

Ref.	Theme	Environmental Factor	Environmental Objective	Potential Impact (How the Project interacts with assets, values, uses and location. Include clear description of the cause)	Consequence (Clearly understand what is the final impact)	Initial Risk Rating			Proposed Control Measures (Additional controls to be implemented to further reduce the risk)	Residual Risk Rating			Reference in referral
						Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating	
1. Land													
1.1	Land	Terrestrial environmental quality	Protect the quality and integrity of land and soils so that environmental values are supported and maintained.	Initial vegetation clearing and land preparation works may be susceptible to wind erosion	Loss of top soils and soil structure from the landscape and scoured areas reduces the soils capacity to support productive crops. Sedimentation and dust build up on receiving environment can reduce its health and ability to sustain ecosystems.	Major	Likely	High	<ul style="list-style-type: none"> - Land types not suitable for development due to high wind erosion risk have been excluded from development and appropriately buffered. - Clearing plan design to allow for A large 2-8km wide buffer between production block in addition to 200m wide corridors between each horticulture plot - An approved Erosion and Sediment Control Plans will be implemented prior to project development activities (and throughout construction and operations) that will comply with the following requirements: <ul style="list-style-type: none"> - clearing only during suitable wind/weather conditions - Staged clearing to reduce areas of bare ground - Establishment of permanent windbreak trees around the production block boundaries growing to 15 plus meters high - Use of water sprays on major trafficked areas - Will utilise to 'Managing Outback Roads' produced by Rangelands NRM in 2019 as the guiding reference in preparation of the roads. - Horticultural plots developed perpendicular to predominant winds and will start from the eastern prevailing wind side of the Horticultural plots and clear towards the west. - Irrigation installation will be completed as quickly as possible once land is cleared. This will enable establishment of short, and long, term windbreaks and planting of crops to minimise the exposure time of the soil without vegetation. - All erosion and sediment control measures will be installed and maintained in good working order. - daily site inspections shall consist of visual assessment of erosion and sediment control structures to verify their condition and effectiveness. - Records of inspections are to be kept and made available upon request. - Rearrange and reposition control measures as required to maintain their efficiency. - Remove all temporary control measures following rehabilitation or when otherwise no longer required. - Areas established during stage 1 land clearing will be used as trial areas to establish effectiveness of different short term and long term sediment and erosion control measures and to inform further stages of the project 	Moderate	Unlikely	Medium	Section 5.1 - Climate Section 7.1.1 - Terrestrial Environmental Quality and Landforms Appendix K - Land Suitability Assessment for part of Singleton Station (McGrath 2020) Appendix F - SCF Erosion Control Document
1.2	Land	Terrestrial environmental quality	Protect the quality and integrity of land and soils so that environmental values are supported and maintained.	Ongoing horticulture operations may be susceptible to wind erosion	Loss of top soils and soil structure from the landscape and scoured areas reduces the soils capacity to support productive crops. Sedimentation and dust build up on receiving environment can reduce its health and ability to sustain ecosystems.	Moderate	Possible	Medium	<ul style="list-style-type: none"> - All measures listed in item 1.1. above in a addition to: - plant cereal or other ground covers prior to seasonal rainfall for groundcover protection to minimise water runoff, and wind erosion risks. 	Minor	Unlikely	Low	Section 5.1 - Climate Section 7.1.1 - Terrestrial Environmental Quality and Landforms Appendix K - Land Suitability Assessment for part of Singleton Station (McGrath 2020) Appendix F - SCF Erosion Control Document
1.3	Land	Terrestrial environmental quality	Protect the quality and integrity of land and soils so that environmental values are supported and maintained.	Initial vegetation clearing (and exposed soils throughout project) may be susceptible to water erosion	Loss of top soils and soil structure from the landscape and scoured areas reduces the soils capacity to support productive crops. Sedimentation on receiving environment can reduce its health and ability to sustain ecosystems.	Minor	Unlikely	Low	<ul style="list-style-type: none"> - All measures listed in item 1.1. above in a addition to: - Land types not suitable for development due to high water erosion risk have been excluded from development and appropriately buffered. All land types for development have been assessed to have characteristics of Slow runoff; highly permeable; and rapidly drained soils - In the non-productive areas on the corners of irrigated centre pivot production areas the soil cover will be managed by slashing to maintain the soil cover and reduce risk of water erosion. - clearing only during the winter months during lowest rainfall period and only during suitable wind/weather conditions - Early installation of all drainage erosion and sediment control measures. - Any runoff from the site will comply with the requirements of the DENR Guidelines and relevant legislation. - Maintain native vegetation buffers around Horticultural Plots to filter run off and promote infiltration before the runoff reaches drainage lines 	Minor	Rare	Low	Section 5.9 - Surface water hydrology Section 7.1.1 - Terrestrial environmental quality and Landforms Section 7.2.2 - Inland water environmental quality and hydrological processes Appendix F - Erosion and Sediment Control Document
1.4	Land	Terrestrial environmental quality	Protect the quality and integrity of land and soils so that environmental values are supported and maintained.	Clearing of vegetation and development of land (for eastern borefield block only) that is associated with the Taylors Creek flood out area and its margins.	Degradation/ erosion of soils and potential downstream effects of erosion and sedimentation.	Moderate	Unlikely	Medium	<ul style="list-style-type: none"> - All measures listed in item 1.1 above, with the addition of the following: - A 2 to 8km wide buffer will be kept between the Eastern and Western Production blocks clearing extents (with the exception of the eastern borefield block), in the location of the greatest depth of the 1% AEP flood and will retain all native vegetation associated with the Taylor Creek drainage floor - Minimise the extent of clearing for borefield construction outside of cropping areas. 	Moderate	Rare	Low	Appendix F - Erosion and Sediment Control Document
1.5	Land	Terrestrial environmental quality	Protect the quality and integrity of land and soils so that environmental values are supported and maintained.	Inappropriate management and/or disposal of solid waste during project construction and/or operation	Contaminated sites and contaminants may travel in overland flow to drainage areas during high rainfall events potentially leading to downstream contamination.	Moderate	Possible	Medium	<ul style="list-style-type: none"> - Remove from the site and dispose of all waste materials, including green waste food scraps ad other putrescible wastes, horticultural waste chemicals and effluent in an appropriate manner. - Recycle waste materials where appropriate. - Maintain a Waste Management Register to record the types, amounts and location of waste reused, recycled, stockpiles and/or disposed of. - Implement measures to reduce re-use and recycle waste products/materials including soil, food waste and vegetation. - Storage of chemicals, fuel and oils and cleaning of machinery equipment will be minimised and undertaken in designated bunded areas - Minimise use of chemicals and fertilisers, following agronomic guidance and label requirements. 	Minor	Unlikely	Low	
1.6	Land	Terrestrial environmental quality	Protect the quality and integrity of land and soils so that environmental values are supported and maintained.	Inappropriate management and/or disposal of liquid waste / waste water during project construction and/or operation	Contaminated sites and contaminants may travel in overland flow to drainage areas during high rainfall events potentially leading to downstream contamination.	Moderate	Unlikely	Medium	<ul style="list-style-type: none"> - Engineered wastewater stabilisation ponds to control seepage, overtopping and/or pond failure event. - The primary disposal method is evaporation and irrigation to a defined area. The treated water should then decanted and discharged to land. 	Minor	Rare	Low	
1.7	Land	Terrestrial environmental quality	Protect the quality and integrity of land and soils so that environmental values are supported and maintained.	Soil quality - Change in soil chemistry (becoming more saline) and health from water use	Saline water (<1000 micro siemens/cm) combined with sodicity negatively affects soil chemistry and the infiltration of irrigation water	Moderate	Unlikely	Medium	Control measures identified in the salinity impact assessment an will be controlled through implementation of CP6 management plan	Minor	Unlikely	Low	Section 5 - Existing Environment
1.8	Land	Terrestrial ecosystems	Protect terrestrial habitats to maintain environmental values including biodiversity, ecological integrity and ecological functioning.	Vegetation clearing (regionally common and widespread sandplain land units and vegetation types) i.e. direct loss of all vegetation in the clearing footprint and potential foraging, sheltering and breeding habitat for fauna	<ul style="list-style-type: none"> - Loss of approx. 4,037 ha of bioregionally common sandplain habitat for terrestrial flora and fauna species - Habitat degradation of surrounding, retained vegetation through indirect impacts including edge effects in adjacent areas of retained vegetation. 	Moderate	Likely	High	<ul style="list-style-type: none"> - A final clearing plan (refer to Figure 3-4 in the referral) allows the following controls and considerations for land clearing: <ul style="list-style-type: none"> - Pre-clearance surveys will be conducted by suitably qualified ecologists in all areas to be cleared of vegetation - Threatened species monitoring may be implemented where required as identified during pre-clearance and habitat assessment surveys - The large north-south corridor "no-go zone" is strictly off-limits for all personnel who will remain on marked access tracks when travelling between the Production blocks. - Areas marked for clearing will be strategically planned in order to conserve as many large trees as possible - Implementation of cool, low intensity burns of development plots prior to clearing to allow wildlife to vacate the area prior to clearing of vegetation. - Staged clearing of vegetation to minimize areas is applied with the exception to the eastern borefield - Proponent has developed a Biodiversity management plan (Appendix C) that addresses ongoing land management requirements areas surrounding the development within Singleton Station (including weeds, pests and fire management) - Manage grazing (limiting access to cattle) - Implement weed monitoring and control program - Develop and implement a fire management plan that includes ecological burns (which will carefully consider the timing and frequency of burning depending on the vegetation community) - Monitoring locations within these vegetation communities should be included within the GDE monitoring and management plan in order to track trends in biological condition 	Minor	Likely	Medium	Section 5 - Existing Environment Section 7.1.2 - Terrestrial Ecosystems Appendix C - Biodiversity Assessment Report

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1.9	Land	Terrestrial ecosystems	Protect terrestrial habitats to maintain environmental values including biodiversity, ecological integrity and ecological functioning.	Vegetation clearing required for development area that includes potential foraging, sheltering and breeding habitat for potential threatened fauna (Greater Bilby) occurring within and surrounding the clearing area	Impact on individual or population of threatened fauna species that may: - lead to a long-term decrease in the size of a population - reduce the area of occupancy of the species - fragment an existing population into two or more populations - adversely affect habitat critical to the survival of a species - disrupt the breeding cycle of a population - modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline - result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat - introduce disease that may cause the species to decline - interfere with the recovery of the species	Moderate	Possible	Medium	Proponent will develop a Final Clearing Plan including: - Suitably qualified ecologists will conduct a two-stage pre-clearance survey. Stage 1 will identify the occurrence of threatened species and/or their habitat (including Greater Bilby and/or sign there-of). Where Greater Bilby (or Bilby burrows) are identified, the stage 2 trapping and re-location program will be implemented prior to clearing commences. - 200m wide wildlife corridors and a large 2-8km wide 'no-go-zone' between production blocks will be retained between horticulture plots to link vegetation areas and areas outside the project areas - Implementation of cool, low intensity burns of development plots prior to clearing to allow wildlife to vacate the area prior to clearing of vegetation. - Staged clearing of vegetation to minimize areas of bare ground and reduce effects of initial footprint. - Proponent has developed a Biodiversity management plan (Appendix C) that addresses ongoing land management requirements areas surrounding the development within Singleton Station (including weeds, pests and fire management). The management of the surrounding area will address some of the key threatening processes for Greater Bilby. These outcomes are expected to improve the overall quality of potential Bilby habitat within Singleton Station compared to previous conditions in the absence of any land management actions.	Minor	Unlikely	Low	Section 5 - Existing Environment Section 7.1.2 - Terrestrial Ecosystems Appendix A of Appendix C - Biodiversity Assessment Report
1.10	Land	Terrestrial ecosystems	Protect terrestrial habitats to maintain environmental values including biodiversity, ecological integrity and ecological functioning.	Impact on threatened fauna by disturbance from noise, lighting, dust and vibration during construction	Impact on individual or population of listed threatened species that may: - lead to a long-term decrease in the size of a population - reduce the area of occupancy of the species - fragment an existing population into two or more populations - adversely affect habitat critical to the survival of a species - disrupt the breeding cycle of a population - modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	Minor	Unlikely	Low	All controls as lists in item 1.1.	Minor	Unlikely	Low	Section 5.1 - Climate Section 7.1.1 - Terrestrial Environmental Quality and Landforms Appendix K - Land Suitability Assessment for part of Singleton Station (McGrath 2020) Appendix R - Erosion and Sediment Control Framework
1.11	Land	Terrestrial ecosystems	Protect terrestrial habitats to maintain environmental values including biodiversity, ecological integrity and ecological functioning.	Changes in vegetation structure, flora and fauna communities (Transition from arid woodland to irrigated orchards and crops)	Will result in a significant shift in habitat structure and resource availability. This has the potential to attract and support large populations of invertebrates (both native and introduced), birds with generalist diets, Little Red Flying Fox and invasive vertebrate species because of the changes in resources.	Moderate	Possible	Medium	The Proposal will operate under a Biodiversity Management Plan (Appendix C of Appendix C) which details two key aspects of management: 1.Management of the construction and operation of the Proposal (both the horticultural operation and the accommodation and services hub). 2.Implementing additional land management of the surrounding landscape within Singleton Station.	Moderate	Possible	Medium	Section 5 - Existing Environment Section 7.1.2 - Terrestrial Ecosystems Appendix A of Appendix C - Biodiversity Assessment Report
1.12	Land	Terrestrial ecosystems	Protect terrestrial habitats to maintain environmental values including biodiversity, ecological integrity and ecological functioning.	Project development activities can introduce new weeds and /or spread existing weed species into new areas	Loss of ecological values (habitat) due to increased competition for light, space and nutrients, and loss of shelter and/or foraging opportunities for native fauna and potential changes to fire regime due to changes in fuel loads	Minor	Possible	Medium	- Each development plot will have a buffer to surrounding vegetation which will be kept clear of weeds and horticultural species as necessary. A biodiversity management plan (See Appendix C of Appendix C of the referral) includes ongoing management actions for retained vegetation and specifies that all buffers and corridors will be managed for weeds. - Onsite biosecurity wheel bath/washes and washdown facilities will be used for all plant and machinery entering Singleton from elsewhere and after accessing areas of Singleton known to contain weeds or Buffel Grass (see below for key areas of concern). - Nominated site personnel to be trained in weed identification and reporting, and vehicle weed hygiene requirements as part of induction (see BMP for full details) - weeds will be identified, contained and eradicated as per the weed management measures specified in the Biodiversity Management Plan and in accordance with NT Government Weed Management Handbook recommendations - Monitoring for weed introduction and/or spread will be carried out following soil disturbance and following rainfall in all areas where clearing and/or production activities occur. Monitoring will also include all roads and tracks used by project development and project operations personnel. - Organic waste (including hay) will not be removed from production block areas where practicable and will be composted in a purpose built and secure facility as close as possible to the production block to reduce the spread of potential weeds and horticulture species. - Weed control measures (where required) will include chemical control, using herbicide (foliar sprays (for seedlings), granulated herbicides (for seedlings or adults), basal bark and cut stump herbicide treatments (for seedlings or adults)) and Physical methods include hand pulling, burning and soil cultivation. - Monitoring for the spread of horticulture and fodder species into surrounding native vegetation will also be conducted during weed survey and controlled as required. This is of particular importance for fodder species include Rhodes Grass (Chloris gayana). - Areas with high Buffel grass loads will be delineated (and included in weed maps referenced above) and managed separately from other vegetation communities, preferred treatment for Buffel is outlined in the NR Buffel grass management Guide	Minor	Unlikely	Low	Section 5 - Existing Environment Section 7.1.2 - Terrestrial Ecosystems Appendix A of Appendix C - Biodiversity Assessment Report
1.13	Land	Terrestrial ecosystems	Protect terrestrial habitats to maintain environmental values including biodiversity, ecological integrity and ecological functioning.	Horticultural and planted windbreak species originating from the development spreading outside the property boundaries via wind, surface water flow or vehicle transport.	Loss of ecological values (habitat) due to increased competition for light, space and nutrients, changes to fire intensity and subsequent reduction in quality and quantity of shelter and/or foraging opportunities for native fauna	Minor	Unlikely	Low	The management and control horticultural species occurring outside the development area will be included in the weed management plan, as detailed in item 1.8 above and within Appendix A or Appendix C. - The permanent boundary windbreaks will consist of regionally native species (see details below for approved species) will be positioned on the outer edges of the horticultural areas (approx. 2 m) wide. - The windbreaks to be developed at increments throughout cropping areas will also be local natives, particularly Acacia aneura (or similar) for long term wind breaks and Acacia victoriae for fast growing wind breaks, rather than Casuarina species which may intercept the water table and cause unintended water use. Acacia species also have benefit of nitrogen fixing.	Minor	Rare	Low	Section 5 - Existing Environment Section 7.1.2 - Terrestrial Ecosystems Appendix A of Appendix C - Biodiversity Assessment Report
1.14	Land	Terrestrial ecosystems	Protect terrestrial habitats to maintain environmental values including biodiversity, ecological integrity and ecological functioning.	Project development activities can create new open areas and tracks, in addition to waste generation from horticulture and services hub that have the potential to attract invasive species that increase competition and predation pressure on native species e.g. cats, foxes.	Impact on individual or population of listed threatened species that may: - lead to a long-term decrease in the size of a population - reduce the area of occupancy of the species - disrupt the breeding cycle of a population - result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat - introduce disease that may cause the species to decline - interfere with the recovery of the species	Moderate	Possible	Medium	A pest monitoring and management plan will be in effect throughout all stages of the development as detailed in Appendix A of Appendix C (Biodiversity Management Plan).	Moderate	Unlikely	Medium	Section 5 - Existing Environment Section 7.1.2 - Terrestrial Ecosystems Appendix A of Appendix C - Biodiversity Assessment Report

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1.15	Land	Terrestrial ecosystems	Protect terrestrial habitats to maintain environmental values including biodiversity, ecological integrity and ecological functioning.	Land clearing for the eastern borefield. Site activities provide source of ignition that can result in unmanaged and unplanned bushfire	Loss of or decline in condition of Sandhill Tea Tree Shrubland (sensitive vegetation)	Minor	Possible	Medium	Approximately 6.6 ha of land type 6 (correlated with land unit 10a1) will be cleared for the Proposal. This land type is thought to indicate the edges of the Taylor creek drainage floor, which hosts the sensitive and inflow dependent vegetation community: Sandhill tea tree shrublands. Its extent within the 6.6 ha of potential habitat within the clearing area is unknown, however it is not thought to consist of a significant area of the vegetation community. In all areas to be cleared, pre-clearance survey must first be conducted by a suitably qualified ecologist(s) prior to burning and clearing. These surveys will be designed to achieve the following: -Identify, and map biodiversity values, including GDEs, sensitive vegetation communities (i.e. Sandhill Tea Tree Shrubland within the clearing footprint. Where located, micro siting the 25 m x 25 m borepads at the time of construction to avoid disturbance to this vegetation community where practicable. -Manage grazing (limiting access to cattle) -Implement weed monitoring and control program (See BMP for details) -Develop and implement a fire management plan that includes ecological burns (which will carefully consider the timing and frequency of burning depending on the vegetation community) (See BMP for details)	Minor	Unlikely	Low	Section 5 - Existing Environment Section 7.1.2 - Terrestrial Ecosystems Appendix A of Appendix C - Biodiversity Assessment Report
1.16	Land	Terrestrial ecosystems	Protect terrestrial habitats to maintain environmental values including biodiversity, ecological integrity and ecological functioning.	Site activities provide source of ignition that can result in unmanaged and unplanned bushfire	Unmanaged bushfire can negatively impact ecological integrity of landscapes, and lead to immediate death of, and a loss of shelter and/or foraging opportunities, for native fauna.	Major	Possible	High	Controls listed in the Biodiversity Management Plan include: - Firebreaks will be maintained (width of 4 metres that is mineral earth or slashed to a height of between 25 mm and 50 mm with the slashed material removed); - The property will maintain cleared fire access trails within the perimeter of the boundary of the property - Around key facilities and shall be maintained on a seasonal basis. Fire breaks will be 4 m that is mineral earth or slashed to a height of between 25 mm and 50 mm with the slashed material removed. - During the Declared Fire Danger Period, no burning may take place without first obtaining a permit to burn from a Fire Warden or Fire Control Officer at the Bushfires NT Alice Springs Office on 088952 3066. - Hot works are other Proposal activities with the potential to cause wildfire must adhere to the following measures: - Monitor NAFI to identify any severe, extreme and catastrophic Fire Danger Index (FDI) days and assess risk of conducting activities on such days and if additional controls are required to conduct the day's activities. - No hot works will be conducted within proximity to native vegetation or on days of total fire band and/or high winds - Prior to hot works commencing on site, surrounding area shall be cleared of all combustible material and a fire extinguisher and some other means of fire suppression shall be provided and available. - Cigarette smoking shall be restricted to approved areas only, with appropriate cigarette butt disposal facilities available. - Any burning of rubbish or open fires must be contained within approved facilities and will not occur near native vegetation - Vehicles will remain on existing roads and tracks where practicable. - Vehicle undersides shall be checked and any material stuck around exhaust manifolds shall be removed as part of normal vehicle pre-start check routines. Ecological burns will be implemented in the land surrounding the Proposal within Singleton Station. Optimal timing, frequency and area aim to support biodiversity values of the region (see BMP for details).	Minor	Unlikely	Low	Section 5 - Existing Environment Section 7.1.2 - Terrestrial Ecosystems Appendix C of Appendix C - Biodiversity Assessment Report
1.17	Land	Terrestrial ecosystems	Protect terrestrial habitats to maintain environmental values including biodiversity, ecological integrity and ecological functioning.	Negative impacts to over and above 30% of all sandplain and alluvial GDEs modelled to occur within both Singleton Station and the whole GDE protection area.	Exceeding 30% loss of GDEs may cause unacceptable decline in quality and quantity of habitat and biodiversity values (including Thring Swamp Sites of Botanical Significance, sensitive and/or significant vegetation communities include Coolibah low open woodland, and potentially occurring threatened species such as the Grey Falcon). - A decline in primary productivity including reduced shoot and root growth - Reduced ecosystem function - Reduced reproduction and recruitment - Changes in floristics - Pest plant, animal and pathogen invasion - Major shifts in vegetation structure	Moderate	Unlikely	Medium	A quantitative analysis of potential impacts to GDEs due to the proposed groundwater extraction for the Proposal has been completed using a GDE distribution model and a numerical groundwater model. The borefield layout for the Project has been carefully designed in order to minimise impacts to biodiversity values (particularly GDEs). The predicted loss of GDEs from land clearing cumulatively with the potential losses or negative impacts from groundwater drawdown from water extraction remains well below the permitted 30% at 21.4% of sandplain GDE (2,817 ha) and 11.5% of alluvial GDE (366.96 ha). There will be an adaptive management plan including monitoring and management of GDEs implemented prior to commencement of the Project as described in Appendix G - Groundwater Monitoring and Adaptive Management Plan. This management plan will achieve the conditions in the Groundwater Extraction licence and will be designed to minimise and reduce negative impacts to GDEs over the 30% threshold. Details for this management plan will be developed and implemented prior to commencement of the Proposal. The land management strategies included in the Biodiversity Management Plan (appendix A of Appendix C) including feral predator monitoring and management, fire management, weed and grazing management, are expected to mitigate some of the key threatening processes to GDEs and may mitigate the effects of groundwater drawdown. - Avoid disturbance to GDEs during vegetation clearing for the Proposal where possible i.e. micro-siting the eastern borefield and access tracks - Manage grazing in major areas of alluvial GDE (limiting access to cattle) - Implement weed monitoring and control program to main areas of alluvial GDE (and sandplain GDE where buffel grass occurs) - Develop and implement a fire management plan that includes ecological burns (which will carefully consider the timing and frequency of burning depending on the vegetation community within the GDE)	Moderate	Rare	Low	Section 5 - Existing Environment Section 7.1.2 - Terrestrial Ecosystems Appendix C - Biodiversity Assessment Report Appendix G - Adaptive management plan and groundwater monitoring program (CP7 and CP8)
1.18	Land	Terrestrial environmental quality	Protect terrestrial habitats to maintain environmental values including biodiversity, ecological integrity and ecological functioning.	Impacts to soil quality - change in soil chemistry and health from application of irrigation waters. I.e., sodicity, salinity and other (nutrients, soil structure, ability to rehabilitate the land after cropping) Operational Impacts to inherent soil conditions diminishing soil productivity and health, reducing options for future land use.	Reduced viability of cropping land	Moderate	Likely	High	- Implementation and compliance with CPs- Adaptive management plan and groundwater monitoring program CP7 and CP8 - Additional field investigations- Further onsite intrusive investigations required to confirm soil chemistry across site to verify soil conditions and groundwater sampling and analysis to confirm groundwater chemistry - Amendment of cropping plan if required to match crops to soil types and water quality as verified by intrusive onsite investigations - Irrigation management plan will be developed to capture all mitigation measures related to changes in soil to avoid environmental impact including, but not limited to : -Requirements for ongoing monitoring of salinity, sodicity and change to soil chemistry and measures to remediate impacts if they occur - pH adjustment and other amendments to groundwater quality by adjusting water with fertigation prior to application to condition soils (i.e., injection of nutrients, calcium, magnesium, etc.) as required - Addition of fertilisers and organic matter to condition soil as required (in response to plant tissue and soil monitoring and visual monitoring) - Real-time soil moisture monitoring and application of irrigation water to meet crop requirements plus a leaching fraction to flush salts through the rootzone	Minor	Possible	Medium	Section 7.2.3- Hydrological and Hydrogeological processes Appendix L - Salinity Report Appendix G - Adaptive management plan and groundwater monitoring program (CP7 and CP8)
1.19	Land	Terrestrial ecosystems	Protect terrestrial habitats to maintain environmental values including biodiversity, ecological integrity and ecological functioning.	Saline soils formed over 30 years of operation of the project result in poor rehabilitation of the landscape	Biodiversity – GDE and terrestrial vegetation decline or death	Moderate	Likely	High	- Implementation and compliance with CPs- Adaptive management plan and groundwater monitoring program CP7 and CP8 - Implementation of CP6 Salinity impacts to the Land and Water Resource - Development of an irrigation management plan to capture all mitigation measures related to changes in soil to avoid environmental impact to soils	Minor	Possible	Medium	Section 7.2.3- Hydrological and Hydrogeological processes Appendix L - Salinity Report Appendix G - Adaptive management plan and groundwater monitoring program (CP7 and CP8)
2. Water													
2.1	Water	Hydrological processes	Protect the hydrological regimes of groundwater and surface water so that environmental values including ecological health, land uses and the welfare and amenity of people are maintained.	Groundwater extraction during operation of up to 40 ML/annum from borefields in the development area	Impact on other users in the vicinity- pumping cost increases for surrounding land owners	Minor	Likely	Medium	- Hydrological modelling and refinement of borefield design to minimise impact on drawdown other users - Implementation and compliance with the water licence CPs- CP7 and CP8 Adaptive Management Plan and Groundwater Monitoring Program	Minor	Possible	Medium	Section 7.2.3- Hydrological and Hydrogeological processes Appendix R - Groundwater Dependant Ecosystems Mapping and Borefield Design Appendix G- Adaptive management plan and groundwater monitoring program (CP7 and CP8)
2.2	Water	Hydrological processes	Protect the hydrological regimes of groundwater and surface water so that environmental values including ecological health, land uses and the welfare and amenity of people are maintained.	Impacts to hydrological flow regime across the local landscape during operation and potentially altering natural run off into Wycliffe creek during rainfall events	Change overland flow patterns and disrupt existing hydrological flow regime impacting downstream ecological environment	Minor	Possible	Medium	- Design will be developed so that overland flow is redirected away from horticultural areas but is able to reach Wycliffe creek - Implementation of stormwater management plan that will minimise impacts and maintains to greatest possible extent, natural hydrological regime - Implementation of surface water management plan and surface water monitoring program to monitor downstream impacts	Minor	Unlikely	Low	Section 7.2.3- Hydrological and Hydrogeological processes Appendix Q- Stormwater management plan

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2.3	Water	Inland water environmental quality	Protect the quality of groundwater and surface water so that environmental values including ecological health, land uses and the welfare and amenity of people are maintained.	Impacts of proposed land use on surface water quality due to use of nutrients/ pesticides/herbicides in development areas	Aquatic ecosystem contamination downstream as a result of inappropriate management of waste water/other contaminants from horticultural activities	Minor	Unlikely	Low	<ul style="list-style-type: none"> -The correct use and placement of both chemicals and fertiliser is paramount to the operation. A zero tolerance to off target drift. -Establishment of wind breaks around horticultural plots following clearing to reduce drift -Fertigation allows for smaller and more regular delivery of fertiliser, often absorbed through leaf tissue. This will substantially reduce the risk of excess nutrients being applied, leading to leaching or run-off. -Moisture and nutrient monitoring systems will further minimise excessive applications and nutrient loss. -The farms isolated location will reduce biosecurity risks, and therefore reduce the need for chemical controls. -Care will be taken to ensure the correct placement of chemicals and fertiliser not only to avoid environmental impacts, but also to ensure food safety, avoid OH&S risks and reduce costs. -The area is free from many harmful insects and diseases which will help to reduce the need for chemical applications. Integrated pest management techniques will be applied, and all chemical use will be in accordance with label recommendations. -Maintain native vegetation buffers around Horticultural Plots to filter run off and promote infiltration before the runoff reaches drainage lines -Only conducting chemical application during suitable weather and wind conditions. -Adhering to all MSDS requirements including operating under an insect pest -A Spill Management Policy and Procedure will be developed for the SHP operations. -Storage facilities will be bunded, along with the provisions of appropriate and specific fuel/oil spill kits, personal protective equipment and first aid requirements. -Cleaning of machinery and equipment will be in designated areas to minimise any risk to crops and surrounding environment and monitoring of the site for management of wastewater. -Input materials will be delivered to farm in a range of storage items from bags, 25, 10 and 5 L bottles through to larger tanker bulk deliveries. -The National DrumMUSTER® program will be utilised for the disposal of containers. TI Tree currently has the closest DrumMUSTER collection site. -There is potential to establish a DrumMUSTER site at the SHP property. This will be explored further with Barkley Regional Council and DrumMUSTER in line with the increasing volumes of product used on site. -Recycling of containers, such as 1,000 L shuttles/IBC Pods will be utilised wherever possible by returning to the product supplying company or recycling programs. -Bags will also be recycled, or appropriately disposed of as required. -Excess mixed product will be minimised by mixing tank volumes to the volume of spray required to finish the commodity/patch. This is undertaken utilising agronomic programs to calculate the application rate and volume required for each patch area. -The usage of chemicals/fertilisers in irrigated horticultural best practice production is targeted to the labelled use of the product and nutrient/pest control requirements of the plant and produce. -Any chemical use cannot exceed the label rate, unless by an approved APVMA or state government permit for use. -The SHP will be aiming to minimise any storage on farm with deliveries based on an 'as needed' requirement. However, due to the location of the property and distance from suppliers it is expected that 	Minor	Unlikely	Low	Appendix R - Groundwater Dependent Ecosystem Mapping and Borefield Design
2.4	Water	Inland water environmental quality	Protect the quality of groundwater and surface water so that environmental values including ecological health, land uses and the welfare and amenity of people are maintained.	Release of sediments on cleared land via overland flow reaching Wycliffe creek and/or other drainage lines i.e. following the slope of the land	Impact on riparian vegetation and associated aquatic fauna through increased sediment load and reduced water quality.	Minor	Unlikely	Low	<ul style="list-style-type: none"> - Land capability assessment to measure slope and vulnerability of the soils to overland flow - Staged clearing to reduce areas of bare ground and initial footprint on the site. - Implementation of Erosion and Sediment Control Plan 	Minor	Unlikely	Low	See Appendix K- Land capability Assessment (McGrath) Appendix F- Erosion and Sediment Control Document
2.5	Water	Inland water environmental quality	Protect the quality of groundwater and surface water so that environmental values including ecological health, land uses and the welfare and amenity of people are maintained.	Fertilizer, pesticide and herbicide entering ground water through seepage	Contaminated groundwater impacts on environmental values and other users	Minor	Possible	Medium	<ul style="list-style-type: none"> - Implementation and compliance with CPs- Adaptive management plan and groundwater monitoring program CP7 and CP8 - Investigate and understand baseline water quality values and natural variation over time -maintain monitoring bores and monitor groundwater quality (as per CP and CP8) - Implement Hazardous Materials Management Plan - Implement the ESCP which provide details on drip feed irrigation practices and land management 	Minor	Unlikely	Low	Section 7.2.3- Hydrological and Hydrogeological processes Appendix H - Hazardous materials management plan Appendix F- Erosion and sediment control Document Appendix G- Adaptive management plan and groundwater monitoring program (CP7 and CP8)
2.6	Water	Inland water environmental quality	Protect terrestrial habitats to maintain environmental values including biodiversity, ecological integrity and ecological functioning.	Groundwater extraction during operation of up to 40 ML/annum from borefields in the development area	Groundwater drawdown has the potential to reduce the quantity and quality of habitats for stygofauna, which could lead to localised extinctions and reduction in populations and community structure	Moderate	Possible	Medium	There were very few bores identified within the drawdown zone that were considered likely to contain stygofauna. Stygofauna are most likely to be negatively impacted (if present) in close proximity to the borefield and also where terrestrial and surface aquatic GDEs have been modelled as impacted or lost due to drawdown - Therefore, borefield scenario 45, in limiting impacts to surface aquatic GDEs may also limit the potential impacts to stygofauna (if present).	Minor	Unlikely	Low	Section 5 - Existing Environment Section 7.1.2 - Terrestrial Ecosystems Appendix C - Biodiversity Assessment Report Appendix G - Adaptive management plan and groundwater monitoring program (CP7 and CP8)
2.7	Water	Aquatic ecosystems	Protect the quality of groundwater and surface water so that environmental values including ecological health, land uses and the welfare and amenity of people are maintained.	Operational risk of secondary salinity - recharge of aquifer by irrigation drainage that is re-irrigated. Secondary salinity is caused by saline irrigation water and potentially a local deep drainage throttle creating a perched water table at shallow depth (<3 m)	Impact crop species that can not be grown and productive under saline irrigation	Moderate	Likely	High	<ul style="list-style-type: none"> - Implementation and compliance with CPs- Adaptive management plan and groundwater monitoring program CP7 and CP8 - Staged entitlements under the Water Licence, must demonstrate no adverse impact before granted next staged entitlement -Further onsite intrusive investigations to be completed (as required to establish borefield and groundwater monitoring network) to gain sufficient additional data to update of the solute transport model to reduce modelling uncertainty related to secondary salinity Ongoing monitoring and management of groundwater quality of applied irrigation water through the Adaptive Management Plan Include adaptive management for increasing salinity in the Irrigation management plan to include measures to mitigate risk from increased salinity of irrigation water such as planting of salinity tolerant species or crop species for which established salinity management practices are available (i.e., use of salt tolerant rootstocks) 	Minor	Likely	Medium	Section 7.2.3- Hydrological and Hydrogeological processes Appendix L - Salinity Assessment Appendix G- Adaptive management plan and groundwater monitoring program (CP7 and CP8)
3. Air													
3.1	Air	Air quality	Protect air quality and minimise emissions and their impact so that environmental values are maintained.	Emissions from construction traffic and equipment, including dust production and greenhouse gas emissions.	Construction would generate dust, which would reduce local air quality and deposit dust within nearby waterways and at sensitive receivers	Negligible	Possible	Low	<ul style="list-style-type: none"> - A CEMP will be implemented to manage construction activities causing dust emissions and measure s to reduce the potential for emissions to air -Dust suppression techniques will be implemented and incorporated into the ESCP, as per the techniques outlined in the Managing Urban Stormwater: Soil and Construction Volume 1 (Landform, 2004), such as water spraying of surfaces and covering stockpiles -Wheels of all site equipment and vehicles will be cleaned so that material with the potential to generate dust is not spread, including but not limited to construction rumble strips/wheels wash at the site egress location. -All vehicles transporting loose materials will have the entire load covered and/or secured to prevent any large items, excess dust or debris depositing onto the roadway during travel to and from the site. 	Negligible	Unlikely	Low	Section 7.3.1 Air quality and greenhouse gas Appendix U- GHG Assessment
3.2	Air	Air quality	Protect air quality and minimise emissions and their impact so that environmental values are maintained.	Emissions from farming operations, including dust from wind erosion and greenhouse gas emissions .	Impact on soil quality (nutrients) and increase human exposure to air pollution	Moderate	Possible	Medium	<ul style="list-style-type: none"> - Consideration of potential for wind erosion in future design of horticulture development - Implementation of Operation ESCP to manage dust generating activities 	Minor	Unlikely	Low	Section 7.3.1 Air quality and greenhouse gas Appendix U- GHG Assessment
3.3	Air	Air quality	Protect air quality and minimise emissions and their impact so that environmental values are maintained.	Chemical spray drift pollution contaminating neighboring properties	Impact on quality of life or capacity to get economic return from land use on adjacent properties	Negligible	Possible	Low	<ul style="list-style-type: none"> - Implementation of Operation ESCP to manage dust generating activities - Neighboring communities and public facilities are outside of 10 kms from the closest development plot. - Dust erosion control measures including: - On-property speed limits enforced - Establishment of wind breaks around horticultural plots following clearing - limiting the number of new roads and tracks cleared for development through utilizing existing roads where possible - managing traffic in conditions when wind strength results in spatially extensive and heavy dust deposition in surrounding habitats - Use of water sprays on major trafficked areas The correct use and placement of both chemicals and fertiliser is paramount to the operation. A zero tolerance to off target drift. 	Negligible	Unlikely	Low	
4. People													
4.1	People	Communities and economy	Enhance communities and the economy and foster resilience to a changing climate, for the welfare, amenity and benefit of current and future generations of Territorians.	Traffic during construction or operation Construction activities leading to changes in access to sites adjacent to the development area	Disruption to daily activities of local residents, landowners and other public road users due to inability to gain access into and out of sites adjacent to the development area	Negligible	Possible	Low	<ul style="list-style-type: none"> - Implementation of approved Traffic Management Plan (TMP) will be implemented during construction phase. 	Negligible	Unlikely	Low	Section 7.6.1 - Traffic Appendix V- traffic management Plan

Ref.	Theme	Environmental Factor	Environmental Objective	Potential Impact (How the Project interacts with assets, values, uses and location. Include clear description of the cause)	Consequence (Clearly understand what is the final impact)	Initial Risk Rating			Proposed Control Measures (Additional controls to be implemented to further reduce the risk)	Residual Risk Rating			Reference in referral
						Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating	
4.2	People	Communities and economy	Enhance communities and the economy and foster resilience to a changing climate, for the welfare, amenity and benefit of current and future generations of Territorians.	Noise and vibration impacts on the amenity and sensitive receivers during construction and operation of the proposal	Disturbance to workers and wildlife during construction of the proposal	Minor	Rare	Low	- A CEMP will be implemented during construction of the Proposal to reduce potential impacts from noise and vibration - Noise emitting machinery/activities will be considered during the detailed design phase of the proposal and measures will be implemented to reduce the impact of these on the accommodation/services hub	Negligible	Rare	Low	
4.3	People	Communities and economy	Enhance communities and the economy and foster resilience to a changing climate, for the welfare, amenity and benefit of current and future generations of Territorians.	Potential impacts to other water licence holders and applicants in the local and regional study area, such as Warrabri and Ilyarne Aboriginal Land Trusts, and Centrefarm. This could create tension in local and regional communities	Reduced water availability and pumping capacity for surrounding licence holders	Moderate	Possible	Medium	Implementation and compliance with Water Extraction Licence Conditions Precedent Compliance with Staging conditions in line with the Licence. Monitoring and adaptive management plans to be implemented	Minor	Unlikely	Low	Section 7.2.3- Hydrological and Hydrogeological processes Section 7.4.1- Social, economic and cultural surroundings Appendix I Socioeconomic Assessment Appendix G Groundwater monitoring and adaptive management plan
4.4	People	Communities and economy	Enhance communities and the economy and foster resilience to a changing climate, for the welfare, amenity and benefit of current and future generations of Territorians.	Potential for competition for particular skills due to the proposal drawing workers from existing jobs. This could inconvenience business owners and require some businesses to increase wages and incentives to attract and train staff.	Workforce shortage for businesses in local and regional study area	Moderate	Possible	Medium	Preparation of a community and stakeholder engagement plan Local and Indigenous employment and procurement plan Training, provision of quality accommodation facilities and flexible work options to attract workers to the regions.	Minor	Unlikely	Low	Section 7.4.1- Social, economic and cultural surroundings Appendix I Socioeconomic Assessment
4.5	People	Communities and economy	Enhance communities and the economy and foster resilience to a changing climate, for the welfare, amenity and benefit of current and future generations of Territorians.	Potential for perceived competition for labour between proposal and existing local horticultural businesses	Create tensions in local communities.	Minor	Possible	Medium	Implementation of workforce management plan Preparation of a community and stakeholder engagement plan Local and Indigenous employment and procurement plan Training, provision of quality accommodation facilities and flexible work options to attract workers to the regions.	Minor	Unlikely	Low	Section 7.4.1- Social, economic and cultural surroundings Appendix I Socioeconomic Assessment
4.6	People	Culture and heritage	Protect sacred sites, culture and heritage.	Within the GDE protection area, groundwater extraction results in - maximum depth to water table exceeding 15 m - maximum depth to water table declines by more than 50% below the baseline level (i.e. no pumping scenario) - results in a rate of drawdown that exceeds 20 cm (0.2 m / year	Potential impacts to sacred sites or Aboriginal cultural values from water drawdown	Severe	Possible	High	Groundwater monitoring program and adaptive management plan This plan will document the groundwater monitoring plan and associated adaptive management program that is proposed to be implemented by the Proponent at the Proposal. The plan will detail the groundwater monitoring method, approach to adaptive management including metrics, actions and responses, and responsibilities. The plan will also outline a review, reporting and auditing framework, which includes a commitment by the Proponent to continuous improvement. The Proponent will develop the plan in consultation with Traditional Owners to inform: - Sacred sites (such as trees, water holes and soaks) they wish to be monitored and included in the monitoring program - Metrics to assess the health of sacred sites, in addition to groundwater drawdown and groundwater quality. Groundwater dependent Aboriginal cultural values impact assessment The Proponent must develop and submit to the Controller a groundwater dependent Aboriginal cultural values impact assessment. The assessment must: - Be prepared by a suitably qualified professional; - Identify, map and document (as appropriate) the cultural values of Aboriginal people that will be impacted by groundwater extraction under this licence; - Identify reference points to be used in modelling the impacts of groundwater extraction under this licence on the identified Aboriginal cultural values; and - Specify monitoring parameters, trigger values and limits for the reference points which can be used to initiate actions under an adaptive management framework. Cultural heritage and cultural awareness induction All contractors and site workers are to be provided a cultural heritage induction that ensures: - All contractors and site workers are aware of the requirements of: • Groundwater monitoring program and adaptive management plan. • Groundwater dependent Aboriginal cultural values impact assessment - All contractors and site workers are aware of the CPs of the water extraction licence and their obligations to ensuring compliance with these CPs. Compliance to AAPA certificate Water licence staging conditions Implementation of Indigenous Ranger Program	Severe	Unlikely	Medium	Section 7.4.2 - Cultural and heritage Appendix G Adaptive management plan and groundwater monitoring program (CP7 and CP8)
4.7	People	Culture and heritage	Protect sacred sites, culture and heritage.	Impact on sacred sites during project establishment	Direct impacts to sacred sites or Aboriginal archaeological sites	Major	Possible	High	Compliance to AAPA certificate Water licence staging conditions Implementation of Indigenous Ranger Program Cultural heritage and cultural awareness induction All contractors and site workers are to be provided a cultural heritage induction that ensures: - All contractors and site workers are aware of the conditions of Authority Certificate C2019/083 for the proposed works. - All contractors and site workers are aware of the conditions of Authority Certificate C2019/083 and their obligations under Part IV of the <i>Northern Territory Aboriginal Sacred Sites Act 1989</i> . - All contractors and site workers are aware of restricted works areas. - All contractors and site workers are aware of chance finds processes for cultural heritage sites and Ancestral remains. Restricted works areas - No works to take place or damage to occur to sacred site features in Restricted Works Area 1, Restricted Works Area 2, Restricted Works Area 3, Restricted Works Area 4, Restricted Works Area 5, Restricted Works Area 6, Restricted Works Area 7, Restricted Works Area 8, Restricted Works Area 9 or Restricted Works Area 10 marked on Annexure A of Authority Certificate C2019/083. - Maintain a buffer of 2 km between Wycliffe Creek and Gum Tree Rise from proposed works	Major	Rare	Low	Section 7.4.2- Cultural and heritage
4.8	People	Human Health	Protect the health of northern Territory population	Potential for change in land use and "mosquito friendly" habitat to increase of mosquito populations	Increased mosquito populations may then increase the potential spread of vector born illnesses to humans in the vicinity of the proposal	Minor	Possible	Medium	- Mitigation measures including the appropriate design of the proposed pond and selection	Negligible	Unlikely	Low	Section 7.4.3 Human Health
4.9	People	Human Health	Protect the health of northern Territory population	Fuel, oil and lubricant spills or waste on may be mis handled during construction and operation of proposal	Leaks or spillage can pose significant risk to human health and safety	Minor	Possible	Medium	Implementation of Hazardous Materials Management Plan	Minor	Unlikely	Low	Section 7.4.3 Human Health