suggested number of samples based on tonnage when sampled without prior information

Tonnes of Disturbed Rock	Minimum Number of Samples
<10,000	3
<100,000	3- 8
<1,000,000	8-26
<10,000,000	26-80
> 10,000,000	few hundred

Source: WA draft guidance – Materials characterisation baseline data requirements for mining proposals

The volumes of waste rock disturbed by the expanded pit will be 36.2 Mt. This total volume should be taken into consideration when determining the adequacy of sampling effort i.e. all else being equal, the number of samples required to adequately characterise the 36 Mt of waste rock produced at Grants Lithium Project, would not be the same as a project that proposes disturbing much larger volumes and/or rock types with a higher risk of PAF material being present. The WA guidelines suggest 26-80 samples for up to 10 Mt of rock. The volume of waste rock produced at Grants Lithium Project is 3.6 times this volume, and so an adequate number of samples would fall in the range of 95-290, but towards the mid to lower end of the range based on the low risk of PAF material being present. A total of 156 samples have been characterised to date, which is within this range and is therefore considered adequate to indicate that the pit is unlikely to encounter large volumes of PAF material.

3.2 Geochemical characteristics or ore and tailings

3.2.1 NT EPA Comment #5

The geochemical characteristics of ore and tailings are unknown. It is noted that two fresh pegmatite samples were analysed, but their geochemical characteristics were not presented separately and cannot be linked to the data table (ID numbers of fresh pegmatite samples unknown).

3.2.2 Further Information Required

- **Provide geochemical characteristics of the ore and tailings.**

3.2.3 Response

Two pegmatite (ore) samples were analysed as part of the waste characterisation; sulfur concentrations are shown in Table 3-4. The sulfur concentrations are below the waste characterisation guidelines in both samples. Concentration of soluble metals was below detection limits, except for manganese which present at a concentration of 0.3 mg/kg in both samples.

Table 3-4. Sulfur concentrations of ore samples

Hole	Sample ID	Depth	Lithology	Weathering	pH	Sulfur – total as S (LECO)
FRC151	FRC151-191	191	Pegmatite	FR	9.3	0.02
FRC151	FRC151-208	208	Pegmatite	FR	9.7	<0.01

The DMS wet screening process will produce fine rejects (tailings). Initial tailings classifications are a silty sand, that should drain successfully. Geochemical characterisation results for the fresh pegmatite ore indicate AMD is not expected to be an issue. No chemical processing is required in the DMS plant. Therefore, tailings solids are expected to be geochemically stable and not contain any PAF or metals at concentrations of concern. Further tailings characterisation work will be undertaken as part of processing plant trials, to confirm the tailings characteristics moving into the TSF detailed design phase. The results of this work will be reported in the MMP.

3.3 Mine Closure Plan

3.3.1 NT EPA Comment # 3

Recognising the short life of mine, it is expected that the mine closure plan would need to be highly developed prior to commencement of mining. Supplement Mine Closure Plan - The proposed revegetation completion criteria are not considered to be adequate to achieve the objective of self-sustaining native vegetation similar to that of surrounding areas.

The Supplement Mine Closure Plan completion criteria (Table 6-1) includes monitoring of the WRD percent ground cover (> or = reference sites), WRD ground cover species richness (> or = 70% of richness of reference sites). Monitoring of dominant species (3) in the ecological dominant layer/emergent layer that defined the pre-disturbance vegetation community are present as saplings and/or trees is proposed for support infrastructure, ROM and stockpiles only. The revegetation strategy lacks detail and is not consistent with the WA Guideline for Preparing Mine Closure Plans (DMP 2015).

3.3.2 Additional Information Required

- **Provide an updated Mine Closure Plan to include additional detail on how all areas of the site would re-establish native vegetation including:**
 - **Measures for ensuring no net loss of native vegetation in rehabilitated areas**
 - **Proposed revegetation strategy and criteria to achieve vegetation composition that is representative of the target ecosystem in species diversity and vegetation structure**
 - **Proposed strategy and criteria for ensuring rehabilitated areas have equivalent or comparable function and resilience of target ecosystems**
 - **Proposed strategy for collection, storage, use and quality control of local seed**
 - **Proposed measures for excluding fire from rehabilitated areas**
 - **Provide information about the increased demand and availability on raw material requirements in rehabilitation such as clay for capping.**

3.3.3 Rehabilitation strategy and completion criteria

The *WA Guideline for Preparing Mine Closure Plans (DMP 2015)* does not include specific measureable criteria for the revegetation of disturbed areas. Rather, the guidelines refer to *WA Guidance Statement (#6) – Guidance for the Assessment of Environmental Factors, rehabilitation of terrestrial ecosystems*, which outlines the

expectations for re-establishing biodiversity values where a site is to be rehabilitated to native vegetation. The revegetation criteria outlined in the Grants Lithium Project Mine Closure Plan (submitted with the Supplement) were developed based on this guideline, and measurable criteria used in other approved mine closure plans prepared in accordance with the WA guidelines. The criteria are consistent with achieving the over-arching rehabilitation objective, which is to rehabilitate the site to a stable non-polluting landform, which supports self-sustaining native vegetation comprising local species.

The *WA guidance statement #6*, notes that specified targets for species diversity based on reference plot data, are usually set at 60-80% of pre-existing taxa. This range is based on achieving a resilient and self-sustaining ecosystem with comparable ecological function, whilst also being an achievable target for disturbed rehabilitated areas. The species-diversity completion criteria provided in the Grants Lithium Project Mine Closure Plan aims to re-establish 70 % ground cover species richness of reference sites, and re-instatement of dominant species in the ecological dominant layer. This is within the range presented in the guidance and is considered an achievable completion criterion.

The request for the Mine Closure Plan to be updated to provide a strategy and criteria that will ensure “no net loss of native vegetation” and “an ecosystem with representative species diversity and vegetation structure” indicates an expectation that the disturbed areas will be rehabilitated to the same as what existed were prior to mining. This expectation is not indicated in the guidelines and experience on other mine sites suggests such completion criteria are unlikely to be achievable. Further, the mine site footprint does not contain any significant or sensitive vegetation types or threatened species habitat, and therefore there is a low residual risk to the NT EPA’s objective for terrestrial flora and fauna. It is accepted that the NT EPA and/or DPIR may have a view on what would constitute acceptable completion criteria for species diversity and vegetation community structure; however, in the absence of any prescribed requirements and given the low level of risk of significant impact associated with this aspect of the project, Core proposes that the completion criteria can be reviewed and agreed through the mining authorisation process, taking into account the NT EPA’s recommendations made in relation to this aspect.

3.3.4 Source of seed for use in rehabilitation

Due to the short mine life and plan to commence rehabilitation of the outer annulus of the WRD early in the mine schedule, it is proposed that seed for use in rehabilitation will be sourced from a local supplier, such as Top End Seeds. It is anticipated that seed will be a combination of material harvested from elsewhere and material collected from within/surrounding the ML. The composition of species in the seed mix will be based on the species composition of pre-disturbance vegetation communities and vegetation communities of reference sites.

3.3.5 Exclusion of fire

Following the completion of construction activities, firebreaks/access trails will be established around the mine site and maintained until the rehabilitation completion criteria are met. The Mine Closure Plan has been updated to reflect the additional management measure.

3.3.6 Requirement for raw materials

The alteration of the mine site layout and disturbance footprint does not change the requirement for raw materials in rehabilitation. Low permeability clay material is only required for the construction of the TSF and dam embankments; which have not significantly changed as part of the updated project footprint. No clay is required for capping or rehabilitation of the WRD, which due to the low risk of AMD has been designed to allow for percolation of water through the landform.

4 TERRESTRIAL FLORA AND FAUNA

Potential impacts to Terrestrial Flora and Fauna were described in Chapter 5 of the Draft EIS. This section provides supplementary information in response to the NT EPA's request for further information in relation to surveys undertaken for the threatened plant species *Typhonium praetermissum*.

4.1 Typhonium surveys

4.1.1 NT EPA Comment #2

The mine site layout was revised in the Supplement to accommodate the larger pit and WRD, resulting in 70 ha increase in the total disturbance footprint (from 181 ha to 251 ha). It is unclear if the increased footprint impacts the threatened species Typhonium praetermissum and alters the potential significance of the impact.

4.1.2 Further Information Required

- Provide results of recent targeted survey for the new area of disturbance.
- Provide potential habitat mapping of the species compared to the updated layout (updated Figure 5-10).
- Include details of the area (ha) of potential Typhonium habitat being cleared and impacted by the new disturbance footprint.
- Assess the potential significance and acceptability of the impact using appropriate methods.

4.1.3 Response

In January 2018, EcOz Environmental Consultants undertook random meander surveys for *T. praetermissum* in potentially suitable habitats within the project area, which were identified based on land unit mapping and inspection by a botanist with experience in surveying for the species. Subsequent to the initial surveys, the NT Herbarium updated the modelled suitable habitat for *T. praetermissum* within the greater Darwin region (DENR, in press). This new modelling indicated additional suitable habitat within the ML that was not included in the initial survey area. Further, the level of survey effort was deemed inadequate to provide for reliable detection of the species if present.

The EIS Terms of Reference required:

"A comprehensive assessment of the regional status of Typhonium praetermissum. The assessment should include the known number of individual plants and patches. The assessment should consider the potential habitat (in ha) and the percentage of habitat that would be impacted by the proposal. The assessment should use the most recent habitat modelling for the species and the NT Flora and Fauna Atlas."

This assessment was documented in Chapter 5, Section 5.2.4. Due to the Draft EIS submission occurring at a time of year unsuited to surveying for *T. praetermissum*, a precautionary approach was adopted. In the absence of complete survey data, the impact assessment was undertaken on the assumption that the species occurs within the disturbance footprint, despite the January 2018 surveys indicating that the habitat present within the ML is sub-optimal. The assessment concluded that the project is unlikely to have a significant impact on the species. Comments from DENR on the Draft EIS noted the deficiencies in on-ground survey effort, but concluded that "it is unlikely that the proposed clearing would result in a significant impact on the population of the species at the regional scale given the low likelihood that an important population is present on the tenement."

Due to the increased disturbance footprint proposed in the Supplement, Core engaged EcOz to undertake more detailed surveys for the species in areas of potentially suitable habitat that occur across the extent of ML3176. The

survey was undertaken between 13 and 15 March 2019. EcOz's senior botanist David van den Hoek conducted the survey, with assistance from field ecologists with previous experience in surveying for the species.

The complete survey report is provided as Appendix B. The survey design adopted a staged approach whereby modelled High likelihood habitats were initially subject to transect based surveys at 40 m spacing to achieve 10% coverage of the area survey. Any detection of the species would trigger the requirement for more detailed surveys in both the modelled High likelihood habitat, and adjacent modelled Moderate likelihood habitats. Some isolated patches of Moderate likelihood habitat located along the water pipeline corridor were surveyed as part of the initial surveys, due to their separation from other modelled habitats within the ML. The extent of modelled High and Moderate likelihood habitat within the ML is shown in the figures included in the survey report.

A number of *Typhonium* plants were recorded during the survey; however, the habitats in which the plants were found, combined with in-field identification, indicated that the plants were unlikely to be *T. praetermissum*. A number of samples were collected and submitted for DNA sequencing by Dr. Matthew Barret at the Kings Park Science Division, Department of Biodiversity, Conservation and Attractions, Western Australia. The results revealed that plants observed during the survey are identified as *Typhonium* sp. Charles Darwin (N.J. Cuff 447) M.D. Barrett. The threat status of this species is yet to be assessed (Conservation Status: Not Evaluated) and it is currently not listed under the *Territory Parks and Wildlife Conservation Act*. The species is known elsewhere from Cobourg Peninsula and Charles Darwin National Park (NT Herbarium 2015).

The comprehensive field survey undertaken at the right time of year, targeting modelled High likelihood *T. praetermissum*, did not detect the species at any locations on the ML. On the basis of the survey results, the proposal is considered unlikely to have a significant impact on the species.

5 INLAND ENVIRONMENTAL WATER QUALITY

Potential impacts to Inland Water Environmental Quality were described in Chapter 8 of the Draft EIS. This section provides supplementary information in response to the NT EPA's request for further information in relation to pit lake hydrological processes and water quality.

5.1 Pit lake water quality

5.1.1 NT EPA Comment # 4

Supplement Mine Closure Plan – Pit lake water quality has been modelled for 70 years post closure and indicates increasing salinity over time. Other nearby pit lakes that were sampled are very shallow (15 m) and therefore may not be suitable as a comparison.

WA Guideline for the preparation of mine closure plans (DMP 2015) suggests it may be useful for groundwater trace level contaminant levels to be modelled for 500-1000 years due to risks phenomena such as evapo-concentration to allow a more accurate assessment the long-term residual risk of the pit lake.

Also, inflow and outflow levels are not modelled beyond 70 years. Is there potential for pit water to outflow to the aquifer beyond 70 years and/or during rain events i.e. 1 in 10, 1 in 100, 1 in 1000?

5.1.2 Further Information Required

- **Based on DMP 2015, provide updated modelling to show what the pit lake water quality is likely to be for the next 500-1000 years and incorporate these findings into the statement of residual risk and relevant sections of the EIS.**

5.1.3 Response

The *WA Guidelines for Preparing Mine Closure Plans* recommend a risk-based approach to mine closure planning. Specifically, in relation to pit lake assessment, Append H of the guidelines suggest that “a *site conceptual model* can be used to identify aspects that pose higher risk”, on the basis that “an understanding of aspects of the pit lake that may lead to higher risk, will allow for more focus on these aspects during data gathering and monitoring, so that the level of work undertaken, avoidance measures and mitigation, are commensurate with the risk that the pit lake represents.” In line with this guidance, the approach to assessment of pit lake hydrology and water quality presented in the Draft EIS and Draft Mine Closure Plan, is based on the risk associated with the potential sources, pathways and receptors present at the Grants Lithium Project site. These are further described below.

Sources

Typically, the most important source of contaminants in a pit lake will be groundwater and the surrounding geology (DMP, 2015, pg. 74). Baseline groundwater monitoring and materials characterisation has been undertaken to inform assessment of potential sources of water quality issues in the Grants pit lake. The methods and results of these baseline assessments are described in the Waste Characterisation Report submitted as Appendix E of the Draft EIS and the updated Water Management Plan submitted with the Supplement. The key findings relevant to assessing what the water quality is likely to be like in the pit lake in the year's post-closure, are summarised below.

Monitoring of groundwater and surface water quality within and surrounding the project area was undertaken over a period of 18 months prior to submission of the Draft EIS and is continuing. The monitoring indicates groundwater with relatively low EC (for groundwater), neutral pH, and generally low concentrations of dissolved metals and nutrients, except for arsenic, phosphorus, iron and lithium, which are elevated in comparison to surface water levels. Water quality is good in the nearby inundated BP33 historic mining pit, which has a similar geology to the Grants Project mine pit. Whilst the Grants pit will be much deeper than the BP33 pit, it does provide a useful

comparison because when full, the long term water quality in both pits is influenced mainly by inflows from the shallow aquifer. The BP33 pit has low EC, and arsenic and phosphorus levels are very low, most likely from dilution with rainwater and/or the precipitation and settlement of insoluble arsenic and phosphorus compounds due to oxidation and co-precipitation with dissolved iron.

The waste characterisation report provided as Appendix E of the Draft EIS, indicates the surrounding geology poses a low risk of acid, metalliferous and/or saline drainage. Small volumes of PAF material are expected to occur in the waste rock and in the pit walls; however, Acid Base Accounting analyses indicate that the surrounding NAF materials have sufficient Acid Neutralising Capacity to offset any acid production. Leachate tests conducted on the waste rock samples detected some metals; however, concentrations were not at levels of concern. Overall, the data collected to date indicates that the waste rock and pit walls are unlikely to be a significant source of contaminants (acid or metals); however, it is acknowledged that the potential contribution of these aspects to the final pit lake water quality, will require further assessment during mining.

The comments received from the NT EPA indicate a concern that evapo-concentration could lead to increasing concentration of salinity and/or metals over time. On this basis, it has been requested, that “based on DMP (2015), modelling of pit lake water quality be prepared for a period of 500-1000 years.” In our interpretation, the DMP (2015) guidelines do not suggest that all pit lakes should be modelled to this extent. The guidelines make this reference specifically in relation to assessment of pit lakes in arid environments, where evapo-concentration is a high risk due to low rainfall inputs and higher solute groundwater inflows. In the case of Grants Lithium Project, the large annual rainfall component and the low conductivity of the groundwater suggest a relatively low risk of evapo-concentration.

As an initial validation of this assessment, the groundwater modelling used a simple mass balance approach to identify whether or not there is likely to be a significant increase in salinity (EC) (through evapo-concentration) in the pit lake after closure. This simple style of modelling, according to DMP (2015) is often pertinent for the early stages of a pit lake assessment when data availability limits the degree of accuracy that can be achieved from more detailed models. The modelling was undertaken with two groundwater inflow scenarios: 220 EC (which is representative of the deeper groundwater system) and 25 EC (which is representative of the shallow groundwater system). Under the 220 EC scenario, salinity increased from an initial value of 25 M μ /cm to a final value of 210 M μ /cm in 2090 when the pit lake is modelled to be in equilibrium with the surrounding aquifer. Under the 25 EC scenario, salinity increased to a final value of 40 M μ /cm. The results indicate that evapo-concentration of salinity and/or metals, is unlikely to be a key driver of pit lake water quality in the long-term.

The ongoing sampling of waste rock during mining, monitoring of pit water quality, and calibration of the groundwater model using measured pit inflow data, will provide the data necessary to validate the risk assessment, within the first two years of mining.

Pathways

If the initial water quality assessment is incorrect and the pit lake contains higher contaminant concentrations than originally anticipated, the level of risk is dependent on the pathways that exist for release of contaminants to the surrounding environment. Based on DMP (2015), groundwater and surface water models developed for the Grants site by suitably qualified hydrogeologists and hydrologists, were used to determine the type of pit lake that will form post-closure. The modelling was subject to independent review, and revised versions addressing deficiencies in the models, were submitted with the Supplement.

Pit lake inflows and outflows were modelled out to 70 years' post-closure because by this time the groundwater has reached a dynamic equilibrium with the water level in the pit lake, which is predicted to stabilise at 7-8 m below the rim of the pit. This means that the typical or average condition is a gradient from the surrounding aquifer system to the pit lake i.e. the pit lake will act as a groundwater sink. Following intense rainfall events, this gradient will temporarily reverse due to the water level in the pit rising above the groundwater level in the surrounding aquifer. This will induce outflow from the pit into the aquifer for short periods; however, once the pit lake water level declines, groundwater will again travel back toward the pit lake. Given the low transmissivity of the aquifer, short-periods of outflow are unlikely to result in pit lake water moving over distances that would result in potential contact with receptors. Further, because the movement is triggered by large rainfall events, the pit lake water entering the aquifer will be diluted.

The modelling results indicate that the water quality in the pit lake is unlikely to influence water quality in the surrounding aquifer. The results also indicate that water levels will stabilise at 7-8 m below the pit rim and are therefore unlikely to be discharged to surface water. Therefore, the key risk posed by poor water quality in the pit lake, is associated with fauna and/or people coming into direct contact with the water. If ongoing monitoring and assessments during operations indicate significant sources of contaminants in the pit lake, then the final Mine Closure Plan will need to assess and manage this risk.

Receptors

If both the water quality predictions and hydrological modelling are incorrect, and contaminants do enter the surrounding environment at levels of concern, then the level of risk will depend on the presence of sensitive receptors. In relation to groundwater, the closest groundwater users (active bores) are located on the Cox Peninsula Road approximately 13 km east and there are no known GDE's down-gradient of the mine site. Given the low transmissivity of the aquifer, temporary outflow of water from the pit lake to the surrounding aquifer during large rain events, will not impact water quality in any bores or GDE's. It is also unlikely to express into the nearby surface water courses, and even if it did, is unlikely to cause a measurable change in water quality as it would be at a time of maximum dilution by surface water flows.

Conclusion

Our interpretation of the WA Guidelines is that a risk-based approach should be applied when considering what is an adequate period for modelling of pit lake water quality. Any attempt to model water quality for a period of 500-1,000 years, using baseline data available from sampling of six bores over a period of 18 months, is unlikely to produce meaningful results and does not appear to be commensurate with the level of risk indicated by the data collected in relation to contaminant sources, pathways and receptors. The purpose of the modelling prepared for the Draft EIS and Supplement, was to scope the level of risk posed by the pit lake, which is consistent with DMP (2015).

The initial results indicate that evapo-concentration is unlikely to lead to long-term water quality issues in the pit lake, due to the significant annual rainfall inputs and inputs from the shallow groundwater system (which does not contain elevated salinity or metals). Modelling indicates that the pit lake will act as a groundwater sink, with short-term rain induced outflows to the aquifer, once the lake level stabilises at 70 years' post-closure. The combination of limited contaminant sources and pathways for release, indicates that the Grants pit lake is unlikely to result in a significant impact to inland water quality and/or hydrological processes.

Core has committed to an ongoing waste characterisation sampling program and monitoring of water quality in the open pit both during operations and post-closure. The results of these monitoring programs will contribute to improved understanding of the long-term sources of contaminants that will contribute to the water quality in the pit lake. Future revisions of the Mine Closure Plan will provide updated predictions of pit lake water quality, over timeframes commensurate with the level of risk associated with increasing contaminant concentrations over time.

5.2 Discharge water quality

5.2.1 NT EPA Comment #6

The NT EPA supports the Proponent's commitment for ongoing water quality monitoring of pit water and MWD1 water during operations, and prior and during discharge. Uncertainty remains on how potential elevated arsenic levels will be managed in the discharge water.

5.2.2 Further information required

- **Demonstrate how waste water discharge will meet water quality objectives/guidelines, including arsenic and other potential contaminants of concern**

5.2.3 Response

Based on the surface water and groundwater quality data collected to date, the levels of several parameters were found to be elevated in the groundwater compared to the surface water. Arsenic, total phosphorus, reactive phosphorus, lithium and iron are elevated in the deeper BCF aquifer. Copper, zinc, TP and reactive phosphorus are consistently elevated in the surface laterite aquifer. Release of water from MWD1 (which will contain mostly groundwater dewatered from the mine pit), must ensure the concentration of these parameters is not increased above levels that may cause environmental harm. For the purpose of assessing the risk of environmental harm, the discharge water quality characteristics have been predicted using the 18 months of monitoring data available from six bores, and compared to the Darwin Harbour Water Quality Objectives, or background levels.

The monitoring undertaken to date is adequate to provide an indication of potential contaminants that could be present in concentrations of concern. However, more monitoring data is needed to accurately predict the discharge water quality characteristics and how these will change over time due to the encountering of different aquifers through the mine life. An improved characterisation of groundwater quality will be achieved following the installation, in May 2019, of additional bores within the shallow laterite aquifer (5 additional bores) and deep BCF aquifer (3 additional bores) at locations up-gradient and down-gradient of the ore body (refer Water Management Plan submitted with Supplement). The final water quality in MWD1 will be influenced by the following factors, which are not accounted for by the currently available monitoring data:

- Lithium concentrations will be influenced by the relative proportions of groundwater originating from the host rock compared to the ore body. Given the relative proportion of host rock compared to ore body in the pit walls will be almost 14 times more (strip ratio 13.8:1), it may be that lithium concentrations will be much less than those measured in the groundwater bores; especially GWB01, which is drilled into the ore body.
- Dissolved arsenic, phosphorus and iron concentrations will be influenced by the extent of absorption / co-precipitation and settlement of insoluble arsenic and phosphorus compounds due to oxidation and reaction with iron.

Table 5-2 and Table 5-3 below detail average contaminant concentrations in the deep and shallow groundwater aquifer and the dilution factors that would be required to reduce those concentrations to those in the surface water, based on direct comparison of measured groundwater concentrations with surface water concentrations. The concentrations are derived based on 3-4 monitoring events only and therefore are indicative. Given the uncertainty around the final MWD1 water quality, it is not currently feasible to finalise a discharge water quality management solution. However, a number of feasible management options have been identified to demonstrate to the NT EPA that discharge water can be released without risk of significant impact to downstream water quality. The options include capacity to dilute the water prior to release, as well as treatment options.

Table 5-1 indicates that groundwater inflows to the pit will be diluted by a factor of 1.1 to 1.6 through mixing with incident rainfall. A further three times can be achieved in the onsite storages (based on current capacity) by mixing the dewatering with freshwater pumped from the Raw Water Dam, or directly from the Mine Site Dam. There is also the option of increasing the storage capacity of MWD1 to allow for greater dilution if required. These options indicate that the on-site water management system, with a minor increase in the capacity of MWD1, could provide for up to five times dilution prior to discharge. This level of dilution would be sufficient to reduce arsenic, iron, copper and zinc to background levels. The on-site storages, based on the current water quality characteristics, may not provide enough capacity to dilute phosphorous or lithium to below guideline/background values.

Phosphorus, whilst not directly toxic to aquatic organisms, in high concentrations can produce algal blooms. Risks associated with algal blooms can be reduced by establishing discharge criteria that allow for controlled release only when flows in the receiving waters will provide for dilution within an acceptable mixing zone. Phosphorous levels may also be reduced further through commonly used treatments. The treatment method will be further developed once the expected discharge water quality is prediction with greater certainty, following installation of the additional bores in May 2019 (see below).

For lithium, background concentrations may not be achievable and further work will be undertaken to establish site-specific release criteria that provide for adequate protection of the downstream environment. To assess the

magnitude of potential risk that elevated lithium concentrations may pose if they eventuate in the discharge water, publically available information from the Talison Lithium mine in WA was reviewed. Talison Lithium conducted two ecotoxicology studies of the impact of discharge in the receiving environment. The first study assessed three local aquatic species to determine an Effective Concentration (EC) at which immobility is observed in 50% of the organisms tested. The lowest 96 hour EC50 of the three species sampled was recorded for Pigmy Perch, at a lithium concentration of 42 mg/L. As the EC50 value does not account for long-term or non-lethal effects of lithium, an attenuation factor was applied to derive a recommended interim trigger value of 0.42 mg/L (CERNM 2013).

The second study, analysed water quality, sediments and macro-faunal species diversity and abundance, and bioaccumulation at sites upstream and downstream of the mine discharge point. Metals in sediments at the closest downstream location were elevated and there was some evidence of bioaccumulation of arsenic and lithium in the flesh of fish and crayfish sampled. However, the majority of ecological indicators were not significantly different from upstream to downstream (CERNM 2014). Upon assessment of the two ecotoxicology studies, the Western Australia Department of Water and Environment Regulation (DWER), noted that the interim trigger value of 0.42 mg/L is too conservative and should not be adopted for regulation, and the DWER will apply a progressive series of limits on lithium concentration in the receiving surface water (DWER 2016).

The above trigger value would be achievable at the Grants Lithium Project site by dilution prior to discharge, requiring a dilution factor of 3.8. At the Talison Lithium mine, water technologies that utilise filtration, high recovery RO and thermal evaporation to reduce lithium in mine water are scheduled to be completed and operational in 2019. This option would only be explored for Grants Project, if further analysis of discharge water characteristics, indicates elevated concentrations are likely to exceed acceptable discharge criteria, developed based on ecotoxicological testing.

The following work, planned for April/May 2019, will provide the information required to enable better prediction of discharge water quality over the life of mine, and subsequently, establishment of discharge criteria.

- Installation of new bores, including pump testing and water quality sampling.
- Monthly sampling of all bores to increase the availability of baseline data on which to base water quality predictions, including analysis of arsenic speciation.
- Revision of the groundwater model, hydraulic conductivity estimates and discharge water quality predictions.
- Eco-toxicological testing to established site-specific discharge criteria for lithium (if revised predictions indicate lithium will be present at concentrations of concern).

If this further work indicates that discharge criteria cannot be achieved by dilution, then a site-specific treatment option will need to be developed. Core accepts that a Mining Authorisation and Waste Discharge Licence will not be issued until it can be demonstrated that discharge water can be managed without posing a significant risk to downstream water quality.

Table 5-1. Dilution of groundwater inflows by incident rainfall in pit and MWD1

Month	Groundwater inflow to pit (ML)	Incident rainfall to pit + MWD1 (ML)	Dilution factor of groundwater from pit with incident rainfall into pit and MWD1
2019 dry season	NA	NA	NA
November 2019	48.2	10.6	1.2
December 2019	49.3	17.3	1.4
January 2020	49.8	29.3	1.6
February 2020	54.5	22.3	1.4
March 2020	64.4	22.0	1.3
2019 wet season total			

Month	Groundwater inflow to pit (ML)	Incident rainfall to pit + MWD1 (ML)	Dilution factor of groundwater from pit with incident rainfall into pit and MWD1
2020 dry season	NA	NA	NA
November 2020	74.4	10.6	1.1
December 2020	71.6	17.3	1.2
January 2021	67.3	29.3	1.4
February 2021	66.3	22.3	1.3
March 2021	64.0	22.0	1.3
2020 wet season total			
2021 dry season	NA	NA	NA
November 2021	52.2	10.6	1.2
December 2021	51.6	17.3	1.3
January 2022	50.3	29.3	1.6
February 2022	48.9	22.3	1.5
March 2022	47.6	22.0	1.5
2021 wet season total			

Table 5-2. Average contaminant concentrations for parameters elevated in deep aquifer and dilution factors required to meet water quality objectives

Parameter	GWB01 average mg/L	GWB03 average mg/L	Objective*	Dilution factor to achieve objective
Arsenic	0.06	0.02	0.013	1.5 to 4.6
Total Phosphorous	0.13	0.23	0.01*	13 to 23
Reactive Phosphorous	0.09	0.26	0.005	18 to 52
Lithium	1.6	0.16	0.001*	160 to 1,600

*No water quality objective – background water quality from baseline adopted as objective

Table 5-3. Average contaminant concentrations for parameters elevated in shallow aquifer and dilution factors required to meet water quality objectives

Parameter	GWB10 average mg/L	Objective*	Dilution factor to achieve objective
Total Phosphorous	0.02	0.01*	2
Reactive Phosphorous	0.062	0.005	12.4
Copper	0.006	0.0014	4.3
Zinc	0.038	0.008	4.75

*No water quality objective – background water quality from baseline adopted as objective

6 AIR QUALITY AND GREENHOUSE GASES

6.1 Updated greenhouse gas emissions calculations

6.1.1 NT EPA Comment # 7

The proposed changes in the Supplement, such as an increase in land clearing and an extension of life of mine, would affect greenhouse gas emissions of the Proposal. An update has not been provided in the Supplement.

6.1.2 Further Information Required

Provide an updated greenhouse gas emissions calculation, including land clearing, and comparisons to NT and national emissions and emission targets.

6.1.3 Response

An updated emissions calculation is provided in Table 6-1. Total emissions have increased by 33%, with the majority of this increase associated with the increased area of land clearing. The portion of NT total annual emissions has increase by 0.07% to 0.47%

Table 6-1. Life of mine greenhouse gas emissions

Purpose	Diesel used (kL)	Energy content factor (GJ/kL)	Emission factor (kg CO2-e/GJ)			Emissions (t CO2-e) Months 1-12	Emissions (t CO2-e) Months 13-24	Emissions (t CO2-e) Months 26-35	Life of mine emissions (t CO2-e)
			CO2	CH4	N2O				
Transport	20454	38.6	69.9	0.1	0.5	35,351	15658.38198	4654.574987	55,664
Stationary	1656	38.6	69.9	0.1	0.2	1,682	1724.206673	1082.162172	4,489
Land clearing	-	-	-	-	-	18,323	-	-	18,323
						55,356	17,383	5,737	78,475

7 WHOLE OF ENVIRONMENT

The request for additional information received from the NT EPA, included a comment in relation to closure options, that is relevant to all environmental factors assessed in the EIS. This comment was raised under the heading of Whole of Environment, and is addressed below.

7.1 Assessment of closure options

7.1.1 NT EPA Comment #8

The life of mine is 3 to 4 years and the final landform and pit lake are in perpetuity.

7.1.2 Additional Information Required

- Discuss the environmental merits of the proposed final landform and pit lake compared to backfilling the pit.
- Discuss the net environmental benefit of each option.
- Describe the whole of environment residual risks including economic costs relating to residual risk of each option.
- Discuss how the preferred option meets the principles of ESD.

7.1.3 Response

The EIS ToR provide the following guidance in relation to the assessment of impacts associated with

“While it is the NT EPA’s preference that open pits or voids are progressively backfilled and rehabilitated, it recognises that a final decision on a closure option needs to be informed by an adequate and transparent evaluation of the benefits, risks and costs of all options. The draft Mine Closure Plan should therefore evaluate all closure and rehabilitation options for the site including progressive backfilling of the pit.”

Core engaged a consultant to assess the feasibility of backfilling the pit. As requested, the consultant’s report referenced in the EIS, was provided with the Supplement. As part of the Study, Innicon assessed the impact and consequences that backfilling the pit would have on:

- any potential to exploit any underground resource beneath the pit
- mine closure goals
- work, health and safety of people and plant during backfill operations
- tailings already placed
- overall economics of the project.

Once the above was formulated, a series of approaches was finalised and a Strengths and Weaknesses analysis carried out for each. Key conclusions and recommendations from the report are summarised below.

- **Backfill material:** There is a deficit of backfill material in order to achieve a water shedding structure due to waste already committed to other critical areas like water storage dams and access roads and diversion bunds. If the pit void is backfilled, the material deficit will result in a pit lake.
- **Dewatering:** The pit dewatering infrastructure (e.g. power, pumps, piping, dams, roads etc) will be required (for the duration of backfilling) to ensure that the pit base is reasonably dry near the live tip face toe out point due to ground water ingress and surface water pit wall runoff.

- **Tailings Storage:** To re-mobilise and re-establish the TSF from its current proposed location (encapsulated within the WRD), would cost up to an additional \$1.7M or an increased pit backfill placement cost of \$54.704M (up from \$53.004M). The establishment of a new TSF as an alternative to the proposed WRD encapsulated option would increase the ML disturbance area by up to 25 ha.
- **Scheduling:** An extension to the LOM Schedule and associated fixed overheads will occur if backfilling activities are required. There would need to be more investigation into the impact on the LOM schedule taking into consideration and special dumping and storage requirements for both tailings and waste material that would likely be required.
- **Underground Mining:** If the pit is backfilled, the only way the resource beneath the pit can be accessed is from the surface either by a surface decline or via a shaft. If a decline option is considered compared to a portal access from deep within the pit void, the additional cost to establish a twin decline would be \$19.958M. If the Grant's pit is backfilled, there is limited potential to undertake a future pit "cutback" to access further ore already delineated at the base of the pit but currently not economic.
- **Economic analysis:** The cost to backfill the pit is estimated at \$53.004M reduces both the Net Present Value and Internal Rate of Return, which may not meet internal Core project return hurdles. The cost of developing a decline from surface as an alternative to starting a decline from a nominal depth from surface of 162m from within the pit, would be an additional \$19.958M. In Core's view the development of the underground resource beneath the Grant's pit would not be considered if the pit was backfilled.

To more explicitly address the EIS ToR, Table 7-1 below provides a summary of the benefits, risks and costs associated with the option of backfilling the pit, compared to the WRD and pit lake remaining on site in perpetuity. In providing this assessment, Core would like to note that based on the cost estimates provided in the Innicon (2019) report, backfilling the pit is not considered a feasible option for the project. The mine design and closure plan, and the project feasibility studies that Core has released publicly, are based on the WRD landform and pit lake remaining in perpetuity. The comparison documented in Table 7-1 indicates that the backfilling option is unlikely to result in significantly improved environmental benefits, mainly because there will be a deficit of material, which will result in a pit lake being present on-site in perpetuity, regardless of the option that is adopted.

The increasing regulator and public desire for mine pits to be backfilled is driven by growing legacy issues that have arisen at mine sites where there are long-term issues associated with seepage of AMD from WRD's, poor pit lake water quality and on-going release of contaminated water to surface water and groundwater. Where these issues arise, there is a significant risk to biological diversity and ecological processes downstream of the mine site, and future generations bear the cost in terms of reduced amenity and land-use options, and government-funded monitoring and rehabilitation. This situation is inconsistent with the principles of Ecologically Sustainable Development (ESD), which the NT EPA are required by law to take into account in its decision-making processes.

In the case of Grants Lithium Project, the waste characterisation and water modelling work prepared for the EIS, indicate that AMD issues are unlikely and the pit lake will act as a groundwater sink in perpetuity. There is no indication that there are any significant sources of contaminants and/or pathways for release of contaminants to surface water or groundwater. The Draft Mine Closure Plan provides strategies and criteria for closure of the landforms and re-instating native vegetation, similar to surrounding areas. The plan also includes an ongoing monitoring and maintenance program to be implemented by Core, until the rehabilitation completion criteria are achieved and the mining bond is returned by DPIR. Whilst it is anticipated that the NT EPA and/or DPIR will require more detail in relation to the proposed rehabilitation and completion criteria, refining these aspects is related to improving long-term rehabilitation success. The additional detail required in the Mine Closure Plan is acknowledged by Core, but for the purpose of the EIS process, is not a factor that would alter the significance of the residual environmental impacts associated with the proposal. Therefore, Core has committed to working with the regulators on these aspects through the mining authorisation process that will occur subsequent to completion of an EIS.

Subject to effective implementation of the Mine Closure Plan, the proposed closure option for Grants Lithium Project is consistent with the principles of ESD. There is no indication of likely future contamination or water quality issues that could significantly impact amenity and use of the surrounding areas and downstream waterways by future generations, or biological diversity and ecological processes.

Table 7-1. Benefits, risks and costs associated with mine closure options

		OPTION 1: NO BACKFILL (PREFERRED)	OPTION 2: BACKFILL
Benefits	Terrestrial flora and fauna	• Re-instatement of native vegetation across all areas of the mine site, excluding the area covered by the pit lake. • The WRD landform will be revegetated with ground layer species only, as shrubs and trees are incompatible with long-term landform stability. • No requirement to establish off-site borrow areas to source materials required to completely fill the pit and establish a water shedding structure. Avoidance of risk associated with land clearing and weed introduction/spread.	• Compared to not backfilling, this option will result in an additional 89ha of land, previously under the WRD, now being rehabilitated with trees. If successful, this increased level of rehabilitation may provide for improved ecological functioning of the rehabilitated community in the long term compared to revegetation with ground layer species as part of Option 1. • As a pit lake will remain, this option does not result in any increase in the area of land that will be rehabilitated in the area of the open pit. • In summary, the net benefit to biodiversity associated with this option, compared to option 1, is an additional 89 ha of rehabilitated Eucalyptus woodland habitat.
	Inland Environmental Quality	• No requirement to establish off-site borrow areas to source materials required to completely fill the pit and establish a water shedding structure. Avoidance of risk associated with land disturbance and erosion in new borrow areas.	• Reduction in long-term risk associated with WRD landform instability and erosion. • Reduction in long-term risk associated with (unexpected) AMD issues.
	Hydrological processes	• None identified. EIS concluded that this option is unlikely to have a significant impact to hydrological processes. Refer risks/impacts section of this table.	• Natural surface water flow paths will be re-instated in the area of the WRD footprint. This will return downstream flows closer to the pre-mining condition; however, there will continue to be some residual reduction in flows downstream due to the presence of the pit lake reducing the overall catchment area.
	Inland water environmental quality	• None identified. EIS concluded that this option is unlikely to have a significant impact to inland water environmental quality. Refer risks/impacts section of this table.	• Reduction in long-term risk associated with landform instability and erosion, and therefore risk of water quality impacts (mainly increased turbidity) in downstream waterways. • Avoidance of any potential for long-term water quality issues associated with (unexpected) production of AMD from the WRD/TSF landform.
	Social, economic and cultural surroundings	• The WRD annulus will be rehabilitated progressively and the bulk of mine closure activities are expected to be completed within six months, following which the only requirement to attend site will be for ongoing monitoring and maintenance of the rehabilitated areas.	• Extended rehabilitation timeframe will result in longer-term employment for a small number of personnel. • Increased area available for future land-use (i.e. the rehabilitated WRD footprint); however, ongoing access restrictions required due to presence of pit lake.

		OPTION 1: NO BACKFILL (PREFERRED)	OPTION 2: BACKFILL
			• Broader public acceptance of the proposal, although this may be lessened if a pit lake remains and/or complete filling results in additional large areas of clearing for borrow pits and introduction of weeds. • Reduction in long-term liability of NT Government and therefore tax payers, associated with unexpected legacy issues. Noting that the NT Government retains a bond that will only be returned in the future if Core can demonstrate all requirements of the Mine Closure Plan have been met and the site poses a very low risk on ongoing liability.
Risks/impacts	Terrestrial flora and fauna	Residual impact to flora and fauna associated with Option 1: • Total and permanent loss of ecological function in the 24ha area of the open pit that will remaining in perpetuity. • Some permanent loss of ecological function previously provided by the area of habitat within the WRD footprint (89ha), which will no longer support emergent tree/shrub species. • The post-closure risk assessment presented in the Mine Closure Plan indicates this option presents a low risk to flora and fauna. There is a Moderate residual risk associated with rehabilitation failure and weed incursion into the rehabilitation areas. The EIS concludes that the residual impact to flora and fauna associated with Option 1 is not considered significant because: • The project disturbance footprint is relatively small and impacts only common vegetation types that are well represented in surrounding areas. • On-ground surveys have confirmed that no threatened species or sensitive vegetation communities will be impacted. This assessment is made independent of rehabilitation outcomes i.e. if rehabilitation was to fail unexpectedly, this still would not result in significant impacts to flora and fauna.	• Residual impact to flora and fauna associated with Option 1 is total and permanent loss of ecological function in the 24ha area of the open pit that will remaining in perpetuity, unless material is imported to site to completely fill the open pit and establish a water shedding landform. • Sourcing of this material would require identification and potentially clearing of borrow areas and poses a significant risk associated with impacts to flora and fauna, and introduction and spread of weeds. This risk would require further assessment. • The establishment of a new TSF, as an alternative to the proposed WRD encapsulated option, would increase the area of disturbance by up to 25 ha. The availability of land that is not subject to inundation is a key limiting factor at the site. The additional area of land clearing will be rehabilitated as part of the Mine Closure Plan; however, if the tailings remain in place, only ground cover vegetation will be reinstated. This loss of vegetation structure within the 25ha, offsets some of the benefit that would be gained by removing the WRD and rehabilitating the footprint.

		OPTION 1: NO BACKFILL (PREFERRED)	OPTION 2: BACKFILL
	Inland Environmental Quality	The WRD/TSF landform will be reshaped, stabilised by erosion and sediment controls, and revegetated. The Mine Closure Plan identifies a high residual risk associated with long-term stability of the landform, which could lead to erosion of soils from the site. The EIS concludes that the residual impact to Inland Environmental Quality associated with Option 1 is not significant because the Mine Closure Plan details adequate procedures for ongoing monitoring and management of this risk. As a result of these controls, large-scale erosion and movement of sediments off-site, is not expected to occur.	Removal of the WRD landform, will further reduce the risks of erosion and landform instability. Ongoing erosion and sediment controls will still be necessary to minimise the risk of erosion around the pit and abandonment bund, if they remain on site.
	Hydrological processes	- Some permanent reduction in surface water flows discharging downstream to West Arm will occur due to the presence of the landforms reducing the total sub-catchment area. Modelled reduction is less than 20% in all months (refer revised modelling results provided as Appendix E of Supplement). - Groundwater modelling indicates the pit will fill over a period of 70 years, at which point water levels will stabilise at 7-8m below the pit rim. On completion of mining the modelled drawdown is up to 20m near the pit, decreasing to 1-2 m at the outer edge of the mine site footprint. The modelled post-closure drawdown is 0.5m with a radial extent of 750m. Refer revised modelling provided as Appendix C of Supplement. The EIS concludes that the residual impact to hydrological processes associated with Option 1 is not significant because: - The MSD will be decommissioned, returning flows closer to pre-mining condition and the residual reduction in flow of less than 20% is unlikely to cause any measurable impact to the ecological values in downstream watercourses. - There are no existing groundwater users or environmental values (GDE's) that would be affected by the modelled extent of drawdown.	- Removal of the WRD landform, will further reduce the risk of long-term and future cumulative impacts associated with alteration of surface water flow regimes downstream of the mine site. This risk was assigned a medium risk rating in the Mine Closure Plan risk assessment for Option 1; removing the WRD would reduce this risk to low. - The increased disturbance footprint required to accommodate a separate TSF, would extend towards the south of the Bynoe Harbour catchment, resulting in some alteration of surface water flow discharges to drainage lines in this catchment area. The impact is unlikely to be significant, given the small area of the catchment that would be affected, but would need to be modelled.

		OPTION 1: NO BACKFILL (PREFERRED)	OPTION 2: BACKFILL
	Inland water environmental quality	- Option 1 is expected to return the mine site to a condition that will result in no measurable impacts to water quality in surface waters downstream or in the groundwater aquifer. The EIS concludes that the residual impact to inland water quality associated with Option 1 is not significant because: - The pit lake is classified as a groundwater sink, excepting during intense rainfall events, when raising of water levels is likely to cause temporary outflow to the surrounding aquifer. - Waste characterisation work indicates a low risk of AMD issues. - There are significant sources of contaminants or pathways for movement of contaminants from the pit lake, into the surrounding surface water and/or groundwater aquifer. - The Mine Closure Plan details the monitoring program that will be implemented to detect any water quality issues.	- On-going dewatering of the pit during backfilling operations, will result in volumes of water excess to the site requirements. In the absence of any processing activities to reuse this water, there may be a requirement to discharge water during the dry season, which would require establishment of an irrigation area within the ML. - Further work would be required to determine discharge volumes, timing and water quality, to inform an assessment of potential impacts to downstream water quality and hydrological processes. - If the pit lake remains post-closure, the lake will be shallower. Further groundwater modelling would be required to classify this lake according to the WA Mine Closure Plan Guidelines. If the pit lake no longer acts as a groundwater sink, there could be a risk to water quality in surrounding surface waters and/or the surrounding aquifers.
	Social, economic and cultural surroundings	- The permanent presence of the WRD/TSF landform and a pit lake on the mine site, will necessitate the need for restriction of public access and will exclude future land-uses from the immediate area. - The post-closure risk assessment presented in the Mine Closure Plan indicates that the landforms pose a medium to high safety risk to members of the public who might access the area unauthorised. - The Mine Closure Plan provides details of how the mine site will be made safe. The abandonment bund and signage is expected to provide adequate warning of the dangers of entry; however, unauthorised entry cannot be prevented altogether. People accessing the mine site unlawfully will risk injury. - The EIS concludes that Option 1 is unlikely result in unacceptable impacts to the community, although it is acknowledged that public comment received on the Draft EIS, indicates some community members would like to see the pit backfilled.	- If a pit lake remains on-site, due to a materials deficit, the risks to public safety will be the same as for Option 1. The risk assessment in the Mine Closure Plan rated the residual risk as medium to low. - Further reduction of this risk would only occur if the pit was completely backfilled. This would require trucking material from borrow pits located off the site, which would increase truck traffic on the roads over an extended period of time, and road safety risks.

		OPTION 1: NO BACKFILL (PREFERRED)	OPTION 2: BACKFILL
Costs		• The costs of rehabilitating the site and payment of a bond to NT Government have been factored into Core's operating costs. • The rehabilitation bond that is required will be calculated and paid as part of the mining authorisation process that occurs following completion of the EIS process and is made publically available. • There is potential on-going liability to NT Government in the event that the project is unsuccessful.	• The cost to backfill the pit has been estimated as \$53 million. • The cost of bring material in from off-site to address the deficit so that the pit can be completely filled, is evidently prohibitive and therefore has not been calculated. • The project is unlikely to be considered finically viable by Core if the pit has to be backfilled as a condition of approval. The potential employment and royalty payments associated with the proposal, will therefore not eventuate.

8 REFERENCES

Centre of Excellence in Natural Resource Management, UWA (CERNM) (2013) Ecotoxicology of lithium, August 2013.

Centre of Excellence in Natural Resource Management, UWA (CERNM) (2014) Surveys of aquatic flora and fauna in Norilup Brook to determine the presence and health thereof and any evidence of bioaccumulation of heavy metals from the Talison Lithium Mine, Greenbushes, Western Australia, February 2014.

Department of Water and Environmental Regulation (DWER) (2016). Licence: Talison Lithium Australia Pty Ltd, Environmental Protection Act 1986, Part V. Licence Number: L4247/1991/13. Accessed: <http://epbcnotices.environment.gov.au/entity/annotation/a212ab72-e554-e811-886f-005056ba00a8/a71d58ad-4cba-48b6-8dab-f3091fc31cd5?t=1552521600341> [01 May 2019]

APPENDIX A NT EPA CORRESPONDANCE

Our ref: NTEPA 2017/0088-045~0002

Mr Blair Duncan
General Manager Project Development, Core Lithium Limited
PO Box 6028, Halifax Street
Adelaide SA 5000

Dear Mr Duncan

RE: CORE LITHIUM LIMITED – GRANTS LITHIUM PROJECT

Thank you for providing the Supplement to the Draft Environmental Impact Statement (the Supplement) for the Grants Lithium Project (the Proposal), received by the Northern Territory Environment Protection Authority (NT EPA) on 22 March 2019.

The NT EPA has reviewed the Supplement in consultation with Northern Territory Government (NTG) advisory agencies. The NT EPA considers that the Supplement substantially addresses comments on the Draft EIS. However, as the Supplement includes design updates and changes that alter the Proposal presented in the Draft Environmental Impact Statement (Draft EIS) the NT EPA is seeking clarification about the effect of these changes on the environment, compared to the Proposal presented in the Draft EIS.

Pursuant to clause 14(2)(a) of the Environmental Assessment Administrative Procedures (EAAP), the NT EPA may direct the Proponent to provide such further information that it considers necessary to facilitate examination of the EIS. As the chairman of the NT EPA, I direct Core Lithium Limited to provide the information requested at Attachment A.

Following receipt of all the further information requested, the EAAP provide the NT EPA with 35 days to prepare its assessment report and provide it to the Minister for the Environment and Natural Resources. However the NT EPA will endeavour to complete the assessment report as close as possible to the original statutory timeframe.

Any queries in relation to this matter should be directed to Ms Lisa Bradley, Director Environmental Assessments on (08) 8924 4144 or Lisa.Bradley@nt.gov.au.

Yours sincerely

A handwritten signature in blue ink, appearing to read 'P. Vogel', with a horizontal line drawn underneath it.

DR PAUL VOGEL AM MAICD
Chairman

12 April 2019

Attached:

- Attachment 1 – Further information request

**ATTACHMENT 1: FURTHER INFORMATION REQUIRED FOLLOWING THE SUPPLEMENT
TO THE DRAFT ENVIRONMENTAL IMPACT ASSESSMENT**

CORE LITHIUM LIMITED – GRANTS LITHIUM PROJECT – APRIL 2019

Factor/section	#	Comment	Further Information Required
Terrestrial Environment Quality and Inland Water Environment Quality	1	The increase in pit depth from 180 m to 200 m and associated changes to the significance of impacts, especially on Terrestrial Environment Quality and Inland Water Environment Quality, have not been sufficiently addressed in the Supplement. No further information or discussion about the additional waste rock (56% increase in volume) characteristics was provided to assess the significance of the pit extension. 156 waste rock samples have undergone geochemical characterisation. The Western Australian Draft Guidance Materials Characterisation Baseline Data Requirements for Mining Proposals (DMP 2016) recommends a ‘few hundred’ samples for waste rock volume >10,000 cubic metres. From the data presented in the Draft EIS, it is unclear where drilling samples have been undertaken and how the results correlate with the expanded pit shell and data provided in the Supplement.	• Provide sufficient information to assess the significance of potential impacts on Terrestrial Environment Quality and Inland Water Environment Quality in relation to – potential sulfur (PAF) and heavy metals concentrations – larger disturbance footprint • Provide information to justify that the waste rock geochemical characterisation is consistent with relevant guidelines for the characterisation of acid, metalliferous and/or saline drainage, and discuss the scientific confidence in the findings • Provide information about the location of each drill bore number in relation to the extended pit shell, preferably in 3D.
Terrestrial flora and fauna	2	The mine site layout was revised in the Supplement to accommodate the larger pit and WRD, resulting in 70 ha increase in the total disturbance footprint (from 181 ha to 251 ha). It is unclear if the increased footprint impacts the threatened species <i>Typhonium praetermissum</i> and alters the potential significance of the impact.	• Provide results of recent targeted survey for the new area of disturbance • Provide potential habitat mapping of the species compared to the updated layout (updated Figure 5-10) • Include details of the area (ha) of potential <i>Typhonium</i> habitat being cleared and impacted by the new disturbance footprint

Factor/section	#	Comment	Further Information Required
			Assess the potential significance and acceptability of the impact using appropriate methods
Terrestrial environmental quality	3	Recognising the short life of mine, it is expected that the mine closure plan would need to be highly developed prior to commencement of mining. Supplement Mine Closure Plan - The proposed revegetation completion criteria are not considered to be adequate to achieve the objective of self-sustaining native vegetation similar to that of surrounding areas. The Supplement Mine Closure Plan completion criteria (Table 6-1) includes monitoring of the WRD percent ground cover (> or = reference sites), WRD ground cover species richness (> or = 70% of richness of reference sites). Monitoring of dominant species (3) in the ecological dominant layer/emergent layer that defined the pre-disturbance vegetation community are present as samplings and/or trees is proposed for support infrastructure, ROM and stockpiles only. The revegetation strategy lacks detail and is not consistent with the WA Guideline for Preparing Mine Closure Plans (DMP 2015).	- Provide an updated Mine Closure Plan to include additional detail on how all areas of the site would re-establish native vegetation including: - Measures for ensuring no net loss of native vegetation in rehabilitated areas - Proposed revegetation strategy and criteria to achieve vegetation composition that is representative of the target ecosystem in species diversity and vegetation structure - Proposed strategy and criteria for ensuring rehabilitated areas have equivalent or comparable function and resilience of target ecosystems - Proposed strategy for collection, storage, use and quality control of local seed - Proposed measures for excluding fire from rehabilitated areas - Provide information about the increased demand and availability on raw material requirements in rehabilitation such as clay for capping?

Factor/section	#	Comment	Further Information Required
Inland environmental water quality and Hydrological Processes	4	Supplement Mine Closure Plan – Pit lake water quality has been modelled for 70 years post closure and indicates increasing salinity over time. Other nearby pit lakes that were sampled are very shallow (15 m) and therefore may not be suitable as a comparison. WA Guideline for the preparation of mine closure plans (DMP 2015) suggests it may be useful for groundwater trace level contaminant levels to be modelled for 500-1000 years due to risks phenomena such as evapo-concentration to allow a more accurate assessment the long-term residual risk of the pit lake. Also, inflow and outflow levels are not modelled beyond 70 years. Is there potential for pit water to outflow to the aquifer beyond 70 years and/or during rain events i.e. 1 in 10, 1 in 100, 1 in 1000.	Based on DMP 2015, provide updated modelling to show what the pit lake water quality is likely to be for the next 500-1000 years and incorporate these findings into the statement of residual risk and relevant sections of the EIS
Inland environmental water quality	5	The geochemical characteristics of ore and tailings are unknown. It is noted that two fresh pegmatite samples were analysed, but their geochemical characteristics were not presented separately and cannot be linked to the data table (ID numbers of fresh pegmatite samples unknown).	Provide geochemical characteristics of the ore and tailings
Inland environmental water quality	6	The NT EPA supports the Proponent's commitment for ongoing water quality monitoring of pit water and MWD1 water during operations, and prior and during discharge. Uncertainty remains on how potential elevated arsenic levels will be managed in the discharge water.	Demonstrate how waste water discharge will meet water quality objectives/guidelines, including arsenic and other potential contaminants of concern
Air quality and greenhouse gases	7	The proposed changes in the Supplement, such as an increase in land clearing and an extension of life of mine, would affect greenhouse gas emissions of the Proposal. An update has not been provided in the Supplement.	Provide an updated greenhouse gas emissions calculation, including land clearing, and comparisons to NT and national emissions and emission targets
Whole of Environment	8	The life of mine is 3 to 4 years and the final landform and pit lake are in perpetuity.	Discuss the environmental merits of the proposed final landform and pit lake compared to backfilling the pit

Factor/section	#	Comment	Further Information Required
			• Discuss the net environmental benefit of each option • Describe the whole of environment residual risks including economic costs relating to residual risk of each option • Discuss how the preferred option meets the principles of ESD
General	9	Update	• A detailed table of changes comparing the Proposal scope in the Draft EIS to the Supplement

APPENDIX B TYPHONIUM SURVEY REPORT



Typhonium praetermissum
Survey Report
Grants Lithium Project
Core Lithium



DOCUMENT CONTROL RECORD

Job	EZ19042
Document ID	176890-32
Author(s)	David van den Hoek

DOCUMENT HISTORY

Rev	Reviewed by	Approved by	Issued to	Date
1	Steve Reynolds	Kylie Welch	Core Lithium	10 April 2019

Recipients are responsible for eliminating all superseded documents in their possession.

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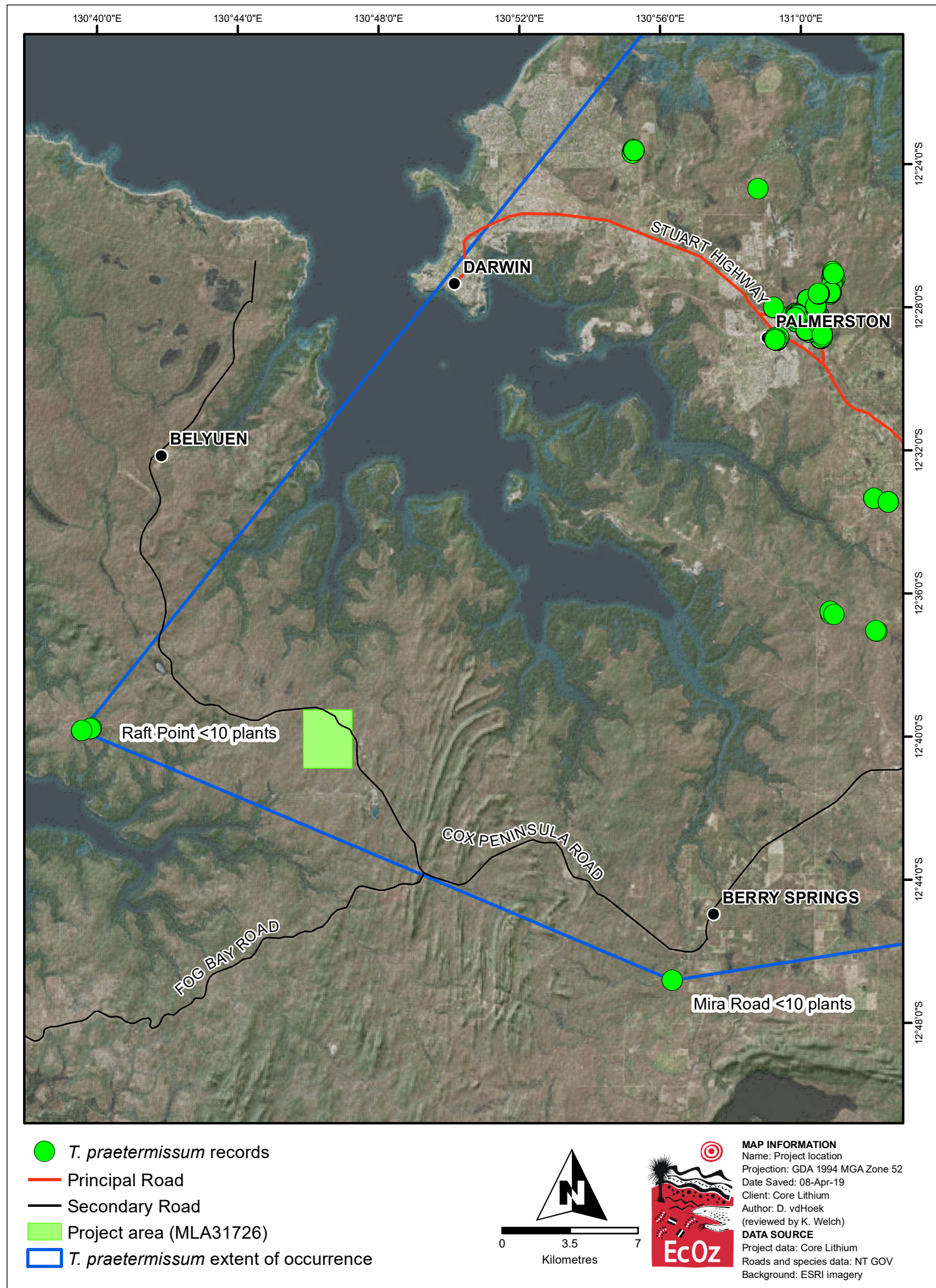
1 INTRODUCTION

The Grants Lithium Project (the project) is being developed by Core Lithium Ltd within Mineral Lease – ML 31726. The project area is located 500 m south of the Cox Peninsula Road, approximately 36 km west of the township of Berry Springs in the Cox Peninsula region of the Northern Territory (Figure 1). The proposal triggered assessment by Environmental Impact Statement (EIS) under the *Environmental Assessment Act*.

The EIS Terms of Reference require assessment of potential impacts to the threatened plant species, *Typhonium praetermissum*. The species is a small perennial herb with aerial parts present only during the annual wet season, usually between December and mid-April (Westaway & Cowie 2012). The species is listed as Vulnerable under the *Territory Parks and Wildlife Conservation Act*.

The known distribution, or species Extent of Occurrence (EoO), extends from the Gunn Point area in the north, south to Noonamah Ridge and west to Cox Peninsula. There are few previous records of *T. praetermissum* on the Cox Peninsula. Only one sub-population has been recorded (of less than 10 plants), near Raft Point, located approximately 11.5 km from the project area. This sub-population is currently the western-most occurrence of the species (Figure 1). The EoO covers 2,400 km² and the area of potential habitat within the currently known extent is 546 km² (DENR 2019).

The Grants Lithium Project area is located towards the south-west edge of the known EoO for *T. praetermissum* as shown in Figure 1. Habitat modelling for the species prepared by the Northern Territory (NT) Herbarium (detailed in Threatened Species of the Greater Darwin Region – *Typhonium praetermissum* version 2.0) (DENR 2019), identifies areas of high and moderate likelihood potential habitat within the project area (Figure 2). This report documents details of the modelled occurrence of potential *T. praetermissum* habitat within the project area and presents the results of field surveys undertaken to assess whether the species is present and could be impacted by the proposal.



Path: Z:\01 EcOz_Documents\04 EcOz Vantage GIS\EZ19042 - Grants Project supplementary ecology 2019\01 Project Files\Figure 2. Typhonium extent.mxd

Figure 1. Project location in relation to known Extent of Occurrence of *Typhonium praetermissum*

2 SURVEY METHODS

2.1 Delineation of survey areas

Typhonium praetermissum plants are typically found in small, relatively open (unshaded) patches of gravel or gravelly sand substrate supporting less than 20% vegetation ground cover and located on the edge of lateritic plateau areas in a somewhat subdued landscape. These areas support an over storey dominated by *Eucalyptus tetradonta* and *Eucalyptus miniata* that is structurally an open woodland with a ground layer dominated by perennial grasses. Soil where the species has been found consists of red-brown clay soil and shallow or gravelly lateritic soil (Westaway & Cowie 2012). Areas of modelled high and moderate likelihood habitat within the project area were identified with reference to DENR (2019) and are shown in Figure 2.

2.1.1 High likelihood habitat

A total of 101.9 ha of high likelihood habitat was identified within the ML, of which 84.3 ha is located within the disturbance footprint and therefore was delineated for field survey. No high likelihood habitat was recorded in the water pipeline corridor or within the dam footprints. A 17.6 ha area of high likelihood habitat located on the northern side of the Cox Peninsula Road, in the north east corner of the ML, was not delineated for survey as it falls outside of the direct disturbance footprint.

2.1.2 Moderate likelihood habitat

A total of 57.7 ha of moderate likelihood habitat was identified within the ML. Of this 7.9 ha was delineated for field survey. Moderate likelihood areas surveyed include three patches of habitat either interested by or adjacent to the water pipeline alignment. Areas of moderate likelihood habitat located adjacent to high likelihood habitat in the north west of the project area was excluded from the survey as it is expected that if present the target species will be detected within the nearby high likelihood areas. No moderate likelihood habitat was recorded in the dam footprints.

2.2 Survey timing

Emergence of plants is most likely after sufficient rainfall from at least one significant monsoon event, usually from around the end of January (Nick Cuff, Senior Botanist, NT Herbarium, pers. comm., Dec. 2017). Surveys for *T. praetermissum* within the project area were undertaken during two separate survey events; 24 January 2018 and 13-15 March 2019. Prior to both surveys, the emergence of *T. praetermissum* was confirmed by visiting known sub-populations within the Darwin region, namely those in Karama and on Middle Arm. The surveys were conducted by EcOz's senior botanist David van den Hoek with assistance from field ecologists with previous experience in surveying for the species.

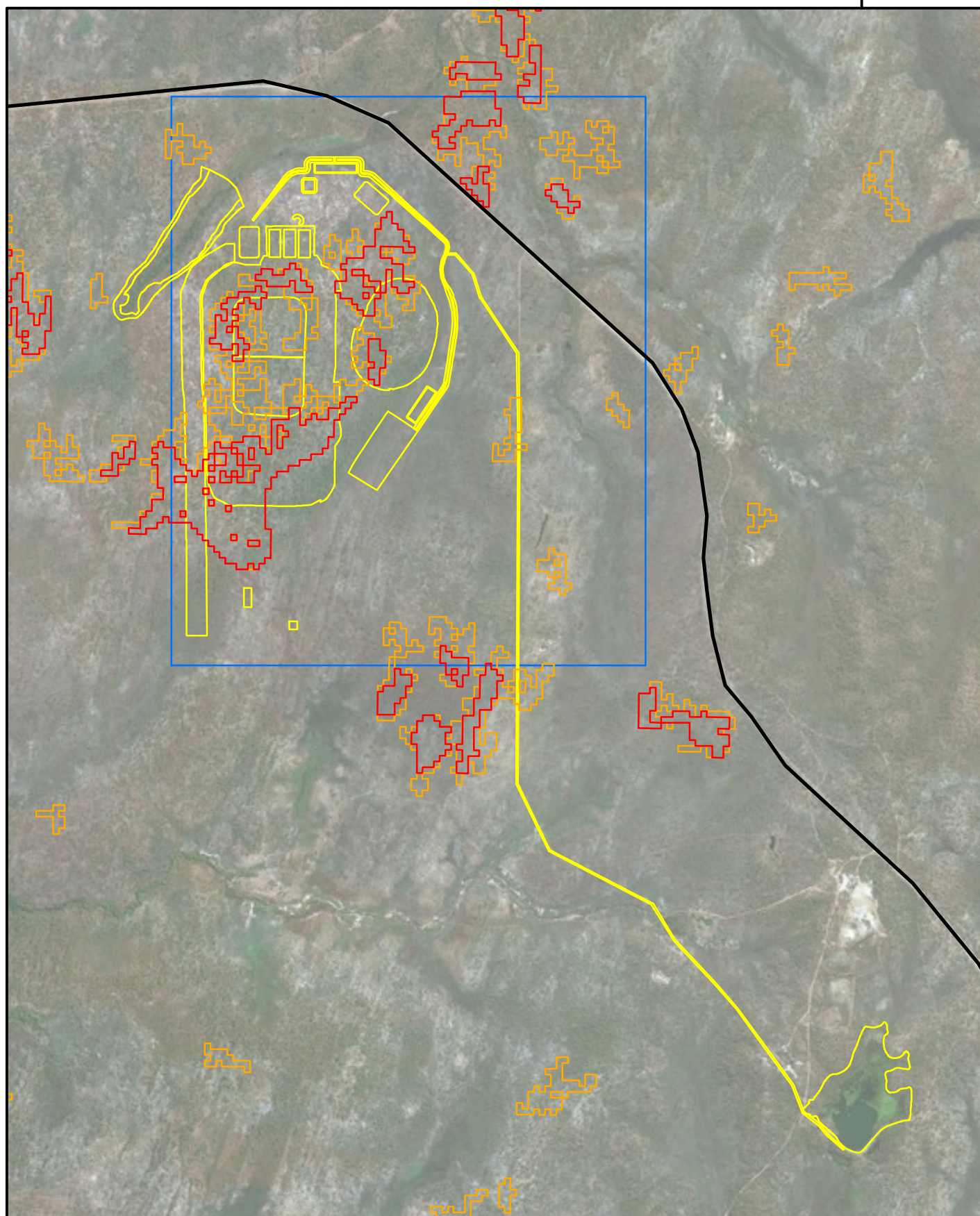
2.3 Survey methods

The survey focused on areas modelled as high likelihood habitat, with the intent that if *T. praetermissum* was recorded in these area, this would trigger the need to expand the survey effort into the adjacent moderate likelihood habitat. Some coverage of moderate likelihood habitat within the mine site disturbance footprint was provided by the January 2018 surveys, which were undertaken prior to the habitat model being available to target survey effort. Three isolated patches of moderate likelihood habitat located along the proposed water pipeline corridor, were also covered by the field survey.

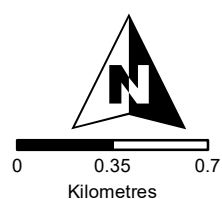
Two separate survey methods were used to assess high and moderate likelihood habitat areas. An average survey width of 2 m observed either side of the transect line was applied. Within high likelihood areas the location of transects was selected to provide 10% coverage of the area surveyed. This is consistent with the

coverage required when undertaking a random meander survey for *T. praetermissum* (Nick Cuff, Senior Botanist, NT Herbarium, pers. comm., March. 2019). Transect lines were spaced 40 m apart across the modelled high likelihood habitat areas. A field map displaying transect lines was georectified and uploaded to a handheld GPS unit for reference in the field. Two surveyors walked alternating transect lines, recording each individual *Typhonium* sp. plant with a waypoint.

In moderate likelihood areas a random meander method was used, with the aim of covering at least 10% of the survey area. A random meander approach was selected to allow survey effort to be focused within the narrow areas identified for survey. A field map displaying moderate likelihood habitat areas intersecting or adjacent to the proposed water pipeline were rectified and uploaded to a handheld GPS unit for reference in the field. Survey areas were walked by two observers using a random meander search method, with the aim of covering at least 10% of the survey area. Observers recorded an average survey width of 2 m either side of the transect line. A waypoint was recorded for each plant observed during the survey.



- Cox Peninsular Highway
- *T. praetermissum* high likelihood
- *T. praetermissum* moderate likelihood
- Mine site components
- Project area (MLA31726)



MAP INFORMATION
 Name: Project location
 Projection: GDA 1994 MGA Zone 52
 Date Saved: 08-Apr-19
 Client: Core Lithium
 Author: D. vdHoek
 (reviewed by K. Welch)
DATA SOURCE
 Project data: Core Lithium
 Roads and species data: NT GOV
 Background: ESRI imagery

Figure 2. *T. praetermissum* high and moderate likelihood habitat areas

3 RESULTS

3.1 High likelihood habitat areas

A total of 37.4 km of transect lines were searched within 84 ha of high likelihood habitat to give a survey coverage of 17.8% (Figure 3). A waypoint was recorded for each *Typhonium* sp. observed during the survey. Thirty-seven *Typhonium* sp. plants were observed during the field surveys, with the majority within the south-west portion of ML31726. Field identification indicated the plants were unlikely to be *T. praetermissum*. This was confirmed by DNA analysis (refer section 3.3).

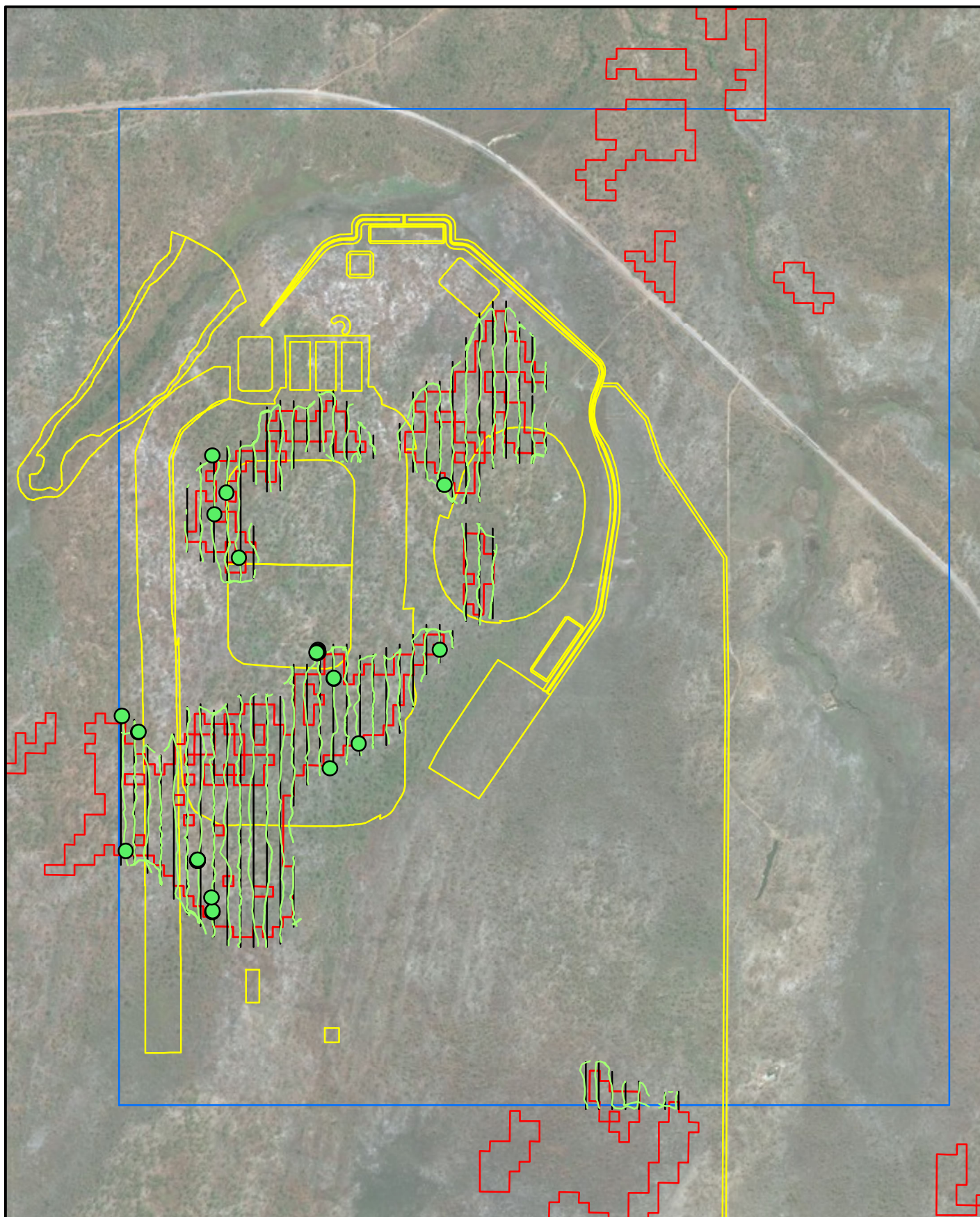
3.2 Moderate likelihood habitat areas

A total of 6.34 km of random meander lines were searched within 7.9 ha of moderate likelihood survey area associated with the water pipeline (Figure 4). Search line extents were calculated after the survey to ensure the minimum 10% coverage was allocated to each area. All three moderate likelihood areas surveyed exceeded the minimum search area required (Table 1).

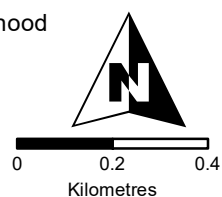
Table 1. Moderate likelihood survey areas, transect lengths and survey coverage

Survey area	Survey area (ha)	Survey length (m)	Survey coverage (%)
Mod 1	2	2,975	59
Mod 2	2.4	1,163	19
Mod 3	3.5	2,202	25

Four *Typhonium* sp. plants were observed in the moderate likelihood habitat during the field surveys. Five additional *Typhonium* sp. Charles Darwin plants were recorded incidentally during the survey, outside of modelled likely habitat areas (Figure 2, Figure 4). Field identification indicated the plants were unlikely to be *T. praetermissum*. This was confirmed by DNA analysis (refer section 3.3).

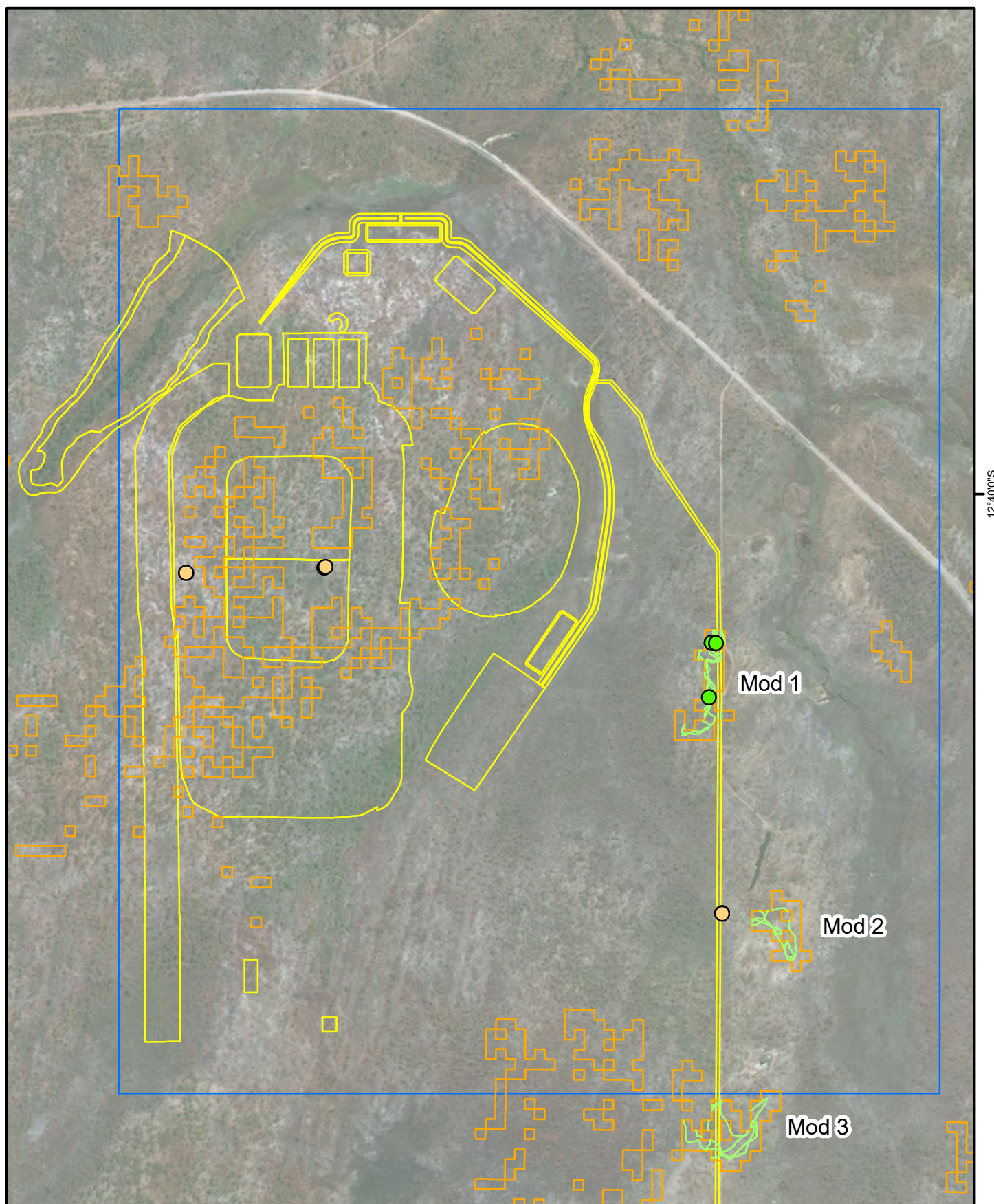


- *T. sp.* Charles Darwin records
- Survey tracks
- 40m transects
- Cox Peninsular Highway
- *T. praetermissum* high likelihood
- Mine site components
- Project area (ML 31726)



MAP INFORMATION
 Name: Project location
 Projection: GDA 1994 MGA Zone 52
 Date Saved: 17-Apr-19
 Client: Core Lithium
 Author: D. vdHoek
 (reviewed by K. Welch)
DATA SOURCE
 Project data: Core Lithium
 Roads and species data: NT GOV
 Survey data: EcOz
 Background: ESRI imagery

Figure 3. Survey transects and *T. sp.* Charles Darwin records within high likelihood survey areas



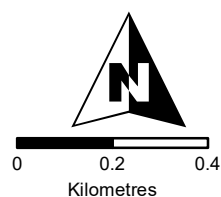
12°40'0"S

Mod 1

Mod 2

Mod 3

- Moderate - *T. sp.* Charles Darwin
- Incidental - *T. sp.* Charles Darwin
- Survey tracks
- T. praetermissum* moderate likelihood
- Mine site components
- Project area (MLA31726)



MAP INFORMATION
 Name: Project location
 Projection: GDA 1994 MGA Zone 52
 Date Saved: 17-Apr-19
 Client: Core Lithium
 Author: D. vdHoek
 (reviewed by K. Welch)
DATA SOURCE
 Project data: Core Lithium
 Roads and species data: NT GOV
 Survey data: EcOz
 Background: ESRI imagery

Figure 4. Survey transects, *T. sp.* Charles Darwin incidental records and records within moderate likelihood areas

3.3 Species identification

As noted above *Typhonium* species were recorded during the survey. Plants were observed within drainage depressions containing sandy clay soils, dominated by wet indicator species including *Grevillea pteridifolia*, *Banksia dentata* and *Melaleuca viridiflora*. The same species of *Typhonium* was also observed on the marginal edges of drainage areas, adjacent to well-drained gravel soils. Typical *T. praetermissum* habitat has a gravelly substrate and supports a *Eucalyptus miniata* open woodland vegetation community. No plants were observed in areas with a gravel substrate, but rather occurred on patches of sandy loam soils situated on the margins. Taking into consideration identifications based on leaf characteristics, the location of the project area and the fact that the major habitat was within areas of poorly drained soils, a tentative field identification of *Typhonium johnsonianum* was made.

Given that the field identification was inconclusive, DNA sequencing and analysis of leaf material, was undertaken to confirm the identity of the plants. The analysis was undertaken by Dr. Matthew Barret at the Kings Park Science Division, Department of Biodiversity, Conservation and Attractions, Western Australia. Three leaf samples of varying leaf forms were collected from a moderately dense patch of plants located within a marginal habitat area, determined to be the most likely habitat to support the target species (location: GDA94, zone 52, 692444E, 8598597N). Three dominant leaf forms were observed in the field (Figure 5), and these were sampled to cover the range of potential types that exist at the location.

The results of DNA sequencing confirmed that plants observed during the survey were the species *Typhonium* sp. Charles Darwin (N.J. Cuff 447) M.D. Barrett. The threat status of this species is yet to be assessed (Conservation Status: Not Evaluated) and it is currently not listed under the *Territory Parks and Wildlife Conservation Act*. The species is known elsewhere from Cobourg Peninsula and Charles Darwin National Park (NT Herbarium 2015).



a). Obtuse leaf apex



b). Attenuate leaf apex



c). Subulate leaf form

Figure 5. Photos of the three dominant leaf forms collected for sequencing

4 CONCLUSION

The results of the survey show that a targeted *Typhonium praetermissum* survey, focused within modelled high and moderate likelihood habitat areas, has not located the species within the project disturbance footprint. Collection and identification of a *Typhonium* sp. located within poorly drained habitat adjacent to the target species preferred habitat, located the occurrence of *Typhonium* sp. Charles Darwin, a species currently not evaluated under the *Territory Parks and Wildlife Conservation Act*. Under its present classification impacts to the species are not considered to be significant.

5 REFERENCES

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