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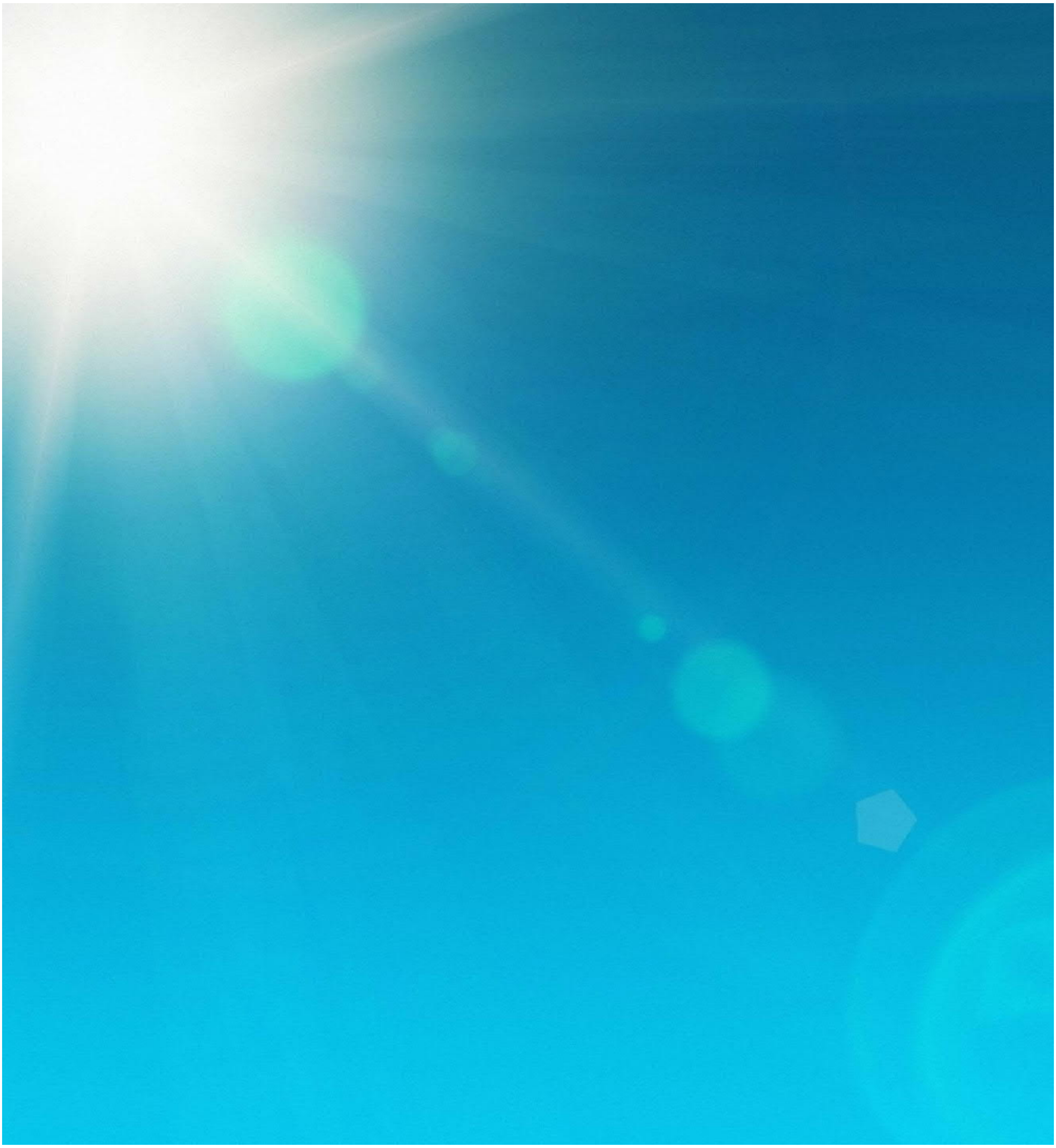
March 2022

Chapter 4 – Terrestrial Environmental Quality

Australia-Asia PowerLink Environmental Impact Statement



Chapter 4 – Terrestrial Environmental Quality

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Revision history

Revision	Date	Purpose	Reviewed by	Approved by
0	18/03/2022	Draft EIS submission	Joe Sheridan	Mark Branson

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4 Terrestrial Environmental Quality

The NT EPA's objective for the Terrestrial environmental quality factor is:

> *"Protect the quality and integrity of land and soils so that environmental values are supported and maintained."*

This chapter assess the potential impacts to the quality and integrity of land and soils associated with the Australia-Asia PowerLink (AAPowerLink) proposal. The potential impacts to land and soils considered in this chapter were identified with reference to the EIS Terms of Reference (TOR) issued by the NT Environment Protection Authority (NT EPA) (Appendix A), issues raised by stakeholders, and professional judgement of the EIS team (Appendix D) based on their knowledge and understanding of the AAPowerLink components and activities described in Chapter 2 Proposal Description. Potential impacts were then assessed using the Environmental Impact Assessment (EIA) methods described in Chapter 3 Impact Assessment. This chapter presents the findings of the EIA process undertaken for the Terrestrial environmental quality factor.

4.1 Information sources

The land and soils present in the AAPowerLink footprint and surrounding areas were determined from targeted field surveys and review of available land systems and land unit mapping. Targeted field surveys were undertaken in the Solar Precinct, Darwin Converter Site and Cable Transition Facilities footprints, to characterise land and soil in these areas where there will be larger areas of ground disturbance and therefore a higher likelihood of impacts to these environmental features (see Appendix O Sub-Appendix A Land Type Report). For the Overhead Transmission Line (OHTL), descriptions were sourced from land systems mapping available at 1:1,000,000 scale for the southern section of the corridor (Lynch et al. 2012; Christian and Stewart 1968; Stewart et al. 1970) and land unit mapping at various scales, which is available for the northern section of the corridor, Darwin Converter Site and Cable Transition Facilities (Easey et al 2020). Geotechnical information from Douglas Partners (2021) was used for the purposes of further verification of soils at the Solar Precinct.

Erosion hazard and risk associated with the land and soil types encountered in the proposal footprint was assessed based on the *Best Practice Erosion and Sediment Control Guidelines* (International Erosion Control Association 2008). The Erosion Hazard Assessment Report prepared by EcOz Environmental Consultants (Appendix M) provides details of the methods and results.

The likely presence/absence of Potential Acid Sulfate Soils (PASS) in the Darwin region was determined with reference to the *Acid sulfate soils of the Darwin region* technical report by Hill and Edmeades (2008). This report was prepared for the land and water division of the NT Department of Natural Resources, Environment the Arts and Sport. The *Atlas of Australian Sulfate Soils* from the Commonwealth Scientific and Industrial Research Organisation (CSIRO) (CSIRO 2013) was utilised to determine PASS in locations outside of the Darwin region.

The presence/absence of environmental values that are supported and maintained by land and soils was determined from stakeholder engagement activities described in Chapter 1 and review of land use mapping information available on NR Maps (https://nrmaps.nt.gov.au/).

4.2 Relevant policies and guidelines

The EIA for the Terrestrial environmental quality factor references the following policies and guidelines:

- *NT Land Clearing Guidelines* (DENR 2019)
- *Best Practice Erosion and Sediment Control Guidelines (*International Erosion Control Association, 2008)
- *National Acid Sulfate Soils Sampling and Identification Methods Manual* (Sullivan et al. 2018)
- *Queensland Acid Sulfate Soil Technical Manual: Soil Management Guidelines* (Dear et al. 2014)
- *Waste Management and Pollution Control Act.*

4.3 Existing environment and values

This section describes the land and soils encountered within the proposal footprint and surrounding areas, and the supported land uses and environmental values.

4.3.1 Solar Precinct

The Solar Precinct footprint located on Powell Creek Station occurs mainly on Redsan land system, which is characterised by level to gently undulating plains with deep sandy soils, moderate erodibility, and low likelihood presences of PASS. Land types[1] across the Solar Precinct were mapped at 1:20,000 scale and ground-truthed in the field, and land types along the access routes were derived from existing NT Government mapping (Lynch et al. 2012; Christian and Stewart 1968; Stewart et al. 1970), except for an approximately 12 km section where no mapping is available.

Field surveys undertaken in November 2020 recorded land, soils, and vegetation information at 76 sites in the Solar Precinct footprint, selected to represent each of the land types, and the main access route was subject to a helicopter flyover, to record the main landforms and identify any areas where specific values or sensitivities are present. Details of the survey methods and results are provided in Appendix O (Sub-Appendix A).

4.3.1.1 Landform and soils

The land type mapping (Figure 4-1) shows four land types present within the Solar Precinct, and five land types traversed by the sections of the proposed access routes where mapping is available. The land types in the Solar Precinct are described in Table 4-1, and land types intersected by the main access road (sealed) corridor are described in Table 4-2. The helicopter survey along the main access road (sealed) corridor also identified some minor drainages and tributaries, often associated with rocky substrate, and a small patch of black soil. Assessment of aerial imagery indicates that the proposed all weather access road (unsealed) corridor passes through similar land types.

Soil physical characteristics were recorded by EcOz Environmental Consultants (2021) at four sites to a depth of 1 m, with surface soil information noted at a further 70 sites and the results are detailed in Appendix O Sub-Appendix A Land Type Report. Soils were identified as being largely tenosols and kandosols, ranging from red to brown-grey sand, sandy loam, and loam, with limited clay presence. The soils are typically well-drained,

[1] A *land type* is a unit of land that incorporates 'a reasonably homogenous part of a land surface, distinct from surrounding terrain with consistent properties in landform, soils or vegetation' (Hooper 1970). They provide a finer level of detail than other types of regional mapping data – such as land systems, the National Vegetation Information System (NVIS) and land units.

with the heavier soils of land type D indicating longer periods of inundation scatted throughout the footprint, with patches ranging from less than one hectare to the largest at 46 ha which is in the centre of the Solar Precinct footprint. Table 4-1 presents a summary of the soils within each of the identified land types.

A preliminary geotechnical investigation of the Solar Precinct by Douglas Partners (2020) indicates that soils are silty sand, sandy clay or just sand, with varying composition percentages of fines, sand, and gravel. Dynamic cone penetration results indicate that the upper 300 mm of soils within the Solar Precinct are very loose, which is expected for aeolian[2] sand deposits. The soil sampling locations are shown on Figure 4-1.

There is little evidence of land and soil impacts caused by cattle grazing within the proposal footprint, and no erosion was observed during field surveys. There are no surface drainage features present and the site selection process for the Solar Precinct has situated the vast majority of the footprint above the maximum modelled flood extents of 0.01% AEP (1-in-1000-year event), which limits the likelihood of site inundation and erosion during high rainfall events. Further detail about flooding can be found in the Flood Modelling Report (SWES, 2022) (Appendix N).

[2] Aeolian (geology) refers to sand or rock material transported or arranged by the wind.

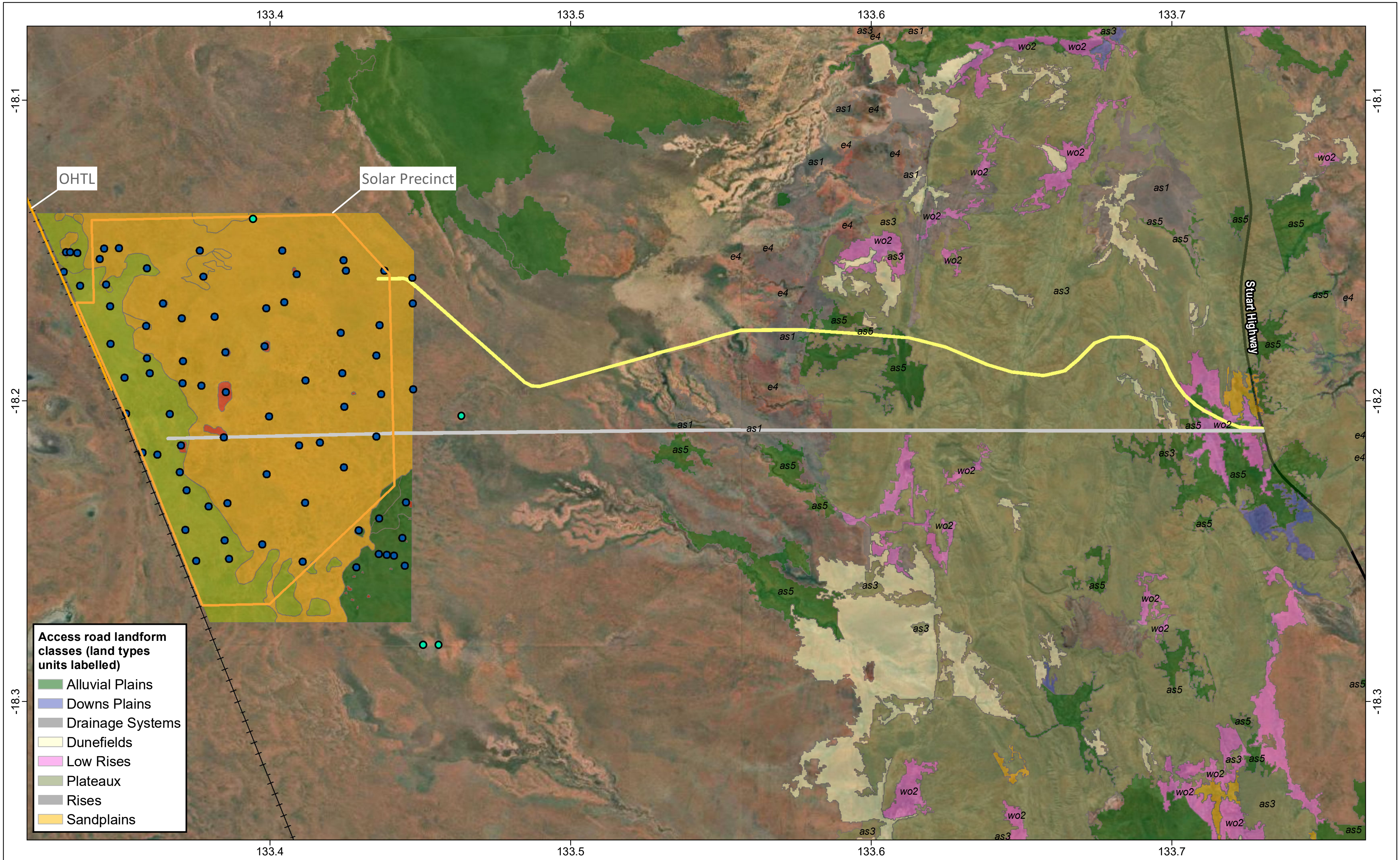
Table 4-1. Solar Precinct land type summary (Source: EcOz, 2020)

Land type	Description	Soil description	Photograph	Approximate area of land type within Solar Precinct
A – sandplain	Sandplain; flat to very gentle slopes (<1%); drainage is via sheet flow in an easterly to north-easterly direction; there are no drainage features present; run-off is expected to be low (and slow due to little relief) with the majority of rainfall rapidly infiltrating into sandy loam soils.	Loamy sand; orange-brown to red-brown; no clay intersected during 1 m auger at sites; Kandosols/Tenosols; thin sandy veneer on surface (aeolian deposits); some areas of greyish exposed loam; soil depth >1 m; no surface gravel or rock; no outcrop present; no salinity indicators present		9439.8 ha
B – loamy plain	Flat plain; gentle slope to the east (<1%); drainage is via sheet flow; no drainage features present; run-off is expected to be low and slow (due to little relief) with the majority of rainfall infiltrating into loamy soils.	Loam to sandy loam; grey-brown to red brown; Kandosols/Tenosols; loose sandy veneer on surface; numerous areas of greyish exposed loam; soil depth >1 m; no surface gravel or rock; no outcrop present; no salinity indicators present.		2439.3 ha

Land type	Description	Soil description	Photograph	Approximate area of land type within Solar Precinct
C – alluvial flats	Flat plain: residual alluvial flats associated with significant (or potentially historic) outflow events from westerly flowing drainages from the Ashburton Range (namely Hunter Creek and, to a lesser extent, Burke Creek); drainage is via sheet flow; no drainage features present.	Sandy loam: grey to grey-brown, some area with redder tone associated with Aeolian (wind-blown) sands from adjacent sandplains; Kandosols/Tenosols some areas of minor crusting and cryptogam; numerous areas of greyish exposed loam; run-off is expected to be low and slow (due to little relief) with the majority of rainfall infiltrating into loamy soils. Water potentially takes longer to infiltrate in this land type; soil depth >1 m; no surface gravel or rock; no outcrop present; no salinity indicators present		11.5 ha
D – shallow depressions	Shallow depression (localised); flat (<1%); minor run-on areas that become inundated for short periods of time following rainfall; drainage entering depressions is via sheet flow from surrounding plains (i.e., no drainage features).	Sandy loam; brown to grey-brown; Tenosols, Dermosols, Kandosols; seasonally inundated, but is not expected to hold water for long period of time due to sandy loam soils having a moderate to high infiltration potential; soil auguring only found clay soils at one depression (site 6); crusting and cryptogam are present; some large cracks present; termite mounds scattered (<1 m); numerous areas of greyish exposed loam; soil depth >1 m; no surface gravel or rock; no outcrop present; no salinity indicators present.		103.4 ha

Table 4-2. Land types intersected by the Solar Precinct access road corridor (Source: EcOz, 2020).

Type	Landform	Soil
Sandstone hills – low hills, hills and stony plateaux on sandstone, siltstone, quartzite, and conglomerate (deeply weathered in places); outcrop with shallow stony soils		
as1	Drainage systems. Valley bottoms with streamlines	Kandosols
as3	Plateaux. Nearly flat upland areas	Tenosols
as5	Alluvial plains. Valley bottoms with streamlines	Tenosols/Kandosols
Lateritic plains and rises – plains and rise associated with deeply weathered profiles (laterite) including sand sheets and other depositional products; sandy and earth soils		
e4	Dune fields. Gentle slops – some dunes	Tenosols
e4	Lateritic plains and rises Low flat areas	Tenosols
wo2	Low rises	Kandosols

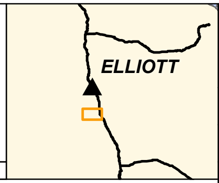


Legend

- AAPowerLink infrastructure
- Main access road (sealed)
- All-weather access road (unsealed)
- Soil sampling locations
- Land type check sites
- Railway
- Principal road

Solar Precinct land types

- A - Sandplain
- B - Loamy plain
- C - Alluvial flats
- D - Shallow depressions



Source: Sun Cable, EcOz, NTG (NR Maps)

Figure 4-1: Map of land types in Solar Precinct and access corridors

Project: Australia-Asia PowerLink	Reference: M-Files ID 198573	Revision: 1
Coordinate System: GDA2020	Date: 09/03/2022	
0 2 4 6 Kilometres	Scale: 1:175,000	A4

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4.3.1.2 Erosion hazard assessment summary

Erosion hazard and soil loss class risk[3] ratings for the Solar Precinct (and all other proposal components) have been assessed using the Revised Universal Soil Loss Equation – RUSLE (IECA 2008). This is used to predict the long term, average, annual soil loss from sheet and rill erosion caused by surface water under the different conditions of the site, during construction (when soils are exposed) and post construction (when groundcover[4] is present in the form of infrastructure). The Solar Precinct results are presented here and the results for the other proposal components are presented in the erosion hazard assessment summary sections for each component below. The full assessment, including assessment criteria for determining erosion hazard can be found in the Erosion Hazard Assessment Report (Appendix M).

Table 4-3 summarises the calculated soil loss volume, which is expressed in tonnes per hectare per year (t/ha/year), and soil loss class (risk rating) for each component of the Solar Precinct footprint. All components have been assigned a 'very low' soil loss class risk rating according to the RUSLE equation. However, because the area of soils disturbed is large (~12,000 ha) the potential for soil loss and erosion hazard is considered extreme (>100,000 m^3 soil lost per year).

Staging of the land clearing and construction activities will reduce the erosion hazard. Only a portion of the footprint will have exposed soils at any given time, with the remainder of the footprint having groundcover present either in the form of natural vegetation, or infrastructure. Soil loss (t/ha/yr) calculations for the construction and post-construction (with groundcover) provided in Table 4-3 indicate that post-construction soil loss and erosion hazard will be reduced to low levels (1 t/ha/yr) across most of the footprint because the soils will be protected by the overlying infrastructure and/or groundcover vegetation.

Table 4-3. Soil loss and erosion hazard summary for the Solar Precinct

Solar Precinct Component	Soil loss (t/ha/yr)	Soil loss class (risk rating)
Solar Precinct (11,997 ha)		
Construction (0% groundcover)	23	1 – Very Low
Post-construction (80% groundcover)	1	1 – Very Low
Operational building infrastructure (3.2 ha) – within Solar Precinct boundary		
Construction (0% groundcover)	23	1 – Very Low
Post-construction (70% groundcover)	1	1 – Very Low
Access Road (gravel) (30 ha) – outside Solar Precinct boundary		
Construction (0% groundcover)	23	1 – Very Low
Post-construction (50% groundcover)	5	1 – Very Low
Access Road (bitumen) (42 ha) – outside Solar Precinct boundary		
Construction (0% groundcover)	23	1 – Very Low
Post-construction (80% groundcover)	1	1 – Very Low

[3] Erosion risk refers to the evaluation of the "risk" of soil erosion when consideration is given to both the degree of erosion (consequence) and the likelihood of the erosion occurring. Best practice erosion control depends on the likelihood and intensity of expected wind or rainfall and therefore requires an assessment of erosion risk utilising rainfall data and mean monthly erosivity values.

[4] Groundcover refers to any infrastructure or hardstand material that will cover disturbed soils from rainfall and wind impacts, e.g., gravel, concrete, or solar panels.

Solar Precinct Component	Soil loss (t/ha/yr)	Soil loss class (risk rating)
Airstrip (6 ha) – outside Solar Precinct boundary		
Construction (0% groundcover)	23	1 – Very Low
Post-construction (70% groundcover)	1	1 – Very Low

4.3.1.3 Potential acid sulfate soils

Potential acid sulfate soils (PASS) mapping indicates that there is a very low probability of PASS presence at the Solar Precinct site (CSIRO 2013). In addition, Douglas Partners (2021) visually assessed the site to have an extremely low probability of PASS presence, with no requirement to be screened in further geotechnical investigations.

4.3.1.4 Land use and environmental values

Land uses in the area that are supported and maintained by land and soils are pastoral production on Powell Creek Station, the Adelaide-Darwin railway, public roads, and Indigenous land uses including hunting, bushfood collection and other cultural practices. Generally, the types of soils present in the footprint have a low to moderate agricultural potential as tenosols have very low chemical fertility and kandasols have moderate chemical fertility and water-holding capacity (Gray, 2002).

Environmental values supported by land and soils are limited to native vegetation. There are no watercourses in the Solar Precinct footprint that could be affected by soil erosion or sedimentation, and the access routes traverse only minor ephemeral drainages. Lake Woods is noted as a significant environmental value in the region; however, the distance between the Solar Precinct and the lake and absence of connecting watercourses means it is not within the zone of influence from any erosion or soil loss impacts derived from the proposal footprint.

4.3.2 Overhead Transmission Line

Land and soils that occur along the approximately 800 km long OHTL corridor from Powell Creek through to Murrumujuk, Gunn Point Peninsula, have been described with reference to available land system mapping (Lynch et al. 2012; Christian and Stewart 1968).

4.3.2.1 Landform and soils

Land systems traversed by the OHTL corridor are described in Table 4-4. Eleven different classes are traversed, with different landform and soils characteristics. In general, the southern half of the OHTL predominantly traverses lateritic plains and rises, and desert sandplains (Figure 4-2). The northern half, passing through Pine Creek, Adelaide River and Darwin, predominantly traverses lateritic plains and rises, but also intersects areas of sandstone and granite hills, and some large areas of alluvial floodplains (Figure 4-3).

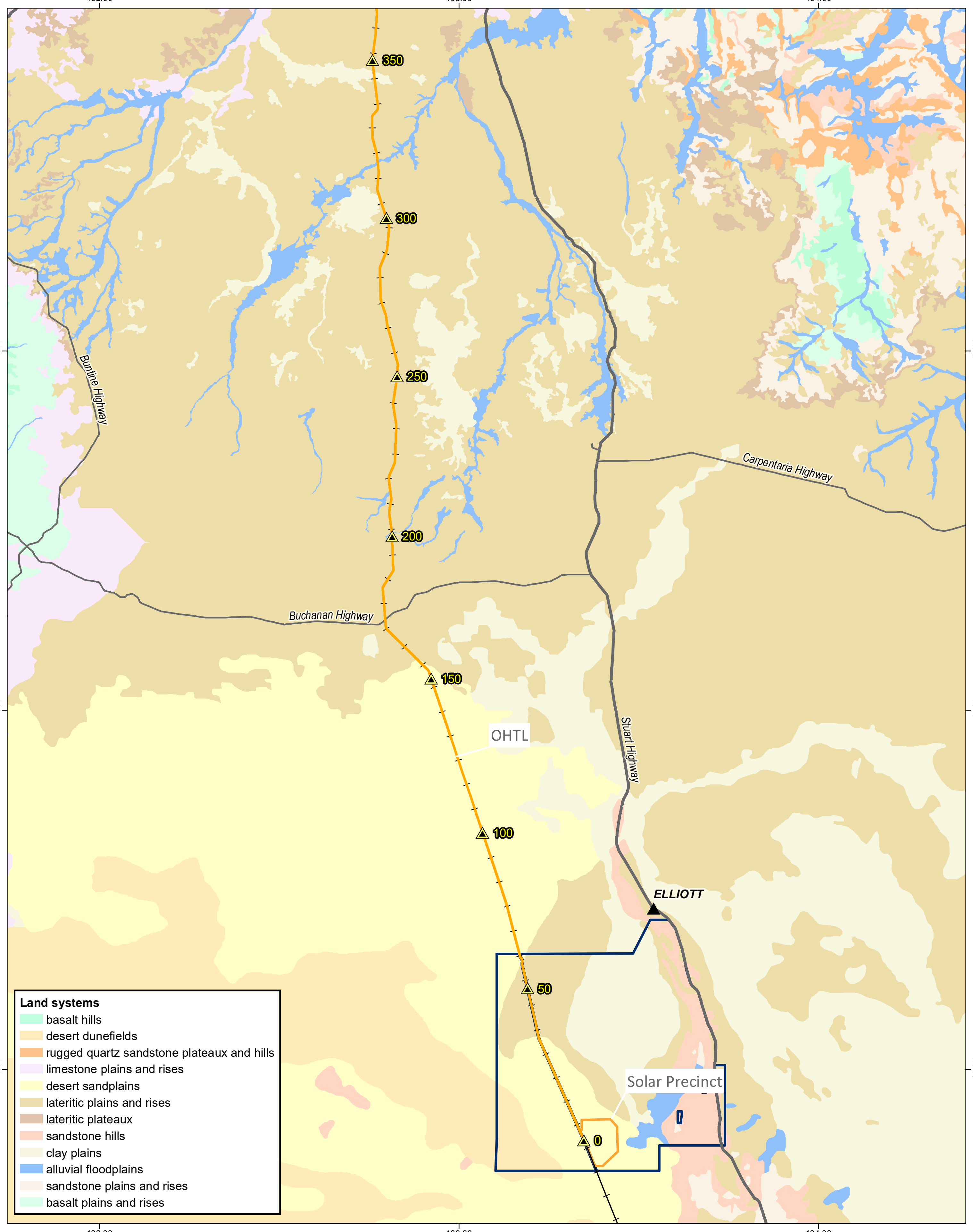
Landforms of particular interest with respect to assessing potential land and soils impacts, are the alluvial floodplains, granite hills and sandstone hills. These areas are distinctly different to the plains traversed by the majority of the OHTL corridor as the slopes and soil types are generally more susceptible to erosion. These landforms are mainly in the northern section of the OHTL (from Kilometre Point (KP) 550 north), within the Pine Creek, Adelaide River and Darwin regions.

Table 4-4. Land systems intersected by OHTL (Source: Lynch et al. 2012; Christian and Stewart 1968)

Class	Landform	Soil*	Land systems	Approximate length of OHTL (km)
Alluvial floodplains	Alluvial floodplains, swamps, drainage depressions and alluvial fans; sandy, silty and clay soils on Quaternary alluvium	Red, brown, yellow silty and sandy earths, brown and grey clays	Banyan, Effington, Fabian, Flatwood, Jundee, McKinlay, Western	23.92
Coastal floodplains	Seasonally flooded coastal floodplains, inundated 3-6 months	Poorly drained clay soils	Pinwinkle	0.67
Clay plains	Level to gently undulating clay plains (black soil plains); cracking clay soils	Olive brown, brown and grey clays	Larrimah	3.69
Desert sandplains	Level to undulating sandplains with red sands	No description	Redsan	133.15
Granite hills	Low hills and hills mostly on granite, gneiss, rhyolite, and some schist; common rock outcrop and surface stone with shallow gritty or stony soils	Skeletal soils and minor coarse sandy yellow soils	Currency	0.84
Granite plains and rises	Gently undulating to undulating plains with rises and low hills on granite, schist, gneiss (deeply weathered in places); coarse grained sandy, earthy and texture contrast soils	Stony and gravelly red and yellow sandy earths	Cully	40.46
Lateritic plains and rises	Plains and rises associated with deeply weathered profiles (laterite) including sand sheets and other depositional products; sandy and earth soils	Loamy or gravelly red and yellow earths, siliceous and earthy sands, sandy brown and earths	Atlas_Ms14, Banjo, Birrimbah, Birrimbah 1, Bulwaddy, Claravale, Elsey, Forrest, Kay, Keating, Keckwick, Keefers Hut, Knifehandle, Krans, Sturt, Woggaman 1	332.78
Lateritic plateaux	Plateaux, scarps, and some rises on deeply weathered sediments; shallow soils with rock outcrop	Shallow, skeletal sandy red and yellow earths	Yujullowan	1.40
Limestone plains and rises	Plains, rises and plateaux on weathered and unweathered Cambrian limestone, dolomite, chalcedony, shale, sandstone, and siltstone with associated sand sheets; sandy and earth soils	Brown sandy and loamy soils, sandy and loamy red and yellow earths	Beemla, Budbudjong, Jindara, Kimbyan, Tagoman, Wallingin	85.66

Class	Landform	Soil*	Land systems	Approximate length of OHTL (km)
Sandstone hills	Low hills, hills and stony plateaux on sandstone, siltstone, quartzite, and conglomerate (deeply weathered in places); outcrop with shallow stony soils	Skeletal soils and outcrop with minor sandy red and yellow gradational soils and shallow gravelly lithosols	Baker	30.58
Sandstone plains and rises	Plains, rises and plateaux on mostly on sandstone, siltstone, claystone, shale, and some limestone; commonly shallow soils with surface stone and rock outcrop	Skeletal soils and shallow gravelly loams and sands; yellow and red earths	Bend, Bustard, Rumwaggon	141.56

*Soil description apply to northern NT only – these details are not available for southern NT land systems



Legend
Town
AAPowerLink infrastructure
Powell Creek Station
OHTL Kilometre Points
Railway
Principal road
Secondary road

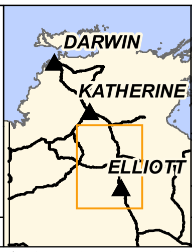


Figure 4-2: Map of land systems traversed by the AAPowerLink infrastructure (southern portion)

N

Project: Australia-Asia PowerLink

0 10 20 30 40 Kilometres

Reference: M-Files ID 198573

Date: 16/02/2022

Revision: 0

Scale: 1:1,500,000

Coordinate System: GDA2020

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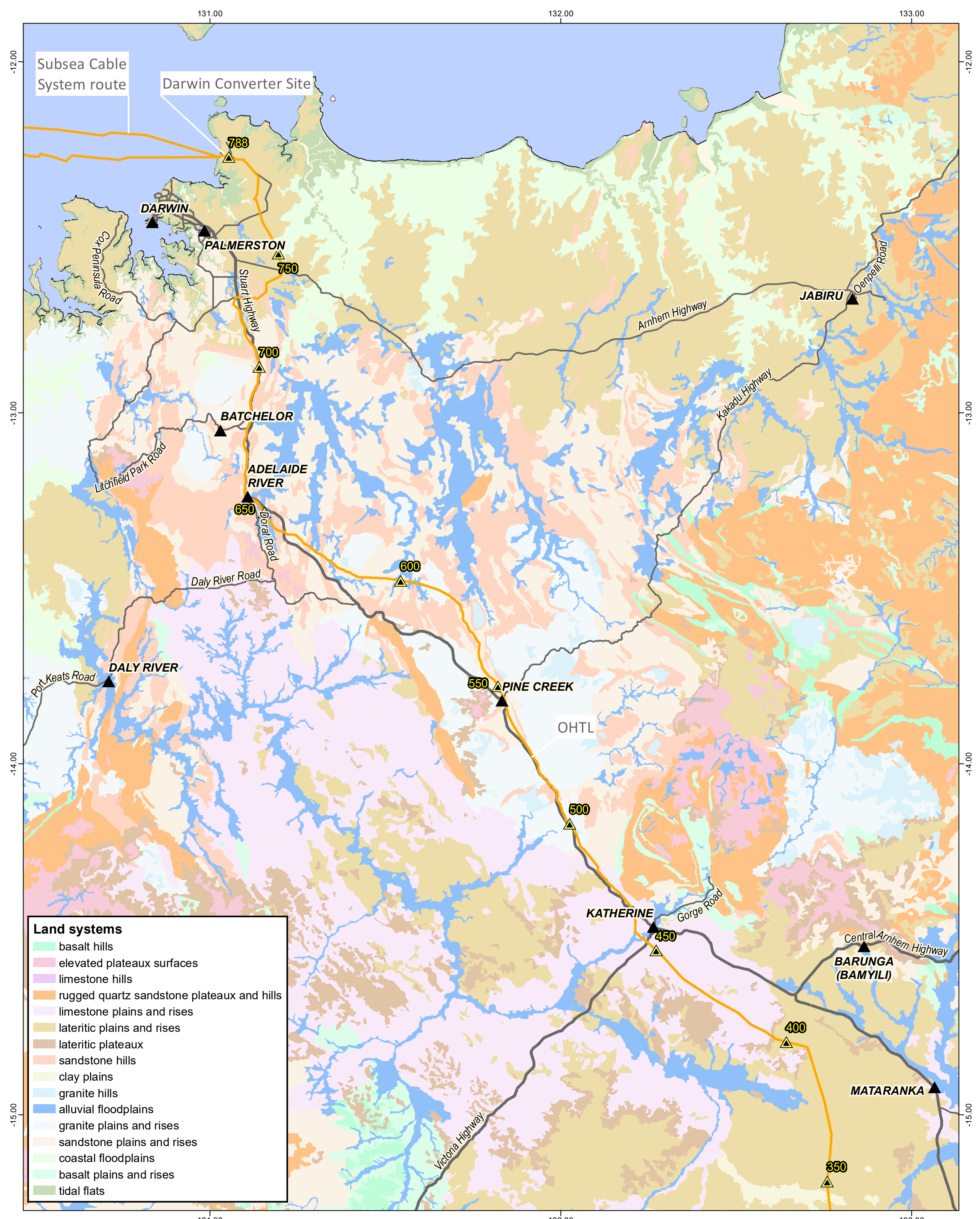
Source: Sun Cable, EcOz, NTG (NR Maps)



Legend

- Town
- AAPowerLink infrastructure
- OHTL Kilometre points
- Railway
- Principal road
- Secondary road

Source: Sun Cable, EcOz, NTG (NR Maps)

Figure 4-3: Map of land systems traversed by the OHTL corridor (northern portion)

N

Project: Australia-Asia PowerLink

0 10 20 30 40 Kilometres

Reference: M Files ID 198573

Date: 16/02/2022

Revision: 0

Scale: 1:1,500,000

Coordinate System: GDA2020

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4.3.2.2 Erosion hazard assessment summary

The landform classes traversed by the OHTL corridor from south to north and associated soil loss volume (t/ha/year) and soil loss class risk rating for each class in provided in Table 4-5. For the OHTL erosion hazard and risk assessment a construction pad of 600 m x 100 m (0.6 ha) and a construction corridor of 300 m x 12 m (0.36 ha) was assessed for each OHTL pole. This conservative approach ensures that the assessment considers the full impact area, while taking into consideration the staged approach to OHTL construction.

As the OHTL traverses through a large portion of the Northern Territory, with varying climate conditions, the erosion risk rating for each area varies, as risk is dependent on rainfall. For the purposes of an erosion hazard assessment, the location of the OHTL was determined using the areas provided by the Darwin Harbour Advisory Committee Research Group (DHACRG), with the addition of Daly Waters and Elliott. Soil loss classes were calculated for the OHTL using mean erosivity data from the DHACRG Ratings for Darwin Airport, Adelaide River, Pine Creek and Katherine. For Daly Waters and Elliot, the erosion risk rating was derived using mean rainfall depth data from BoM for the Daly Waters Station (ID 014618) and Elliot Station (ID 015013).

Landform classes such as sandstone hills, sandstone plains and rises, coastal floodplains and limestone plains and rises presented the highest soil loss class, and subsequent risk ranking in comparison to the other landform classes. These landform classes are more commonly observed in the Pine Creek, Adelaide River and Darwin regions. In addition, these regions have a higher erosivity value, which increases the risk of erosion (due to raindrop impact), resulting in a higher soil loss class risk rating.

4.3.2.3 Potential acid sulfate soils

Potential acid sulfate soils (PASS) mapping created by CSIRO (2013) indicates that there is a very low probability of PASS presence along the majority of the OHTL corridor. There are some sections of high probability of occurrence (>70% chance of occurrence) associated with watercourses located at Adelaide River, Burrell Creek, Edith River and Katherine River (CSIRO 2013). The largest area of both high and low (6-70%) probability ASS is at the Adelaide River floodplains area (from approximately KP600 – KP700) (Figure 4-4).

The acid in PASS can impact soil and water quality, corrode metal, and weaken concrete (Water Quality Australia n.d.). During OHTL construction there is the potential for ASS to be encountered and disturbed, and the potential impacts are discussed in Section 4.4.2.3 below.

4.3.2.4 Land use and environmental values

The quality and integrity of soils is important for the protection of infrastructure assets traversed by the OHTL corridor, which include the Adelaide-Darwin railway and numerous public and private roads. Soil fertility would be variable along the corridor, and the soils do support agriculture in surrounding areas.

Environmental values supported by land and soils are native vegetation cover, and there are watercourse and floodplain habitats traversed by the OHTL corridor that could be susceptible to soil erosion and sedimentation. The corridor crosses 150 watercourses, including major watercourses such as Katherine and Adelaide Rivers. Areas of floodplain are traversed in the Adelaide River region. The northern portion of the OHTL will traverse through the Black Jungle Conservation Reserve and runs adjacent to the Shoal Bay Coastal Reserve where soil conservation is important to protecting conservation values.

Table 4-5. Soil loss and erosion hazard summary for the Overhead Transmission Line

Region/Landform class	Soil loss (t/ha/yr)	Soil loss class (risk rating)
Elliot (KP0 – KP150)		
Desert sandplains	10	1 – Very Low
Lateritic plains and rises	27	1 – Very Low
Daly Waters (KP150 – KP350)		

Region/Landform class	Soil loss (t/ha/yr)	Soil loss class (risk rating)
Lateritic plains and rises	50	1 – Very Low
Alluvial floodplains	50	1 – Very Low
Katherine (KP350 – KP500)		
Lateritic plains and rises	98	1 – Very Low
Limestone plains and rises	121	1 – Very Low
Lateritic plateaux	62	1 – Very Low
Pine Creek (KP500 – KP600)		
Limestone plains and rises	151	2 - Low
Sandstone plains and rises	151	2 - Low
Granite plains and rises	77	1 – Very Low
Granite hills	103	1 – Very Low
Alluvial floodplains	123	1 – Very Low
Sandstone hills	151	2 - Low
Adelaide River (KP600 – KP700)		
Alluvial floodplains	139	1 – Very Low
Sandstone hills	171	2 - Low
Sandstone plains and rises	171	2 - Low
Darwin (KP700 – KP788)		
Lateritic plains and rises	179	2 - Low
Sandstone hills	221	2 - Low
Sandstone plains and rises	221	2 - Low
Alluvial floodplains	179	2 - Low
Coastal floodplains	221	2 - Low

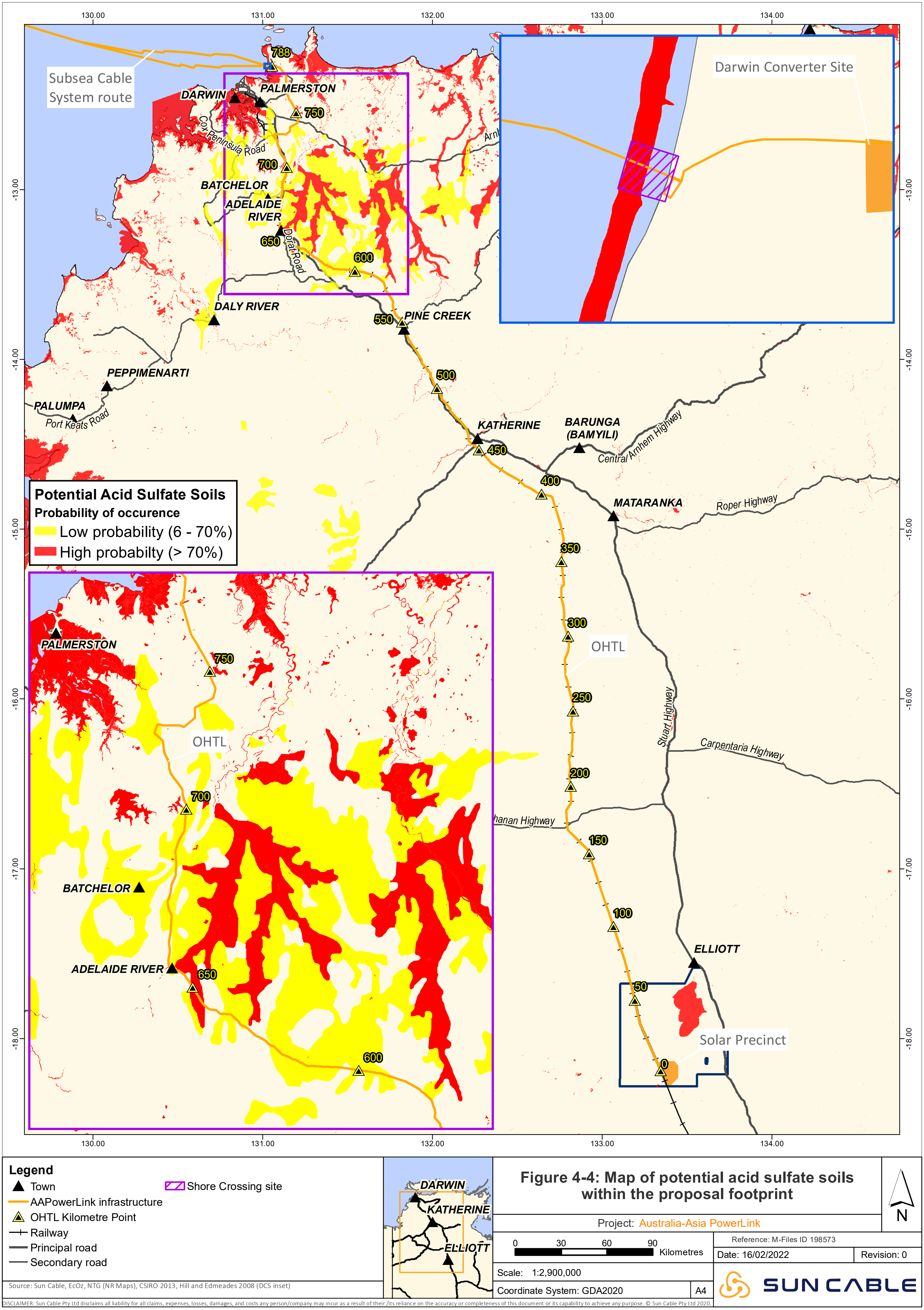


Figure 4-4: Map of potential acid sulfate soils within the proposal footprint

4.3.3 Darwin Converter Site

4.3.3.1 Landform and soils

Land units mapped within the Darwin Converter Site located at Murrumujuk, on the Gunn Point Peninsula, are summarised in Table 4-6 and shown in

Figure 4-5f from Easey et al. (2020). The site is located on undulating upland plains with coarse unconsolidated sands and gravelly soils, associated within land unit 8. There is a seasonal swamp located immediately south-west of the site is located outside of the direct disturbance footprint. This is mapped as land unit 11e below.

Table 4-6. Land units and soils in Darwin Converter Site footprint (Source: Easey et al. 2020).

Land unit	Description	Dominant soil order	Soil depth (m)	Slope range	Drainage	Run-off	Permeability
8 – Plains	Level to gently undulating upland plains	Kandosols	>1.5	1-2%	Well drained	Very slow	Moderately permeable
11 – Swamps	Swamps, billabongs, and closed depressions	Hydrosols	>1	<1%	Very poorly drained	None	Slow

4.3.3.2 Erosion hazard assessment summary

Table 4-7 summarises the soil loss volume (t/ha/year) and soil loss class (risk rating) for the Darwin Converter Site assessed using the Revised Universal Soil Loss Equation – RUSLE (IECA 2008). The high-risk rating during construction is due to the monsoonal climate causing intense rainfall events and the presence of dispersive soil types. When facilities/hardstands are constructed, post-construction the erosion hazard reduces to very low.

Table 4-7. Soil loss and erosion hazard for the Darwin Converter Site and Cable Transition Facilities

Component	Soil loss (t/ha/yr)	Soil loss class (risk rating)
Darwin Converter Site (55ha)		
Construction (0% groundcover)	628	5 – High
Post-construction (70% groundcover)	31	1 – Very Low

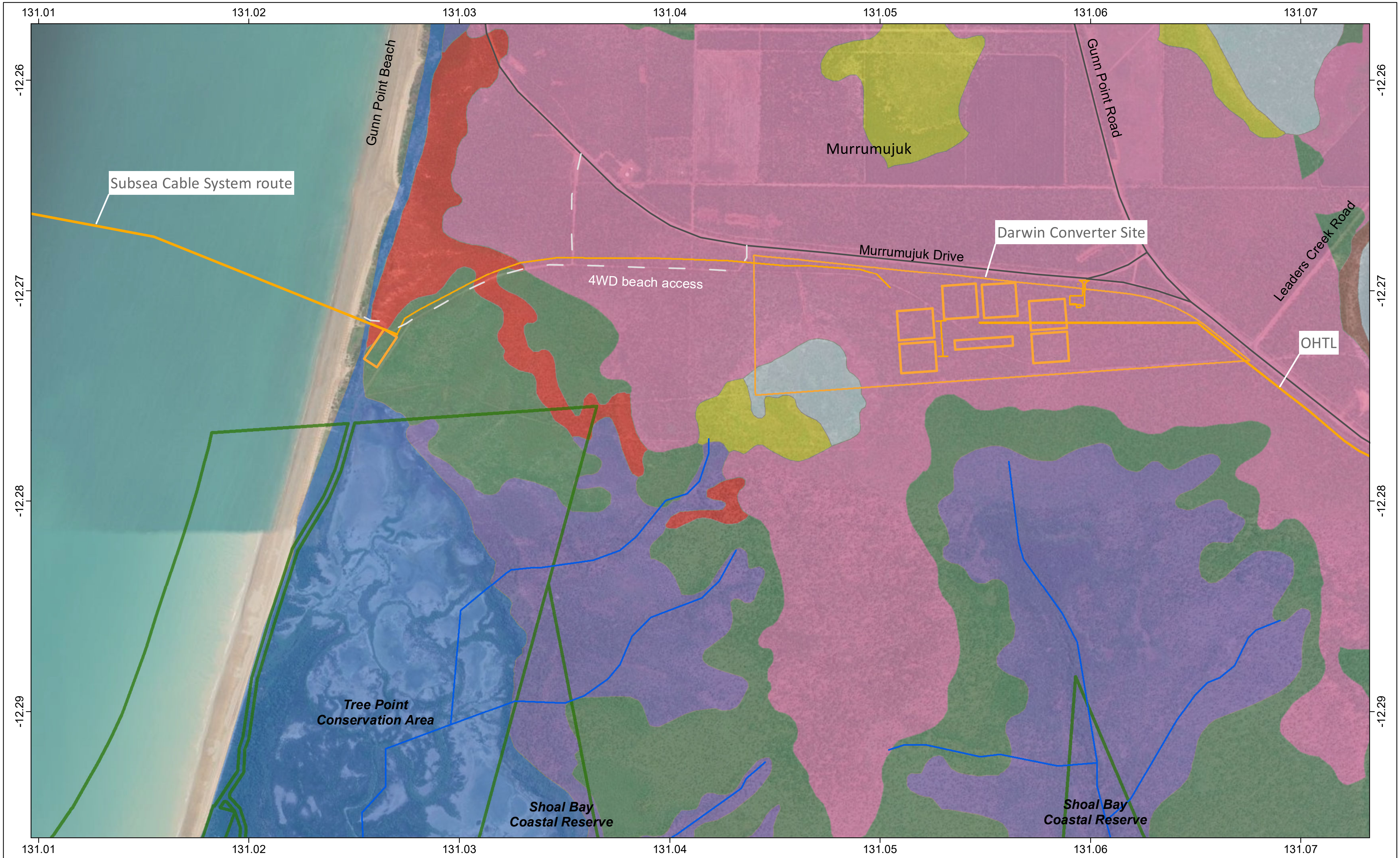
4.3.3.3 Potential acid sulfate soils

There are no areas of PASS within the Darwin Converter Site footprint.

4.3.3.4 Land use and environmental values

The Darwin Converter Site (and Cable Transition Facilities – see below) are located near to Gunn Point Beach, which is an important recreation area for the communities in the Greater Darwin region. The quality and integrity of soils is important for the maintenance of public road access and recreational use of the Gunn Point Beach area and development of the adjacent proposed Project Sea Dragon hatchery site.

Environmental values supported by land and soils are associated with Gunn Point beach west of the site, as well as the Shoal Bay Coastal Reserve and Tree Point Conservation Area, which are both south of the site. These areas support habitat for a range of flora and fauna, including migratory bird species, and protect important coastal habitats as discussed in Chapter 5 Terrestrial Ecosystems.



Legend

- AAPowerLink infrastructure
- NT Parks and Reserves
- 4WD beach access
- Road
- Streams

Land units

- 10 - Drainage systems
- 10b - Drainage systems
- 11 - Swamp
- 12 - Marine
- 6 - Rises
- 7 - Low rises
- 8 - Plains
- 8b - Plains

Source: Sun Cable, EcOz, NTG (NR Maps)

Figure 4-5: Map of land units within the Darwin Converter Site and Cable Transition Facilities footprints

Project: Australia-Asia PowerLink	Reference: M-Files ID 198573	Revision: 1
Coordinate System: GDA2020	Date: 09/03/2022	
0 — 1 Kilometres	Scale: 1:25,000	A4

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4.3.4 Cable Transition Facilities

4.3.4.1 Landform and soils

Land units mapped within the Cable Transition Facilities footprint are summarised Table 4-8 and shown in

Figure 4-5 from Easey et al. (2020). The underground cable corridor component of the footprint traverses level to gently undulating plains, with slopes ranging from 1- 3%, well-drained kandosols, and very slow run-off characteristics, before reaching rises in the west with higher slope ranges of 5-15%, with well-drained rudosols and kandosols. The Land Sea Joint Station is located on moderately to steeply sloping land that forms the transition between the upland plains and the beach.

There is some existing erosion at, and adjacent to, the Cable Transition Facilities that appears to have been caused by 4WD beach access tracks to Gunn Point beach. Four-wheel driving and camping are common in this area and appears to have led to some degradation of the beach dunes.

4.3.4.2 Erosion hazard assessment summary

Table 4-9 summarises the soil loss volume (t/ha/year) and soil loss class (risk rating) for the Cable Transition Facilities assessed using the Revised Universal Soil Loss Equation – RUSLE (IECA 2008). Most of the footprint is within the low rises and plains land units which have slopes of 1-3% and an erosion risk rating of very low. The high and very-high risk ratings during construction are due to the monsoonal climate causing intense rainfall events, areas of slope >2% and the presence of dispersive soil types.

The rises land unit with slopes 5-15% has the highest erosion hazard with a risk rating of very high to extreme. When facilities/hardstands are constructed, post-construction the erosion hazard remains high. This land unit is only present in a small area of the Cable Transition Facilities and will need site-specific erosion and sediment controls during construction due to the erosion hazard posed by the steep slopes and unconsolidated soils.

4.3.4.3 Potential acid sulfate soils

Most of the footprint is of sufficient distance from the coast to not contain PASS; however, the Land Sea Joint Station and trenching required at the Shore Crossing Site will pass through a section of high probability PASS just offshore of the beach crossing (Hill and Eadmeades 2008). The occurrence of PASS in this area and potential impacts associated with disturbance of these materials is discussed in Chapter 9 Marine Environmental Quality.

Table 4-8. Land units and soils in Cable Transition Facilities footprint (Source: Easey et al. 2020).

Land unit	Description	Dominant soil order	Soil depth (m)	Slope range	Drainage	Run-off	Permeability
11 – Swamps	Swamps, billabongs, and closed depressions	Hydrosols	>1	<1%	Very poorly drained	None	Slow
8 – Plains	Level to gently undulating upland plains	Kandosols	>1.5	1-2%	Well drained	Very slow	Moderately permeable
7 – Low rises	Low rises and gently inclined pediment slopes	Kandosols	0.25-0.5	1-3%	Well drained	Slow to moderately rapid	Moderately permeable
6 – Rises	Rises and short steep slopes	Rudosols	<0.25	5-15%	Well drained	Moderately rapid to rapid	Moderately permeable

Table 4-9. Soil loss and erosion hazard summary for the Cable Transition Facilities

Slope class	Component	Soil loss (t/ha/yr)	Soil loss class (risk rating)
Cable Transition Facilities (1ha)			
1% slope	Construction (0% groundcover)	221	1 – Very Low
	Post-construction (70% groundcover)	13	1 – Very Low
3% slope	Construction (0% groundcover)	780	1 – Very Low
	Post-construction (70% groundcover)	54	1 – Very Low
5% slope	Construction (0% groundcover)	1463	6 – Very High
	Post-construction (70% groundcover)	108	1 – Very Low
15% slope	Construction (0% groundcover)	6397	7 – Extreme
	Post-construction (70% groundcover)	537	5 - High

4.4 Potential impacts

The potential impacts to land and soils, and associated environmental values, associated with the AAPowerLink have been assessed using the EIA methodology described in Chapter 3 Impact Assessment. The EIA identified and assessed the following impacts that could occur during construction and/or operations:

- Erosion and topsoil migration caused by soil disturbance
- Contamination of soils
- Disturbance of potential acid sulfate soils (PASS).

The EIA considered the impact avoidance and mitigation measures detailed in Section 4.5 below and assessed the residual impacts to land and soils assuming these measures are effectively implemented. The outcomes of the EIA are summarised Table 4-10 and Table 4-11 and discussed in the subsequent sections.

Table 4-10. Summary of EIA results – Terrestrial Environmental Quality factor - Construction

Impact	Location	Likelihood	Scale	Duration	Magnitude	Value rating	Certainty	Residual Impact
Erosion and topsoil migration Section 4.4.2.1	Solar Precinct	**Likely** Construction will disturb large areas of soil	**Limited** Erosion will affect isolated areas where runoff is concentrated	**Medium-term** Impact occurs intermittently during construction – wet season only	**Minor** Erosion will occur but unlikely to impact adjacent land uses	**Low** No sensitive land uses, or values present	**High** Erosion hazard assessment and ESCP in accordance with IECA guidelines	**Minor**
	OHTL	**Likely** Construction will disturb soils in 22m wide corridor	**Limited** Narrow linear corridor. Erosion hazard limited to where there are steep slopes or watercourses.	**Medium-term** Impact occurs intermittently during construction – wet season only	**Minor** Erosion will occur but unlikely to impact adjacent land uses	**Medium** Railway and road infrastructure could be affected by erosion	**High** Erosion hazard assessment and ESCP in accordance with IECA guidelines	**Minor**
	Darwin Converter Site	**Likely** Construction will disturb soils	**Limited** Erosion will affect isolated areas where runoff is concentrated	**Medium-term** Impact occurs intermittently during construction – wet season only	**Minor** Erosion will occur but unlikely to impact adjacent land uses	**Medium** Seasonal swamp proximate to footprint sensitive to sedimentation caused by erosion	**High** Erosion hazard assessment and ESCP in accordance with IECA guidelines	**Minor**
	Cable Transition Facilities	**Likely** Construction will disturb soils	**Limited** Erosion will affect isolated areas where runoff is concentrated	**Medium-term** Impact occurs intermittently during construction – wet season only	**Minor** Erosion will occur but unlikely to impact adjacent land uses	**High** Soil integrity is important for local biodiversity and recreation values on Gunn Point Beach	**High** Erosion hazard assessment and ESCP in accordance with IECA guidelines	**Minor**

Impact	Location	Likelihood	Scale	Duration	Magnitude	Value rating	Certainty	Residual Impact
Contamination of soils **Section 4.4.2.2**	All sites	**Possible** Storage and handling of fuels and hazardous materials will take place on site	**Limited** Contamination will be limited to small area around site of spill	**Short-term** Spills will occur intermittently. Spills will be detected and remediated immediately.	**Minor** No impact to surface water or groundwater due to small volumes and mitigation measures	**High** Watercourses and groundwater aquifers are sensitive to contamination impacts	**High** Australian Standards are established and proven effective for mitigating risk	**Minor**
Disturbance of potential acid sulfate soils (PASS) **Section 4.4.2.3**	All sites (except Shore Crossing Site – refer Chapter 10)	**Possible** PASS could occur at specific locations along OHTL. Soil testing to be undertaken.	**Limited** Area of potential disturbance will be limited to where pole foundations intersect ASS	**Short-term** ASS would be exposed for a matter of days prior to reburial	**Minor** Oxidation unlikely to occur during short period of exposure	**Medium** Watercourses along OHTL would be sensitive to ASS impacts	**High** Guidelines for identification and management of ASS are established and proven effective	**Minor**

Table 4-11. Summary of EIA results – Terrestrial Environmental Quality factor – operations

Impact	Location	Likelihood	Scale	Duration	Magnitude	Value rating	Certainty	Residual Impact
Erosion and topsoil migration Section 4.4.3.1	All sites	**Possible** Significant rainfall events can cause erosions	**Limited** Erosion will affect isolated areas where runoff is concentrated	**Medium-term** Impact occurs intermittently – wet season only	**Minor** Good drainage design and reinstatement of the footprint will minimise erosion severity	**Medium** Railway and road infrastructure, and seasonal swamp at Darwin Converter Site and Gunn Point Beach could be affected by erosion	**High** Erosion hazard assessment and ESCP in accordance with IECA guidelines	**Minor**
Contamination of soils Section 4.4.3.2	All sites	**Possible** Spills or leaks could occur at fuel storage areas	**Limited** Contamination will be limited to small area around site of spill	**Short-term** Spills will occur intermittently. Spills will be detected and remediated immediately.	**Minor** No impact to surface water or groundwater due to small volumes and mitigation measures	**High** Watercourses and groundwater aquifers are sensitive to contamination impacts	**High** Only aviation fuel stored in significant quantities. Australian Standards established and proven effective for mitigating risk.	**Minor**
Disturbance of potential acid sulfate soils (PASS) Section 4.4.3.3	All sites (except Shore Crossing Site – refer Chapter 10)	**Possible** PASS could occur at specific locations along OHTL. Soil testing to be undertaken.	**Limited** Area of potential disturbance will be limited to repair work requiring excavation where ASS present	**Short-term** ASS would be exposed for a matter of days prior to reburial	**Minor** Oxidation unlikely to occur during short period of exposure	**Medium** Watercourses along OHTL would be sensitive to ASS impacts	**High** Guidelines for identification and management of ASS are established and proven effective	**Minor**

4.4.1 Areas of potential impact

4.4.1.1 Proposal footprint (direct disturbance)

The area within which land and soils will be directly disturbed includes the extent of land that will be cleared to construct the Solar Precinct and access roads, the OHTL corridor, the Darwin Converter Site, and the Cable Transition Facilities. The direct disturbance footprint is outlined in Chapter 2 Proposal Description.

4.4.1.2 Area of influence (indirect disturbance)

Construction and maintenance activities could also indirectly disturb land and soils in surrounding areas. The broader 'area of influence' includes areas adjacent to the proposal footprint that may be subject to increased risk of erosion because of localised changes to surface water flows and drainage. The area of influence is predicted to be limited. Impacts are not expected to extend far beyond the boundary of the proposal footprint because the surrounding area contains undisturbed soils and vegetation that will dissipate overland flows.

Offsite movement of sediments, contamination of soils (by hydrocarbons or hazardous chemicals/waste) and disturbance of PASS could indirectly impact water quality in drainage lines and watercourses adjacent to the proposal footprint, because water movement can transport these contaminants downstream. Water quality impacts are discussed in Chapter 7 Inland Water Environmental Quality.

4.4.2 Construction

Impacts to land and soils will be greatest during the construction phase, when large areas of land and soils will be exposed and disturbed by land clearing and earthworks activities, and when storage and handling of fuels and hazardous chemicals increase the likelihood of spills and leaks, and soil contamination.

4.4.2.1 Erosion and topsoil migration caused by the disturbance of soils

During the construction phase, land clearing will result in soils unavoidably being disturbed and exposed, thereby increasing the likelihood of erosion and/or soil migration by wind and rain. Erosion, if not controlled, could negatively impact the integrity of adjacent public/private infrastructure such as the railway and roads, and also the project infrastructure. Erosion can also lead to loss of topsoil, which could reduce rehabilitation success, and lead to water quality impacts where construction activities occur in proximity to watercourses and aquatic ecosystems. These potential impacts are assessed in Chapters 7 Inland Water Environmental Quality and Chapter 8 Aquatic Ecosystems.

Solar Precinct

The Solar Precinct has an extreme erosion hazard rating, while the access routes generally have a low erosion hazard rating, except for specific locations where the routes cross seasonal watercourses and drainage lines, low rocky hills and ridges and a small patch of black soil (section 4.3.1.2). Erosion and topsoil migration is likely to occur during construction when rainfall creates overland flows across cleared areas and where surface runoff is concentrated by localised changes to surface topography associated with earthworks in the Solar Precinct and along the access roads. During construction, there will be increased erosion risk when soils are exposed over the wet season before infrastructure is constructed and design controls such as roadside drains and culverts have been installed.

Erosion at the Solar Precinct may also be caused by wind as dust storms are common in semi-arid areas particularly when large areas of cleared or bare soils are exposed. Dust management techniques such as water suppression and re-establishment of groundcover beneath the solar panels will be implemented to minimise the impacts of wind erosion. Trials are underway proximate to the Solar Precinct investigating vegetation regrowth under solar arrays which if successful could reduce the impacts of wind and water erosion across the footprint.

Staging of the land clearing and construction activities will reduce the erosion hazard. Only a portion of the footprint will have exposed soils at any given time, with the remainder of the footprint having groundcover present either in the form of natural vegetation, or infrastructure. Soil loss (t/ha/yr) calculations for construction and post-construction indicate that once infrastructure is in place, soil loss and erosion hazard will be reduced to low levels (1 t/ha/yr) across most of the footprint.

Erosion is predicted to affect isolated areas, which can be readily rectified by routine inspection and maintenance works with no long-term impact to surrounding land uses or water quality. To avoid and mitigate erosion, Sun Cable will prepare and implement ESCPs (refer Section 4.5). The likelihood and severity of erosion impacts during construction of the Solar Precinct is summarised in Table 4-10 assuming the adoption of accepted design standards for stormwater drainage infrastructure and effective implementation of a Construction ESCP.

Overhead Transmission Line

Erosion is likely to occur during construction of the OHTL when wet season surface runoff is concentrated by localised changes to surface topography and drainage associated with land disturbance and earthworks. The majority of the route aligns with the Alice Springs-Darwin Railway corridor, which has cleared access along its length, and the railway operator is responsible for inspection and maintenance of erosion. The section of the OHTL that aligns with the Utilities Corridor, traverses previously undisturbed areas where there is limited existing erosion. A construction pad up to 60 m x 100 m is required for each OHTL pole, as well as a 22 m wide construction access road along the length of the OHTL, which will reduce to 6 m width during operations. These areas will be cleared, which will include localised disturbance of soils and therefore an increased risk of erosion. Erosion hazard and risk is low for all of the landforms traversed by the route (section 0); however, it is expected that isolated instances of erosion will occur, in particular where the corridor traverses watercourses, floodplains and areas of steeper slopes associated with rocky hills.

As the OHTL will be cleared and constructed progressively, and there will be progressive re-instatement of disturbed areas (refer Section 2.5 Proposal Description), erosion is only likely to occur during the wet season and is predicted to affect isolated areas for a short period. To reduce the likelihood and severity of erosion Sun Cable will prepare and implement a Construction ESCP. Erosion that does occur will be rectified by routine inspection and maintenance works. This will ensure it is unlikely to cause long-term impact to adjacent infrastructure (namely the railway and public roads), surrounding land uses or water quality in watercourses that are traversed. This is discussed in Section 4.5.

The likelihood and severity of erosion impacts during construction of the OHTL is summarised in Table 4-10 assuming effective implementation of a Construction ESCP.

Darwin Converter Site

The Darwin Converter Site has a high erosion hazard rating (section 4.3.3.2). During construction, there will be a high erosion risk when soils are exposed over the wet season before infrastructure/hardstands are constructed and design controls such as stormwater drainage infrastructure have been installed. To reduce likelihood and severity of erosion a construction ESCP will be implemented (see Section 4.5).

Staging of the land clearing and construction activities will reduce the erosion hazard. Only a portion of the footprint will have exposed soils at any given time, with the remainder of the footprint having groundcover present either in the form of natural vegetation, or infrastructure/hardstand. Soil loss (t/ha/yr) calculations for construction and post-construction indicate that once infrastructure/hardstands are in place, soil loss and erosion hazard will be reduced to low levels (1 t/ha/yr) across most of the footprint.

Erosion is predicted to affect localised areas, which can be rectified by routine inspection and maintenance works with no long-term impact to surrounding land uses or water quality. To reduce the likelihood and severity of erosion, Sun Cable will prepare and implement a Construction ESCP (refer Section 4.5). The likelihood and severity of erosion impacts during construction of the Darwin Converter Site is summarised in

Table 4-10 assuming the adoption of accepted design standards for stormwater drainage infrastructure and effective implementation of a Construction ESCP.

ESCP controls will limit the potential for erosion and topsoil migration impacts on the swamp located within the Darwin Convertor Site by ensuring sediments are not transported to the swamp and isolating the construction areas from this sensitive receptor.

Cable Transition Facilities

The majority of the Cable Transition Facilities footprint has a very low erosion hazard rating, but the Land Sea Joint Station and Shore Crossing Site footprints have a very high to extreme erosion hazard rating (section 4.3.4.2).

During construction of the 2.7 km long Underground Cable Corridor, where the erosion hazard rating is very low, it is predicted that erosion will be limited to isolated occurrences during the wet season. Once the cables are laid and the trenches backfilled, the corridor will be reinstated with native vegetation, and the erosion hazard rating is very low.

During construction of the Land Sea Joint Station and Shore Crossing, where erosion hazard rating is very high to extreme, erosion is still predicted to be limited because the site footprints are small (1 ha and 2.5 ha respectively). The post-construction erosion hazard rating is high for the components of the footprint with steep slopes, indicating that even once the site is reinstated, the presence of steep slopes means there will be an ongoing erosion risk.

Erosion is predicted to affect localised areas, which can be rectified by routine inspection and maintenance works with no long-term impact to surrounding infrastructure, land uses or water quality entering the marine environment. To reduce the likelihood and severity of erosion Sun Cable will prepare and implement a Construction Erosion and Sediment Control Plan (ESCP) and will reinstate the construction footprints with native vegetation and erosion controls (refer section 4.5). The likelihood and severity of erosion impacts during construction of the Cable Transition Facilities is summarised in Table 4-10 assuming the effective implementation of a Construction ESCP and reinstatement.

Subsea Cable System

Impacts relating to this component of the proposal are discussed in Chapter 9 Marine Environmental Quality.

4.4.2.2 Contamination of soils

It is possible that soils could be contaminated by spills during construction of the proposal components. Hazardous substances (e.g., fuel) will be temporarily stored in the construction footprint. All handling and storage of hazardous substances will be in accordance with relevant standards and guidelines, including use of bunding and spill kits. Details of the dangerous goods and hazardous chemicals required to be stored and used for each proposal component is outlined in Section 2.4.3.4 of Chapter 2 Proposal Description.

Transport, storage and handling of dangerous goods and hazardous substances will comply with the Australian Dangerous Goods Code, Australian Standard (AS) 1940 Storage and handling of flammable and combustible liquids and the National Standard NOHSC: 1015 (2001) Storage and Handling of Workplace Dangerous Goods. Dangerous Goods and Hazardous Materials Registers will be maintained for each work area, and all Safety Data Sheets (SDSs) will be stored in the chemical storage facilities. Spill kits, Personal Protective Equipment (PPE) and firefighting equipment will be kept with chemicals as required by legislation, and personnel will be trained in spill response procedures. These controls are routinely implemented on industrial sites and are proven effective at minimising workplace safety and environmental hazards and risks, and are predicted to be effective in ensuring no offsite impacts to soils or water resources from spills or leaks that occur

The likelihood and severity of soil contamination impacts during construction is summarised in Table 4-10 assuming storage and handling complies with all relevant standards and guidelines, and effective implementation of spill response as part of site Emergency Response Procedures.

4.4.2.3 Disturbance of potential acid sulfate soils

PASS is not expected to be exposed by construction activities at the Solar Precinct and the Darwin Converter Site. There is very low probability of PASS presence along the majority of the proposed OHTL services corridor, but there are some sections of high probability of occurrence along the OHTL (Figure 4-4).

Disturbed soils in high-risk areas will be subject to geotechnical testing and assessed for the presence of PASS or ASS. If testing identifies ASS, an ASS Management Plan will be developed that stipulates handling, treatment, and disposal methodologies. ASS testing, treatment and management will be in accordance with applicable standards and guidelines, including *National Acid Sulfate Soils Guidance* (Sullivan et al 2018) and the *Queensland Acid Sulfate Soil Technical Manual* (Dear et al. 2014). This process will ensure the impact associated with PASS are unlikely to impact terrestrial environmental quality.

The occurrence of PASS within the Subsea Cable System footprint is below the low tide mark is discussed in Chapter 9 Marine Environmental Quality.

4.4.3 Operations

During operations, the likelihood and severity of impacts to land and soils reduces to low levels. Isolated occurrences of soil erosion and/or contamination are likely; however, the severity of impacts will be limited, and surrounding land use and environmental values are unlikely to be affected.

4.4.3.1 Erosion and topsoil migration caused by disturbance of soils

The erosion hazard assessments undertaken for each component of the project footprint indicate that post-construction erosion hazard (soil loss risk) is very low or low for all components, excepting the Land Sea Joint Station where the risk remains high due to steeper slopes and unconsolidated soil conditions (refer Sections 4.3.1.2, 4.3.3.2, 4.3.4.2for hazard/risk calculations). The 12,000 ha of land of which majority is beneath the solar fields will be protected by the infrastructure and it is predicted that rainfall runoff from the panels will rapidly infiltrate the soils underneath. Key site selection and design criteria that contribute to avoiding and minimising erosion impacts are:

- The Solar Precinct and Darwin Converter Site are located on flat ground, above the maximum modelled flood extents of 0.01% AEP (1-in-1000-year event) and runoff conditions are slow.
- To minimise overland flows through the Solar Fields, the Solar Precinct drainage design diverts flows from the west of the site through stabilised channels to discharge points on the northern and eastern site boundary. The design criteria are for surface water to discharge at similar rates to pre-construction conditions. Details are provided in Chapter 2 Proposal Description.
- OHTL design avoids placement of poles in drainage lines or other areas of sensitivity with the power cables able to span up to 400 m to avoid disturbing these areas.
- Roadside drainage and culverts will be installed in accordance with accepted road design standards.

The majority of the areas that were cleared and disturbed during construction will be protected from erosion by the constructed infrastructure/hardstand and the remaining areas disturbed for construction of the OHTL corridor and Cable Transition Facilities will be reinstated with native vegetation and/or stabilised with erosion controls prescribed in an ESCP. Acknowledging the higher risk at the Land Sea Joint Station, a site-specific plan will be prepared to specify reinstatement and ongoing monitoring and management requirements for the site post-construction.

Isolated occurrences of erosion will possibly occur each wet season and will require remediation to limit the impact. Erosion is most likely to occur in the stormwater drainage channels, discharge points, and at locations along the OHTL and access roads that traverse steep slopes and drainage lines. Erosion may be more frequent in the first two years following construction whilst the disturbed areas are stabilising.

Isolated occurrences of erosion around the infrastructure can be readily rectified by routine inspection and maintenance works with no long-term impact to surrounding land uses or water quality. To further avoid and mitigate erosion, Sun Cable will prepare and implement ESCPs for each component of the footprint (refer Section 4.5). The likelihood and severity of erosion impacts during operation is summarised in Table 4-11 assuming the adoption of accepted design standards for stormwater drainage infrastructure, reinstatement of disturbed areas post-construction and implementation of ESCPs (including ongoing monitoring and management).

4.4.3.2 Contamination of soils

Fuel (diesel and petrol), oils, lubricants and chemicals will be stored at the Solar Precinct and Darwin Converter Site for operation of those facilities. The electrical infrastructure at the Solar Precinct and Darwin Converter Site will utilise oils and glycol (antifreeze). The largest quantities of fuel will likely be stored at the airstrip at the Solar Precinct.

The facilities are enclosed and are located on concrete hardstands so that spills or leaks of these substances would be contained. Bunding will be incorporated into facility to design as a failsafe to prevent any leakages during operations from leaving the facilities. Details of the substances and volumes stored are provided in Section 2.4.3.4 Chapter 2.

Transport, storage and handling of dangerous goods and hazardous substances will comply with the Australian Dangerous Goods Code, Australian Standard (AS) 1940 Storage and handling of flammable and combustible liquids and the National Standard NOHSC: 1015 (2001) Storage and Handling of Workplace Dangerous Goods. Dangerous Goods and Hazardous Materials Registers will be maintained for each work area, and all Safety Data Sheets (SDSs) will be stored in the chemical storage facilities. Spill kits, Personal Protective Equipment (PPE) and firefighting equipment will be kept with chemicals as required by legislation, and personnel will be trained in spill response procedures. These controls are routinely implemented on industrial sites and are proven effective at minimising workplace safety and environmental hazards and risks, and are predicted to be effective in ensuring no offsite impacts to soils or water resources from spills or leaks that occur

The likelihood and severity of soil contamination impacts occurring during operations is summarised in Table 4-11 assuming storage and handling complies with all relevant standards and guidelines, and effective implementation of spill response as part of site Emergency Response Procedures.

4.4.3.3 Disturbance of acid sulfate soils

Repair activities could require small-scale excavation. This would be an infrequent occurrence and the potential for encountering PASS is low. PASS assessment and management measures will be developed for any excavation works.

4.5 Avoidance, Mitigation and Monitoring

Sun Cable is committed to applying the environmental decision-making hierarchy. Consistent with section 26 of the *EP Act* this involves applying the following approaches in order of priority:

1. Avoid - Ensure that actions are designed to avoid adverse impacts on the environment.
2. Mitigate - Identify management options to mitigate adverse impacts on the environment to the greatest extent practicable.

3. Offset - If appropriate, provide for environmental offsets for residual adverse impacts on the environment that cannot be avoided or mitigated.

The environmental management framework that will be adopted for the construction and operation of the AAPowerLink is detailed in Chapter 17 Environmental Management. For each of the impacts to land and soils discussed in this chapter, Table 4-12 summarises the actions taken to avoid environmental impacts (through site selection and design) and actions proposed to minimise impacts during construction, operation and decommissioning of the proposal. The proposed controls are routine for land development and industrial operations and, assuming proper implementation and adaptive management, there is a high level of certainty that the measures will be effective.

Table 4-12. Terrestrial environmental quality – Commitments

Impact	Avoidance	Mitigation	Monitoring	Reporting
Erosion and topsoil migration caused by disturbance of soils	Solar Precinct and Darwin Converter site footprint is located and flat land above the maximum flood extent of 0.01% AEP (i.e., 1-in-1000-year flood event). Stormwater system design criteria is for discharge at similar rates to existing conditions. OHTL poles will be micro sited to avoid watercourses or drainage lines, or in areas where surface drainage could be affected. Roadside drainage and culverts will be installed in accordance with accepted road design standards.	Implementation of site-specific ESCP, which will be commensurate with the risk of erosion in each location. Reinstatement of OHTL corridor and Cable Transition Facilities footprints post-construction with native vegetation species and erosion controls.	Annual post wet season monitoring of rehabilitation success until disturbed areas stabilised. Visual inspections of drainage structures, discharge points and site boundaries following rain events. Post-wet season inspections of footprint and maintenance of emerging erosion issues.	Internal record keeping and reporting in accordance with ESCP.
Contamination of soils	Identify and (where practicable) adopt practical zero-carbon technology solutions such as electric vehicles, plant and equipment and remote solar energy systems, so no requirement for large fuel storages. Fuels and hazardous chemicals will be stored and handled in accordance with Australian standards and guidelines.	An Environmental Emergency and Spill Response Plan will be in place and equipment provided at all storage and handling locations. Construction and operations staff will be trained in spill response.	Visual inspections around storage locations and work areas.	Internal incident reporting. Incidents of off-site pollution or nuisance reported to the NT EPA within 24 hours.

Impact	Avoidance	Mitigation	Monitoring	Reporting
Acid sulfate soils disturbance	Nil	Development of an ASSMP if ASS is identified in soil disturbance areas during construction. As per the developed ASSMP treatment of PASS to neutralise acidity and prevent impact on surrounding environment.	Visual inspections and testing of any confirmed ASS in line with National Acid Sulfate Soils Guidance material.	Internal records of PASS testing and management actions.

4.6 Residual impact

Each impact to land and soils was assigned a residual impact rating taking into consideration the scale, magnitude and duration of the impacts, the presence/absence of environmental values and/or sensitive receptors and the level of certainty with respect to the intensity of the impact and the effectiveness of the mitigation measures. The residual impact ratings adopted in the assessment are provided in Table 4-13.

Table 4-13. Residual impact ratings adopted for the AAPowerLink EIA

Ratings and Description
Minor: A minor residual impact is unlikely to be significant.
A minor impact generally has two or more of the following characteristics: Scale: Limited/Localised Magnitude: Negligible/Minor Duration: Short-term/ Medium-term/Reversible. OR There are no sensitive receptors or land uses present, and the environment does not contain any aspects that are valuable or otherwise important or unique (i.e., Very Low/Low rating), and there is moderate to high degree of certainty about the likelihood and intensity of the impact, and the effectiveness of proposed mitigation measures.
Moderate: A moderate residual impact has potential to be significant. The significance depends on the acceptability of the impacts and the effectiveness of mitigation measures.
A moderate impact generally has two or more of the following characteristics: Scale: Localised/Regional Magnitude: Moderate Duration: Medium-term/Long-term AND/OR There are sensitive receptors or land uses present, or environmental aspects that are valuable or otherwise important or unique (i.e., Medium-High value rating), and there is a low degree of certainty about the impact, and the effectiveness of proposed mitigation measures.
Major: A major residual impact is likely to be significant. The level of acceptability will depend on offsets or benefits compensating for the impact.
Impact generally has two or more of the following characteristics: Scale: Regional/ Widespread Magnitude: Moderate/Major Duration: Long-term/Permanent AND There are sensitive receptors or land uses present, or environmental aspects that are valuable or otherwise important or unique (i.e., Medium-High value rating).

The residual impact to land and soils from the AAPowerLink construction activities is summarised in Table 4-4.

Table 4-14. Residual impact ratings for impacts to Terrestrial environmental quality

Impact	Residual impact rating
Construction	
Erosion and topsoil migration	Minor
Soil contamination	Minor
Disturbance of ASS	Minor
Operations	
Erosion and topsoil migration	Minor
Soil contamination	Minor
Disturbance of ASS	Minor

As stated at the start of this chapter, the NT EPAs objective for the terrestrial environmental quality factor is to:

'Protect the quality and integrity of land and soils so that environmental values are supported and maintained'.

The results of the EIA undertaken for the Terrestrial Environmental Quality factor indicate that the proposal is likely to have a minor residual impacts to land and soils associated with erosion, contamination from spills and disturbance of ASS. These impacts are proposed to be avoided and mitigated using the design criteria, mitigation and monitoring measures described in Table 4-12. These controls are routine practice in land development and industrial projects and therefore there is a high degree of certainty that they will be effective in protecting the quality and integrity of land and soils from potential impacts associated with the proposal. The potential impacts of the proposal are predicted to affect limited areas of land and soils within and immediately surrounding the proposal footprint, for short periods between when the issue emerges and is identified and rectified. The predicted scale and duration of the impacts are such that they are unlikely to affect environmental values (habitats and water resources) or surrounding land uses (railway and public roads).

4.7 Cumulative impacts

The framework used to assess cumulative impacts from the AAPowerLink, and other existing and future developments is described in Chapter 3 Impact Assessment. The process involves considering the cumulative or combined impacts to land and soils associated with the residual impacts from the AAPowerLink, existing land and soils impacts, and impacts associated with reasonably foreseeable developments described in Chapter 3. Due to the Low level of residual impact to land and soils associated with the AAPowerLink proposal there is limited potential for cumulative to occur. Through the EIA process, the following areas of potential cumulative impacts were identified:

- Combined land clearing and development in the Barkly region associated with the AAPowerLink, agriculture, mining and Beetaloo-Sub-Basin onshore gas developments has potential to alter overland flows across large areas of land, which could increase occurrences of erosion. These occurrences would still be expected to be affect small areas and can be readily rectified.
- In the OHTL (Railway Corridor), there is some potential for the combined disturbance of the railway and the OHTL to cause erosion; however, the potential for offsite impacts to occur is limited by design controls (drainage and culverts), and routine inspection and maintenance activities undertaken by the railway operator and Sun Cable.
- Combined land clearing and development at Murrumujuk, Gunn Point, associated with the AAPowerLink, Sea Dragon Hatchery, and future development of residential areas and/or a Renewable Energy Hub, has potential to alter overland flows across large areas of land, which could increase occurrences of erosion. There is already erosion occurring along the coastline associated with recreational access to Gunn Point Beach. There is an opportunity for Sun Cable to restore environmental conditions in areas near the Cable Transition Facilities by addressing existing erosion subject to agreement from the relevant land and roads authorities.

4.8 Offsets

The EIA did not identify any significant impacts to land and soils that require offsets.

4.9 References

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