5.0 LAND

5.1 METHODOLOGY

Assessment of land resources in the study corridor was undertaken in two stages; a literature review and a field investigation.

The following literature applicable to the site was identified and reviewed:

- Spatial data sources (GIS framework provided by Searle *et al.*, 2007; Maher, 1996) were reviewed to consider topographic, geologic and soils characteristics likely to exist on site and factors which were likely to be major issues such as sodicity and salinity;
- Digital 1:250,000 Geology Data Base, Geosciences Australia 2005 for geology and soil mapping; and
- A search of the DERM Interactive Resource and Tenure Maps for active mining or exploration leases.

A field investigation was undertaken during the 6th and 7th of January 2010 by a Soil and Hydrology Scientist. The investigation included:

- A reconnaissance of the study corridor looking for variation in soils characteristics based on surface condition and comparing with mapping for the site;
- Surface observations and soils profile descriptions at selected locations;
- Survey observations recorded in accordance with the recommendations contained in the *Australian Soil and Land Survey Field Handbook* (McDonald *et al*., 1990) and *Australian Soil Classification* (Isbell 2002).
- An inspection of the site for any likely contaminating activities (existing and historic) i.e. old cattle dips, land fill sites, etc;
- Strategic soil sampling to test for erodibility potential and nutrient status to inform rehabilitation/revegetation; and
- Analysis of soils results to determine requirements for soil amelioration rates (e.g. gypsum to counteract sodicity and fertiliser rates for revegetation).

5.2 TOPOGRAPHY/GEOMORPHOLOGY

5.2.1 Existing Environment

The terrain of the study site can generally be described as level to gently undulating plains with a maximum slope of 3 %. The natural elevation of the proposed alignment ranges from 321m AHD to 370m AHD (refer to Figure 5.1).

The proposed alignment traverses three ephemeral watercourses, being Kogan, Eastern Branch and Braemer Creeks (refer to Figure 7.1). All watercourses are tributaries of the Condamine River.

5.2.2 Potential Impacts

The construction of the transmission line and associated infrastructure will result in minimal changes to the topography of the terrain as it is generally flat and will require minimal earthworks.

Major diversion of water is unlikely however there may be minor changes to drainage patterns to divert water flows around the tower platforms. Potential impacts on water flows and hydrology are further discussed in Section 7.0.

5.3 GEOLOGY AND SOILS

5.3.1 Existing Environment

5.3.1.1 Geology

The site is located entirely on Kumbarilla sandstone and alluvium geology (Digital 1:250,000 Geology Data Base, Geosciences Australia 2005) (Figure 5.2). The Kumbarilla sandstones are the principle geology of the study corridor, where alluvium is present within the vicinity of the watercourses which traverse the study corridor (refer to (Figure 5.2). The Kumbarilla sandstones which date from Mesozoic times (most likely Jurassic to Lower Cretaceous), contain mainly clayey labile to quartoze sandstone with some siltstone, mudstone and polymictic conglomerates materials (Maher, 1996). These sandstone formations were significantly eroded in the period following Tertiary times. As this site is contained within the ironbark/bull oak Land Resource Area (LRA) (Maher, 1996) the rocks were harder than other sandstones in the region and hence have been left as low hills. The alluvium geology, which dates from the Holocene period, is mainly composed of clay, silt, sand and gravel.

5.3.1.2 Soils

The proposed alignment is contained within a number of LRA's (Maher, 1996; Harris 1998) as indicated by Figure 5.3. The dominant LRA's which are traversed consist of Light Forests and Ironbark / Bull Oak Forests. An LRA contains a number of different soils that vary according to site within the landscape unit. The common soil types within the LRAs are shown in Table 5.1.

During site investigation a number of shallow soil holes (up to 0.5m) were dug to investigate soil characteristics of the site (refer to Figure 5.1 for sampling locations). Soil descriptions undertaken along the alignment indicated the principle soil types consist of Braemar and Cutthroat. These soils are defined as Sodosols (Isbell *et al*, 1997). Sodosol soils are characterized with a clear or abrupt textural B horizon in which the major part of the upper 0.2 m of the B2 horizon (or the major part of the entire B2 horizon if it is less than 0.2m thick) is sodic and not strongly acid. Sodicity influences erosion potential through its influence on soil structure and dispersibility of clay particles. Sodic soils have poor structure which is easily broken down by raindrop impact and susceptible to entrainment. Combidiban soil type dominated the alluvial plains associated with Braemar Creek.

Samples were taken for each soil type and sent to a laboratory to be tested for their erosion and nutrient status. Figure 5.2 summarises these results. This data has been used to inform the EMP in regards to quantities of soil ameliorants that may be required for soil stabilisation (gypsum to counteract sodicity), and revegetation (fertiliser rates).

TABLE 5.1 COMPARISON OF SOIL MAPPING AND FIELD SAMPLES

LAND RESOURCE AREA	KNOWN SOILS COMMON	DESCRIPTION OF SOIL TYPES	SOIL SAMPLE LOCATION REPRESENTATIVE OF SOIL TYPES
1a and 1c : Clay Alluvial Plains	Condamine	Fine self-mulching, black cracking clays on alluvial plains.	
	Arubial	Thin (<15cm) bleached sandy surface, over brown or black clay subsoil on alluvial plains.	
	Cecilvale	Surface sealing,grey or black cracking clays, with a coarse blocky subsoil, on alluvial plains.	
	Combidiban (Associated Soil)	Thick to very thick (30-100 cm), bleached, loose sandy surface, over mottled, brownish grey, light brown or yellowish brown sandy clay subsoil on alluvial plains.	WD01, WD02, WD05,WD13
3a: Cypress Pine Sands	Bogandilla	Thin (<15cm), bleached sandy surface, over brown or black clay subsoil on alluvial plains, poplar box or false sandalwood or bull oak.	
	Chincilla	Very deep, reddish brown sands.	
	Combidiban	Thick to very thick (30-100 cm), bleached, loose sandy surface, over mottled, brownish grey, light brown or yellowish brown sandy clay subsoil on alluvial plains.	
	Davy	Very deep, yellow or brown sands.	
7a: Ironbark / Bull Oak Forests	Braemar	Moderately thick (20 – 40 cm), bleached sandy surface, over mottled, yellowish brown to greyish brown clay subsoil derived from sandstone.	WD10, WD11, WD14, WD15
	Channing	Thin (<15cm), bleached sandy loam to loam surface, over brown or red clay subsoil overlying sandstone, narrow-leaved ironbark or bull oak or cypress pine.	WD08 WD06
	Cutthroat	thick (>30cm) bleached loose sandy surface, over mottled, yellowish brown sand clay subsoil overlying sandstone; and surface, over red brown clay overlying sandstone.	WD10, WD11, WD14, WD15
9b: Light Forests	Binkey	Shallow texture contrast soils, bleached sandy surface, over mottled, gravelly clay subsoil.	
	Minnabilla,	Very shallow (<45 cm), gravelly, red (may occasionally be black) soils, rock outcrop.	
	Flinton	Shallow to deep soils, sandy to loamy surface, with acid,red, massive subsoil.	WD16

Source: Maher (1995)

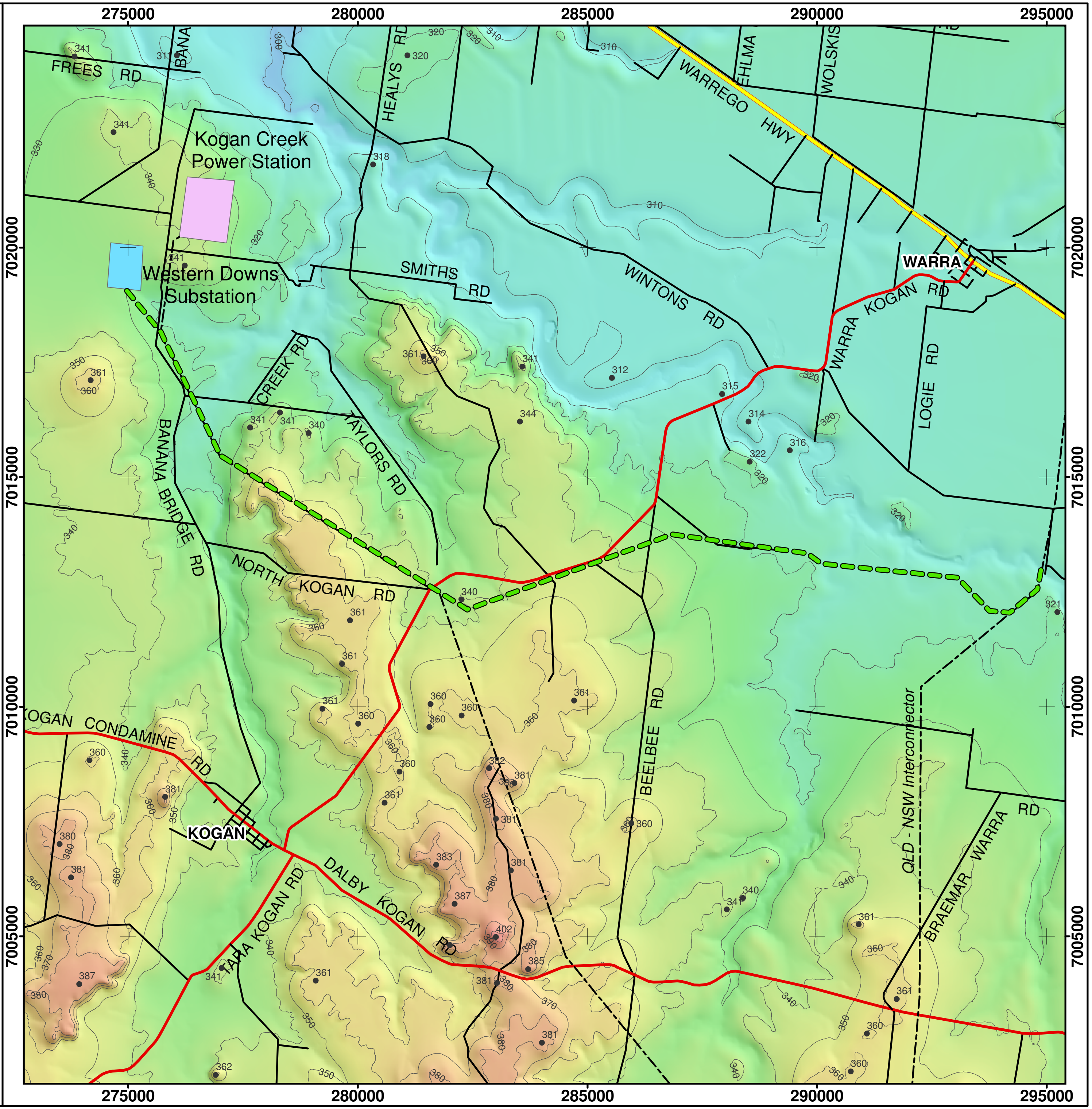
The study corridor is not subject to an approved project plan for soil conservation under the *Soil Conservation Act 1986.*

Powerlink Western Downs EIA

Topography

Figure 5.1

- Spot Height
- Study Alignment
- Existing 275 kV Line
- Contour 10m interval
- Highway
- Main Road
- Local Road
- Sub-station
- Power Station



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Scale 1 : 120 000
Datum / Projection: GDA94 MGA Zone 56

terranean mapping technologies

RPS

21 June 2010

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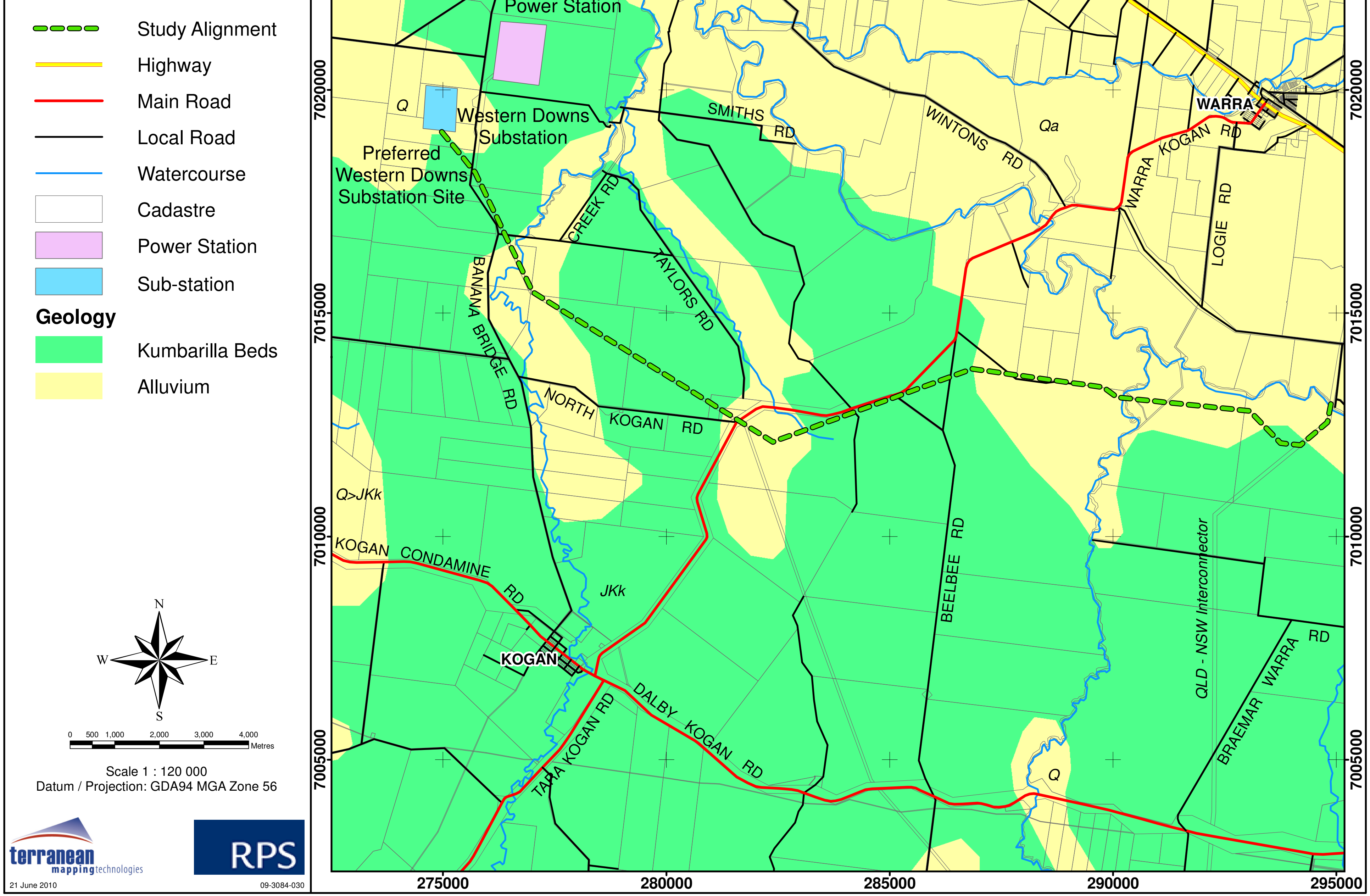
Powerlink Western Downs EIA

Geology

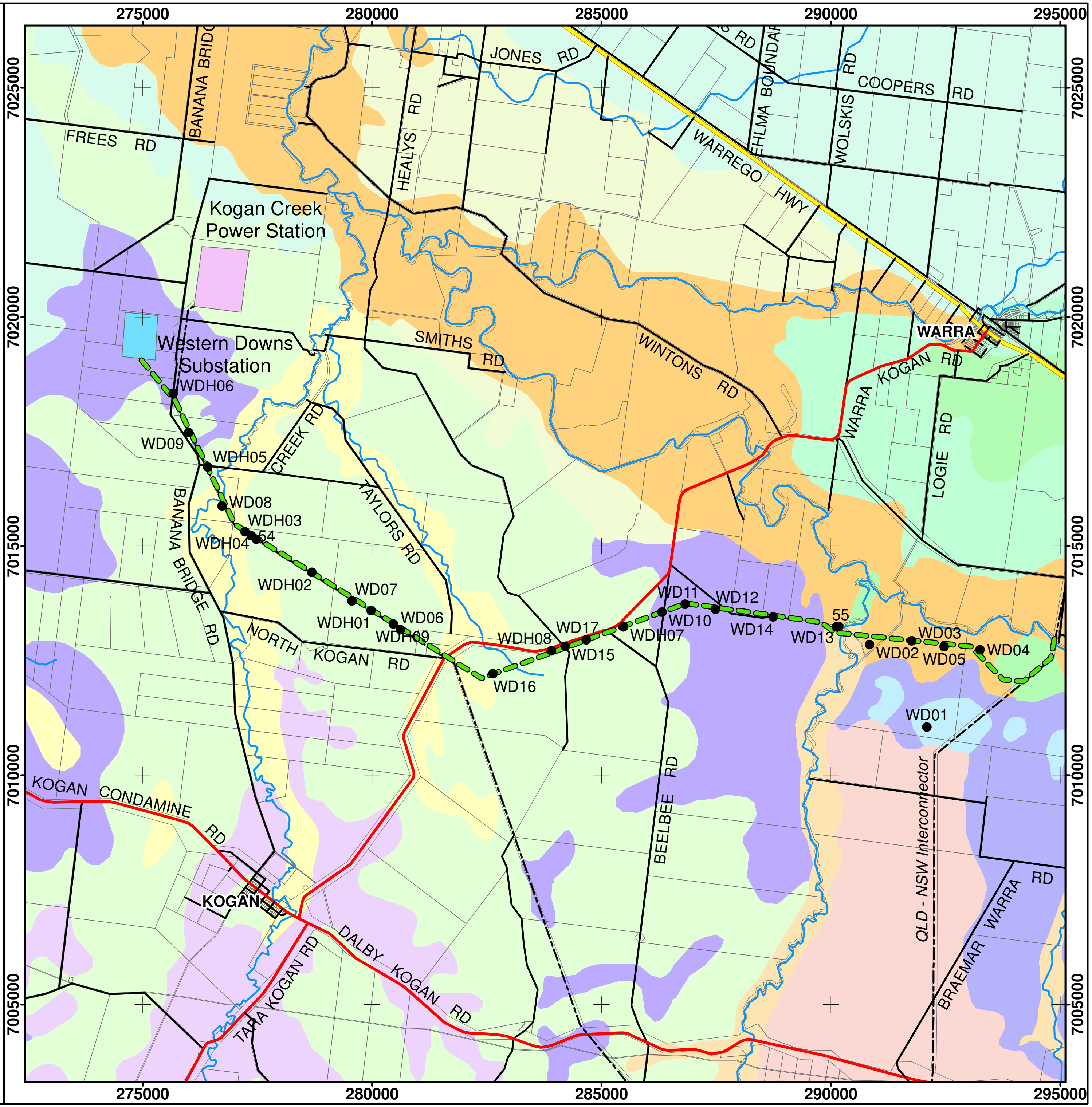
Figure 5.2



Powerlink Western Downs EIS

Soil

Figure 5.3



Land Resource Area

- Clay Alluvial Plains
- Poplar Box Flat Plains
- Cypress Pine Sands
- Brigalow Plains
- Ironbark / Bull Oak Forests
- Poplar Box Rises
- Light Forests
- Recent Alluvial Plains
- Older Alluvial Plains
- Alluvial Plains - Sandy Sodosols
- Brigalow Uplands
- Sandstone Forests
- Ironbark / Bull Oak Sodolols
- Survey Sites and EVR
- Study Alignment
- Existing 275 kV Line
- Highway
- Main Road
- Local Road
- Watercourse
- Cadastre
- Power Station
- Sub-station

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Scale 1 : 120 000

Datum / Projection: GDA94 MGA Zone 56

terranean mapping technologies

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5.3.1.3 Soil erosion

Erosion rate depends upon slope, slope length, aspect, elevation, prevailing weather direction, flood susceptibility and the erodibility of each particular soil type. The majority of the proposed Project will occur over flat topography (level to gently inclined) which substantially decreases the risk of erosion. The banks of the Kogan and Braemar Creeks range from moderately inclined to steep, which is the area of the proposed alignment which poses the greatest risk to erosion.

The study of the proposed alignment revealed two potential erosion hotspots. The main area of concern is located within the existing Kogan to Braemar alignment, adjacent to Kogan Creek (refer to Plate 5.1). The underlying precursor to the present erosion is likely to be the disturbance of the surface soil and the exposure of sodic subsoils and the steepness of the watercourse bank (Kogan Creek) adjacent to the erosion. It should be noted that anecdotal evidence suggests that this erosion was in place prior to the construction of the Kogan to Braemar alignment. Previous advice by the Department of Natural Resources and Water (at the time of construction of the Kogan to Braemar line) to Powerlink regarding this erosion was to leave the erosion in its current state and ensure that any activities in the area did not exacerbate the situation by altering or concentrating water flows.

The other erosion hotspot is adjacent to Braemar Creek (refer to Plate 5.2). The erosion is likely to be associated with the by wash of a large dam installed on the creek.

PLATE 5.1 SIGNIFICANT EROSION ADJACENT TO KOGAN CREEK.

PLATE 5.2 EROSION WHICH IS LIKELY TO BE ASSOCIATED WITH THE BRAEMAR CREEK DAM.

Sodicity

Soils are generally considered sodic if they have an exchangeable sodium percentage (ESP) of the total cation exchange capacity (CEC) greater than 6% (Rengasamy and Olsson 1991), soils above 16 are generally classified as highly sodic. ESP for the surface soils analysed ranged from non-sodic (2.6%) to moderately sodic (12.2%). The ESP for subsoils analysed range from non-sodic (4.8%) to highly sodic (24.8%). Sodic soil can be ameliorated by the increasing the calcium availability, the most cost effective method is through the addition of gypsum.

The Gypsy program (CRC Sugar, BSES, CSIRO 2000) was used to calculate the rates of gypsum application that would be required to counteract the sodicity levels for these soils based on the soils results from Table 5.2. It was determined that gypsum application at a maximum rate of 24.8 t/Ha will be required for the disturbance of any soils during the construction process, to reach a non-limiting ESP.

TABLE 5.2 SUMMARY OF SOILS SAMPLE RESULTS

SITE	EC (DS/M)	PH	CEC	NA ME/100G	K ME/100 G	CA ME/100G	MG ME/100G	AL(MG /KG)	P (MG/ KG)	EAT	ESP (%)	GYPSUM TO REACH NON-LIMITING ESP (T/HA)[1]
WD01 0-20	0.09	6.0	25.5	1.7	0.8	11.1	8.5	<0.1	10	3(2)	6.7	13.5
WD02 0-25	0.10	8.0	45.3	3.2	0.5	22.4	15.9	<0.1	19	3(2)	7.1	24.8
WD02 80-100	0.73	7.7	45.1	6.4	0.3	19.3	17.5	<0.1	38	3(2)	14.2	
WD05 0-20	0.19	8.9	40.7	2.7	0.4	20.0	13.5	<0.1	66	4	6.6	20.5
WD06 0-25	0.07	4.5	6.9	0.5	0.2	1.4	1.0	1.4	4	3(1)	7.2	4.8
WD08 0-10	0.55	6.2	19.2	0.5	0.4	12.5	2.9	<0.1	6	5	2.6	11.5
WD08 10-35	0.14	8.9	22.0	2.7	0.3	11.2	4.1	<0.1	3	3(2)	12.3	
WD10 0-20	0.01	5.7	4.9	0.3	0.2	1.7	0.6	<0.1	4	5	6.1	23.8
WD 10 20-40	0.27	8.2	16.2	4.6	0.1	0.9	8.7	<0.1	1	2(2)	28.4	
WD 11 0-20	0.05	5.9	8.2	1.0	0.1	1.8	3.5	0.3	7	3(2)	12.2	14.4
WD 11 25-40	0.16	6.0	12.3	2.3	0.1	1.0	6.0	0.1	5	2(2)	18.6	
WD13 0-20	0.11	7.7	36.0	1.1	0.7	18.8	10.0	<0.1	14	5	3.1	6.6
WD14 0-20	<0.01	5.3	4.2	0.3	0.2	1.2	0.8	0.3	17	3(1)	7.1	18.5
WD14 20-40	0.21	7.0	14.5	3.6	0.1	1.0	7.4	0.1	2	2(2)	24.8	
WD15 0-20	0.03	5.3	4.7	0.6	0.2	1.2	0.9	0.3	4	5	12.8	5.6
WD15 20-30	0.06	5.2	6.6	0.8	0.1	1.2	2.4	0.4	1	3(2)	12.1	
WD16 0-15	0.09	4.8	8.0	0.5	0.4	1.6	1.4	2.1	7	3(1)	6.25	1.9
WD16 15-35	0.01	5.0	6.2	0.3	0.2	0.6	0.8	1.8	4	5	4.8	

Source: [1]Gpysy Calculations (CRC Sugar, BSES, CSIRO 2000)

Particle Size Analysis

As indicated by Table 5.3 both fine and coarse textured soils were identified throughout the alignment. Particle analysis indicates that sites WD01, WD02, WD05, WD08, WD10, WD13 and WD15 are classified as fine type soils, which indicates the bulk of which are fine grained (>33% finer than 0.02mm diameter). The target particle size adopted for the site will be 0.002 mm to ensure treatment of finer soil texture (IE Aust, 1996).

TABLE 5.3 PARTICLE SIZE ANALYSIS

SITE	PARTICLE SIZE ANALYSIS (%W/W)					
	CLAY <0.002MM	SILT <0.002-0.02MM	FINE SAND 0.02-0.2MM	COURSE SAND 0.2-2MM	GRAVEL >2MM	<0.02 MM(%)
WD01 0-20	36	17	35	10	2	53
WD02 0-25	58	22	16	4	<1	80
WD02 80-100	59	20	18	3	0	79
WD05 0-20	36	10	42	12	0	46
WD06 0-25	11	9	52	15	13	20
WD08 0-10	18	24	55	3	0	42
WD08 10-35	34	24	40	2	0	58
WD10 0-20	5	6	40	48	1	11
WD 10 20-40	33	5	29	33	<1	38
WD 11 0-20	18	8	39	34	1	26
WD 11 20-40	25	5	37	33	<1	30
WD13 0-20	42	9	39	10	<1	51
WD14 0-20	6	5	50	39	0	11
WD14 20-40	25	3	42	30	0	28
WD15 0-20	12	6	32	48	2	18
WD15 20-30	34	3	22	39	2	37
WD16 0-15	8	3	26	6	57	11
WD16 15-35	8	2	22	4	5	10
	Indicates bulk of which are fine grained (>33% finer than 0.02 mm diameter)					

Emerson's Aggregate Testing

The physical Emerson's Aggregate Testing (refer to **Table 5.2**) confirms the result of analytical testing, predominantly returning dispersive classes 2, 3, 4 and 5. The EAT for the majority of soil samples indicates that soil dispersion was slight and may be prone to slake. The EAT of samples WD11 20-40 and WD14 20-40 indicated that these subsoils had high dispersion, which is likely to be associated with high ESP. Classes described in AS 1289.3.8.1 – 1997 are reproduced in **Table 5.4**.

TABLE 5.4 EMERSON AGGREGATE TEST CLASS NUMBER DEFINITIONS

EMERSON CLASS NUMBER	DEFINITION
Class 1	Air dried crumbs of soil show a strong dispersion reaction, ie, a colloidal cloud covers nearly the whole of the bottom of the beaker, usually in a very thin layer. The reaction should be evident within 10 min. In extreme cases all the water in the beaker becomes cloudy leaving only a coarse residue in a cloud of clay.
Class 2	Air-dried crumbs of soil show a moderate to slight reaction. A moderate reaction consists of an easily recognisable cloud of colloids in suspension, usually spreading ht thin steak on the bottom of the beaker. A slight reaction consists of the bare hint of cloud in water at the surface of the crumbs
Class 3	The soil remoulded at the plastic limit disperses in water
Class 4	The remoulded soil does not disperse in water. Calcium carbonate (calcite)or calcium sulfate (gypsum) is present
Class 5	The remoulded soil does not disperse in water and the 1:5 soil/water suspension remains dispersed after 5 min
Class 6	The remoulded soil does not disperse in water and the 1:5 soil/water suspension begins to flocculate within 5 min
Class 7	The air-dried crumbs of soil remain coherent in water and swells
Class 8	The air-dried crumbs of soil remain coherent in water and do not swell

Source: AS 1289.3.8.1-2006

5.3.1.4 Revegetation

An electrical conductivity (EC) of more than 0.16 dS/m may indicate a salinity issue within the soil. The EC measurement for the surface soil samples WD05 (0.19 dS/m) and WD08 (0.55 dS/m) are considered high; indicating that the growth of most plants propagated within these soils may be affected.

The pH values for the soil samples ranged from extremely acidic (4.5) to strongly alkaline (8.9), which indicates that pH in areas along the alignment are unsuitable for some plant growth. WD06 0-25 was identified as being extremely acidic with a high level of exchangeable aluminum, indicating that the growth of some plants may be affected. Other surface samples which were identified as being acidic included WD06, 0-25, WD14 0-20 and WD15 0-20.

The Cation Exchange Capacity (CEC) is a measure of the ability of the soil to hold and exchange cations with the soil solution. The cation exchange capacity of the samples tested ranged from low to very high. ESP for the surface soils analysed ranged from non-sodic (2.6%) to moderately sodic (12.2%). As well as the undesirable attribute of enhanced soil erosion the sodic soils present, they also have contribute to poor plant growth.

Surface soil sampled within the western extent of the alignment (WD01, WD02, WD05, WD13 and WD14) contained relatively high concentrations of Available P (ranging from 10 to 66 mg/kg). Analysis of surface soil samples from the eastern extent (WD06, WD08, WD10, WD11, WD15 and WD16) determined that the Available P concentrations within this section of the alignment were generally low to moderate (ranging from 4 to 7 mg/kg) where plant growth is likely to benefit from the application of phosphate fertilizer.

5.3.2 Overview

As confirmed through the laboratory analysis, the soils which characterized the proposed alignment are determined to have a high erosion potential. The moderate to high fine particle content within soil samples WD01, WD02, WD05, WD08, WD10, WD13 and WD15 highlighted the need for best practice erosion and sediment control, whereas those soils exhibiting high gravel percentage (WD06, WD10, WD11, WD14, WD15, WD16) will be more resistant to raindrop impact and entrainment, however present a rehabilitation limitation through their poor moisture holding capacity.

All sub-soil samples returned an Emerson Class indicating a dispersive soil type that may erode if disturbed (refer to Table 5.2).

Sodic soils are present along a large proportion of the study alignment. Sodic soils can present a severe limitation to plant growth and are generally highly erosive. If these soils are used in rehabilitation or have been disturbed during construction they will be highly erodible. Treatment with gypsum (24.8 t/Ha) may be considered to improve the exchangeable sodium levels for these samples.

Additional soil ameliorative procedures are required on certain areas of the proposed alignment to ensure that the soil is suitable for revegetation purposes. Low available phosphorus concentrations identified in samples WD06, WD08, WD10, WD11, WD15 and WD16 which lie predominantly in the eastern extent of the proposed alignment, indicated that plant growth is likely to benefit from the application of phosphate fertiliser (10-20 P kg/ha).

Samples WD06 0-25, WD06 0-25, WD14 0-20 and WD15 0-20 were identified as being acidic, whereby the growth of some plants may be affected. As such good quality agricultural lime (calcium carbonate) may be applied at a rate of 2.5 to 3 t/Ha to treat the acidity.

Soil samples within the vicinity of the sampling locations WD02 and WD08, returned high conductivity values indicating that they are likely to be non-productive. Due to the high conductivity concentrations present and the poor drainage associated with the clay sub-soils, exposure of these soils should be avoided where possible. Mulching of the soil surface should occur post-construction where exposure of these soils is unavoidable.

5.3.3 Salinity

A review of mapping developed as part of the Strategic Salinity Risk Assessment in the Condamine Catchment (Searle et al, 2007) indicates that there are no existing salinity locations within the Project site. Saline soils may be associated with the underlying sedimentary rock and unconsolidated sedimentary parent material. At a larger landscape scale, there are also virtually no existing salinity locations in all of the Kumbarilla sandstones in the Condamine Catchment. While subsoils are saline, this is mainly a function of low permeability of these subsoils and the accumulation of salts within the profile over geological time.

Searle *et al.* (2007) concludes that there is a moderate salinity risk for the subcatchment in which the project site is located, but that this is not relevant to the Kumbarilla landscape on which the proposed alignment is located.

5.3.4 Acid Sulphate Soils

Acid sulphate soils (ASS) are a characteristic feature of low lying coastal environments in Queensland, particularly where landform elevations are below 5m AHD. The geomorphic and site description criteria that are used to determine if ASS are likely to be present include:

- Land with elevation less than 5m AHD;
- Soil and sediment of recent geological age (Holocene); and
- Marine and estuarine sediments and tidal.

As the natural elevation of the alignment area is greater than 100m AHD, the occurrence of potential acid sulphate soils along the length of the alignment is considered negligible.

5.3.5 Good Quality Agricultural Land

In accordance with the Chinchilla Shire (2006) and Wambo Shire Planning Schemes (2005), **Figure 5.4** illustrates the quality of agricultural land contained within the area of the study corridor. The study alignment traverses the GQAL classifications Class A and Class B (recognised as Good Quality Agricultural Land). The four classes of agricultural land have been defined for Queensland are described in **Table 5.5**. In the context of the entire alignment, minimal areas of GQAL are traversed by the proposed alignment. In total the proposed alignment traverses approximately 2km of Class A and 5.5km of Class B GQAL. Cropping currently occurs in the eastern portion of the proposed alignment. Cropping and grazing will still be able to occur within the transmission line easement in accordance with the guidelines provided in Powerlink's *Farming Near Transmission Lines* Information Sheet.

TABLE 5.5 CLASSES OF AGRICULTURAL LAND

CLASS	DESCRIPTION
Class A	**Crop land** — land suitable for current and potential crops with limitations to production that range from none to moderate levels. All crop land is considered to be GQAL.
Class B	**Limited crop land** — land that is marginal for current and potential crops due to severe limitations; and suitable for pastures. Engineering and/or agronomic improvements may be required before the land is considered suitable for pasture cropping. Land marginal for particular crops of local significance is considered to be GQAL.
Class C	**Pasture land** — land suitable only for improved or native pastures due to limitations that preclude continuous cultivation for crop production; but some areas may tolerate a short period of ground disturbance for pasture establishment.
Class D	**Non-agricultural land** — land not suitable for agricultural uses due to extreme limitations. This may be undisturbed land with significant habitat, conservation and/or catchment values, or land that may be unsuitable because of very steep slopes, shallow soils, rock outcrops or poor drainage.

5.3.6 Mining and Petroleum

The Queensland Government Department of Mines and Energy's, Interactive Resource and Tenure Maps (IRTM), were accessed (18 January 2010) to determine any registered exploration permits, leases, licenses and permits within or immediately adjacent to the study area, and the results are shown in **Figure 5.5 a - e**.

In summary:

- Australian CBM Pty Ltd hold a Petroleum lease (Tenure no. 253) which covers a small portion of the proposed route central to the study alignment. The company also hold a Petroleum lease (Tenure no. 194) which covers approximately 10 km of the eastern extent of the alignment (Figure 5.5c);
- Aberdare Collieries Pty Ltd hold a Mineral Development License over the western extent of the proposed alignment (Figure 5.5d);
- Linc Energy Ltd holds a current exploration permit Coal (EPC) for the western part of the study alignment. Linc Energy Ltd and Peabody (Wilkie Creek) Pty Ltd both hold a current EPC over the eastern extent of the study alignment (Figure 5.5a);
- Coal resource areas have been allocated within the study area. The coal resource areas have been identified overlaying both portions of the eastern and western sections of the subject area;
- Australian CBM Pty Ltd (a subsidiary company of Arrow Energy) has been granted a Petroleum Lease Application over the eastern extent of the study area and an application from the company has been submitted for sections along the western extent (Figure 5.5c); and
- A Petroleum Exploration Permit has been granted for the entire western extent of the study alignment (Figure 5.5b). Exploration permits will not affect the location of the transmission line.

Subsequently, additional exploration permits for coal have been granted adjacent to the subject area:

- Clean Global Energy Operations Pty Ltd and Spinifex Rural Management Pty Ltd hold EPCs adjacent to the subject area.

5.3.7 Potentially Contaminated Land

The field survey did not identify any potential sources of contamination throughout the proposed subject area therefore DERM's Environmental Management Register (EMR) and Contaminated Land Register (CLR) were not searched for notifications of contaminated land within the study site.

The Department of Defence provides a database of areas affected by unexploded ordnance contamination (UXOs). Review of the database revealed that the study site and surrounding area are not affected by UXOs.

5.4 Potential Impacts

5.4.1 Soil Erosion

Due to the site having low slopes and a sandy loam soil surface, the project site is not considered to have a high risk of water erosion while the soil surface is intact. However, texture contrast soils with sodic subsoils are prone to tunnel erosion, and the problem occurs when the subsoils are exposed. Tunnels generally form under the surface and eventually cave in to form gullies. The rehabilitation of tunnel eroded areas can be difficult and expensive to repair.

Potential for erosion of susceptible saline/sodic subsoils is a key concern during the construction phase. This will only be of concern where subsoils are exposed by any new access tracks and when these soils are excavated as a result of construction works. Powerlink utilises existing tracks wherever possible; however, where new tracks are necessary, care is to be taken not to expose subsoils.

There is potential for erosion if water flows are concentrated. Impedance of flows within the vicinity of the tower locations and along access tracks should be minimised and sheet flow conditions, as would naturally occur, should be maintained as much as possible.

5.5 MITIGATION MEASURES

5.5.1 Soil Erosion

The primary issue to be dealt with in regards to soil erosion is associated with sodic soils in the study corridor. There is a the need to reduce the risk that erosion of subsoils occurs due to construction activities. This will be achieved by ensuring that earthworks are conducted in a manner which limits the exposure of sodic subsoils to water flow where practicable.

To prevent the disturbance of the soil surface, land clearing should be limited to the removal of aboveground woody material only. Wherever reasonable and practical, cleared vegetation should be mulched (eg. Via tub grinding or megamulching) for use on the site as an erosion control aid. Alternative clearing methods will be considered for areas where it is likely that sodic subsoils could be exposed by traditional clearing methods

In order to minimise flow concentration, levelling of the tower sites and tracks should be conducted in a fashion so as to maintain sheet flow of water across the site. Possible impediments to flows such as roads should either be constructed flat with ground level or constructed of coarse gravel to allow water to flow through, in accordance with Powerlink's Transmission Line Access Tracks Standard.

Where bunding and drainage channels are required to direct water away from tower pads, or where chemical or hydrocarbon storage is required during the construction of the transmission line, the bank will be pushed up from the back so not as to expose the sodic subsoils to water flows. The material used to construct the bund and drainage channels should be treated with gypsum, fertilised and seeded with grass to stabilise them as soon as possible after construction.

Where concentration of water flows does occur due to the construction of drainage channels associated with access tracks, the discharge points should be on a soil not susceptible to tunnel erosion and be well grassed. Where this is not possible, drainage channels and outlets should be fitted with level spreaders.

Best practice on managing these soils will be employed and all earthworks to level pads for towers will ensure:

- Subsoils are not exposed to water flows;
- High levels of surface cover are maintained to reduce erosion potential;
- Water flows are kept distributed and not channelized to reduce erosion potential; and
- Any banks that are required to be constructed are formed from the lower side as not to expose the subsoil in the bank channel.

Where tunnelling and gully erosion exist (or in the event they are created due to earthworks on site) the following practices will be used to stabilise the site:

- Divert water from the top of the eroded area; it is vital to find a safe disposal area, otherwise the problem is simply being transferrred. The disposal site must be well grassed and on a soil not susceptible to tunnel erosion or within a constructed sediment pond;
- If the tunnels are close to the surface and shallow (less than 60cm to the bottom of the tunnel) intensive cross ripping and the addition of gypsum may succeed. Gypsum should be applied to the surface and incorporated into the soil via ripping. The first ripping should be up and down the slope and subsequent ripping at right angles to the first;
- If the tunnels are deeper than 60cm, the tunnels can be filled with soil. This should be done when the soil moisture conditions are fairly high and it is vital the area is well compacted. The soil used as fill should be sourced from an area not susceptible to tunnel erosion. Surface capping should be applied to at least 300mm;
- The effected area should be treated with gypsum, fertilised and sown to grasses suitable for the area; and
- Ongoing regular monitoring is vital.

In addition to the above recommendations, the Best Practice Erosion and Sediment Control (IECA 2008) outlines best practice sediment and erosion control measures in Queensland. These measures must be implemented in all disturbance areas as identified in the EMP (see Appendix F)

Powerlink Western Downs EIA
Agricultural Land Quality
Figure 5.4

- Study Alignment
- Existing 275 kV Line
- Watercourse
- Highway
- Main Road
- Local Road
- Cadastre
- Power Station
- Sub-station

Good Quality Agricultural Land

- Class A
- Class B

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0 500 1,000 2,000 3,000 4,000 Meters

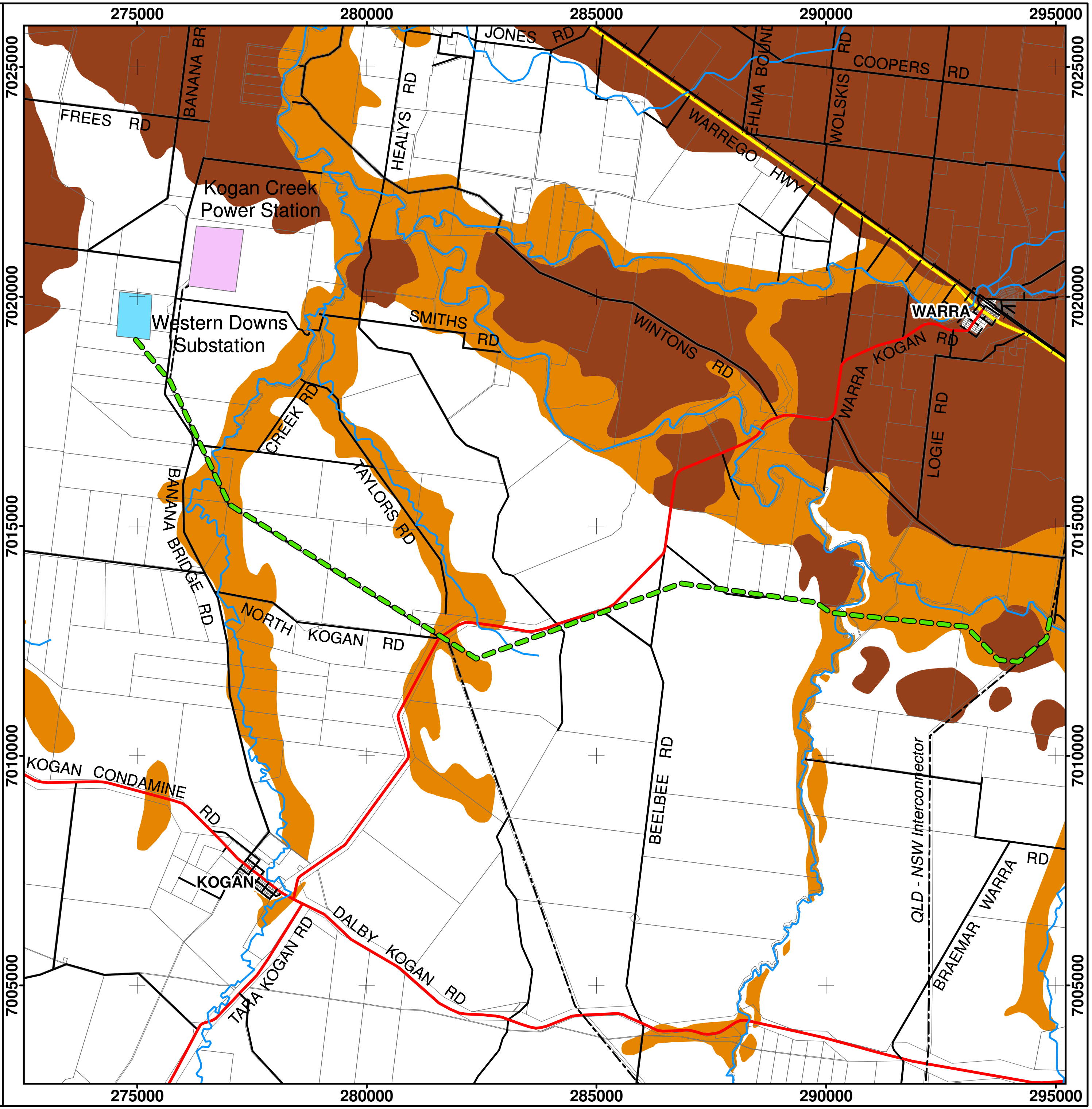
Scale 1: 120 000
Datum / Projection: GDA94 MGA Zone 56

terranean mapping technologies

RPS

21 June 2010

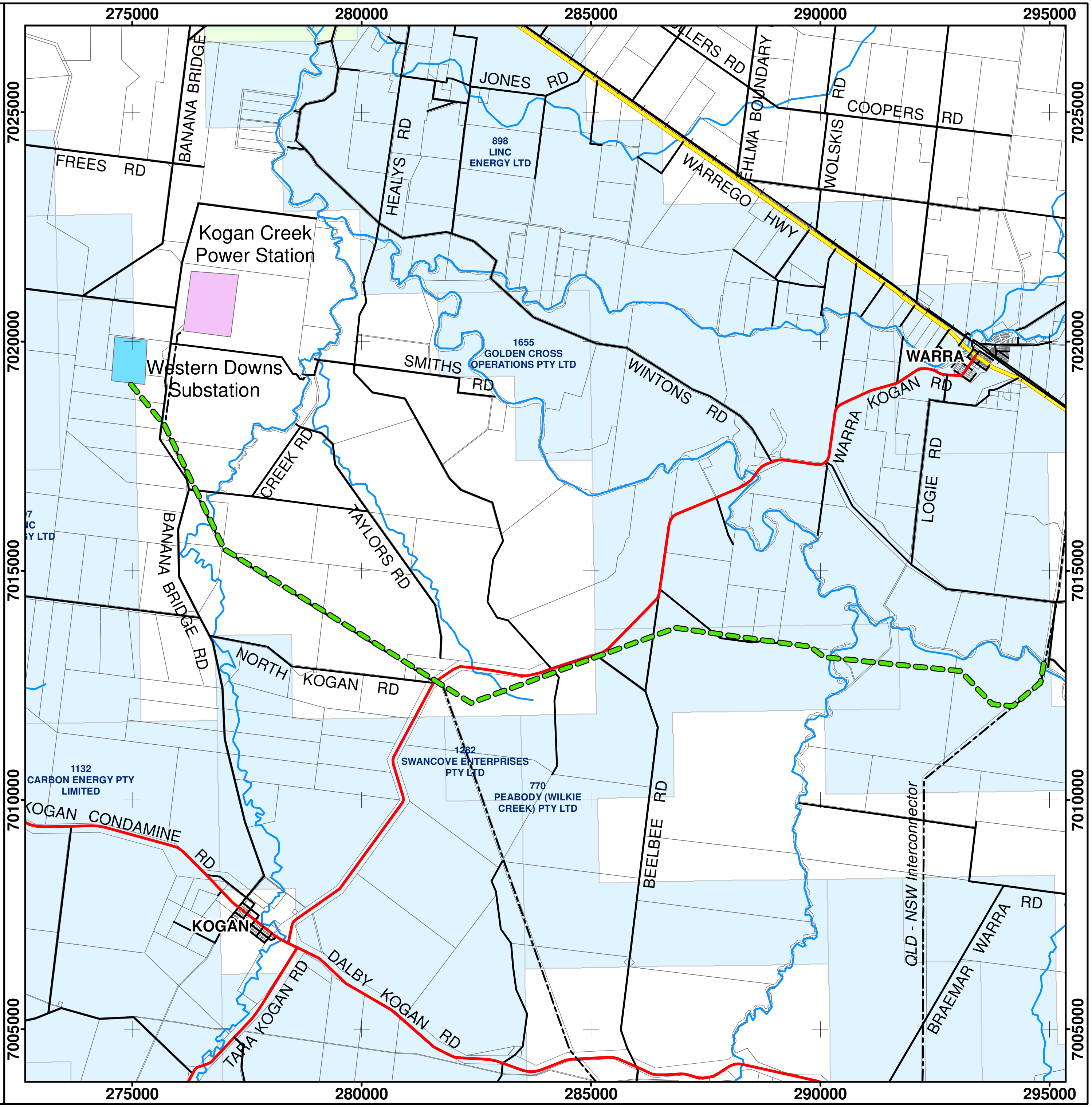
09-3084-032



Powerlink Western Downs EIA

Coal Exploration Permits

Figure 5.5a



Study Alignment
Existing 275 kV Line
Highway
Main Road
Local Road
Watercourse
Cadastre
Power Station
Sub-station

Exploration Permits (Coal)

APPLICATION
GRANTED

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Scale 1 : 120 000
Datum / Projection: GDA94 MGA Zone 56

terranean mapping technologies

RPS

21 June 2010

09-3084-033

Powerlink Western Downs EIA

Petroleum Exploration Permits

Figure 5.5b

Study Alignment
Existing 275 kV Line
Highway
Main Road
Local Road
Watercourse
Cadastre
Power Station
Sub-station

Exploration Permits (Petroleum)

APPLICATION
GRANTED

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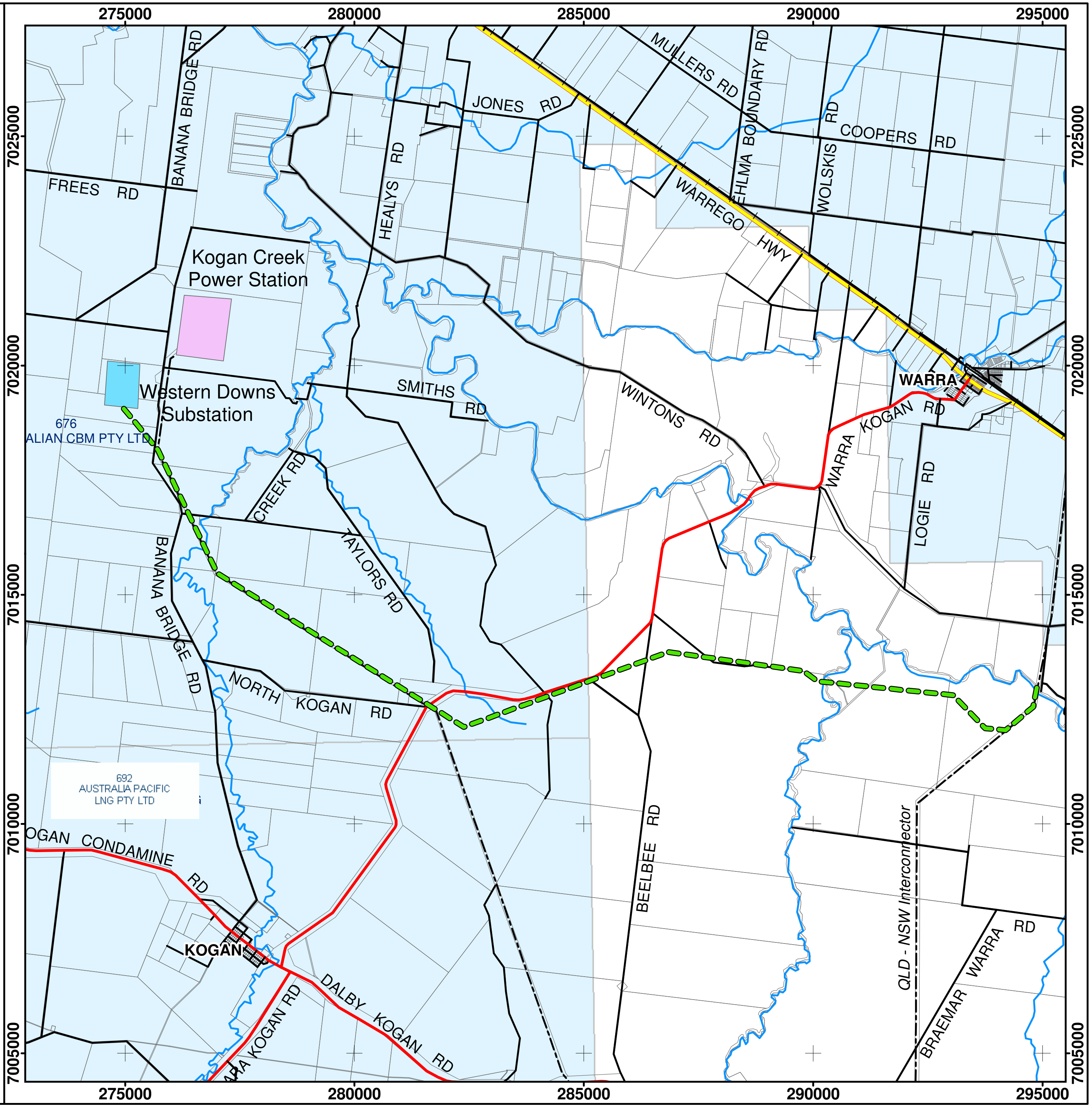
Scale 1 : 120 000
Datum / Projection: GDA94 MGA Zone 56

terranean mapping technologies

RPS

21 June 2010

09-3084-034



Powerlink Western Downs EIA

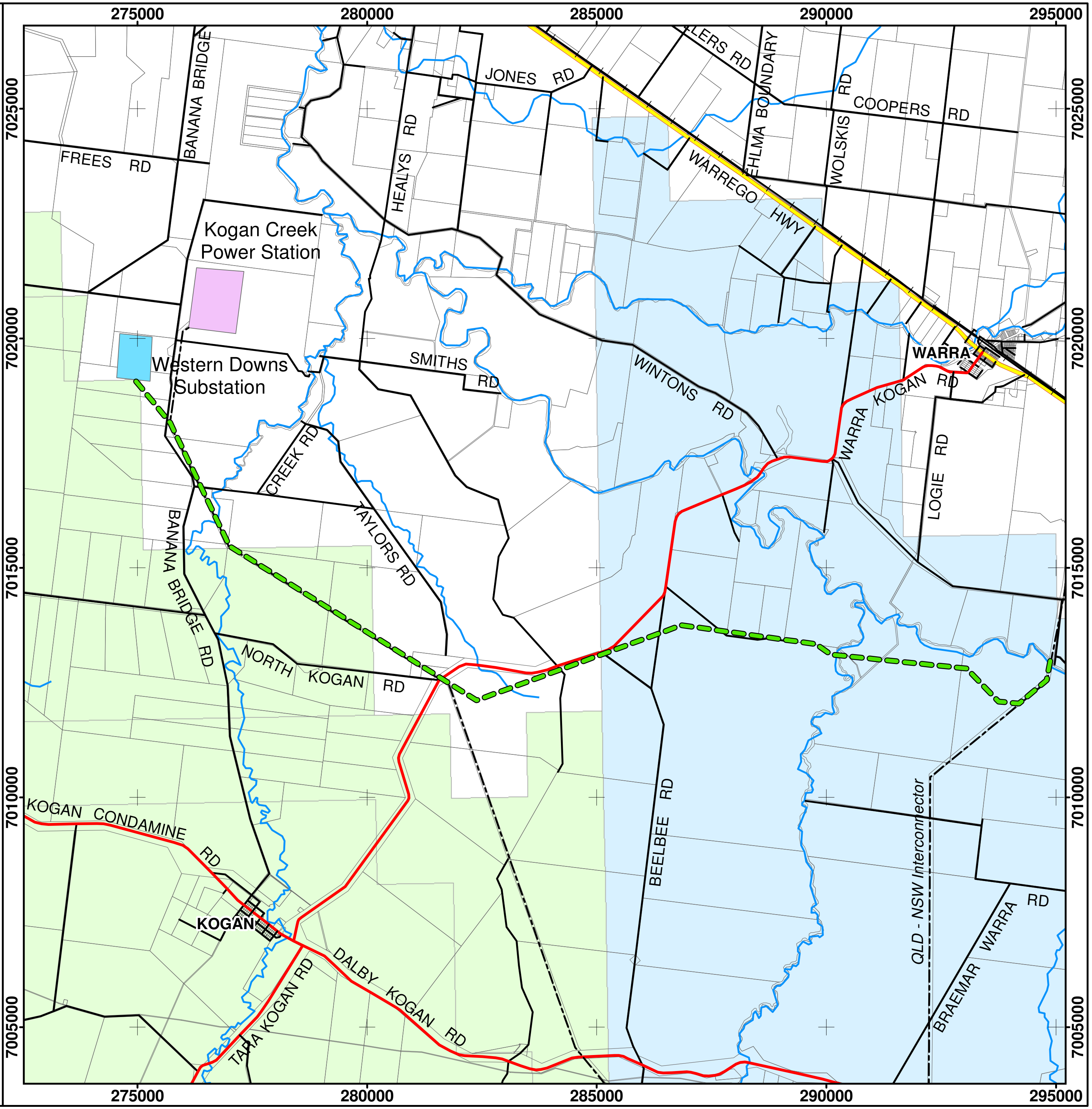
Petroleum Lease Applications

Figure 5.5c

Study Alignment
Existing 275 kV Line
Power Station
Sub-station
Highway
Main Road
Local Road
Watercourse
Cadastre

Petroleum Lease Application

APPLICATION
GRANTED



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Scale 1 : 100 000
Datum / Projection: GDA94 MGA Zone 56

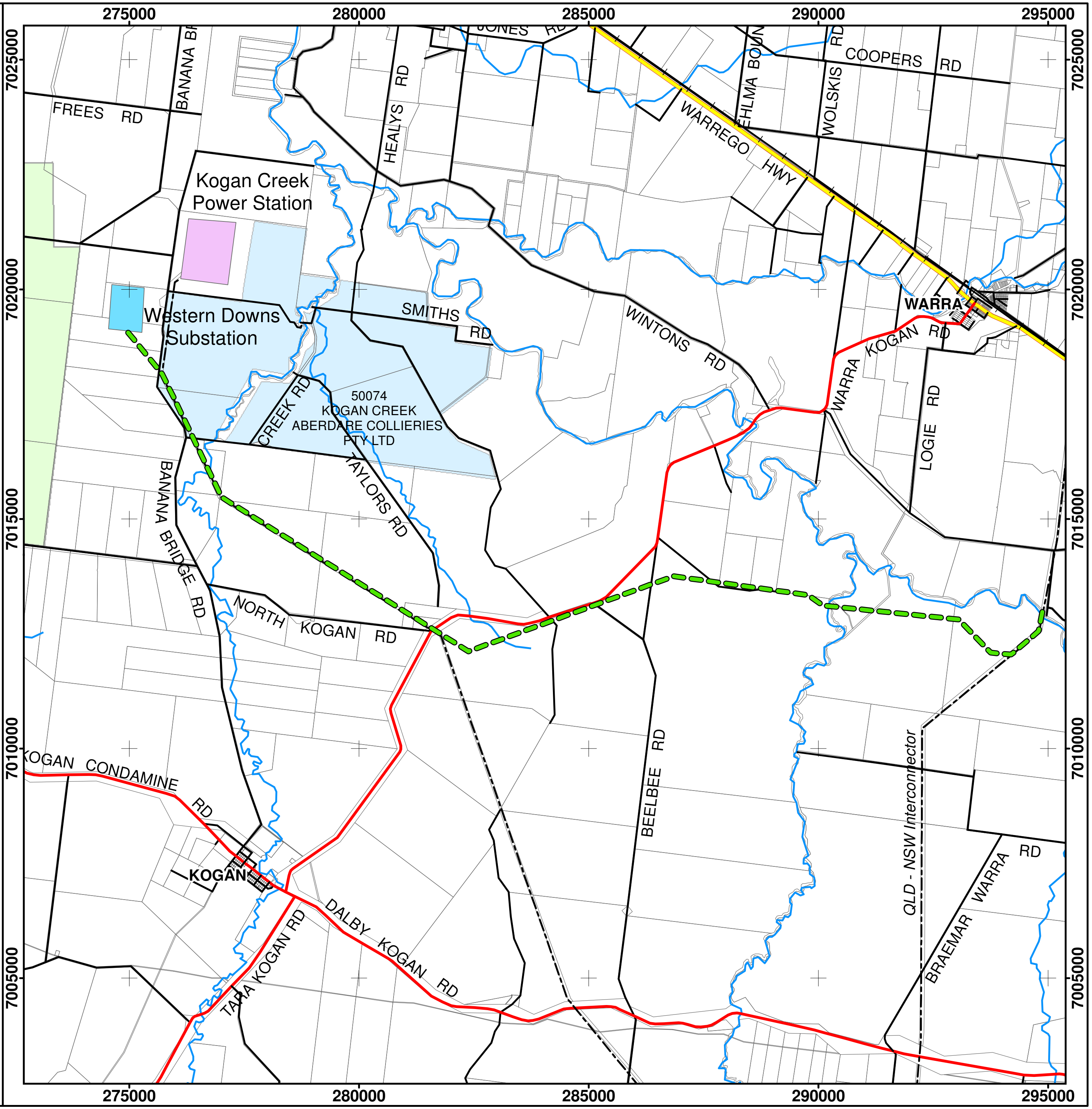
terranean mapping technologies
CONICS

3 March 2010
09-3084-035

Powerlink Western Downs EIA
Mining Tenements
Figure 5.5d

- Study Alignment
- Existing 275 kV Line
- Highway
- Main Road
- Local Road
- Watercourse
- Cadastre
- Power Station
- Sub-station

Mining Leases
- APPLICATION
- GRANTED



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Scale 1 : 120 000
Datum / Projection: GDA94 MGA Zone 56

terranean mapping technologies

RPS

21 June 2010

09-3084-036

Powerlink Western Downs EIA

Mineral Development Licences

Figure 5.5e

Study Alignment

Existing 275 kV Line

Highway

Main Road

Local Road

Watercourse

Cadastre

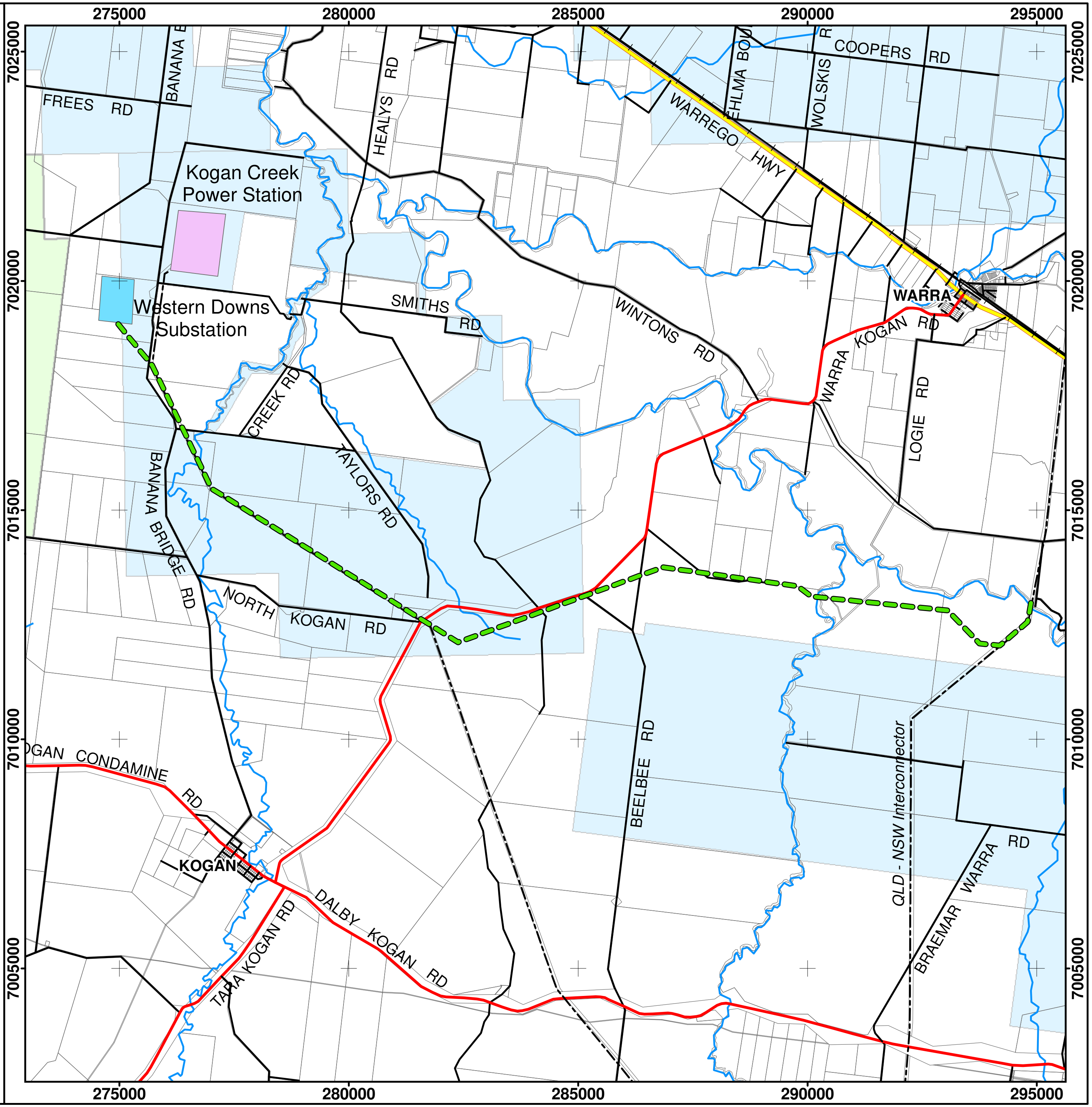
Power Station

Sub-station

Mineral Development Licenses

GRANTED

APPLICATION



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Datum / Projection: GDA94 MGA Zone 56

terranean mapping technologies

RPS

21 June 2010

09-3084-037