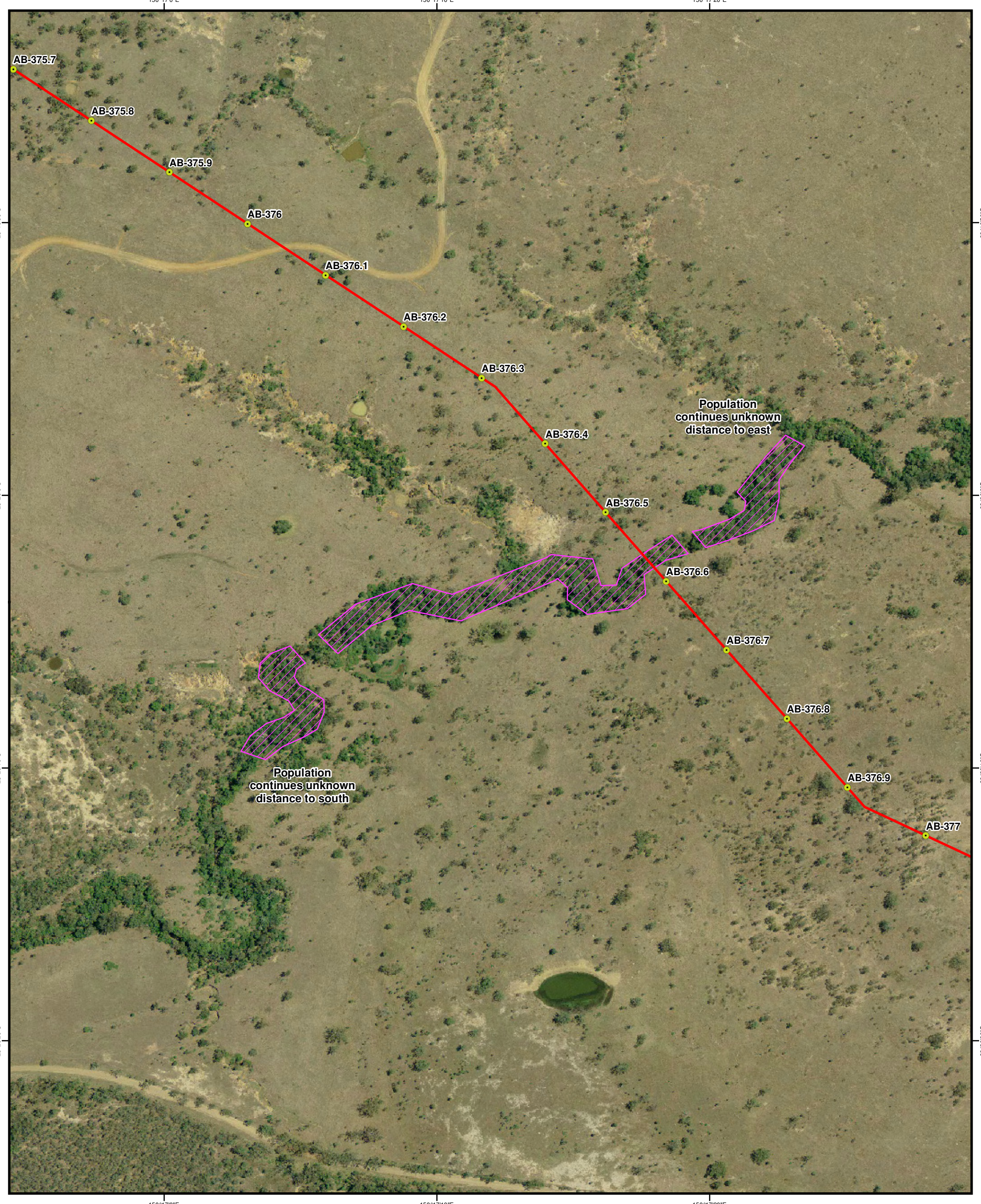

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Document
BE004_MP_002A_euc_raveretiana_Population_Deep_Creek

Job Number: BE004

Approved GIS Team Leader			BN	28/08/2013
R1	BN	CF	ISSUED TO CLIENT	28/08/2013
R0	BN	CL	ISSUED TO CLIENT	05/06/2013
REV	By	CHK	Description	Date

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Scale: 1:4,000 when printed at A3

Coordinate System:
GCS GDA 1994
Datum: GDA 1994
Units: Degree

LEGEND

- Kilometre point
- ABP Route - RevH1
- Surveyed *Eucalyptus raveretiana* population

***Eucalyptus raveretiana* on Deep Creek**

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Arrow Bowen Pipeline
Revision H1

A3

1.3 Natural grasslands of the Queensland Central Highlands and the northern Fitzroy Basin

1.3.1 Conservation status

National: Endangered Ecological Community (EEC) under EPBC Act.

Queensland: Natural grasslands of the Queensland Central Highlands and the northern Fitzroy Basin ecological community occur within the following seven Queensland Regional Ecosystems (REs):

- three REs with an Endangered biodiversity status (11.3.21, 11.9.12, 11.11.17)
- three REs with an Of Concern biodiversity status (11.4.4, 11.4.11, 11.8.11)
- one RE with a No Concern biodiversity status (11.9.3).

1.3.2 Description

Native grasslands are dynamic ecological communities that once occurred over a large area of Australia, although few patches of undisturbed native grasslands now remain. The species composition of native grasslands is highly variable and is influenced by factors such as geology, land use, soil, climate and rainfall (Butler 2007). The Natural grasslands of the Queensland Central Highlands and the northern Fitzroy Basin (hereafter called CQ Native Grasslands) are typically composed of a mixture of forbs and native grasses, a tree canopy that is either absent or sparse and a ground layer that is typically dominated by perennial native grasses (DSEWPaC 2008a; 2008b).

1.3.3 Distribution

The CQ Native Grasslands are endemic to Queensland and occur within the Brigalow Belt North and Brigalow Belt South bioregions, which are largely within the Central Highlands and northern Fitzroy River Basin regions of Queensland (Figure 1). The EEC extends south to the Expedition, Carnarvon, Great Dividing, Drummond and Narrien ranges; and north to the

Clark, Denham, Connors and Broadsound ranges (DSEWPaC 2008a). The CQ Native Grasslands may also coincide with the EPBC-listed Brigalow (*Acacia harpophylla*) dominant and co-dominant ecological community (DSEWPaC 2008a).

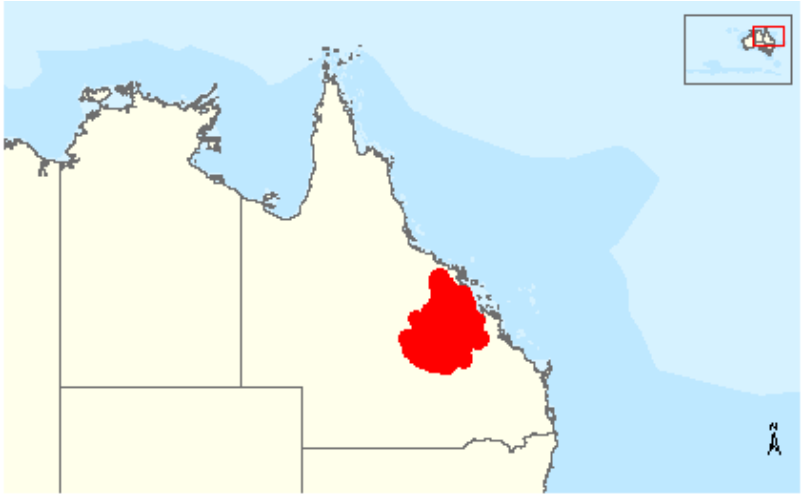


Figure 2 Distribution of Weeping Myall woodlands. Source: (DSEWPaC 2013)

The Interim Biogeographic Regionalisation for Australia (IBRA) identifies eight subregions within the north and south Brigalow Belt bioregions where the CQ Native Grasslands occur (Table 6) (DSEWPaC 2008a).

Table 6 Subregions within the EEC identified by the IBRA.

Brigalow Belt North subregions	Brigalow Belt South subregions
BBN 6 Northern Bowen Basin	BBS 1 Claude River Downs
BBN 9 Anakie Inlier	BBS 9 Buckland Basalts
BBN 10 Basalt Downs	
BBN 11 Isaac-Comet Downs	
BBN 12 Nebo-Connors Range	
BBN 13 South Drummond Basin	

1.3.4 Habitat in Queensland

The CQ Native Grasslands usually occur on flat or gently undulating ground. Soils mainly consist of fine textured vertosols (cracking clays) that are often deep, although soils can be shallower on sloping land and ridges (Fensham 1999). The EEC occurs in a subtropical, subhumid climatic zone, with a marked wet summer and moderately dry winter with a mean annual rainfall from 500 to 700 mm (Fensham 1999). The CQ Native Grasslands ecological community corresponds to seven Queensland REs (Table 7).

Table 7 Description, biodiversity status and VM Act status of the equivalent REs in the CQ Native Grasslands EEC.

RE	RE Description	VMA Status*	BD Status*
11.3.21	*Dichanthium sericeum* and/or *Astrebla* spp. grassland on alluvial plains - cracking clay soils	E	E
11.4.4	*Dichanthium* spp., *Astrebla* spp. grassland on Cainozoic clay plains	LC	OC
11.4.11	*Dichanthium sericeum*, *Astrebla* spp. and patchy *Acacia harpophylla*, *Eucalyptus coolabah* on Cainozoic clay plains	OC	OC
11.8.11	*Dichanthium sericeum* grassland on Cainozoic igneous rocks	OC	OC
11.9.3	*Dichanthium* spp., *Astrebla* spp. grassland on fine-grained sedimentary rocks	LC	NC
11.9.12	*Dichanthium sericeum* grassland with clumps of *Acacia harpophylla* on fine-grained sedimentary rocks	E	E
11.11.17	*Dichanthium sericeum* grassland on old sedimentary rocks with varying degrees of metamorphism and folding.	OC	E

* VM Act and Biodiversity Status recognised by Qld DEHP: E = Endangered; OC = Of Concern; LC = Least Concern; NC = No Concern at Present

1.3.5 Threats

Native grasslands are among the most threatened ecosystems in Australia due to cropping, overgrazing by stock, ploughing, grading, weed invasion, salinity, herbicide and fertiliser spraying and inappropriate management regimes (Kirkpatrick et al. 1995; Benson et al. 2006).

Actual threats to the CQ Native Grasslands are identified as (Butler 2007):

- grazing, cropping and pasture improvement
- weeds and pest animals
- mining activities
- construction of roads and other infrastructure.

Potential threats include:

- climate change
- lack of knowledge.

1.3.6 Recovery actions

No recovery plan has been prepared for the CQ Native Grasslands EEC. DSEWPaC (2008a) identifies the following priority recovery and threat abatement actions for the listed ecological community:

Habitat Loss, Disturbance and Modification

- Monitor known occurrences to identify key threats or the progress of recovery, including the effectiveness of management actions and the need to adapt them if necessary.
- Identify occurrences of high conservation priority.
- Undertake survey work in potential habitat to locate remnants.
- Avoid mowing and slashing during peak flowering season from spring to summer.
- Ensure chemicals or other mechanisms used to eradicate weeds do not have a significant adverse impact on the ecological community.
- Ensure road widening and maintenance activities (or other infrastructure or development activities) in areas where the ecological community occurs minimise adverse impacts on known sites.
- Investigate and implement formal conservation arrangements such as the use of covenants, conservation agreements or inclusion in reserve tenure.

Invasive Weeds

- Develop and implement management plans for the eradication of weeds such as Parthenium (*Parthenium hysterophorus*), Parkinsonia (*Parkinsonia aculeata*), Prickly Acacia (*Acacia nilotica* subsp. *indica*) and Buffel Grass (*Cenchrus ciliaris*).
- Manage sites to prevent introduction of invasive weeds, which could become a threat to the ecological community, using appropriate methods.
- Observe appropriate State protocols to avoid the spread of weeds. Implement good hygiene measures for mowing and grading equipment and take appropriate steps to avoid dispersing seeds when moving stock.
- Maintaining a good cover of native perennial grasses and spelling the grasslands from grazing are reliable methods of managing the risk of weed invasion.

Trampling, Browsing or Grazing

- Grazing management should focus on maintaining a good cover of perennial grasses and legumes (especially the most palatable species) and maintaining vegetation cover through the driest years.
- Develop and implement a stock management plan for roadside verges and travelling stock routes.
- Manage known sites on private property to ensure appropriate cattle and sheep grazing regimes are conducted outside the growing season (i.e. when plants are not fertile).
- Provide and/or promote incentives for good management.
- Where possible, use an intermittent grazing regime in preference to burning. Avoid burning (or grazing or slashing) during peak flowering season (spring to summer).

Animal Predation or Competition

- Develop and implement management plans for the control of the House Mouse (*Mus musculus*).

Conservation Information

- Raise awareness of the ecological community within the local community. The production of region specific fact sheets or information brochures could benefit land managers.

1.3.7 CQ Native Grasslands condition assessment

Native grasslands are dynamic ecosystems where species composition can change, yearly and seasonally. There are very few patches of undisturbed native grasslands remaining and most patches now have some degree of disturbance and degradation. DSEWPaC (2008a) provide a range of diagnostic features and condition thresholds to identify CQ Native Grasslands EECs:

- The ecological community occurs within eight Brigalow Belt North and Brigalow Belt South subregions, which are largely within the Central Highlands and northern Fitzroy River Basin regions of Queensland.
- Tree canopy is absent or sparse (less than 10% projective crown cover). If it can be demonstrated, beyond reasonable doubt, that the grassland was derived from cleared woodland then it is not part of the national ecological community.
- The ground layer is typically dominated by perennial native grasses and contains at least three of the indicator native species listed below:
  - *Aristida latifolia* (Feather-top wiregrass)
  - *Aristida leptopoda* (White speargrass)
  - *Astrebla elymoides* (Hoop Mitchell grass)
  - *Astrebla lappacea* (Curly Mitchell grass)
  - *Astrebla squarrosa* (Bull Mitchell grass)
  - *Bothriochloa erianthoides* (Satin-top grass)
  - *Dichanthium queenslandicum* (King bluegrass)
  - *Dichanthium sericeum* (Queensland bluegrass)
  - *Eriochloa crebra* (Cup grass)
  - *Panicum decompositum* (Native millet)
  - *Panicum queenslandicum* (Yabila grass)
  - *Paspalidium globoideum* (Shot grass)
  - *Thellungia advena* (Coolibah grass).

Patches must meet the “best quality” or “good quality” condition thresholds listed in Table 3.

Table 8 Condition thresholds for the CQ Native Grasslands Ecological Community (source: DSEWPC 2008a).

	Best quality	Good quality
Patch size	At least 1 ha.	At least 5 ha.
Grasses	At least 4 native perennial grass species from the list of perennial native grass indicator species.	At least 3 native perennial grass species from the list of perennial native grass indicator species.
Tussock cover	At least 200 native grass tussocks.	At least 200 native grass tussocks.
Woody shrub cover*	Total projected canopy cover of shrubs is less than 30%.	Total projected canopy cover of shrubs is less than 50%.
Introduced species	Perennial non-woody introduced species are less than 5% of the total projected perennial plant cover.	Perennial non-woody introduced species are less than 30% of the total projected perennial plant cover.

* The shrub layer is typically absent. However, where shrubs are present, they are defined as woody plants, more than 0.5 m tall that occupy the mid vegetation layer. The upper, or tree canopy layer, is also typically absent but may comprise scattered trees to less than 10% projective crown cover.

1.3.8 Survey effort and methods undertaken for ABP

To assess the presence of the EEC, all areas containing mapped REs that form components of the CQ Native Grasslands were surveyed and assessed according to the diagnostic features, condition thresholds and survey methodology outlined by DSEWPaC (2008a). If the ground-truthed RE was found to be consistent with the mapped RE during the survey, it was then determined if:

- the community occurred within the eight subregions identified by IBRA in the north and south Brigalow Belt bioregions
- the grassland was not derived from cleared woodland
- the tree canopy was less than 10% projective crown cover
- the ground layer was dominated by perennial native grasses and contained at least three of the indicator native species
- the community met or exceeded the condition thresholds outlined by DSEWPaC (2008a).

Each community was assessed in accordance to the sampling methodology provided by DSEWPaC (2008a). The sampling was conducted using the following criteria:

- The quadrat size was based on an area of 0.1 ha (e.g. 50 m x 20 m).
- The selected survey area contained the most apparent native perennial grass species.
- Surveys were conducted during a good season and within two months of effective rain in order to maximise the assessment of condition.
- Where possible, surveys were conducted two months after cessation of disturbance (fire/grazing/mowing/slashing). While this was not possible in all cases, all sites had good ground cover, allowing surveys to effectively assess diagnostic features and condition.

1.3.9 ABP survey results

DEHP mapping identified six occurrences of REs that form components of the CQ Native Grasslands EEC within the ROW. Surveys at these sites confirmed two occurrences of RE 11.8.11 on the ABP mainline between KP 35.25 to 36.70 and KP 37.05 to 37.43 (1.83 km of the ROW - Table 4). The remaining areas mapped within the ROW were either non-remnant or contained REs that were not components of the CQ Native Grasslands EEC. Maps showing locations of the field-verified CQ Natural Grassland EEC are provided.

Table 9 Survey results, total length and area of all mapped REs that correspond to the CQ Natural Grassland EECs

KP Start (km)	KP End (km)	Mapped RE	Surveyed RE	EPBC Status	Length (km)	Area (ha) within the ROW
35.25	36.70	11.8.11/11.8.5	11.8.11	E	1.45	5.79
37.05	37.43	11.8.11/11.8.5	11.8.11	E	0.38	1.52
37.43	37.58	11.8.11/11.8.5	Non-remnant	-		
39.39	39.59	11.8.11/11.8.5	11.5.3	-		
74.51	74.82	11.8.11/11.8.5	Non-remnant	-		
165.83	166.11	11.3.21	11.3.2/11.3.7	-		
				EEC total	**1.83**	**7.31**

1.3.9.1 Potential impacts without mitigation

Without mitigation, the project will result in a direct loss of 7.31 ha of CQ Natural Grassland EEC. Potential indirect impacts on adjacent communities could include:

- spread of weeds
- changes in fire regimes.

1.3.9.2 Assessment of potential impacts with mitigation

The revision H1 alignment transects 1.83 km of the CQ Native Grasslands EEC from KP 32.25 to 37.43. It is not feasible to avoid the EEC in this section of the ROW, as the pipeline is highly constrained by existing coal mines (Burton Colliery to the east and Goonyella Colliery to the west) and the EEC extends a large distance either side of the ROW (at least 8 km to the east and 16 km to the west). At the time of writing, it is uncertain whether this northern section of the pipeline will be constructed. If this section is constructed, an offset plan would be developed and submitted to DSEWPaC for approval before any works commence.

Weed risks will be managed in accordance with a Weed Management Plan, which will incorporate weed hygiene measures to avoid introduction of new weeds and spread of existing weeds, weed control works before, during and after construction, and a monitoring program to evaluate the effectiveness of weed management and trigger contingency measures if performance criteria are not met.

The Project will implement a no-burning policy to manage activities that could cause fires

and develop an Emergency Response Plan that will identify resources and emergency responses to any fire incident.

The potential impacts to the CQ Native Grasslands EEC from construction of the ABP and the mitigation measures to reduce the risk of impacts are listed in Table 3.

Table 10 Raw Risk (before mitigation) and Residual Risk (after mitigation) associated with construction of the ABP on CQ Natural Grasslands.

Impact	Impact before mitigation*	Mitigation measures	Impact after mitigation*
Direct impacts			
Removal of community Removal of CQ Natural Grasslands	M	- where CQ Natural Grasslands are found, investigate possible route revisions to reduce clearing of EEC - minimise clearing of RE 11.8.11, which contain EEC - use existing cleared corridors where possible - rehabilitate the ROW following construction - clearly mark out areas to be cleared and retained	M
Indirect impacts			
Changes in water quality Impacts to water leading to changes in habitat downstream	NA	- no mitigation measures for water quality recommended for this EEC as it is not dependent on riparian /wetland habitats	NA
Changes in hydrology Changes in hydrology of waterways caused by damming, changes in morphology or diversions	NA	- no mitigation measures for hydrology recommended for this EEC as it is not dependent on riparian / wetland habitats	NA
Soil degradation Erosion and sediment loss	L	- scarify or rip ROW after construction and before respreading topsoil to reduce soil compaction, improve water infiltration and promote vegetation regrowth - develop and implement an Erosion and Sediment Control Plan	I
Habitat fragmentation Fragmentation of habitat leading to a reduction in remnant size, increased edge effects and isolation of populations	L	- minimise areas of remnant vegetation to be cleared - use existing cleared corridors where possible - rehabilitate the ROW following construction	I
Increase in weed abundance -increased competition with native plant species -smothering of native vegetation -increased fuel loads and risk of wildfires	L	- develop and implement a Weed Management Plan - implement site weed hygiene protocols - control weeds in the ROW before, during and after construction - monitor to evaluate the effectiveness of weed management	I
Fire -damage to CQ Natural Grasslands	L	- Implement a no-burning policy for the Project - develop and implement an Emergency Response Plan, which will manage activities that could cause fires and identify resources and emergency responses for any fire incident	I

I- Insignificant, L- Low, M – Moderate, H – High, E- Extremely High, NA- Not applicable

1.3.10 Evaluation under MNES significant impact guidelines

The following assessments are based on existing information.

***Significant impact criteria*:**

Will the action reduce the extent of an ecological community?

Construction of the revision H1 ABP will require clearing of up to 7.31 ha of CQ Natural Grassland EEC. The area of clearing may be reduced by ongoing route revisions and minimising the width of the ROW where feasible. Clearing may be avoided altogether if the northern 50 km of the ABP is not constructed.

Will the action fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines?

The action would result in the temporary creation of a 40 m corridor through 1.83 km of EEC. A corridor of this width is unlikely to affect the ability of wind-pollinated grass species to disperse and maintain viable populations. Edge effects such as weed invasion and fire will be managed by implementation of a Weed Management Plan and Emergency Response Plan. The majority of the ROW (except for a 7 m wide track) will be rehabilitated after construction using native grasses and shrubs, further reducing fragmentation effects.

Will the action adversely affect habitat critical to the survival of an ecological community?

The action will require clearing of up to 7.31 ha of CQ Natural Grassland EEC. However, the majority of the ROW (except for a 7 m wide track which will be rehabilitated using native grass) will be rehabilitated after construction using native grasses and shrubs, reducing the area of impact. Any remaining impacts would be offset according to an offset plan approved by DSEWPaC.

Will the action modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns?

Construction of the gas pipeline is unlikely to impact on abiotic factors necessary for the survival of this EEC, as it grows on flat to gently undulating vertosols. Post-construction rehabilitation of the ROW will re-establish original land profiles and drainage patterns according to a Sediment and Erosion Management Plan.

Will the action cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species, for example through regular burning or flora or fauna harvesting?

The temporary creation of a 40 m corridor through the EEC is unlikely to affect the ability of wind-pollinated grass species to disperse and maintain viable populations. Weed impacts will be minimised by the development and implementation of a Weed Management Plan. An Emergency Response Plan will detail appropriate fire management strategies during

construction and operation of the pipeline.

Will the action cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to:

- assisting invasive species, that are harmful to the listed ecological community, to become established, or
- causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community?

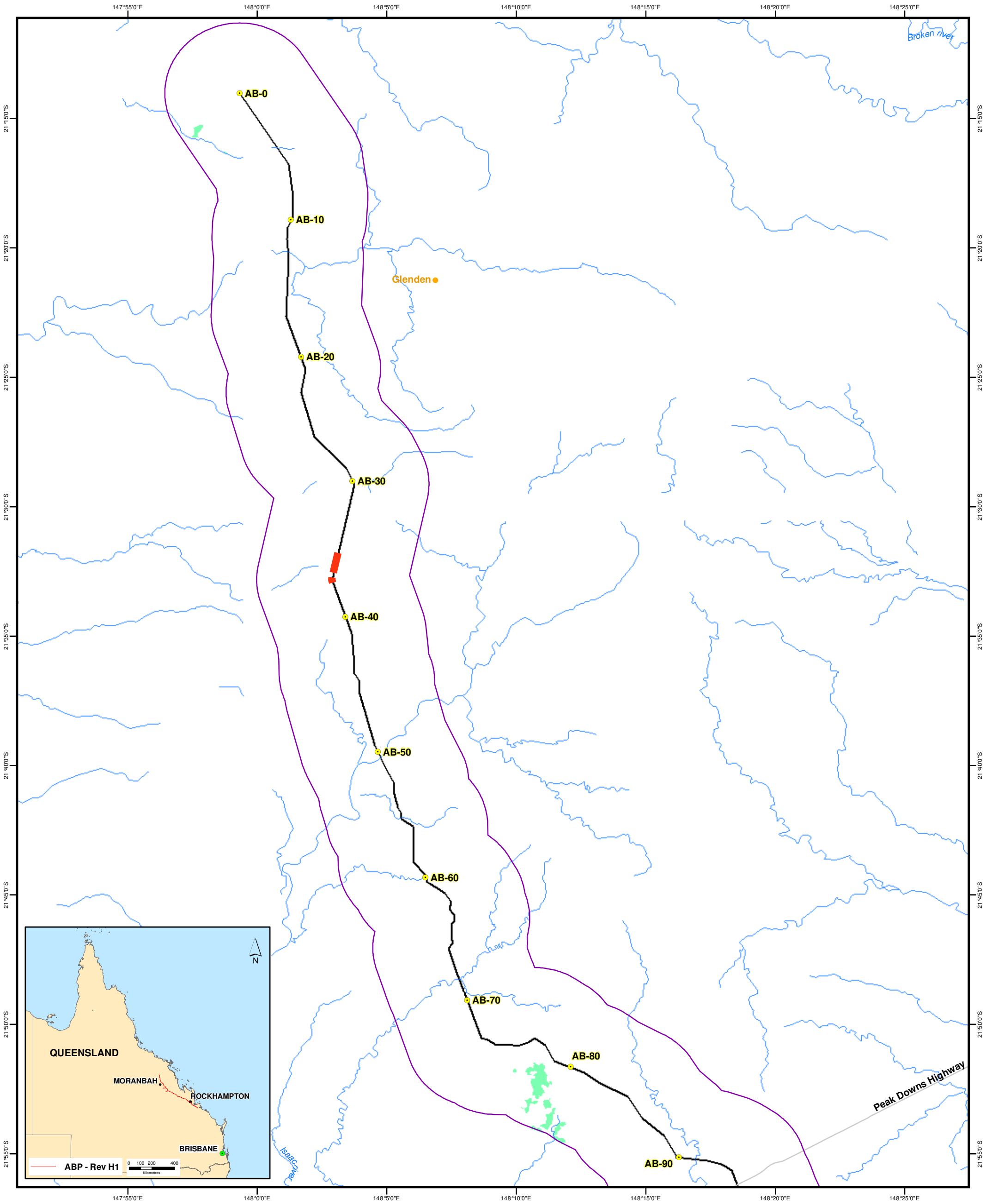
Provided that the proposed mitigation measures are effectively implemented, impacts are expected to be limited to the direct loss of a small area of EEC. A Weed Management Plan will be prepared and implemented before, during and after construction to manage the risk of weeds. Construction of the pipeline is not expected to change the distribution of weeds or pest species. Post-construction rehabilitation of the ROW will re-establish original land profiles and drainage patterns according to a Sediment and Erosion Management Plan and revegetate the majority of the ROW with native grass and shrub species.

Will the action interfere with the recovery of an ecological community?

The action will require clearing of up to 7.31 ha of CQ Natural Grassland EEC. However, the majority of the ROW (except for a 7 m wide track) will be rehabilitated after construction using native grasses and shrubs and trees, reducing the area of impact. Indirect impacts will be mitigated by development and implementation of a Weed Management Plan, Sediment and Erosion Management Plan and Emergency Response Plan. Any remaining impacts will be offset according to an offset plan approved by DSEWPaC.

1.3.11 Conclusion

The revision H1 alignment transects 1.83 km of the CQ Native Grasslands EEC from KP 32.25 to 37.43. It is not feasible to avoid the EEC in this section of the ROW, as the community extends large distances to the east and west of the alignment and large coal mines constrain the location of the pipeline. Direct impacts will be reduced by rehabilitation of the majority of the ROW (except for a 7 m wide track) after construction using native grasses and shrubs. Any remaining impacts will be offset according to an offset plan approved by DSEWPaC. It is possible that the northern 50 km of pipeline will not be constructed, which will avoid any impacts on this EEC.



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Document
BE004_MP_006I_NaturalGrasslands_RevH1

Job Number: BE004

Approved GIS Team Leader			BN	30/08/2013
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- Kilometre Point
- Waterway or Coast Line
- Main roads
- ABP - Rev H1
- Potential Habitat in ROW (Field Verified)
- Potential Habitat in Buffer (from State RE Mapping)
- Buffer (5 km)

Natural grasslands of the Queensland Central Highlands and the northern Fitzroy Basin

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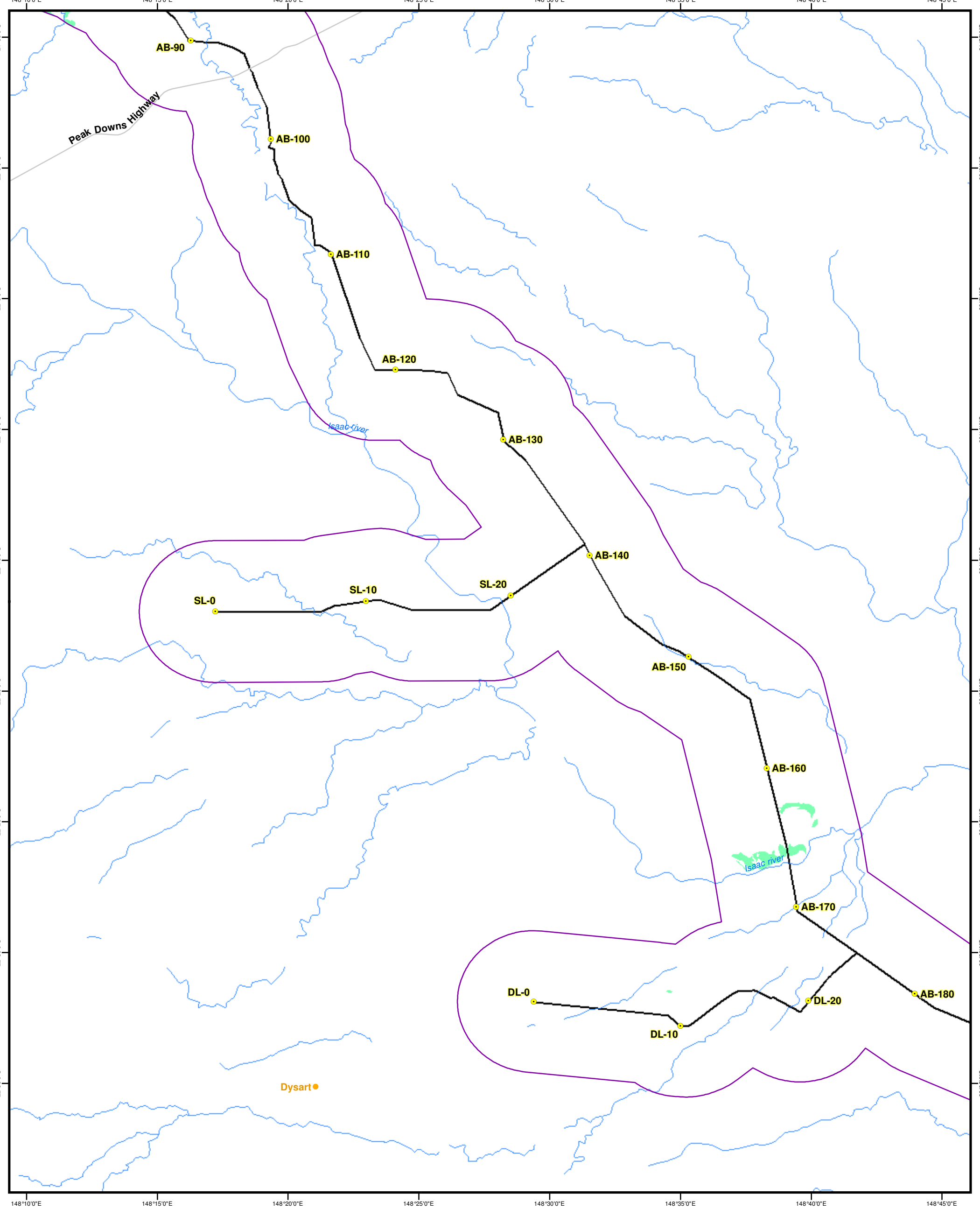

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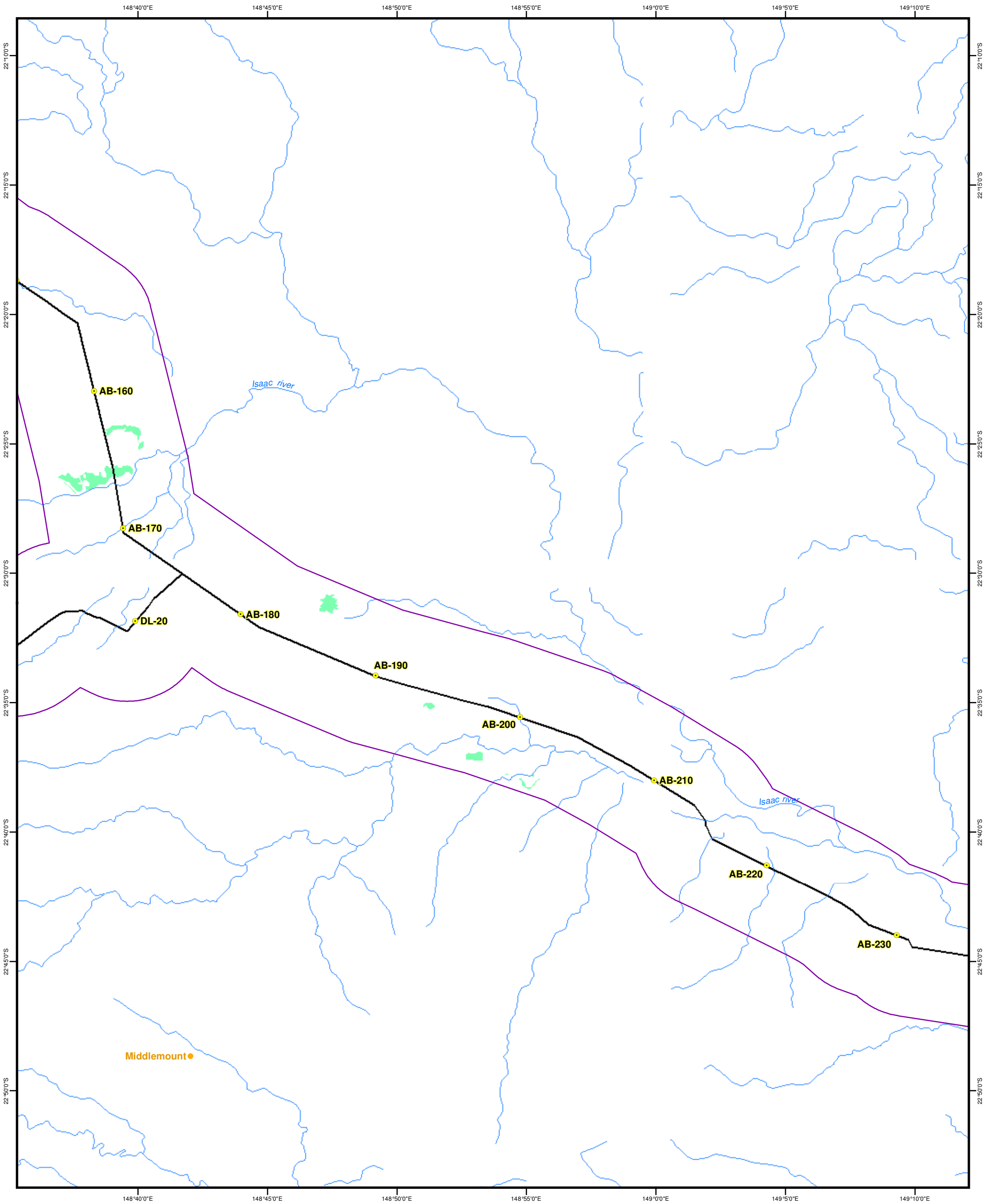

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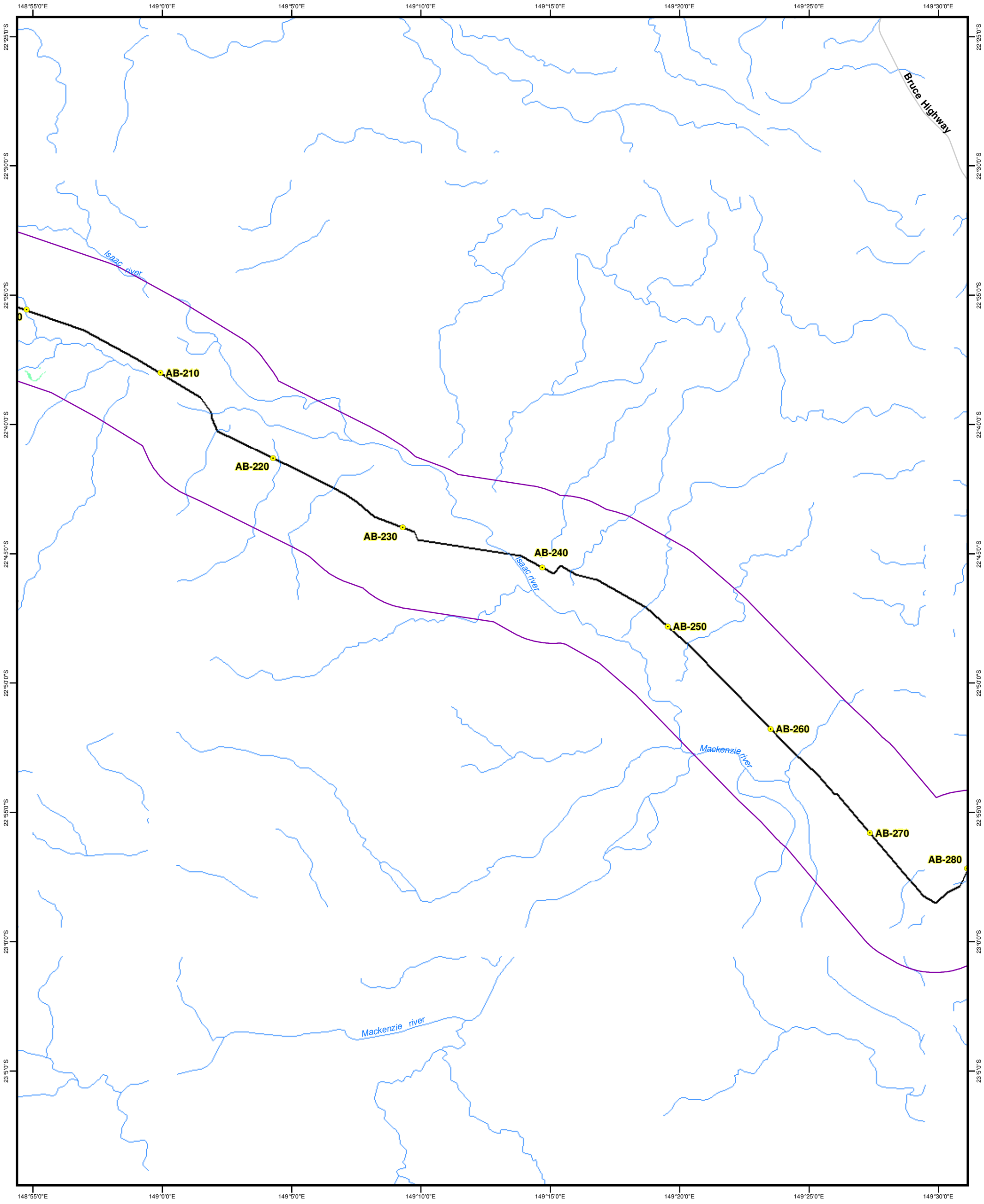

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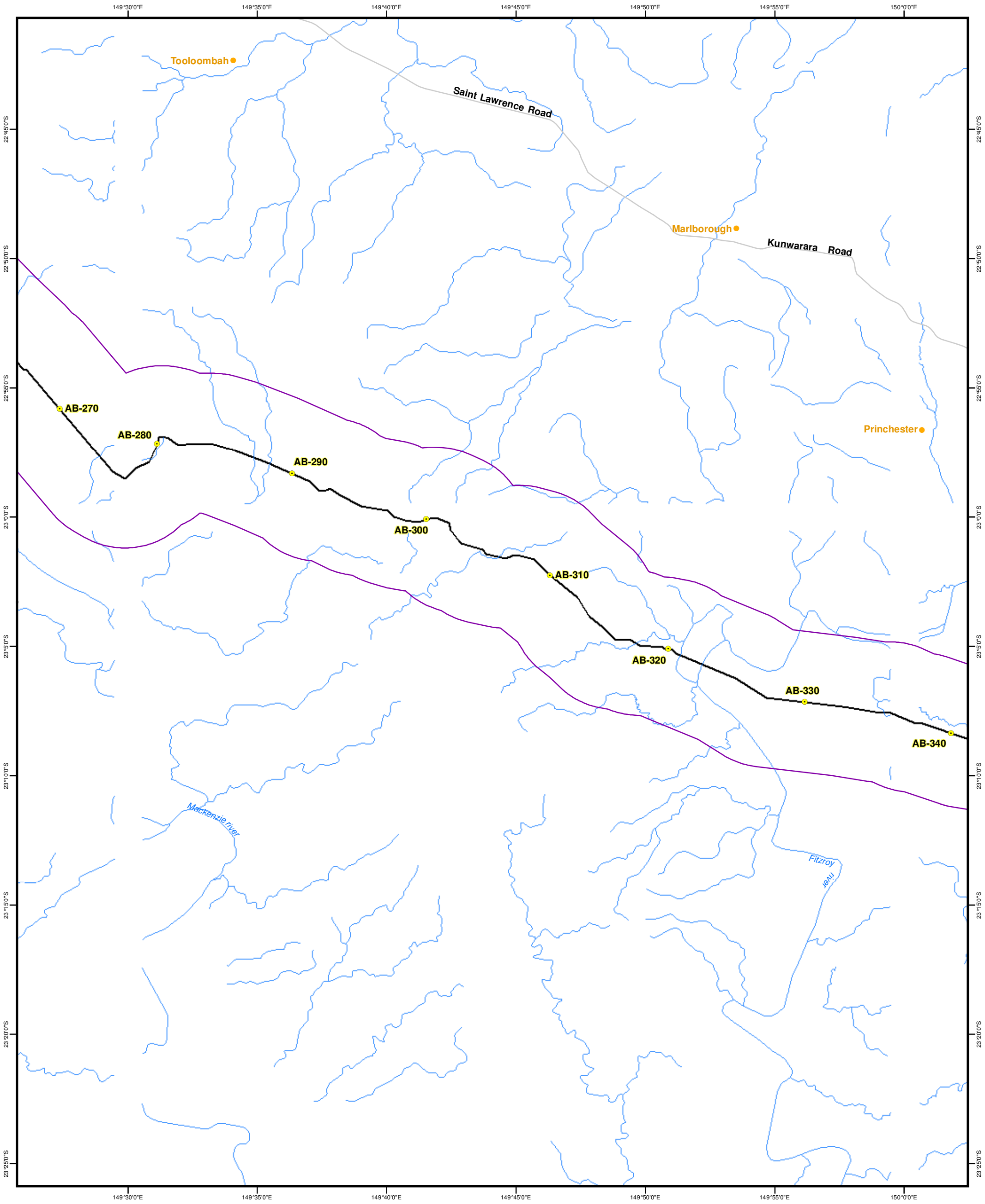

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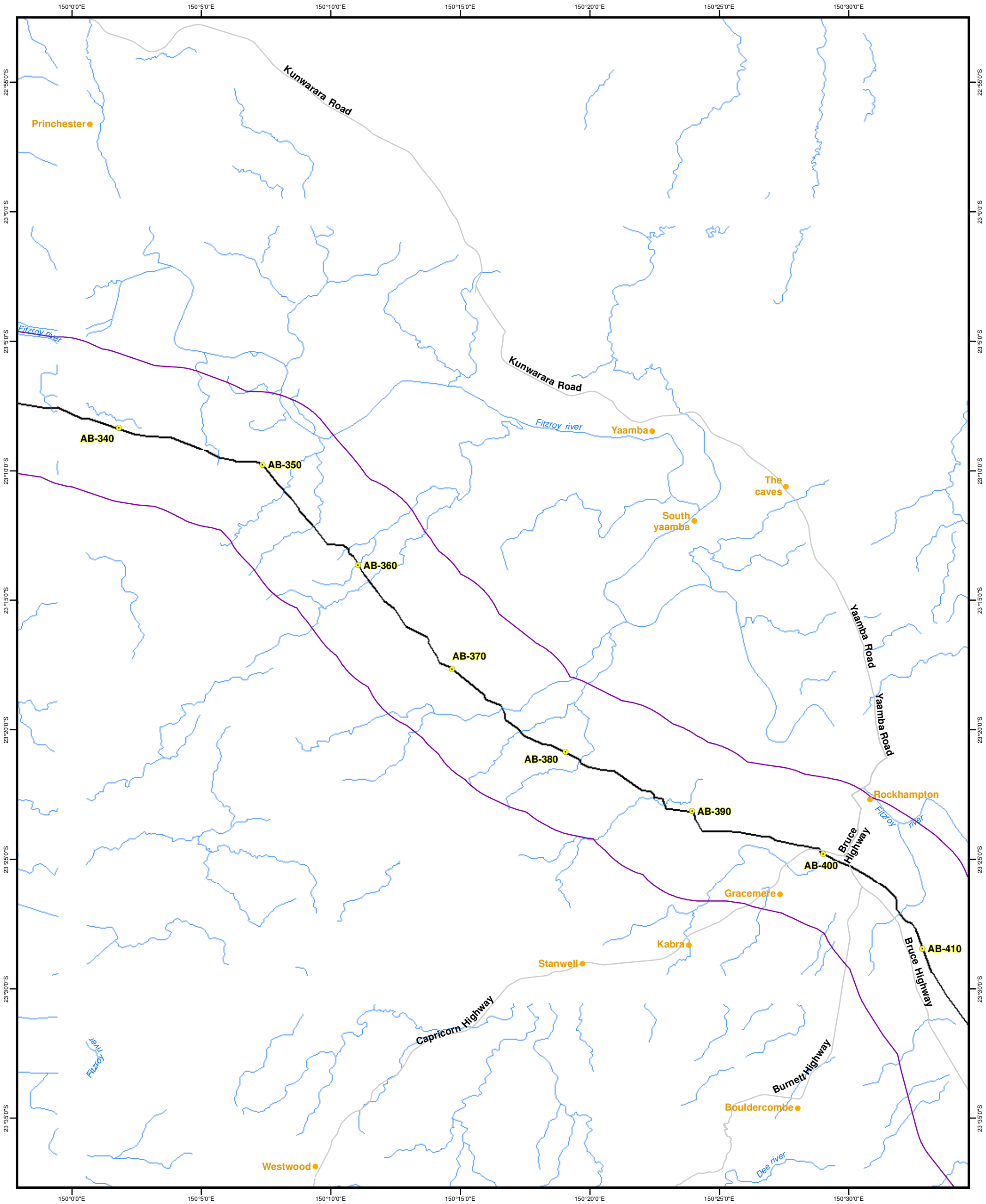

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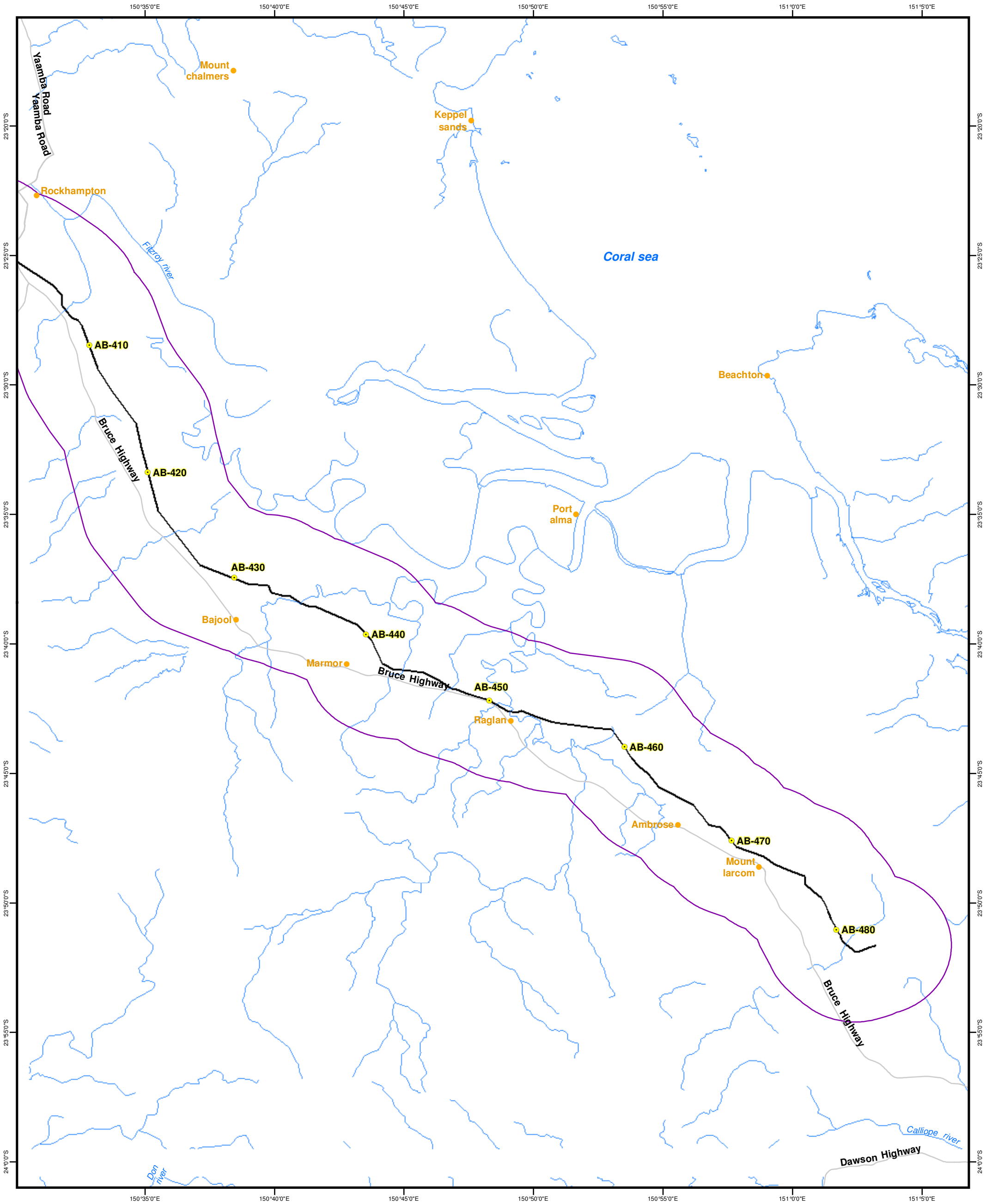

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BE004_MP_006I_NaturalGrasslands_RevH1

Job Number: BE004

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REV	By	CHK	Description	Date

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Kilometres

Scale: 1:250,000 when printed at A3

Coordinate System:
GCS GDA 1994
Datum: GDA 1994
Units: Degree

LEGEND

- City or town
- Kilometre Point
- Waterway or Coast Line
- Main roads
- ABP - Rev H1
- Buffer (5 km)

Natural grasslands of the Queensland Central Highlands and the northern Fitzroy Basin

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1.4 Weeping Myall Woodlands

Source: 3D Environmental 2013

1.4.1 Conservation status

Queensland: Weeping Myall Woodlands Ecological Community occurs in Regional Ecosystem (RE) 11.3.2, which has an Of Concern biodiversity status

National: Endangered Ecological Community (EEC) under EPBC Act

1.4.2 Description

Weeping Myall Woodlands naturally occur as grassy or shrubby open woodlands (<10% foliage cover) to woodlands (10-30% foliage cover), and may include more than 80 species of plants. Weeping Myall Woodlands are generally 4 to 12 m high with Weeping Myall (*Acacia pendula*) the sole or dominant overstorey tree species. Other woodland species that may also form part of the overstorey include:

- Western Rosewood (*Alectryon oleifolius* subsp. *elongatus*)
- Poplar Box (*Eucalyptus populnea*)
- Black Box (*Eucalyptus largiflorens*)
- Grey Mistletoe (*Amyema quandang*) commonly occurs on the branches of weeping myall trees throughout the ecological community's range (DSEWPaC 2008).

Weeping Myall goes through regular cycles of senescence and regeneration, is susceptible to defoliation by Bag-shelter Moth (*Ochrogaster lunifer*) caterpillars and is often lopped for domestic stock fodder. Therefore, the ecological community can contain Weeping Myall trees that are living, defoliated or dead.

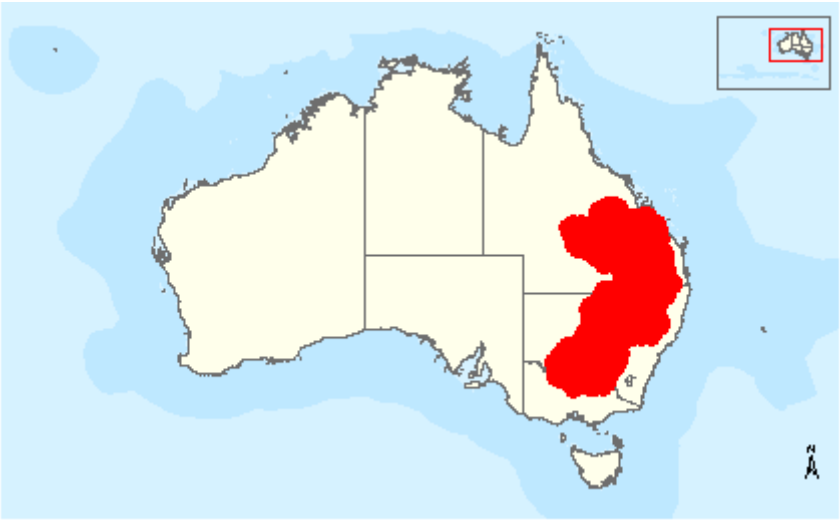
The understorey of Weeping Myall Woodlands often includes an open layer of shrubs above an open ground layer of grasses and herbs. In many areas, however, the shrub layer has disappeared through overgrazing and dieback events, resulting in a primarily grassy understorey (Beadle 1948). In the northern parts of the ecological community, summer-growing grasses such as Mitchell Grass (*Astrebla* spp.) and Queensland Blue Grass (*Dichanthium sericeum*) may be more abundant than in the south. The ground layer includes a diversity of grasses and forbs (Benson 2006, White et al. 2002).

1.4.3 Distribution

The Weeping Myall Woodlands Ecological Community occurs on the inland alluvial plains west of the Great Dividing Range in NSW and Queensland. It occurs in the Riverina, NSW South Western Slopes, Darling Riverine Plains, Brigalow Belt South, Brigalow Belt North, Murray-Darling Depression, Nandewar and Cobar Peneplain Bioregions (DSEWPaC 2008).

In Queensland, Weeping Myall woodlands are found in the following Natural Resource Management / Catchment Management Authority Regions (DSEWPaC 2009):

- Queensland Murray Darling (Border Rivers & Maranoa-Balonne)
- Condamine
- Fitzroy Basin
- South West Queensland
- Burnett-Mary.



Distribution of Weeping Myall woodlands. Source: (DSEWPaC 2008)

1.4.4 Habitat in Queensland

Although *Acacia pendula* occurs widely in Queensland, Weeping Myall Woodlands are restricted to small patches that occur within two Queensland REs, including (DSEWPaC 2009):

- 11.3.2 - *Eucalyptus populnea* woodland on alluvial plains
- 11.3.28 - *Casuarina cristata* ± *Eucalyptus coolabah* open woodland on alluvial plains.

The Queensland Herbarium assigns an Of Concern biodiversity status to both of these REs. It is not possible to estimate the exact proportion of each RE that comprises Weeping Myall Woodlands but it is likely to be small, at most 5% of the RE extent. Most patches of Weeping Myall Woodlands are less than 1 to 2 ha in area (DSEWPaC 2013a).

Small patches of Weeping Myall trees may also occur in REs 11.9.3a and 4.9.6. However, these occurrences are on different landscape and soil types (undulating country on fine grained sedimentary rocks) to the landzone 3 regional ecosystems which occur on alluvial plains. Subsequently, they are not considered to be part of the listed ecological community (DSEWPaC 2008).

Weeping Myall Woodlands generally occur on flat areas, shallow depressions or gilgais on raised alluvial plains. They occur on black, brown, red-brown, grey clay or clay loam soils. The areas associated with this ecological community rarely flood and are not associated with active drainage channels (DSEWPaC 2009).

1.4.5 Threats

The main threats to the ecological community are clearing and ongoing degradation (DSEWPaC 2008, 2009). Weeping Myall occurs on highly fertile and arable soils where there is significant pressure to clear for cropping. Other threats include:

- overgrazing
- lopping for drought fodder
- weed invasion
- fertiliser and herbicide application
- loss of fauna from the ecological community
- increased levels of herbivory by caterpillars of the bag-shelter moth.

1.4.6 Recovery actions

No recovery plan has been prepared for the Weeping Myall Woodlands Endangered Ecological Community (EEC). DSEWPaC (2008) identifies the following priority recovery and threat abatement actions for the listed ecological community:

- protecting remnants of the listed ecological community through the development of conservation agreements and covenants
- the use of strategic grazing that allows regeneration
- replanting of understorey species where they have been depleted
- use of lopping methods that do not result in the death of the dominant tree species
- avoiding the application of fertilisers and herbicides in or near remnants
- protecting remnants from weeds including the speedy eradication of any new invasions
- raising awareness of Weeping Myall Woodlands within the community.

1.4.7 ABP survey results

A total of 18 occurrences of RE 11.3.2 were found on the ABP mainline, Saraji and Dysart laterals:

- 17 occur as pure 11.3.2
- two occur as a mixed community of 11.3.2 (75%) and 11.3.7 (25%)
- one occurs as a mixed community of 11.3.2 (50%) and 11.3.25 (50%).

Surveys were conducted in 12 sites containing RE 11.3.2 within the ROW and 18 sites adjacent to the ROW (up to 500 m from the centre line). No evidence of communities dominated by Weeping Myall was found in any of these surveys.

Based on existing survey results, it is unlikely that any Weeping Myall Woodlands occur within the ROW. However, all remaining areas of RE 11.3.2 within and adjacent to the ROW will be surveyed to confirm this finding before construction commences.

1.4.8 Impacts of ABP on Weeping Myall Woodland EEC

1.4.8.1 Potential impacts without mitigation

The project will have no direct or indirect impacts on this EEC, based on existing survey results.

Indirect impacts on adjacent communities could include an increase in weed densities.

1.4.8.2 Assessment of potential impacts with mitigation

If found within the ROW, stands of Weeping Myall are likely to be small and therefore can be avoided by minor route changes.

If surveys identify that removal of trees is unavoidable, offset provisions would apply under Commonwealth offset policies for Weeping Myall Woodlands, and under state offset policies for the Of Concern RE 11.3.2.

Weed risks will be managed in accordance with a weed management plan, which will incorporate weed hygiene measures to avoid introduction of new weeds and spread of existing weeds, weed control works before, during and after construction. A monitoring program will be implemented to evaluate the effectiveness of weed management and trigger contingency measures if performance criteria are not met.

The Project will implement a no-burning policy to manage activities that could cause fires and identify resources and emergency responses to any fire incident.

The potential impacts to Weeping Myall Woodlands from construction of the ABP (based on existing knowledge of occurrence within the ROW) and proposed mitigation measures to reduce the risk of impacts are listed in Table 3.

Table 11 Raw Risk (before mitigation) and Residual Risk (after mitigation) associated with construction of the ABP on Weeping Myall Woodlands

Impact	Raw Riskt before mitigation*	Mitigation measures	Residual Risk after mitigation*
Direct impacts			
Removal of community Removal of Weeping Myall Woodlands	L	- survey all areas of RE 11.3.2 not yet ground-truthed within ROW to assess presence of EEC - if any Weeping Myall Woodlands found, investigate minor route revisions to avoid EEC - minimise clearing of RE 11.3.2, which can contain EEC - use existing cleared corridors where possible - rehabilitate the ROW following construction - clearly mark out areas to be cleared and retained	I
Indirect impacts			
Changes in water quality Impacts to water leading to changes in habitat downstream	NA	- no mitigation measures for water quality recommended for this species as it is not dependent on riparian /wetland habitats	NA
Changes in hydrology Changes in hydrology of waterways caused by damming, changes in morphology or diversions	NA	- no mitigation measures for hydrology recommended for this species as it is not dependent on riparian / wetland habitats	NA
Soil degradation Erosion and sediment loss	L	- scarify or rip ROW after construction and before respreading topsoil to reduce soil compaction, improve water infiltration and promote vegetation regrowth - develop and implement an erosion and sediment control plan	I
Habitat fragmentation Fragmentation of habitat leading to a reduction in remnant size, increased edge effects and isolation of populations	L	- EEC typically occurs in small (<2 ha) isolated patches, so appears tolerant to fragmentation effects - minimise areas of remnant vegetation to be cleared - use existing cleared corridors where possible - rehabilitate the ROW following construction	I
Increase in weed abundance -increased competition with native plant species -smothering of native vegetation -increased fuel loads and risk of wildfires	L	- develop and implement a Weed Management Plan - implement site weed hygiene protocols - control weeds in the ROW before, during and after construction - monitor to evaluate the effectiveness of weed management	I
Fire -damage to plants	L	- Implement a no-burning policy for the Project develop and implement an emergency response plan, which will manage activities that could cause fires and identify resources and emergency responses for any fire incident	I

I- Insignificant, L- Low, M – Moderate, H – High, E- Extremely High, NA- Not applicable

1.4.9 Evaluation under MNES significant impact guidelines

Weeping Myall Woodlands generally occur as small areas (less than 1-2 ha) within RE 11.3.2. No Weeping Myall Woodland was detected during surveys of the majority of RE 11.3.2 within the ROW, but small areas could occur within unsurveyed areas of RE 11.3.2. Further surveys will be conducted to confirm that this EEC is not present in or adjacent to the ROW. If any patches are found, they are likely to be small enough to be easily avoided by minor route realignments.

The following assessments are based on existing information.

***Significant impact criteria*:**

Will the action reduce the extent of an ecological community?

Based on existing information the action will not result in reduction of the Weeping Myall Woodland ecological community. If any patches are found, they are likely to be less than 2 ha and therefore small enough to be easily avoided by minor route realignments.

Will the action fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines?

The Weeping Myall Woodland EEC typically occurs in small (<2 ha) isolated patches, so is likely to be tolerant to fragmentation effects. Based on existing information the action will not fragment or increase fragmentation of the ecological community.

Will the action adversely affect habitat critical to the survival of an ecological community?

Based on existing information the action will not adversely affect habitat critical for the survival of the ecological community. If patches are found within the ROW they could be avoided by minor route realignment.

Will the action modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns?

Based on existing information the action will not modify or destroy abiotic or factors necessary for the survival of the ecological community. Post-construction rehabilitation of the ROW will re-establish original land profiles and drainage patterns according to a sediment and erosion management plan.

Will the action cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species, for example through regular burning or flora or fauna harvesting?

Based on existing information the action will not cause a substantial change in species composition of the ecological community, or a decline or loss of functionally important species. An emergency response plan will detail appropriate fire management strategies during construction and operation of the pipeline.

Will the action cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to:

- assisting invasive species, that are harmful to the listed ecological community, to become established, or

- causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community?

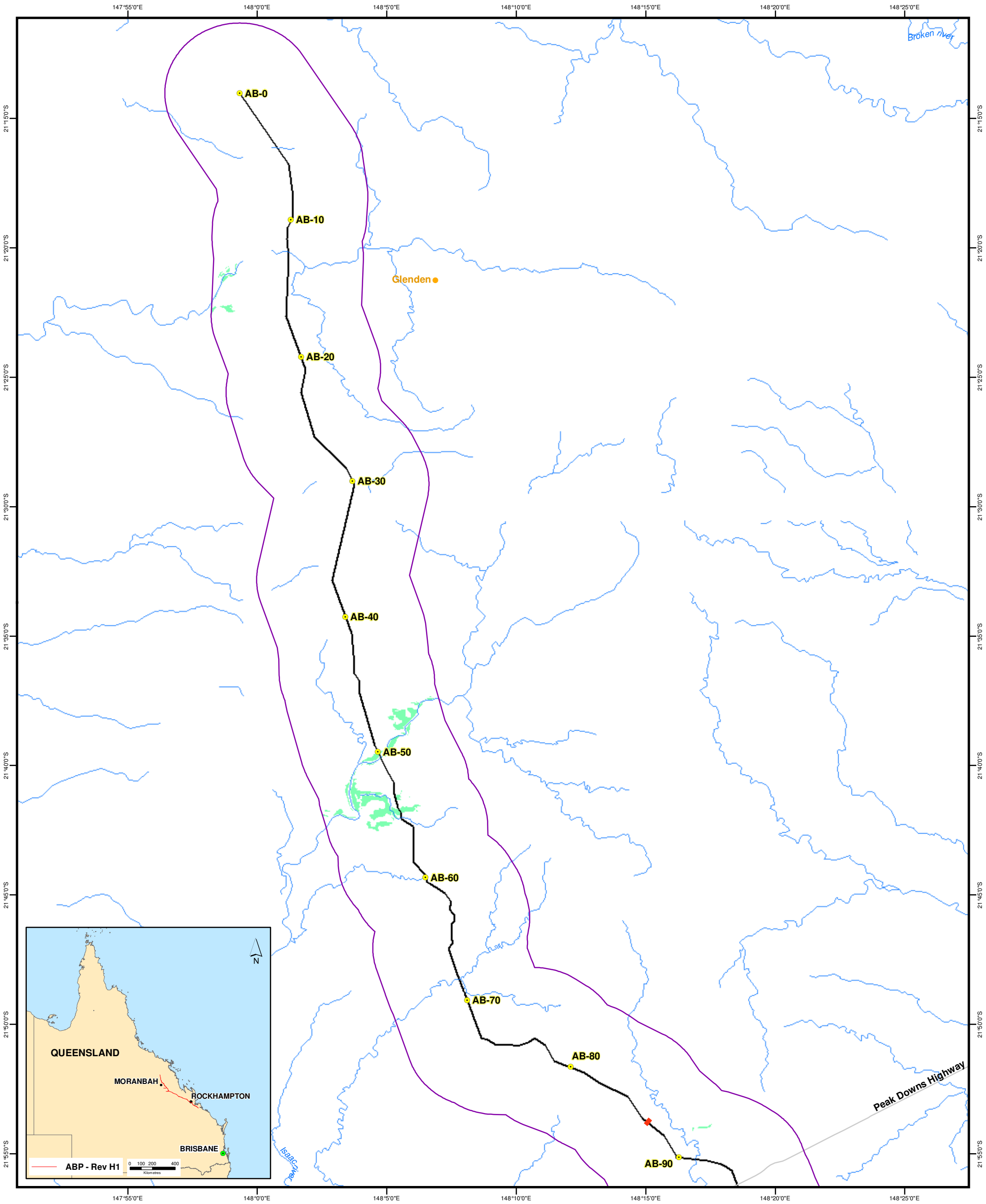
Based on existing information the action will not result in substantial reduction in the quality or integrity of the ecological community. A weed management plan will address potential invasive plant threats and reduce likelihood of adverse ecological outcomes (e.g. reduced regeneration potential, changed fire behaviour).

Will the action interfere with the recovery of an ecological community?

Based on existing information the action will not interfere with the recovery of the ecological community. If any patches are found, they are likely to be less than 2 ha and therefore small enough to be easily avoided by minor route realignments. The action is also unlikely to have any indirect impacts on Weeping Myall Woodlands.

1.4.10 Conclusion

No Weeping Myall was detected in or adjacent to the ROW during field surveys. Further targeted surveys may detect small patches of the community that meet the criteria for inclusion in the EEC. If Weeping Myall is found it is likely that it can be avoided by minor route changes. Provided that mitigation measures outlined in management plans are effectively implemented, indirect impacts are expected to be of a short duration and are not expected to affect Weeping Myall communities.



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Job Number: BE004

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REV	By	CHK	Description	Date

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Kilometres

Scale: 1:250,000 when printed at A3

Coordinate System:
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Datum: GDA 1994
Units: Degree

LEGEND

- City or town
- Kilometre Point
- Waterway or Coast Line
- Main roads
- ABP - Rev H1
- Potential Habitat in ROW (Field Verified)
- Potential Habitat in Buffer (from State RE Mapping)
- Buffer (5 km)

Weeping Myall

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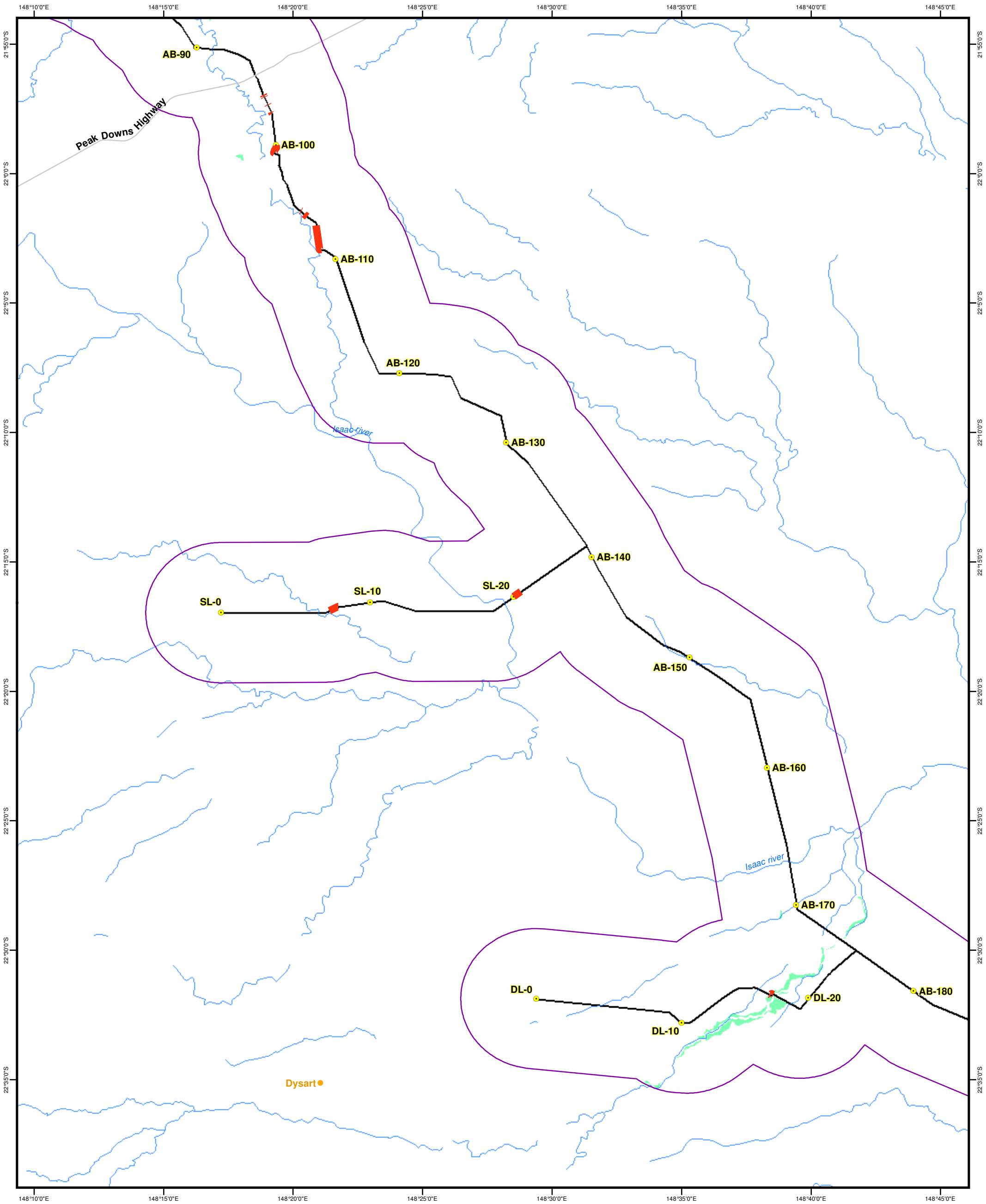
Page 1 of 7

A3



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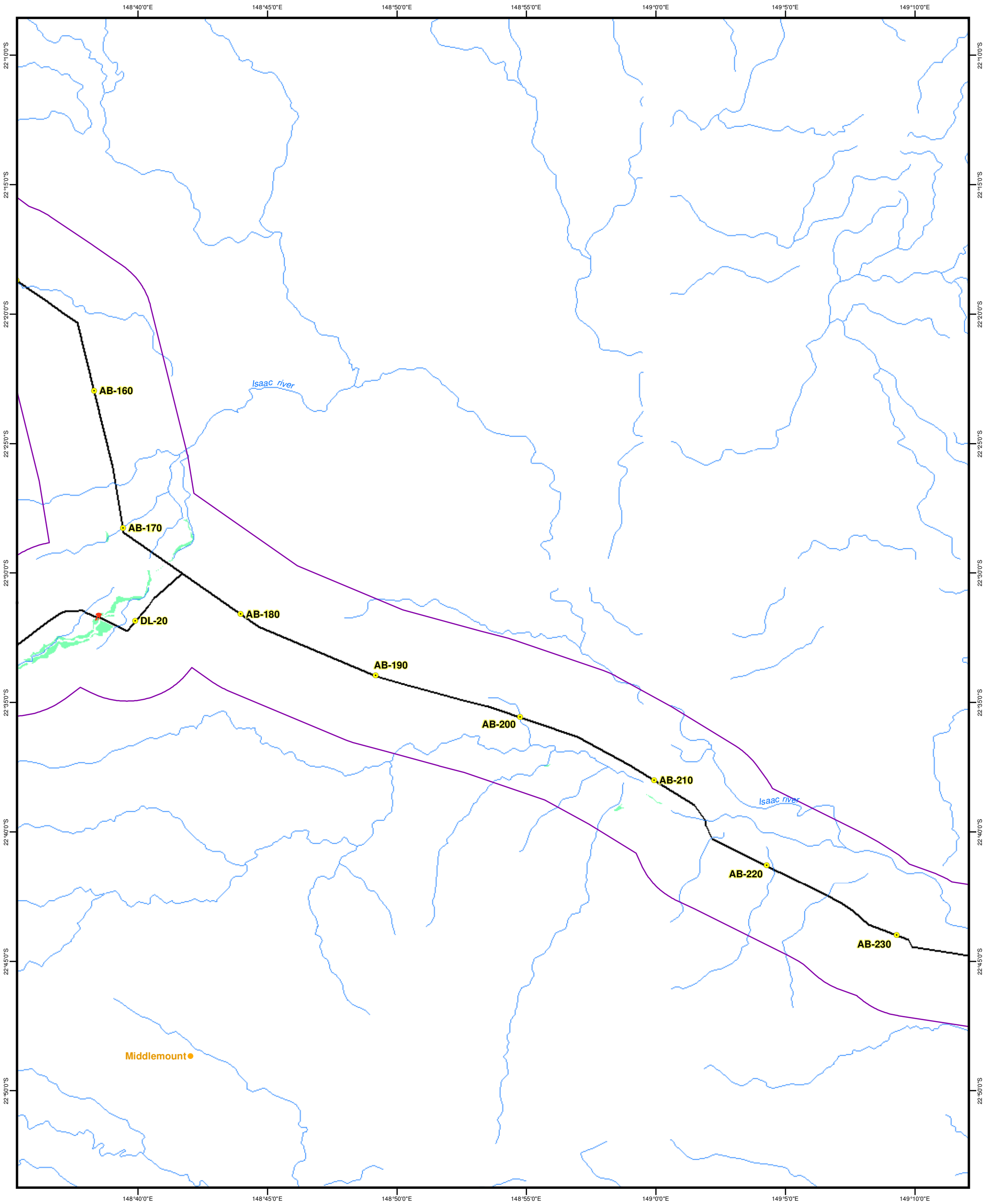

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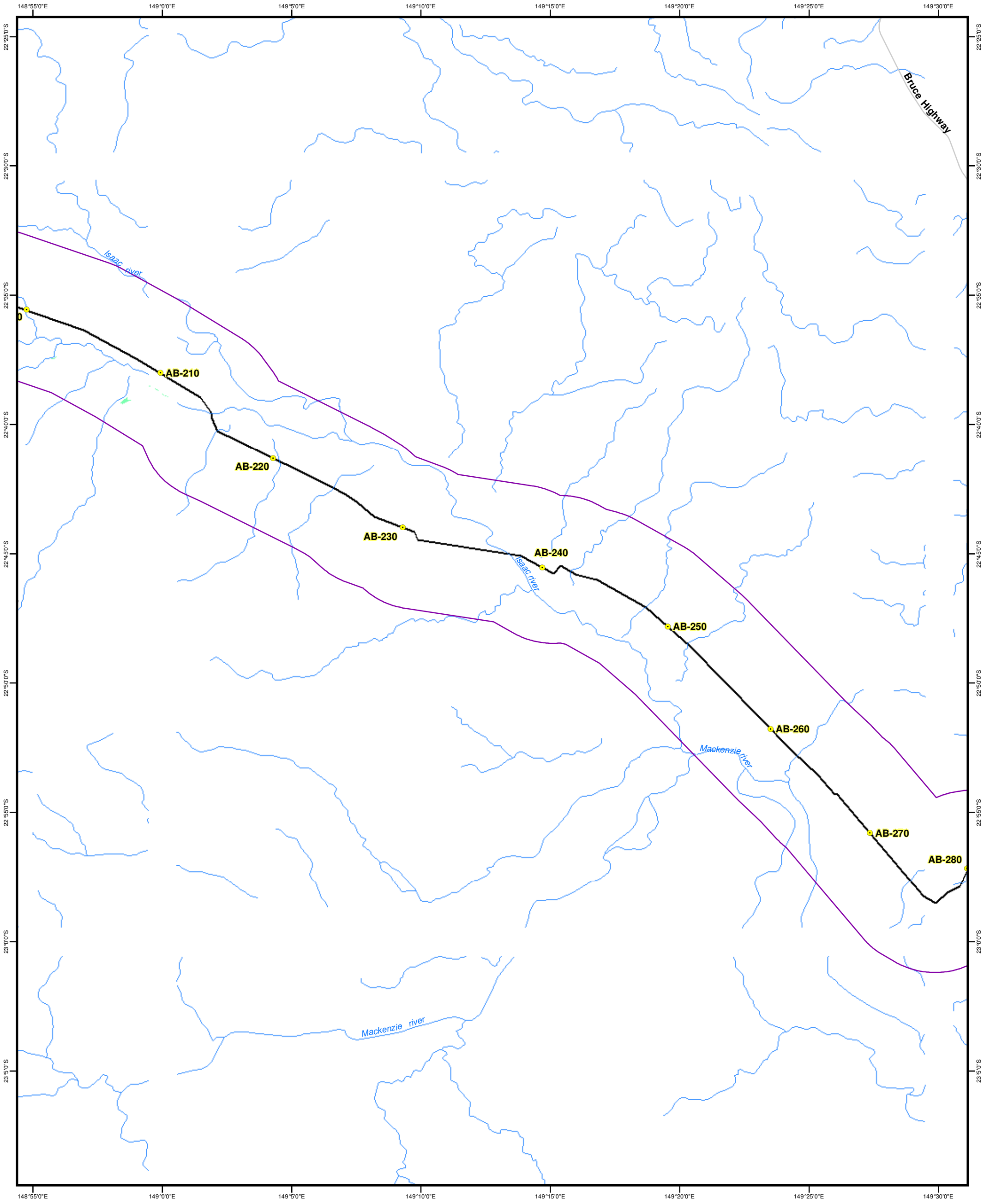

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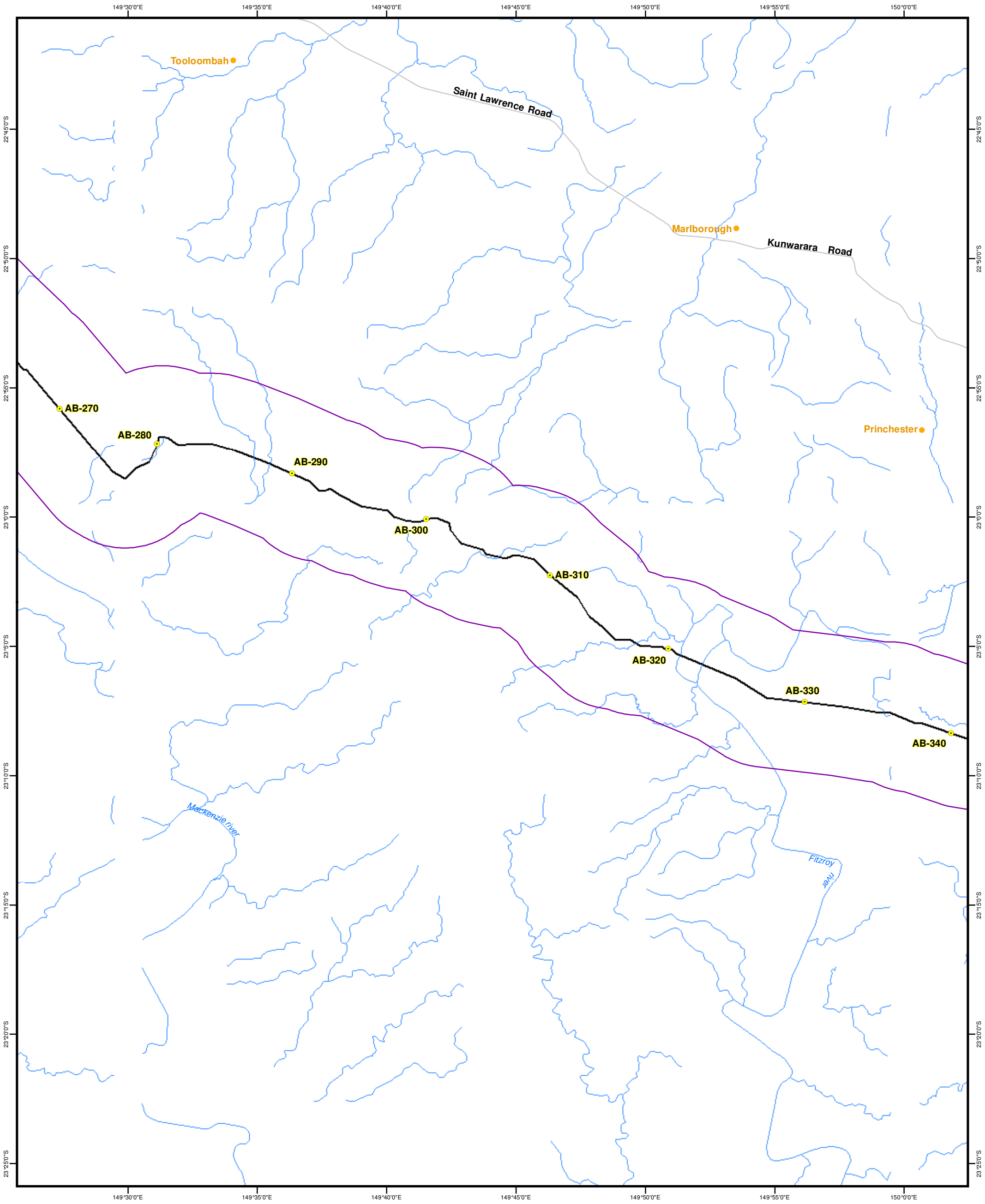

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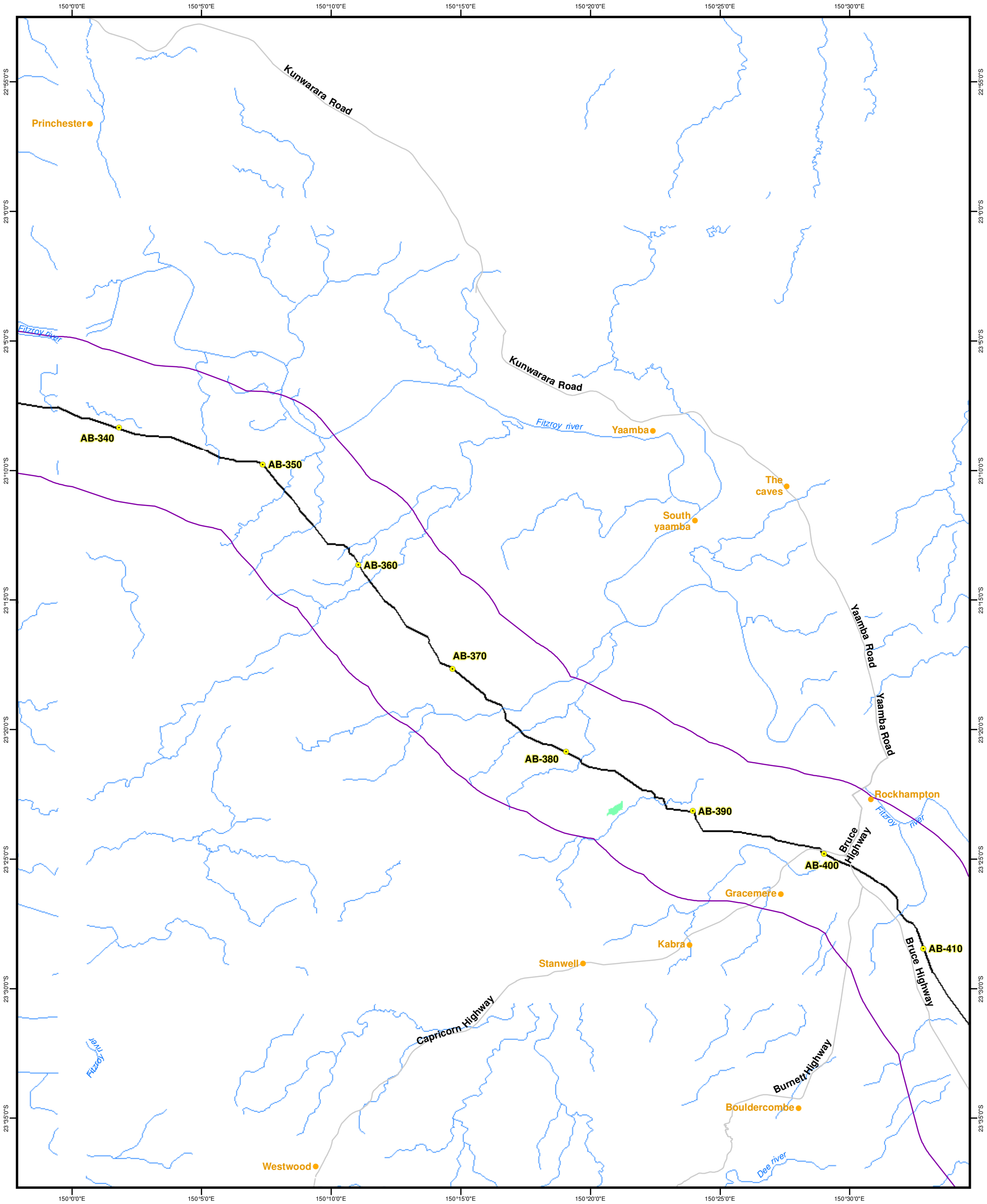

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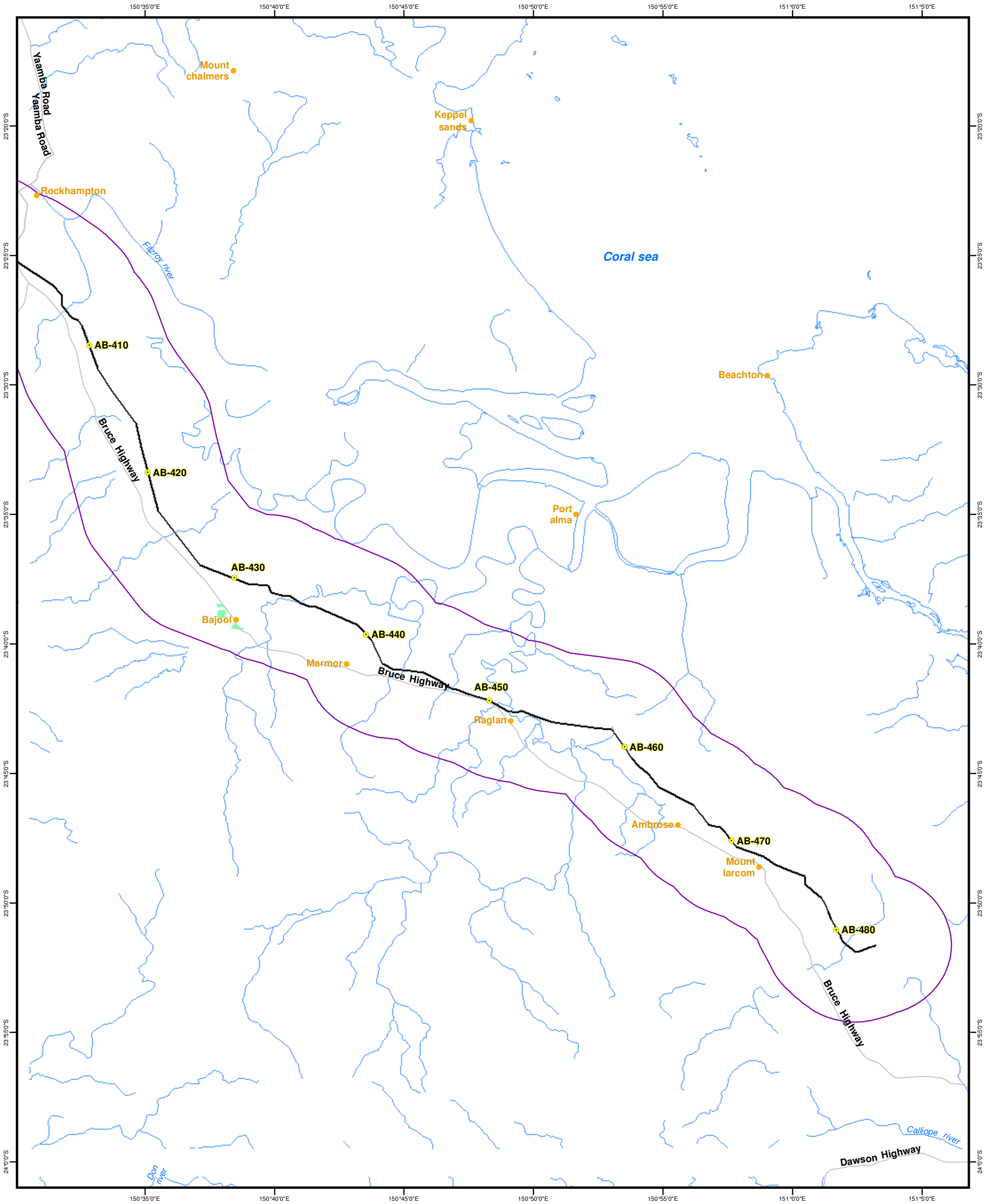

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Weeping Myall

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2 Fauna

2.1 *Denisonia maculata* (Ornamental Snake)

Photo taken by Ben Nottidge, Green Leaf Ecology

2.1.1 Conservation Status

Queensland: Vulnerable under the NC Act

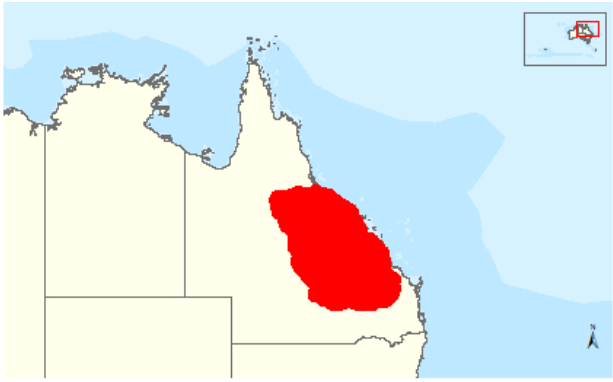
National: Vulnerable under the EPBC Act

2.1.2 Description

The Ornamental Snake is a brown, grey-brown or black snake with distinctly barred lips and a white/cream belly. They grow to approximately 50 cm and when sexually mature, have a minimum snout-vent length of 24.7 cm for females and 23.0 cm for males (Shine 1983). The mid-body scales are smooth and in rows of 17 (EHP 2012).

2.1.3 Distribution

The Ornamental Snake is known to inhabit the north and south sub-regions of the Brigalow Belt bioregion. The species' core distribution occurs within the drainage system of the Fitzroy and Dawson Rivers (McDonald et al. 1991; Cogger et al. 1993).



Distribution of *Denisonia maculata*.

Source: DSEWPaC 2013a

2.1.4 Habitat

The Ornamental Snake prefers habitat that is close to its prey (frogs). It is found in vegetation communities dominated by Brigalow (*Acacia harpophylla*), Gidgee (*Acacia cambagei*), Blackwood (*Acacia argyrodendron*) or Coolibah (*Eucalyptus coolabah*). It prefers moist woodlands and open forests, particularly gilgai (melon-hole) mounds, as well as lake margins and wetlands (Brigalow Belt Reptiles Workshop 2010; Wilson & Knowles 1988). The species typically seeks refuge during dry periods within soil cracks on gilgai mounds (Brigalow Belt Reptiles Workshop 2010). DSEWPaC (2013a) states that Ornamental Snake is known to occur in REs 11.4.3, 11.4.6, 11.4.8, 11.4.9, 11.3.3 and 11.5.16. Recent surveys for Arrow Energy near Moranbah have recorded large numbers of Ornamental Snakes in cleared and disturbed paddocks that contain cracking soils and gilgais (C. Free, pers. obs.).

2.1.5 Ecology

The Ornamental Snake feeds predominantly on a range of frog species. It is a viviparous (live-bearing) species with a mean litter size of 6.8 (Shine 1983). The breeding season for this species is unknown but is likely to coincide with abundance of frogs in the wet season.

Breeding season

Likely breeding season	Breeding unlikely

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

2.1.6 Activity period

Ornamental Snakes are nocturnally active. They shelter during the day in deep soil cracks, or under fallen timber, rocks and bark. The species is thought to be active throughout the

warmer months, with peak activity likely to be in early summer. The snake can remain inactive for months throughout dry times in suitable shelter sites (DSEWPaC 2013a; Shine 1983). A high abundance of snakes was observed to coincide with an abundance of young frogs emerging from an ephemeral pool (DSEWPaC 2013a).

2.1.7 Threats

Identified threats to this species include (DSEWPaC 2013a):

- inadequate knowledge of the species
- habitat loss through clearing for activities such as roads, ploughing (including levelling of gilgaied microtopography), railways, mining-related activities, pipeline constructions
- habitat fragmentation
- habitat degradation by overgrazing by stock, especially cattle
- grazing of gilgais during the wet season leading to soil compaction and compromising of soil structure
- alteration of landscape hydrology in and around gilgai environments
- alteration of water quality through chemical and sediment pollution of wet areas
- ingestion of cane toads
- predation by feral species
- invasive weeds.

2.1.8 DSEWPaC recommended survey methods

No survey methods are known to reliably detect the Ornamental Snake during the dry season. The species is most likely to be encountered by:

- searching around suitable gilgai habitat while frogs are active, approximately 1–3 days following heavy rainfall (greater than 5 mm), especially thunderstorms
- driving on roads at night, after wet weather when frogs are active, may be necessary if wet weather precludes access to suitable (gilgai) habitat
- diurnal searches under sheltering sites (rocks, logs or other large objects on the ground)
- pitfall and funnel trap arrays could be trialled (DSEWPaC 2011a; DSEWPaC 2013a).

The species has also been found in abundance 3 to 4 weeks after heavy rainfall when young frogs are emerging in and around gilgais/wetlands. The optimal climatic conditions for the Ornamental Snake occur with the combination of high temperatures, humidity and electrical storms which typically occur from January to mid-March.

2.1.9 Survey effort and methods undertaken for ABP

Targeted surveys for Ornamental Snake were conducted at four sites during the summer survey period in December 2011. Surveys in winter 2011 and spring 2011 also sampled sites containing preferred habitat of this species.

Survey techniques included pitfall trapping, active searching, and spotlighting on foot and from a car travelling at slow speed.

Targeted surveys conducted during the summer survey period in December 2011, involved thirty minutes of nocturnal spotlighting on foot along roads and ground habitat within each site. Spotlighting was also completed along roads and tracks whilst travelling between sites.

Sampling undertaken during the spring survey period in September 2011 included pitfall trapping with drift fences. The standard pitfall trapping effort for each site was 3 buckets along a 30 m drift fence for a minimum of 4 nights, used in conjunction with funnel traps. Pitfall traps were not able to be installed at every site due to difficult substrates.

Sampling for reptiles during the winter survey period in June/July 2011 focussed on active searching under potential shelter sites. Each site was actively searched for thirty minutes. Searches were undertaken before mid-morning (i.e. before reptiles had reached their optimal body temperature).

2.1.10 Comparison with DSEWPaC guidelines

The effort conducted during the field surveys for this species is shown in Table 12 along with the effort recommended under the DSEWPaC guidelines. It must be noted that the guidelines are recommendations only and surveys are ongoing.

Table 12 Actual and DSEWPaC recommended survey effort for ornamental snake in suitable habitat

Method	Actual effort	SEWPC
Spotlighting and active search (hours)	5 (5 sites) x 2 hours = 10	7.26
Trap effort (trap nights)	3 traps for 4 nights = 12	12

2.1.11 ABP survey results

This species was not recorded within the ROW but was detected in the surrounding study area. ABP surveys recorded Ornamental Snake in alluvial woodland 6 km south west of KP 166, 6.3 km south west of KP 166 and 3 km south west of KP 206.1 on the revision SR mainline.

Potential habitat for Ornamental Snake in the ROW is summarised in Table 2. Only 5.3 ha of remnant vegetation (RE 11.3.3) suitable for Ornamental Snake occur within the ROW. Additional REs found on cracking clay soils within the buffer may provide good habitat for Ornamental Snake prey species. Recent surveys completed for Arrow Energy near Moranbah suggest that the species can also occur in highly modified and disturbed habitats (e.g. buffel grass paddocks) that contain clay soils with gilgais. The *Referral guidelines for*

nationally threatened Brigalow Belt reptiles does not identify critical habitat for this species and given that this species also occurs in non-remnant habitat it is unlikely that any critical habitat occurs in the ROW. An assessment of the impacts on this potential habitat is discussed in Section 1.1.12.

Table 13 Remnant REs that contain potential habitat for Ornamental Snake within the ROW (based on field verified REs).

RE	RE description	Potential habitat area in the ROW (ha)	Potential habitat in the 5 km buffer (ha)	% of buffer*	Critical habitat in the ROW (ha)
11.3.3	Eucalyptus coolabah woodland on alluvial plains	5.3	3941.48	0.13	0
	Other REs containing suitable habitat in the 5 km buffer	0	2459.59	0	
	Totals	5.3	6401.07	0.08	0

***** percent of the potential habitat within the ROW which is contained within the 5 km buffer .

2.1.12 Impacts of ABP on Ornamental Snake

2.1.12.1 Potential impacts without mitigation

Ornamental Snakes inhabit woodlands and disturbed cleared habitat on clay soils. They remain in soil cracks during the day and emerge at night to feed on frogs. Impacts associated with the proposed project could include:

- temporary loss of remnant woodland vegetation that could provide habitat for Ornamental Snake
- trenchfall
- increased pest animal abundance associated with improper disposal of food waste
- damage to soil structure including soil compaction, destruction of gilgais and destruction of soil cracks
- direct mortality through excavation and collisions with vehicles during construction, operation and maintenance.

2.1.12.2 Assessment of potential impacts with mitigation

Table 2 summarises potential direct and indirect impacts of the project on Ornamental Snake populations and proposed measures to mitigate potential impacts. The table provides a risk assessment for each impact with and without mitigation measures.

Table 14 Raw Risk (before mitigation) and Residual Risk (after mitigation) associated with construction of the ABP on Ornamental Snake.

Impact	Raw Risk before mitigation	Mitigation measures	Residual Risk after mitigation
Direct impacts			
Removal of habitat Removal of vegetation which could provide potential foraging, breeding and sheltering habitat	L	- minimise areas of remnant vegetation to be cleared on deep cracking clay soils -use existing cleared corridors where possible -clearly mark out areas to be cleared and retained - -rehabilitate the ROW following construction	I
Trenchfall Death of individuals trapped in the trench	M	-monitoring of open trenches by fauna spotter catchers during the construction period -minimise the length of time the trench is open - if possible, install drift fencing to prevent animals from falling in the trench - install ramps in the trenches to allow animals to escape	I
Fatalities Death of individuals via vehicles and equipment during clearing, construction and operation	M	-maintain an appropriate speed limit in the ROW especially in areas where the ROW goes through remnant vegetation -employ a spotter catcher to check microhabitat prior to clearing to remove individuals before clearing commences -if possible use pre-clearance trapping or spotlighting in areas with cracking clay soils to capture individuals prior to clearing -employ a spotter catcher to be on hand during clearing to move displaced animals -avoid working at night when Ornamental Snakes are active and potentially present on the ROW or access tracks	I
Indirect impacts			
Changes in water quality Impacts to water quality upstream leading to changes in vegetation/habitat downstream	I	Temporary disturbance during construction is not likely to affect the downstream vegetation or habitat.	I
Changes in hydrology Changes in wet/dry cycling of waterways caused by damming, changes in morphology or diversions	I	Temporary disturbance during construction is not likely to affect the downstream vegetation or habitat.	I
Habitat fragmentation Fragmentation of habitat leading to a reduction in remnant size, increased edge effects and isolation of population	L	-minimise areas of remnant vegetation on deep cracking claysoils to be cleared -use existing cleared corridors where possible -rehabilitate the ROW following construction	I
Increase in weed abundance -increased competition with native plant species used for foraging and shelter. -smothering of native vegetation	L	-develop and implement a Weed Management Plan -control weeds in the ROW before and after construction -implement site weed hygiene protocols	I
Increase in introduced predator abundance Increase in introduced predator abundance caused by increased food availability in the ROW	L	-develop and implement a Waste Management Plan -develop and implement a Pest Management Plan -educate staff about the importance of removing any food waste from the ROW -keep the work site clean of debris which could be used as -shelter for introduced predators	I
Removal of micro-habitat Removal of logs, leaf litter and debris, cracking clays, gilgais	L	-rehabilitate the ROW following construction -reinstate microhabitat such as logs, rocks and leaf litter after construction	I
Noise and disturbance Disturbance caused by noise or human disturbance leading to stress, disease and abandonment	N/A	-no mitigation measures for noise are recommended for this species as it is not likely to be impacted by noise created during the day -ensure staff stay within the ROW and do not disturb	N/A

of habitat.		neighbouring habitats	
Spread of disease	N/A	-no mitigation measures for reducing the spread of disease are recommended for this species as there are no known diseases for this species which could be spread by human activities	N/A

I-Insignificant, L- Low, M – Moderate, H – High, E- Extremely High; N/A – impact not applicable to this species.

The project will result in the temporary loss of some remnant vegetation on deep cracking clay soils that could provide habitat for Ornamental Snake. However, Ornamental Snakes also inhabit highly modified grazing areas dominated by introduced pasture grasses with cracking clay soils (DSEWPaC 2013a). The temporary loss of remnant vegetation is unlikely to impact Ornamental Snake populations given that they also occur in highly modified and disturbed habitats. Impacts will be further reduced by progressive construction of the pipeline within the ROW (which will limit the extent of disturbance at any one time) and progressive rehabilitation immediately following construction (which will restore suitable habitat and microhabitat features). Gilgais and soil cracks will reform naturally with alternating swelling and shrinking of clay soils during the wet/dry cycle. The impact on this species from clearing of habitat is therefore considered to be **Insignificant**.

There is a small chance that Ornamental Snake could fall into open trenches. Before clearing and construction commence, pre-clearance surveys will be undertaken to relocate as many individuals as possible to adjacent suitable habitat. During construction, trench inspection, by trained fauna handling personnel, will occur every morning to check for animals (including Ornamental Snakes) that may have fallen into the trench overnight. Works will be undertaken progressively to minimise the length of trench open during construction at any one time. Refuges (such a moistened sacks) will also be placed within the trench for shelter to reduce mortalities. If any snakes are detected in the trenches, they will be safely captured and released into suitable habitat a safe distance from where the works are occurring. With the implementation of proposed mitigation measures, the impact of trenchfall on Ornamental Snake is considered to be **Insignificant.**

There is a moderate chance that an Ornamental Snake could be killed or injured during clearing or construction activities as a result of vehicle strike or excavating in cracking clay soils. Pre-clearance surveys will be conducted along the ROW prior to construction to remove any snakes found within the ROW. A spotter catcher will be on hand during clearing to remove any animals found during excavation. Therefore the impact of direct fatalities on Ornamental Snake populations is considered to be **Low**.

With mitigation measures, construction of the pipeline is not expected to change the risks to Ornamental Snakes from the introduction of pests. Introduced predators (such as foxes and cats) are present and active in the area. Reasonable management measures, such as the removal of food waste from the ROW or induction programs which stress non-feeding of animals will ensure a Low level of risk from pests.

Ornamental Snakes rely on soil cracks and debris (logs, etc.) for shelter. The temporary removal of this micro-habitat in the ROW could impact Ornamental Snake populations in the local area. However, logs and debris removed from the ROW will be placed back in the ROW after construction so the loss of these features will only be temporary. Topsoil will be

reinstated following construction and soil compaction will be relieved by scarification and / or ripping. Soil cracks and gilgais will reform naturally with alternating swelling and shrinking of clay soils over time. Therefore, the impact of removal of micro-habitat on Ornamental Snake is likely to be **Low**.

Overall the impact of the ABP project on Ornamental Snake is considered to be **Low** provided that all the mitigation measures listed in Table 2 are implemented.

2.1.13 Evaluation under MNES significant impact guidelines

The *Draft referral guidelines for nationally threatened Brigalow Belt reptiles* states that important habitat should be used as a surrogate for important population during assessments involving Brigalow Belt reptiles. If the habitat is considered important under any of the "important habitat" criteria, then the habitat is deemed to be important habitat. Important micro-habitats for Ornamental Snake include gilgai depressions and mounds. Habitat connectivity between gilgais and other suitable habitats is also important. The presence of important habitat is assessed under the four criteria specified in the guidelines.

Suitable habitat for this species is considered important habitat if it is any of the following:

Habitat where the species has been identified during a survey

This species was not recorded within the ROW but was detected in the surrounding study area.

ABP surveys recorded Ornamental Snake in alluvial woodland 6 km south west of KP 166, 6.3 km south west of KP 166 and 3 km south west of KP 206.1 on the revision SR mainline.

Near the limits of the species known range

The pipeline runs through the known and likely range of the species. The action will not impact habitat at the limits of the species known range. The habitat in the ROW is not important habitat based on this criterion.

Large patches of contiguous, suitable habitat and viable landscape corridors (necessary for the purposes of breeding, dispersal or maintaining the genetic diversity of the species over successive generations)

The pipeline will disturb large patches of remnant vegetation within corridors that could be used for dispersal. Recent surveys have found that the species can also occur in non-remnant land with suitable cracking soils, gilgais and frogs. The temporary disturbance and the occurrence of this species in non-remnant land indicates that the pipeline will not disturb important habitat.

A habitat type where the species is identified during a survey, but which was previously thought not to support the species

Surveys of the ABP recorded this species only in habitat already known to support the species. The habitat in the ROW is not important habitat based on this criterion.

Is there an important population of this species in the study site?

The ABP pipeline contains habitat where the species has been identified during a survey and areas of suitable habitat that could be used for breeding and dispersal.

Surveys undertaken for this species on the ROW have not recorded any of this species present within the ROW. Consequently, the possibility that important populations may be present is regarded as unlikely.

Will the action lead to a long-term decrease in the size of an important population of a species?

The proposal will temporarily clear potential habitat for Ornamental Snake. However, construction of the pipeline will be progressive with clearing and rehabilitation occurring continuously within the designated ROW so that only a small amount of potential habitat will be impacted at any one time. Additionally, rehabilitation will be ongoing and clearing effects will be short-term. Ornamental Snakes inhabit modified and disturbed habitats including pasture. Consequently, provided mitigation measures listed in Table 2, particularly those related to soil compaction, trenchfall and direct mortality are implemented, the action is unlikely to result in a significant decline in an important population of Ornamental Snakes.

Will the action reduce the area of occupancy of an important population of a species?

The proposal is unlikely to lead to a permanent decrease in the area of occupancy for this species as the species will inhabit heavily modified habitats that contain important microhabitat features such as soil cracks, gilgais and suitable prey habitat. Provided that soil structure is maintained through the stockpiling and replacement of soil in the original profile, landscape topography is restored and logs are returned to the ROW following construction, the action in unlikely to lead to a reduction in occupancy of an important population.

Will the action fragment an existing important population into two or more populations?

Clearing will result in the short-term partial fragmentation of remnant vegetation by the construction of a 40 m ROW. However, the majority of the ROW (except for a 7 m wide track) will be allowed to regenerate to a habitat of similar quality to that present before construction. Further, this species occurs in heavily modified open habitats (e.g. buffel grass grazing paddocks) so is unlikely to be impacted by clearing of remnant vegetation within the ROW. The action is therefore unlikely to lead to fragmentation of an important population of Ornamental Snake.

Will the action adversely affect habitat critical to the survival of a species?

No critical habitat for brigalow reptiles has been identified on the Register of Critical Habitat under the EPBC Act. No habitat critical for the species survival is listed in the *Draft referral guidelines for nationally threatened Brigalow Belt reptiles*.

Will the action disrupt the breeding cycle of an important population?

There is very little information about the breeding cycle of Ornamental Snake, but breeding is likely to occur during the period of maximum activity in summer. Construction in areas of cracking clay soils will be conducted in the dry season, when Ornamental Snakes are less active, reducing the likely impact on Ornamental Snake breeding activities. Given the short period of time required for construction it is unlikely the proposed action will impact the breeding cycle of the species.

Will the action modify, destroy or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?

The ABP pipeline will modify potential habitat for this species through clearing. However, the species also inhabits heavily modified habitats that contain important microhabitat features such as soil cracks, gilgais and habitat for frogs.

Gilgais are known to reform after levelling of the ground if the ground is left undisturbed for a number of wetting and drying cycles (Victorian Department of Primary Industry, 2011). It is likely that any gilgais in the ROW which are levelled during the construction, will reform again following rehabilitation of the ROW. Furthermore, provided that soil structure is maintained through the stockpiling and replacement of soil in the original profile, landscape topography is restored and logs are returned to the ROW following construction, the action in unlikely to lead to impacts to habitats to the extent that an important population will decline.

Will the action result in harmful invasive species becoming established in the species' habitat?

Field surveys have identified a number of invasive flora species and feral animals are currently present throughout the project site. Pest and weed management plans will ensure these species are adequately managed during both the construction and operational phases of the project so it unlikely that the action will result in the establishment of invasive species.

Will the action result in the introduction of disease(s) that may cause the species to decline?

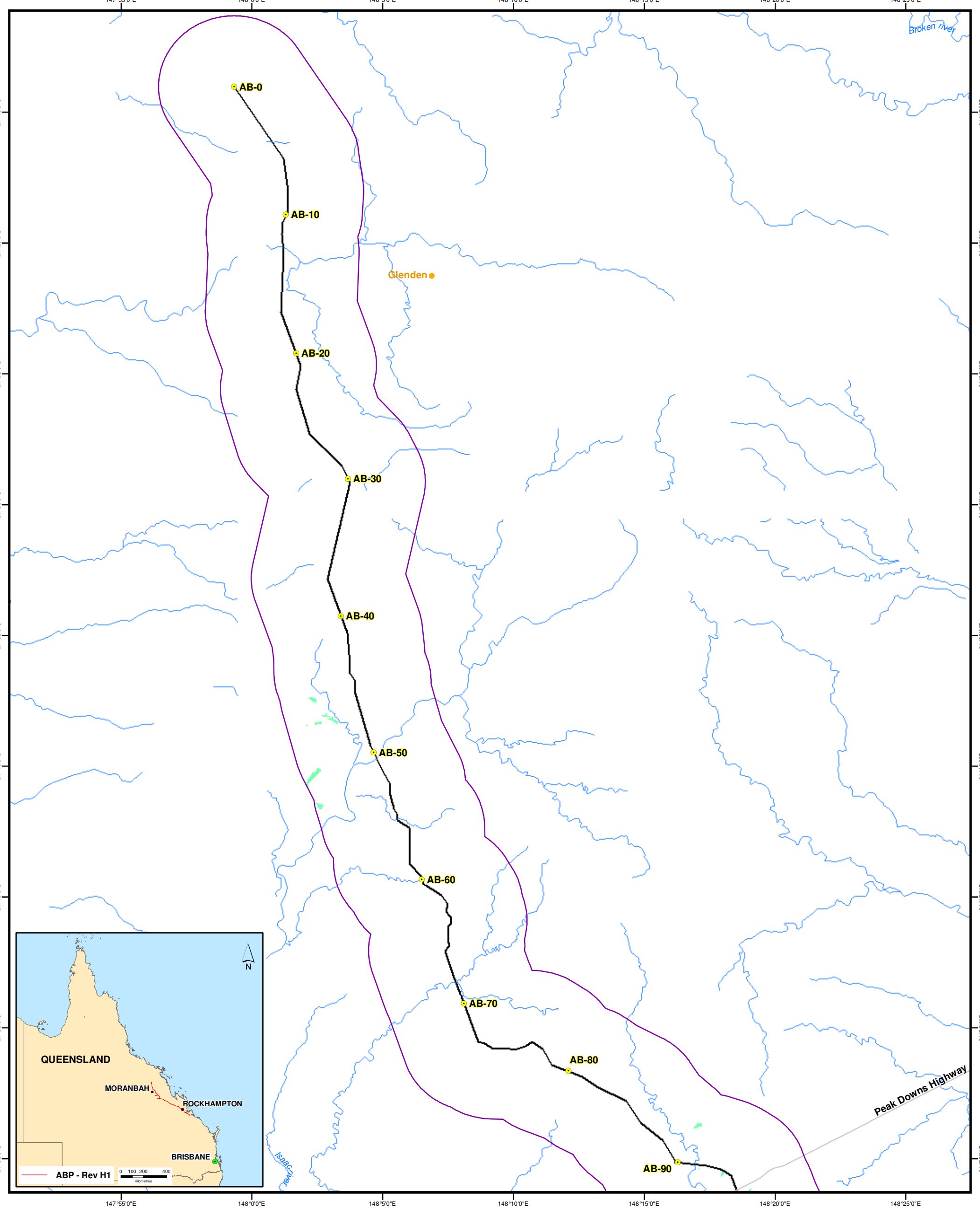
There are no known diseases likely to be introduced to the project site that would significantly affect the Ornamental Snake.

Will the action interfere substantially with the recovery of the species?

Clearing of habitat on the site is likely to have minor local impacts on the species. Provided that mitigation measures listed in Table 2 are implemented, the action is unlikely to interfere with the recovery of the species as a whole.

2.1.14 Conclusion

With the successful implementation of the recommended mitigation measures, it is considered that the impact of the project on the Ornamental Snake will be of low overall significance. This species will be included in a significant species management plan for the ABP.



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Job Number: BE004

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REV	By	CHK	Description	Date

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Kilometres

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Coordinate System:
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LEGEND

- City or town
- Kilometre Point
- Waterway or Coast Line
- Main roads
- ABP - Rev H1
- Potential Habitat in Buffer (from State RE Mapping)
- Buffer (5 km)

Ornamental Snake

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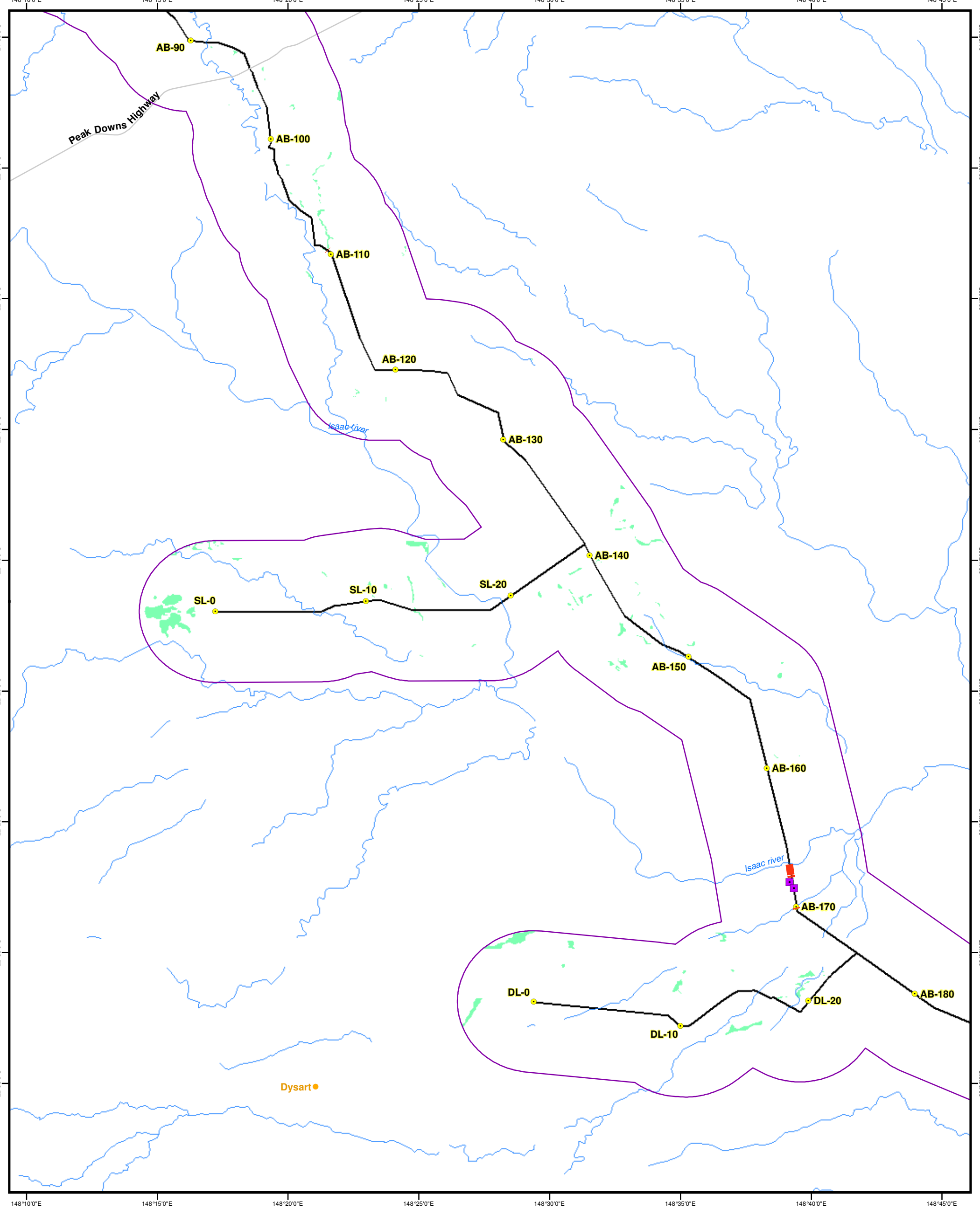
Page 1 of 7

A3



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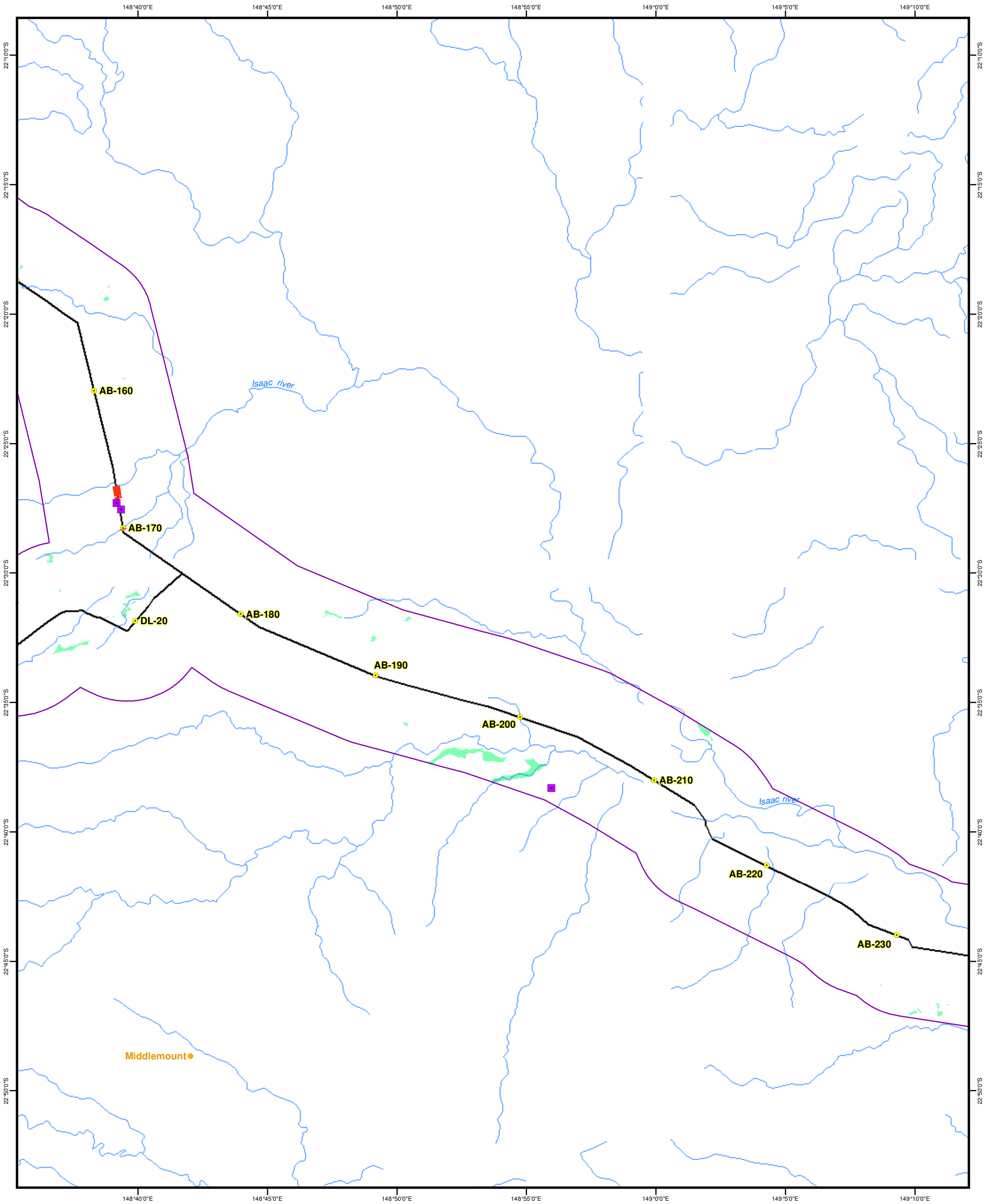

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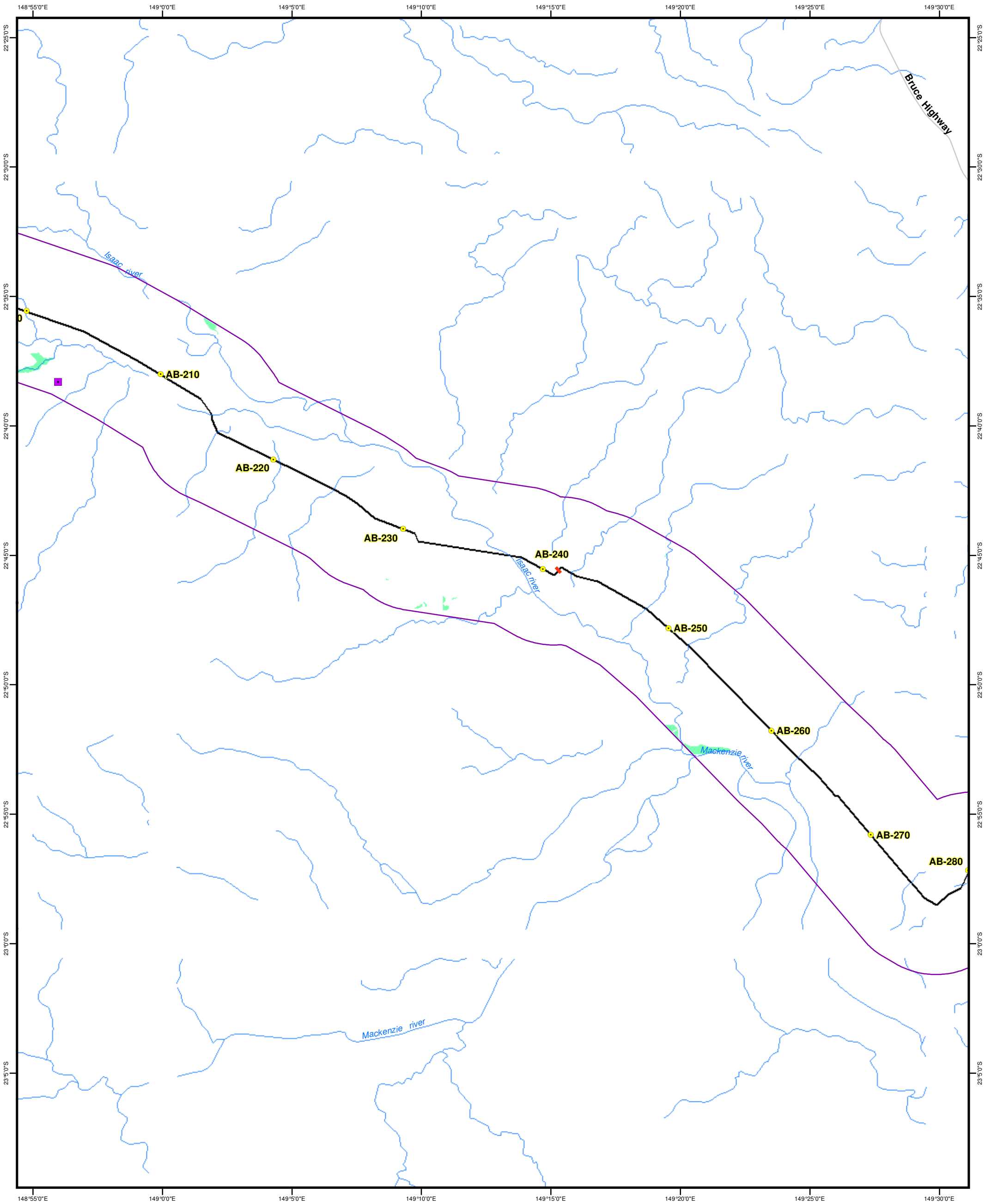

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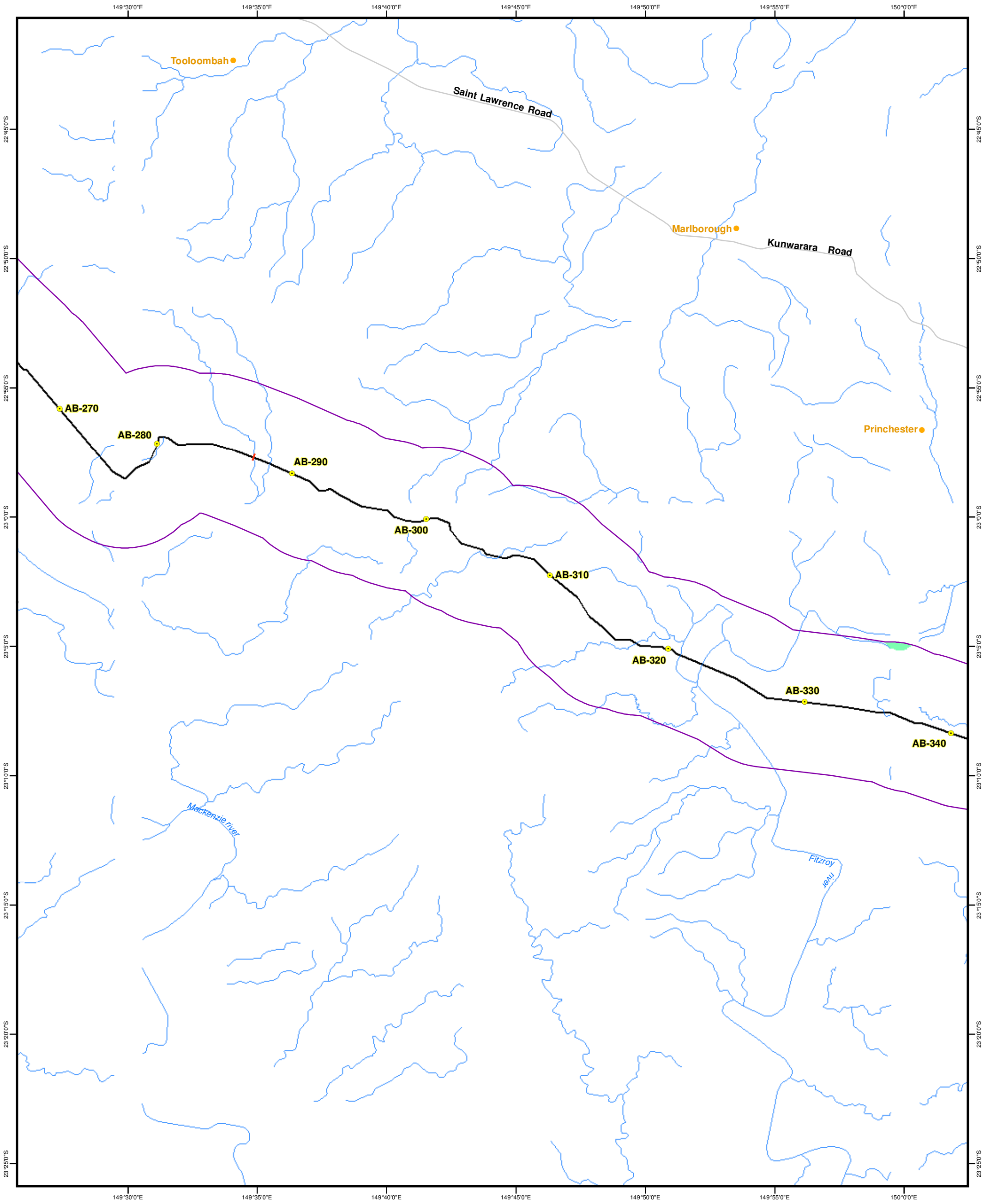

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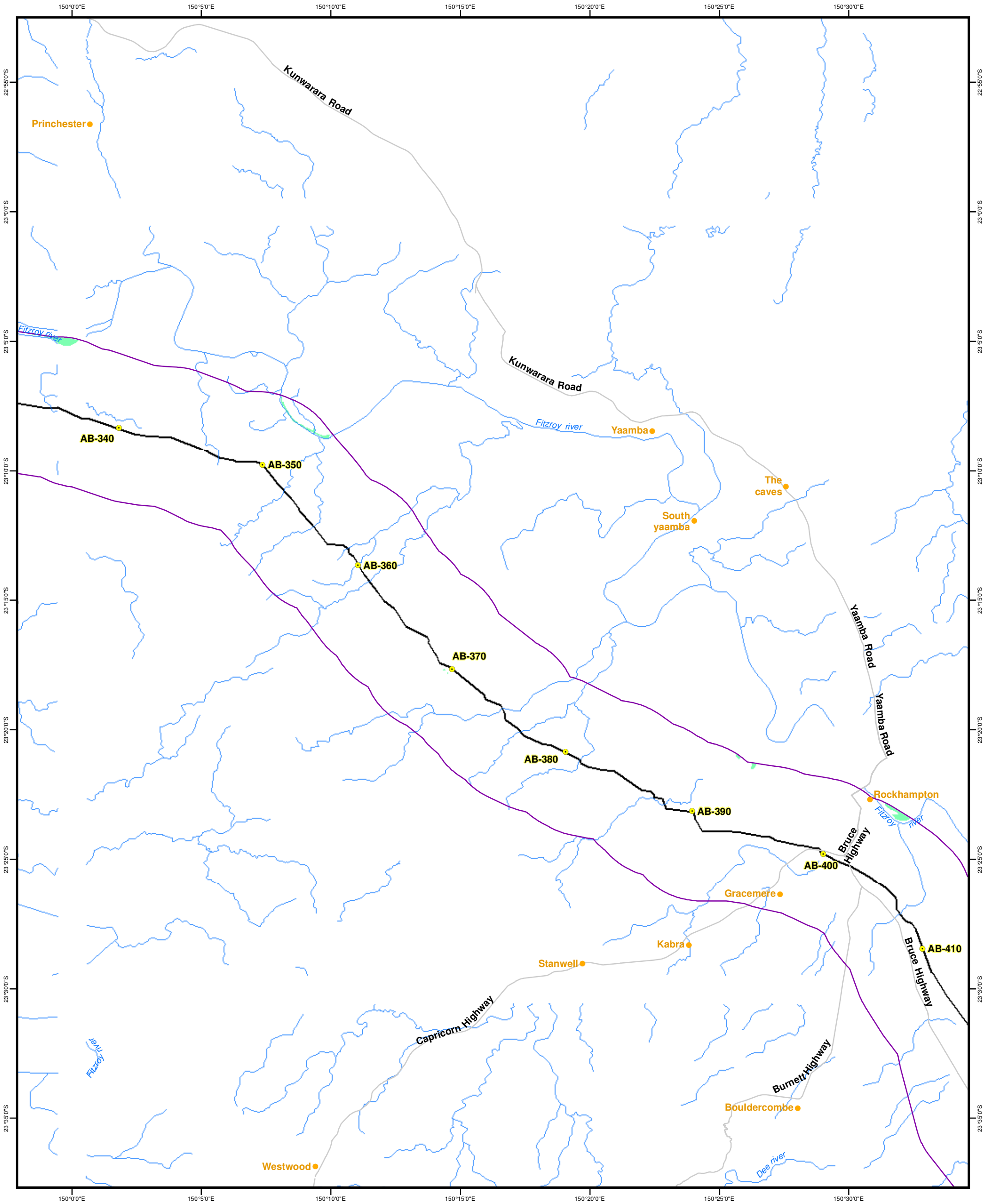

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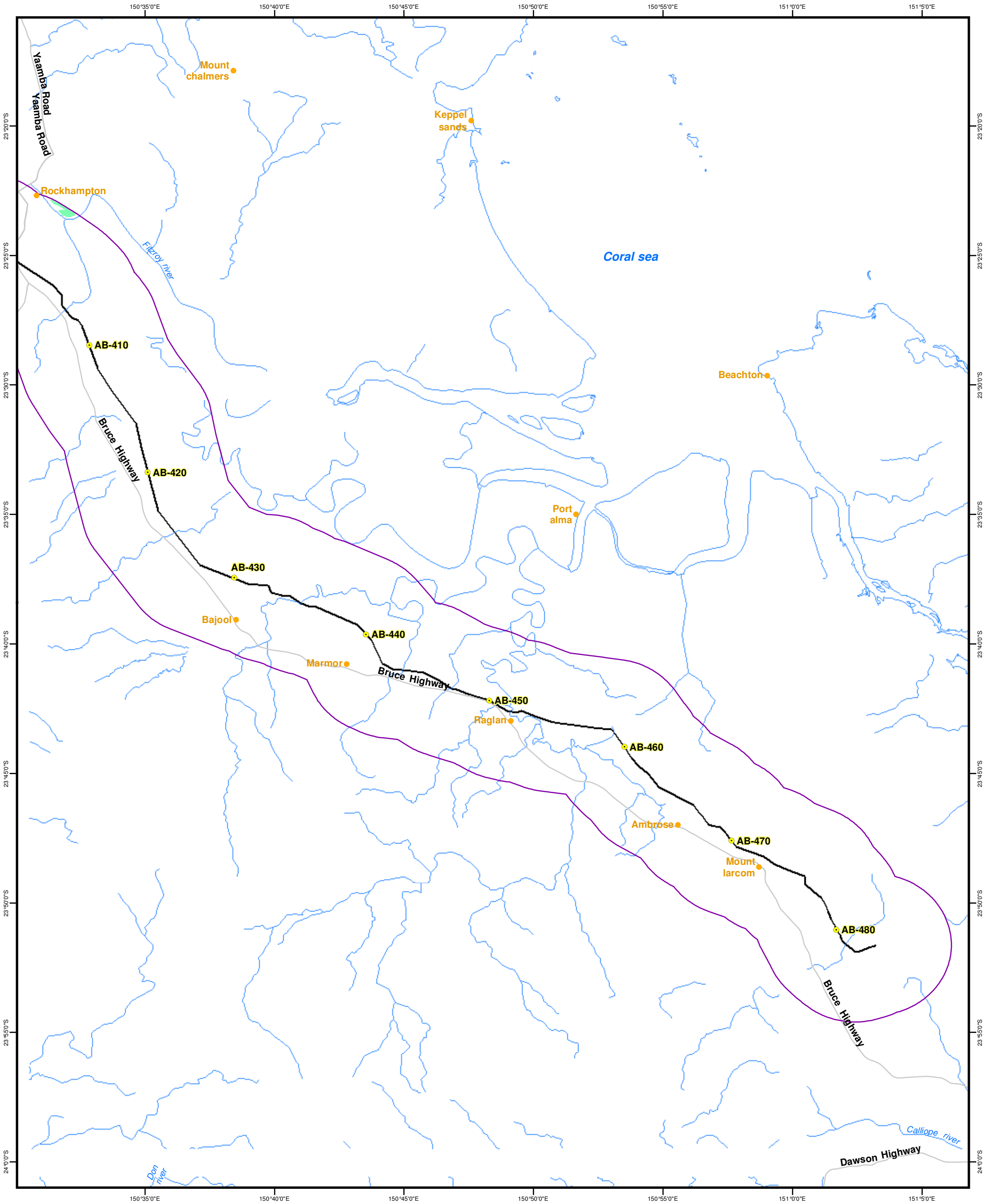

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2.2 *Egernia rugosa* (Yakka Skink)

2.2.1 Conservation Status

Queensland: Vulnerable under the NC Act

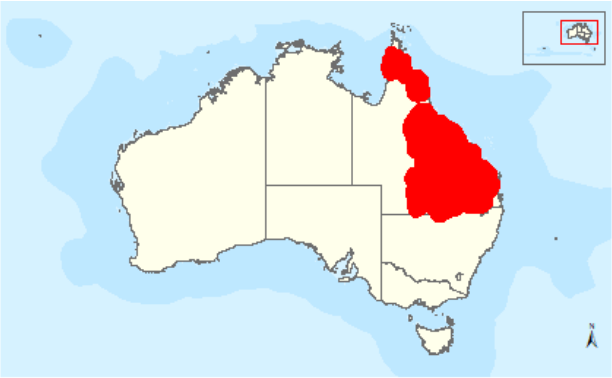
National: Vulnerable under the EPBC Act

2.2.2 Description

The Yakka Skink is a large lizard with a snout vent length of 200 mm, and has a robust build and thick tail. Generally brown, this species has a distinctive dark stripe down the back and pale brown stripes on its sides (Wilson 2009).

2.2.3 Distribution

The Yakka Skink is restricted to Queensland, although a small amount of potential habitat occurs in northern NSW (Cogger 2000). The Yakka Skink's known distribution extends from the east Queensland coast to the hinterland. This area covers the northern and southern parts of the Brigalow Belt, South-east Queensland, Mulga Lands, Einasleigh Uplands, Cape York Peninsula and the Wet Tropics bioregions (Brigalow Belt Reptiles Workshop 2010; Cogger 2000).



Distribution of *Egernia rugosa* in Australia. Source: DSEWPaC 2013a

2.2.4 Habitat

The Yakka Skink's core habitat is within the Mulga Lands and Brigalow Belt bioregions (TSN 2008). This species inhabits woodland, scrub and open dry sclerophyll forest (Brigalow Belt Reptiles Workshop 2010; Cogger 2000; Wilson & Knowles 1988), typically dominated by ironbark (e.g. *E. crebra*), poplar box (*E. populnea*), Bull Oak (*Allocasuarina luehmannii*) or *Acacia* species such as brigalow (*A. harpophylla*). They shelter in logs, abandoned rabbit warrens, log piles, rock crevices, tree roots and sink holes (Curtis et. al. 2012). Burrows are excavated in a variety of substrates which includes loam, sand and clay (Curtis et. al. 2012).

2.2.5 Ecology

The Yakka Skink is highly sociable, with populations occurring mainly in colonies. These groups consist of adults and juveniles of various sizes (Chapple 2003). Even though a colony of skinks may use a number of shelter sites during the year, an occupied burrow will be indicated by the piles of recent scats near its entrance. The Yakka Skink is omnivorous; it ambushes small creatures such as beetles, grasshoppers and spiders that venture near the burrow entrance, and also forages for soft plant material and fruits. The Yakka Skink bears live young and rarely produces more than six per litter. The breeding season for this species has not been recorded (Chapple 2003) but it is likely that this species breeds when it is most active in late spring and summer.

Breeding season

Breeding less likely	Likely breeding season

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

2.2.6 Activity period

Schmida (1985) states that the species is most active during the early morning and late afternoon, while Ehmann (1992) reports personal observations of both diurnal and (on warm nights) nocturnal activity. The species is very wary and will quickly retreat into its burrow or shelter site in response to nearby movement or disturbance. Nothing is reported on seasonal activity patterns, but Queensland Museum specimens have been collected in November (two), December (one), February (three) and March (two), suggesting a peak in activity in late spring and summer, like other large *Egernia* species (DSEWPaC 2013a).

2.2.7 Threats

The threats to this species include (DSEWPaC 2013a):

- habitat loss and degradation
- removal of microhabitat, such as rocks, logs and fallen bark
- predation by feral animals
- the Yakka Skink exhibits high site-fidelity/low fecundity and is long-lived, therefore this species is susceptible to potential population crashes.

2.2.8 Recovery actions

No recovery plan has been prepared for Yakka Skink. DSEWPaC (2013a) identifies the following actions designed to assist in the recovery of this species:

- identify suitable habitat for conservation of Yakka Skink

- identify key threats and develop management guidelines to protect key habitat
- monitor and evaluate recovery actions and apply an adaptive management approach
- ensure Yakka Skink conservation is incorporated into appropriate land management decisions.

2.2.9 DSEWPaC recommended survey methods

Targeted surveys should be undertaken during optimal conditions. As a general rule, surveys should only be undertaken from late September through to late March when weather conditions are warm, not too dry and maximum temperatures are greater than 25°C on most survey days. All of the listed Brigalow Belt reptiles are difficult to detect and are therefore likely to require more than one applicable survey technique to ascertain whether they are present or absent.

One-off diurnal searches

Searching for burrow systems and communal defecation sites is the most reliable method of detection. Optimal survey time is during the coolest parts of the day. Surveys should be conducted over a minimum of three days, and should include a minimum of 1.5 person hours per hectare for habitats of average complexity. Potential Yakka Skink colony sites can be watched using a telescope or binoculars at 30 m distance.

Transects

Transects can be used to survey for Yakka Skink in large habitat patches (>10 ha) and should be strategically positioned to adequately sample representative microhabitats in each habitat type.

Spotlighting

Spotlighting should target large logs between dusk and early morning hours. It is most effective on warm, humid evenings. Surveys should be conducted over a minimum of three days, and should include a minimum of 1.5 person hours per hectare for habitats of average complexity.

Elliott and cage trapping

Trapping should target colony sites through diurnal surveys of suitable habitat. One large Elliott-style trap (15.5 cm x 15 cm x 46 cm) and one cage trap should be placed as close as possible to burrow entrances. Traps should be checked every morning and early evening (after the optimal foraging periods) over four days (DSEWPaC 2011a).

2.2.10 Survey effort and methods undertaken for ABP

Emphasis was placed on selecting sites that had a high level of microhabitat diversity (presence of understorey, logs, leaf litter and other debris) as these sites were considered most likely to support Yakka Skink.

Survey techniques used included active searching, and spotlighting.

Sampling for reptiles focussed on active searching under potential shelter sites. Each site was actively searched for thirty minutes. Searches were undertaken before mid-morning (i.e. before reptiles had reached their optimal body temperature). Thirty minutes of nocturnal spotlighting was conducted on foot along roads and ground habitat within each site. Spotlighting was also completed along roads and tracks whilst travelling to sites.

2.2.10.1 Comparison with DSEWPaC guidelines

The effort conducted during the field surveys for this species is shown in Table 15 along with the effort recommended under the DSEWPaC guidelines. It must be noted that the guidelines are recommendations only and surveys are ongoing.

Table 15 Actual and DSEWPaC recommended survey effort for Yakka Skink

Methods	Actual effort	DSEWPC
Spotlighting effort (hours)	47	381
Active search effort (hours)	80.40	381
Trap effort (trap nights)	3 traps (6 locations) x 4 nights = 72	768

2.2.11 ABP survey results

This species was not recorded during the field surveys.

Yakka Skink could potentially occur within the ROW in 15 REs (Table 16) with a total area of 254.65 ha. The majority of the remaining REs lie within small remnants or narrow parts of larger remnants. The majority of the ROW is mapped by DSEWPaC (2013a) as habitat in which Yakka Skink 'may occur'. The area in the vicinity of KP 436 and 456 is mapped as habitat in which the Yakka Skink is 'known or likely' to occur. However the pipeline route avoids remnant vegetation in this area and intersects areas identified as potential habitat. No habitat has been identified as habitat critical for the survival of Yakka Skink in the *Draft referral guidelines for nationally threatened Brigalow Belt reptiles.* An assessment of the impacts on this potential habitat is discussed in Section1.1.13.

Table 16 Remnant REs that contain potential habitat for Yakka Skink within the ROW

RE	Habitat Type	Potential habitat in ROW (ha)	Potential habitat in the 5 km buffer (ha)	% of buffer*	Critical habitat in ROW (ha)
11.3.1	*Acacia harpophylla* and/or *Casuarina cristata* open forest on alluvial plains	1.29	3666.53	0.03	0
11.3.2	*Eucalyptus populnea* woodland on alluvial plains	29.14	11397.97	0.25	0
11.3.3	*Eucalyptus coolabah* woodland on alluvial plains	5.30	3941.48	0.13	0
11.3.4	*Eucalyptus tereticornis* and/or *Eucalyptus* spp. tall woodland on alluvial plains	0.63	3235.83	0.01	0
11.3.7	*Corymbia* spp. woodland on alluvial plains. Sandy soils	4.24	1112.84	0.38	0

11.3.25	*Eucalyptus tereticornis* or *E. camaldulensis* woodland fringing drainage lines	17.34	9112.56	0.19	0
11.3.26	*Eucalyptus moluccana* or *E. microcarpa* woodland to open forest on margins of alluvial plains	5.64	3088.83	0.18	0
11.3.36	*Eucalyptus crebra* and/or *E. populnea* and/or *E. melanophloia* on alluvial plains. Higher terraces	3.23	332.98	0.97	0
11.5.3	*Eucalyptus populnea* and/or *E. melanophloia* and/or *Corymbia clarksoniana* on Cainozoic sand plains/remnant surfaces	79.57	18509.98	0.42	0
11.5.9	*Eucalyptus crebra* and other *Eucalyptus* spp. and *Corymbia* spp. woodland on Cainozoic sand plains/remnant surfaces. Plateaus and broad crests	26.72	6600.89	0.40	0
11.5.12	*Corymbia clarksoniana* woodland and other *Corymbia* spp. and *Eucalyptus* spp. on Cainozoic sand plains/remnant surfaces	12.87	1361.91	0.94	0
11.7.2	*Acacia* spp. woodland on lateritic duricrust. Scarp retreat zone	19.04	7791.01	0.24	0
11.8.5	*Eucalyptus orgadophila* open woodland on Cainozoic igneous rocks	42.47	9636.93	0.44	0
11.9.2	*Eucalyptus melanophloia +/- E. orgadophila* woodland on fine-grained sedimentary rocks	0.70	1357.38	0.05	0
11.9.9	*Eucalyptus crebra* woodland on fine-grained sedimentary rocks	6.47	2837.52	0.22	0
	Other REs containing suitable habitat in the 5 km buffer	0	23616.56	0	
	Totals	254.65	107601.2	0.23	

***** percent of the potential habitat within the ROW which is contained within the 5 km buffer .

2.2.11.1 Other survey results

There were two records for Yakka Skink from the Wildnet search area within the 5 km buffer. No Queensland Museum records were found in close proximity to the project site.

2.2.12 Impacts of ABP on Yakka Skink

2.2.12.1 Potential impacts without mitigation

Yakka Skinks inhabit woodland, scrub and open dry sclerophyll forest, typically dominated by Narrow-leaved Red Ironbark (e.g. *E. crebra*), Poplar Box (*E. populnea*), Bull Oak (*Allocasuarina luehmannii*) or *Acacia* species such as Brigalow (*A. harpophylla*). They shelter in logs, abandoned rabbit warrens, rock crevices, tree roots and sink holes. Impacts associated with the proposed project could include:

- temporary loss of remnant woodland vegetation that could provide habitat for Yakka Skink
- trenchfall
- increased pest animal abundance associated with improper disposal of food waste
- destruction of colony shelters (log piles, rock piles, warrens, etc.)
- direct mortality through excavation works and collisions with vehicles during construction, operation and maintenance.

2.2.12.2 Assessment of potential impacts with mitigation

Table 17 summarises potential direct and indirect impacts of the project on Yakka Skink populations and proposed measures to mitigate potential impacts. The table provides a risk assessment for each impact with and without mitigation measures.

Table 17 Raw risk (before mitigation) and residual risk (after mitigation) associated with construction of the ABP on Yakka Skink

Impact	Raw Risk before mitigation	Mitigation measures	Residual Risk after mitigation
Direct impacts			
Removal of habitat Removal of remnant vegetation representing potential foraging, breeding and sheltering habitat	M	-minimise areas of remnant vegetation to be cleared -use existing cleared corridors where possible -clearly mark out areas to be cleared and retained -rehabilitate the ROW following construction -reinstate microhabitat (logs, etc) after construction	L
Trenchfall Death of individuals trapped in the trench	M	-employ a spotter catcher to check microhabitat prior to clearing and to remove individuals before clearing commences -monitoring of open trenches by fauna spotter catchers during the construction period -minimise the length of time the trench is open -implement measures to protect colonies identified/relocated adjacent to ROW	I
Fatalities Death of individuals via vehicles and equipment during clearing, construction and operation	L	-maintain an appropriate speed limit in the ROW especially in areas where the ROW goes through remnant vegetation -employ a spotter catcher to check microhabitat prior to clearing and to remove individuals before clearing commences -consider pre-clearance trapping or spotlighting to capture individuals prior to clearing if a population is found in the ROW -employ a spotter catcher during construction to be on hand during clearing to move displaced animals	I
Indirect impacts			
Changes in water quality Impacts to water quality upstream leading to changes in vegetation/habitat downstream	NA	-no mitigation measures for water quality recommended for this species as it is not dependent on aquatic habitats or riparian vegetation	NA
Changes in hydrology Changes in wet/dry cycling of waterways caused by damming, changes in morphology or diversions	NA	-no mitigation measures for hydrology are recommended for this species as it is not dependent on aquatic habitats or riparian vegetation	NA
Habitat fragmentation Fragmentation of habitat leading to a reduction in remnant size, increased edge effects and isolation of population	L	-minimise areas of remnant vegetation to be cleared -use existing cleared corridors where possible -rehabilitate the ROW following construction -reinstate microhabitat (logs, etc) after construction	L
Increase in weed abundance Increased competition with native plant species used for foraging and shelter Smothering of native vegetation	L	-develop and implement a weed management plan -control weeds in the ROW before, during and after construction -implement site weed hygiene protocols	I

Increase in introduced predator abundance Increase in introduced predator abundance caused by increased food availability in the ROW	L	-develop and implement a Waste Management Plan -develop and implement a Pest Management Plan -educate staff about the importance of removing any food waste from the ROW -keep the work site clean of debris which could be used as shelter for introduced predators	L
Removal of micro-habitat Removal of logs, leaf litter and debris	M	-rehabilitate the ROW following construction -reinstate microhabitat such as logs, rocks and leaf litter after construction -Pre-clearance surveys will be conducted along the ROW prior to construction to identify important microhabitat -all log piles found to have Yakka Skink colonies should be relocated to adjacent habitat using a qualified spotter catcher	L
Noise and disturbance Disturbance caused by noise or human disturbance leading to stress, disease and abandonment of habitat.	NA	-no mitigation measures for noise are recommended for this species as it is not likely to be impacted by noise	NA
Spread of disease	NA	-no mitigation measures for reducing the spread of disease are recommended for this species as there are no known diseases for this species which could be spread by human activities	NA

I- Insignificant, L- Low, M – Moderate, H – High, E- Extremely High, NA - impact not likely to occur.

The project will result in the temporary loss of some remnant vegetation that could provide habitat for Yakka Skink. This species was not recorded during the surveys and no known records of this species occur within the ROW. Progressive construction of the pipeline within the ROW (which will limit the extent of disturbance at any one time) and progressive rehabilitation immediately following construction (which will restore many of the microhabitat features) will limit the impacts to potential habitats.

This species can occur in cleared and disturbed habitats (including around human habitation) as long as the microhabitat features needed for the colony are present (e.g. log piles, rabbit warrens or cement slabs). Provided that the ROW is rehabilitated and logs and other microhabitat features are returned to the ROW following construction, the impact of habitat clearing on this species is likely to be **Low**.

There is a small chance that Yakka Skink could fall in open trenches. Trenches will be regularly checked by experienced personnel every morning to check for animals that may have fallen into the trench overnight. To reduce the number of animals falling into the trench, pre-clearance surveys will be undertaken to facilitate relocation where appropriate and the amount of trench open during construction at any one time will be minimised as much as possible.

Refuges (such a moistened sacks) will also be placed within the trench to shelter animals and reduce mortalities. If any skinks are detected in the trenches, they will be captured and released into suitable habitat a safe distance from where the works are occurring. With these mitigation measures, the impact of trenchfall on Yakka Skink is considered to be **Low**.

There is a small chance that a Yakka Skink could be killed or injured during clearing or construction activities as a result of vehicle strike or excavation works. Pre-clearance surveys will be conducted along the ROW prior to construction to identify potential colony sites (e.g. log piles with evidence of Yakka Skink occupation). If an active colony is found in

the ROW, the preferred option is to avoid it by a minor realignment of the pipeline. If the colony cannot be avoided, the colony will be relocated to a suitable area adjacent to the ROW by a qualified spotter catcher, in accordance with an approved translocation management plan. Colonies adjacent to the ROW will be monitored during construction works to ensure that impacts are minimised. Provided that proposed mitigation measures are implemented, the risk of Yakka Skink fatalities is considered to be **Low**.

Construction of the pipeline is not expected to change the risks to Yakka Skink resulting from the introduction of pests. Introduced predators (such as foxes and cats) that are present and active in the area are able to transit the area using existing tracks and fencelines. Reasonable management measures, such as the removal of food waste from the ROW and induction programs which stress the importance of not feeding animals will ensure a **Low** level of risk from pests.

Yakka Skink colonies rely on log piles, rock piles, old rabbit warrens and burrows for shelter. Logs will be temporarily placed on the edge of the ROW during vegetation clearing. Logs removed from the ROW will be placed back in the ROW after construction so the loss of these features will only be temporary. Therefore, the impact of removal of micro-habitat on Yakka Skink is likely to be **Low**.

Overall the impact of the ABP project on Yakka Skink is considered to be **Low** provided that all the mitigation measures listed in Table 26 are implemented.

2.2.13 Evaluation under MNES significant impact guidelines

The *Draft referral guidelines for nationally threatened Brigalow Belt reptiles* states that important habitat should be used as a surrogate for important population during assessments involving Brigalow Belt reptiles. Important habitats for Yakka Skink include any contiguous patch of suitable habitat, particularly remnant vegetation, where a colony is known or identified, and any microhabitat where colonies are likely to be found. Given the Yakka Skink's longevity (up to 20 years), low fecundity (2-5 years to sexual maturity), high site-fidelity, and highly fragmented populations, this species may be prone to localised extinctions. The presence of important habitat is assessed under the four criteria specified in the guidelines.

Suitable habitat for this species is considered important habitat if it is:

Habitat where the species has been identified during a survey

This species was not recorded during surveys in the study site, therefore the ABP ROW is not considered to contain important habitat under this criterion.

Near the limits of the species known range

The ABP is not located near the limit of the species' known range. Therefore the habitat along ABP is not considered important habitat under this criterion.

Large patches of contiguous, suitable habitat and viable landscape corridors (necessary for the purposes of breeding, dispersal or maintaining the genetic diversity of the species over successive generations)

The pipeline passes through large patches of remnant vegetation that contain suitable habitat and that could be used for dispersal. Therefore some of the habitat within the ABP ROW could be considered suitable habitat under this criterion.

A habitat type where the species is identified during a survey, but which was previously thought not to support the species

This species was not recorded during surveys and was not recorded in habitat not previously thought to support the species. Therefore the habitat along ABP is not considered important habitat under this criterion.

Is there an important population of this species in the study site?

No Yakka Skinks were recorded during surveys. The ABP transects potential habitat for this species however, there is no evidence that the pipeline will transect an important population. Furthermore, the ROW contains no potential habitat within the area mapped as 'known or likely to occur' by DEWSPaC.

Will the action lead to a long-term decrease in the size of an important population of a species?

No Yakka Skinks were recorded during surveys. Pre-clearance surveys will be conducted along the entire alignment to identify any Yakka Skink colonies present in the ROW. Provided that any colonies discovered in the ROW are avoided or relocated to adjacent habitat and measures are implemented to protect colonies adjacent to the ROW, it is unlikely that any significant number of Yakka Skinks will be impacted during the project. Therefore it is unlikely that the project will result in a long-term decrease of an important population of Yakka Skink.

Will the action reduce the area of occupancy of an important population of a species?

The ROW contains no potential habitat within the area mapped as 'known or likely to occur' by DSEWPaC and 254.65 ha of potential habitat within the area mapped as 'may occur'. Although no colonies were detected during surveys, the removal of this habitat may temporarily reduce the occupancy of this species. Progressive construction of the pipeline within the ROW (which will limit the extent of disturbance at any one time) and progressive rehabilitation immediately following construction (which will restore potential habitat and microhabitat features) will allow the majority of the disturbed area to be reoccupied in a relatively short timeframe. Therefore it is unlikely that the project will reduce the area of occupancy of an important population of Yakka Skink in the long term.

Will the action fragment an existing important population into two or more populations?

Construction will clear potential habitat which is not mapped as "known or likely to occur" by

DSEWPaC. Surveys of the ROW have not identified any Yakka Skinks within the area to be cleared. Due to the narrow clearing footprint and short duration of the disturbance, clearing of the ROW is unlikely to fragment an existing important population of this species in the long term.

Will the action adversely affect habitat critical to the survival of a species?

No critical habitat for brigalow belt reptiles has been identified on the Register of Critical Habitat under the EPBC Act within the proposed ABP project area. No habitat has been identified as habitat critical for the survival of Yakka Skink in the *Draft referral guidelines for nationally threatened Brigalow Belt reptiles.* The action is not likely to affect habitat critical to the survival of this species.

Will the action disrupt the breeding cycle of an important population?

Provided that pre-clearance surveys are conducted along the ROW prior to construction and any colonies found are avoided or moved to adjacent habitat, it is unlikely that the breeding cycle of this species will be significantly impacted by the proposed development.

Will the action modify, destroy or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?

The ABP project will result in the modification and removal of some potential habitat for Yakka Skink, but the proposed clearing within the project site is a relatively small area in comparison to the extent of similar habitat available in the local area. Some temporary reduction in the occupancy of this species is possible but this species can occur in open habitats so it is likely that animals would reoccupy the ROW after rehabilitation and reinstatement of microhabitat features such as logs, rocks and leaf litter. Therefore it is unlikely that the action will modify or remove habitat to the extent that the species is likely to decline.

Will the action result in harmful invasive species becoming established in the species' habitat?

Field surveys have identified a number of invasive flora species and feral animals in the project site. Pest and weed management plans will ensure these species are adequately managed during both the construction and operational phases of the project so it unlikely that the action will result in the establishment of invasive species.

Will the action result in the introduction of disease(s) that may cause the species to decline?

There are no known diseases likely to be introduced to the project site that would significantly affect the Yakka Skink.

Will the action interfere substantially with the recovery of the species?

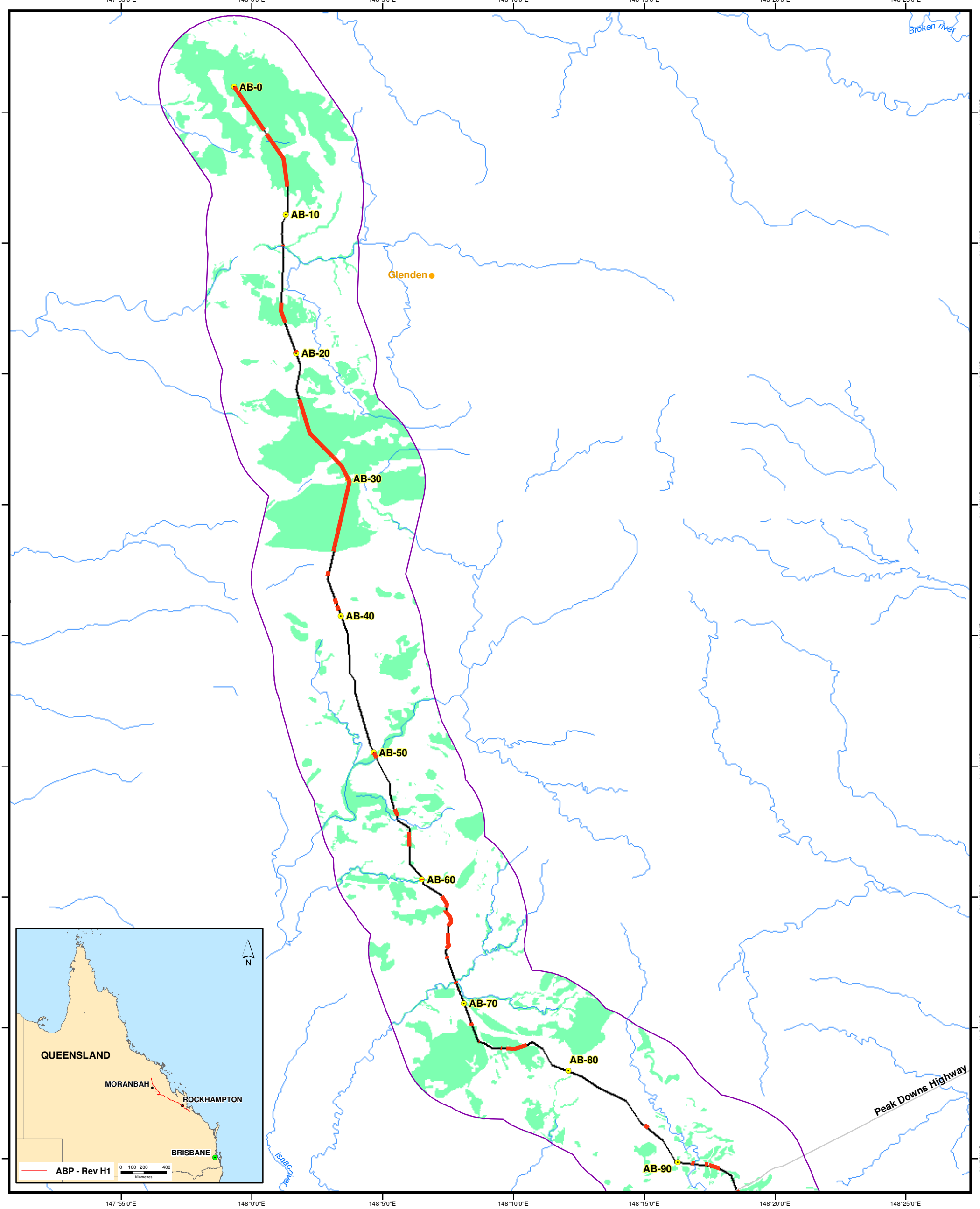
The action is unlikely to significantly impact on the recovery of the species at a national level. Construction will temporarily clear potential habitat which is not mapped as "known or likely to occur" by DSEWPaC. Surveys of the ROW have not identified any Yakka Skinks within

the area to be cleared. Due to the narrow clearing footprint and short duration of the disturbance, clearing of the ROW is unlikely to fragment an existing important population of this species in the long term.

Construction will temporarily clear potential habitat which is not mapped as “known or likely to occur” by DSEWPaC. Surveys of the ROW have not identified any Yakka Skinks within the area to be cleared. Due to the narrow clearing footprint and short duration of the disturbance, clearing of the ROW is unlikely to fragment an existing important population of this species in the long term.

2.2.14 Conclusion

Given this species’ secretive habit, the clumped nature of its distribution and the area of potential habitat, it is possible that Yakka Skink is present within the ROW. However, disturbance effects are contained within non-critical habitat and no identified individuals were located during targeted searches. The impact of the project on this species will be of low overall significance.



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BE004_MP_006C_Yakka_Skink_RevH1

Job Number: BE004

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REV	By	CHK	Description	Date

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Coordinate System:
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LEGEND

- City or town
- Kilometre Point
- Waterway or Coast Line
- Main roads
- ABP - Rev H1
- Potential Habitat in ROW (Field Verified)
- Potential Habitat in Buffer (from State RE Mapping)
- Buffer (5 km)

Yakka Skink

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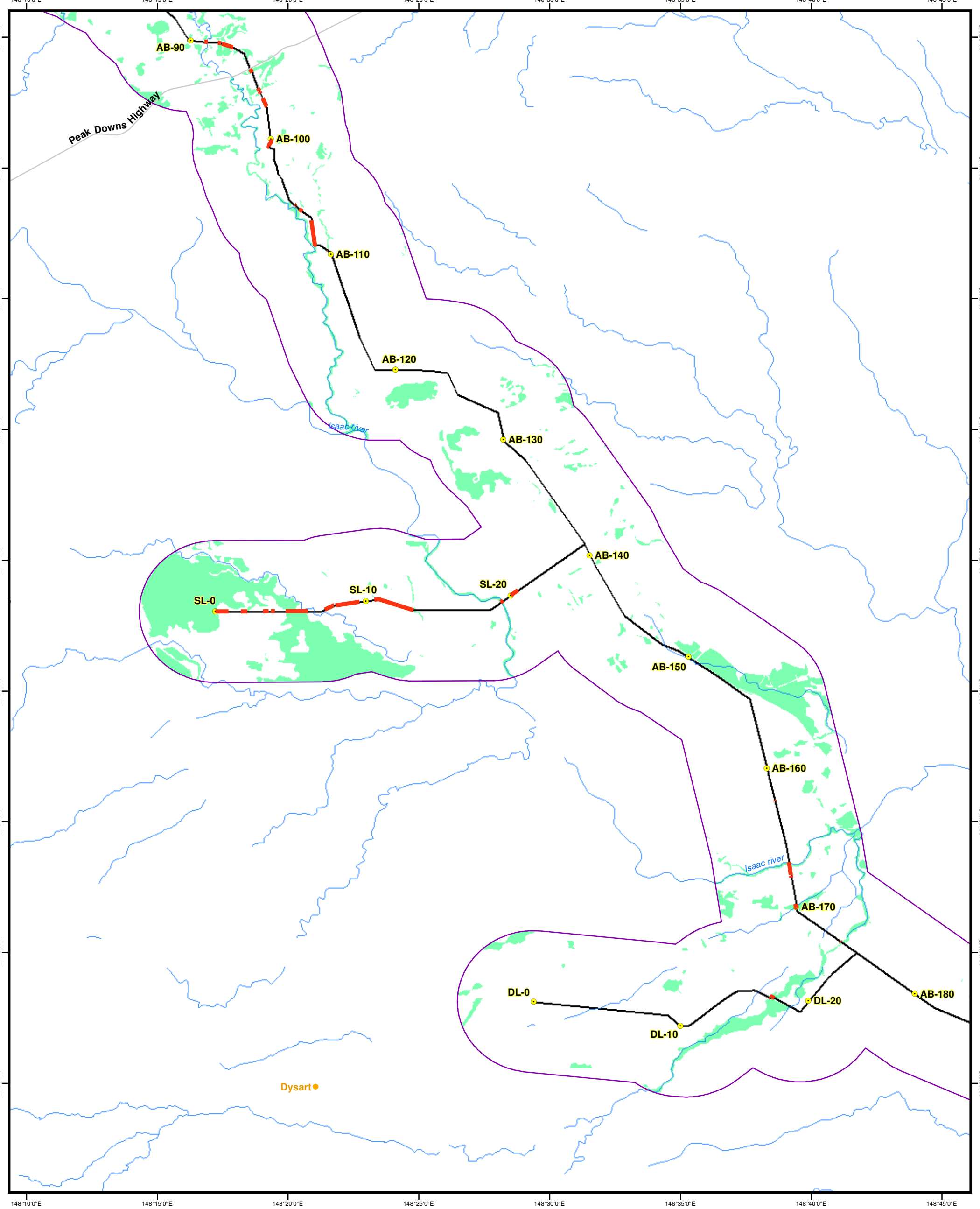
Revision H1

Page 1 of 7

A3



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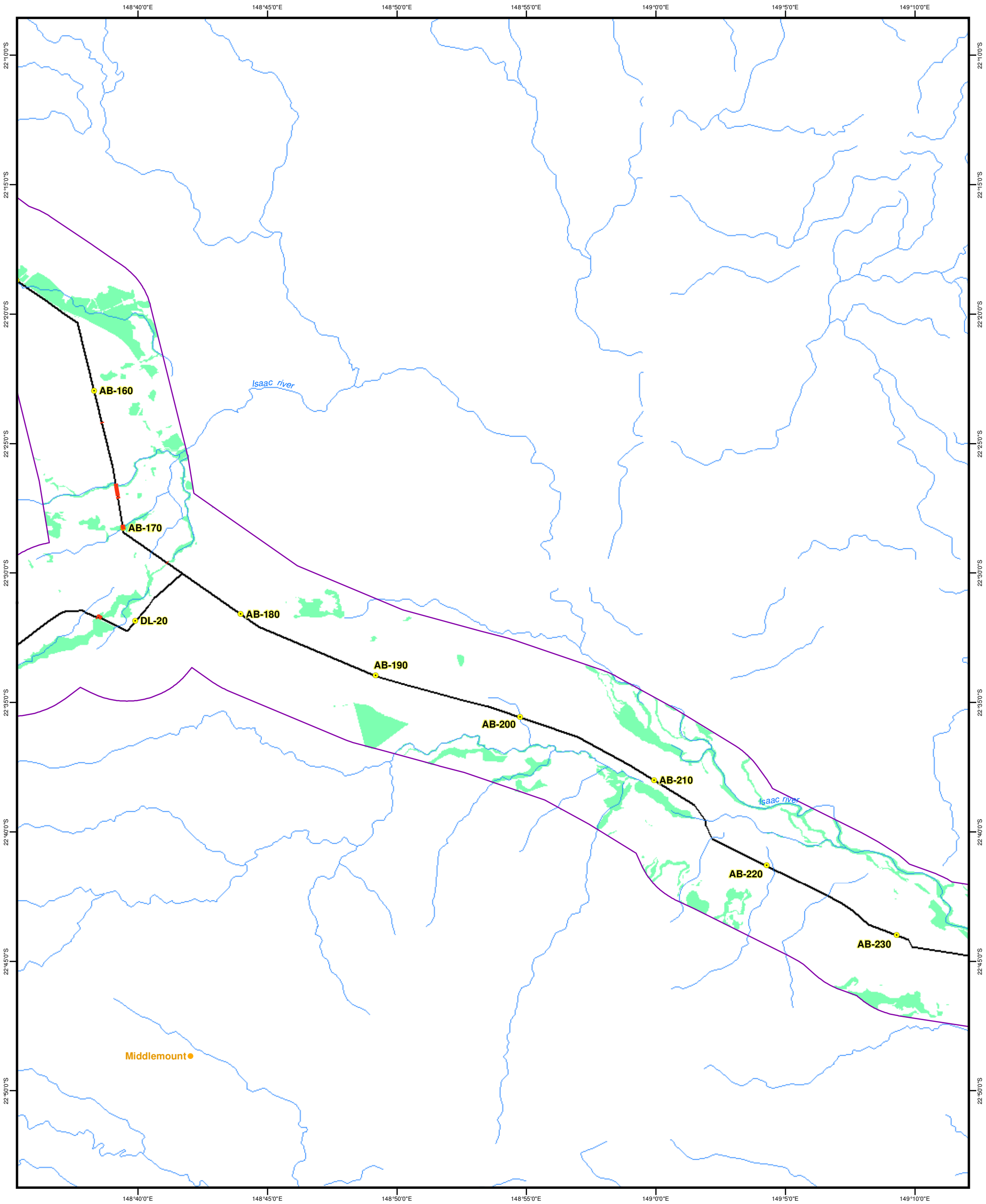

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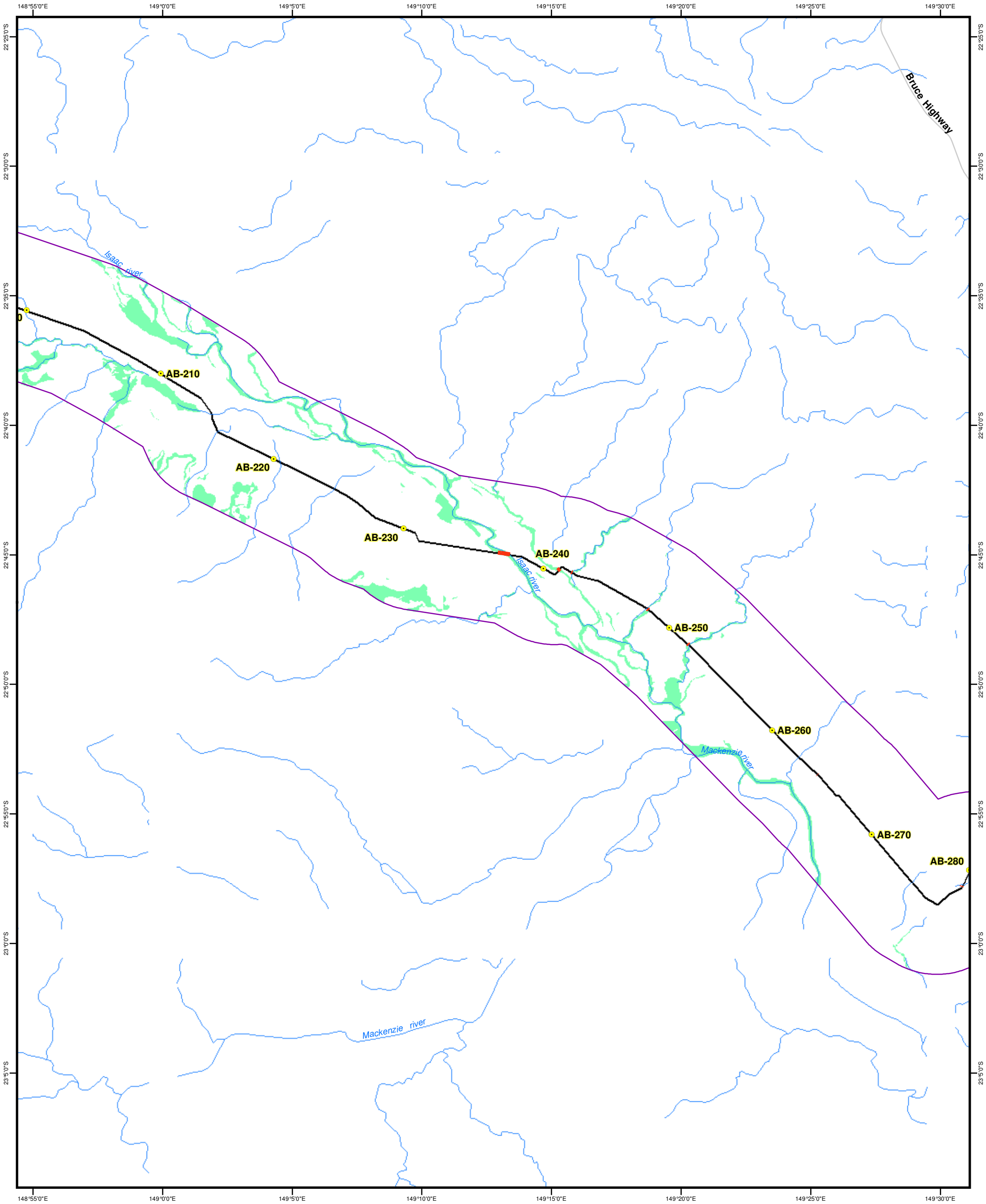
Revision H1

Page 3 of 7

A3



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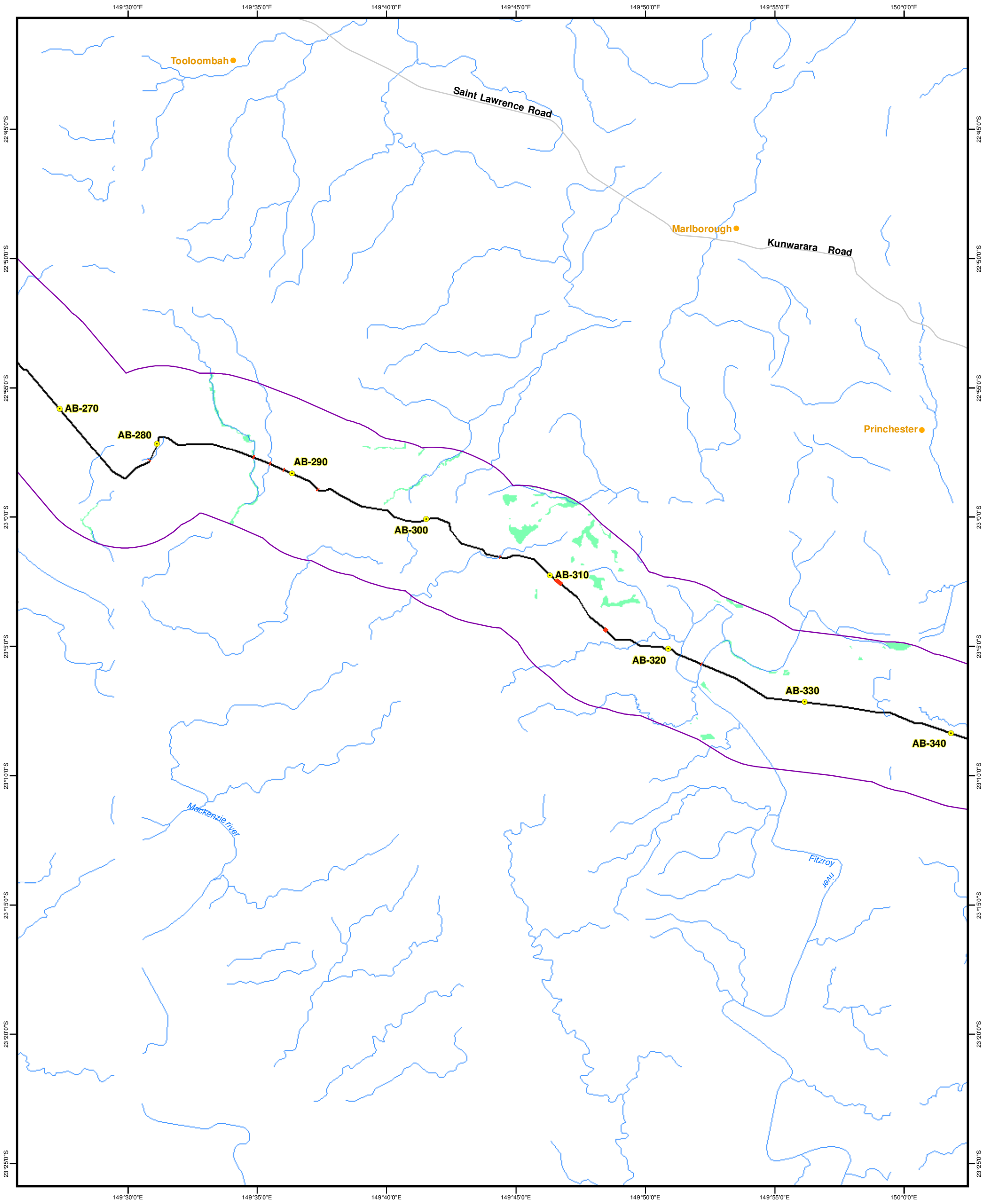

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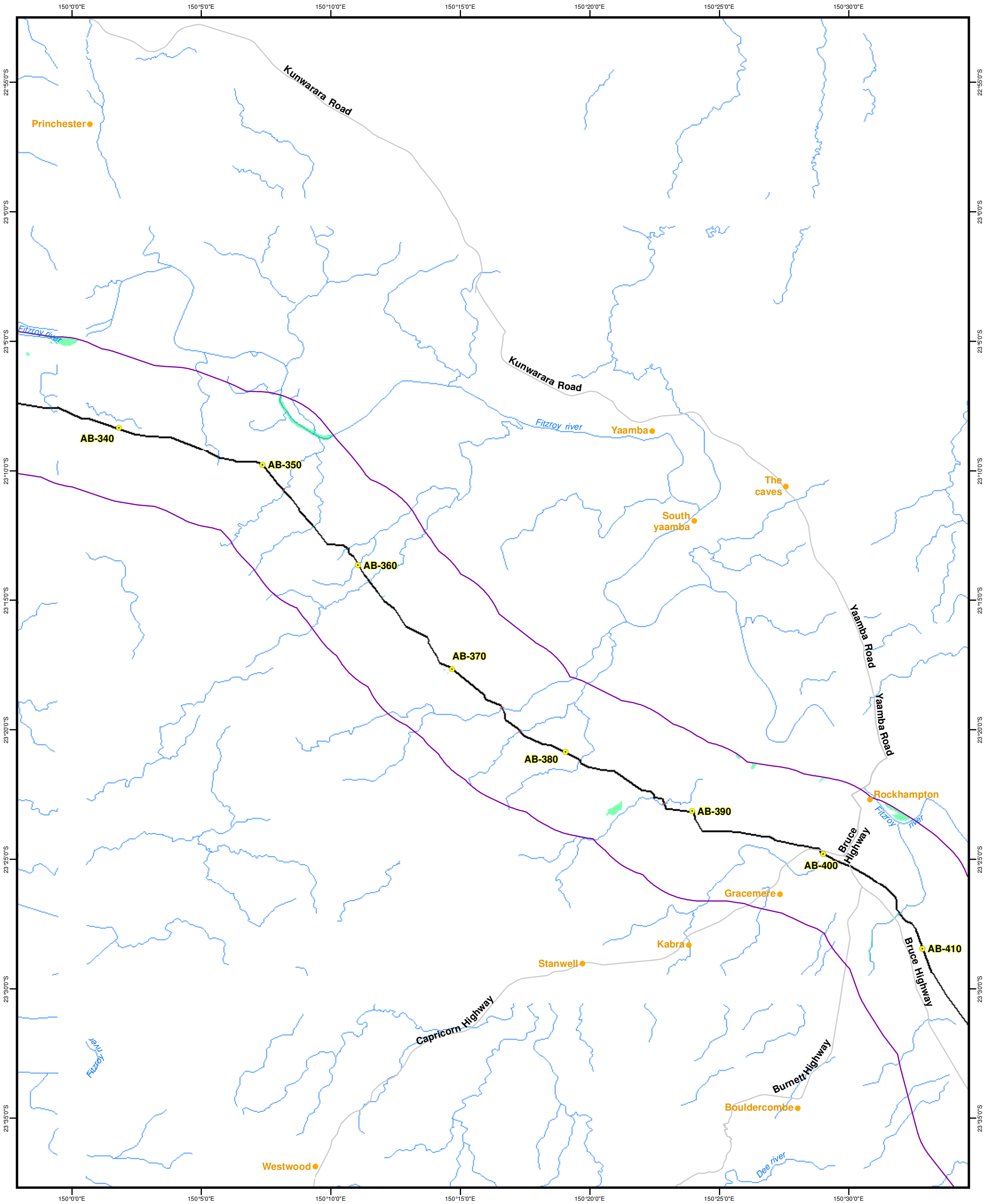

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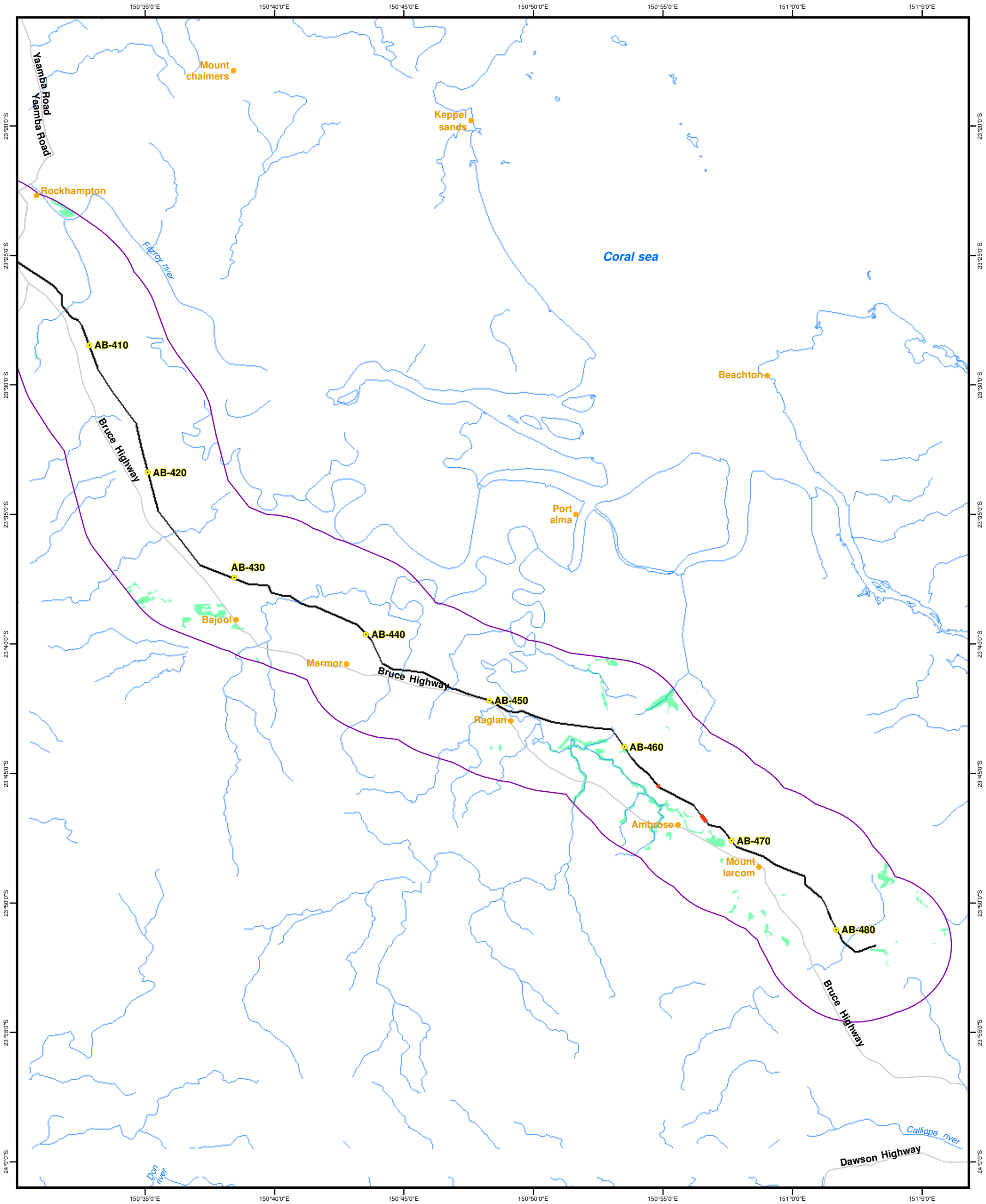

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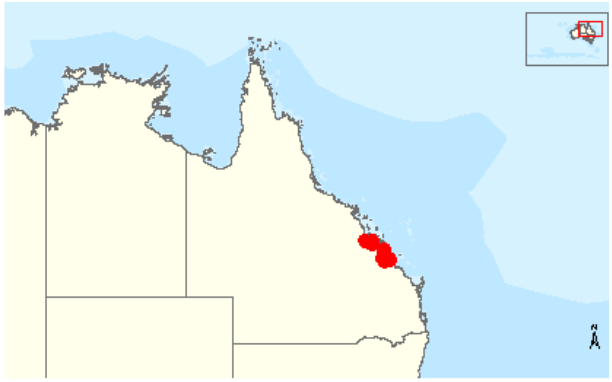
2.3 *Epthianura crocea macgregori (Dawson Yellow Chats)*

Yellow Chat. Photo by Brendan Cook, Avisure



Distribution of Dawson Yellow Chat in Australia. Source: DSEWPaC 2013

Acknowledgement

Arrow Energy would like to acknowledge the contribution made by Wayne Houston from Central Queensland University in the development of this species dossier.

2.3.1 Conservation Status

Queensland: Endangered under the NC Act

National: Critically Endangered under the EPBC Act

2.3.2 Description

The Dawson Yellow Chat, also known as the Capricorn Yellow Chat, is around 11 cm in length and weighs about 9 g (DSEWPaC, 2013a). Adult males are mainly yellow-olive above with a rich golden-yellow head and rump and black crescent on the breast. Adult females are bright yellow on the breast and rump, have a yellow eyebrow and lack the distinct black mark on the breast (Houston et al. 2004a). Juveniles have a more even brown colour on the upperparts, light brown throat and breast, and otherwise paler yellow underparts (Houston et al. 2004a).

2.3.3 Distribution

The Dawson Yellow Chat is restricted to coastal areas of central Queensland (Schodde & Mason 1999) (Figure 3). Breeding populations are known to occur on the Torilla Plain and Fitzroy River Delta (Houston et al. 2004b, 2006). An extensive survey conducted in 2007 failed to detect a population of Dawson Yellow Chat that was previously recorded on Curtis Island in 2002 (Houston et al. 2004a). The current total extent of occurrence is estimated to be between 130 and 145 km² (W. Houston 2007, pers. comm.).

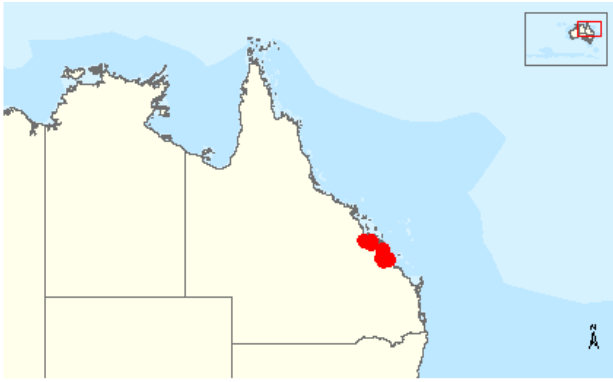


Figure 3 Distribution of Dawson Yellow Chat in Australia. Source: DSEWPaC 2013

2.3.4 Habitat

This section has been contributed by

Dawson Yellow Chats occur on marine plains (i.e. shallow coastal bays that slowly filled with sediments from tidal deposition, or a combination of tidal and fluvial processes about 10,000 years ago). Habitat comprises grass-sedge wetlands (especially those dominated by *Schoenoplectus litoralis* or *Cyperus alopecuroides*) or supratidal saltmarshes (a mixture of the samphire *Tecticornia pergranulata* and the grass *Sporobolus virginicus*) that are temporarily flooded, with pools becoming brackish to hypersaline as they dry (Houston 2010; Houston et al. in press). They also occur in shallow grass-sedge swamps on alluvial plains but only where these immediately abut known marine plain habitats. In some parts of their range they move between breeding habitat and dry season habitat (including the vegetated banks of saltfields) (Houston 2010). Four sites (including two saltfields) have been confirmed as being currently used by Dawson Yellow Chats during the drier months.

Nesting has only been observed in relatively tall sedge, grass or samphire vegetation (typically > 0.25 m) located on channel and pool edges of supratidal saltmarshes and grass-sedge wetlands of marine plains (Houston 2010; Houston et al. in press).

During the breeding season chats typically forage on the muddy surfaces around pool margins and on the foliage of the sedges, grasses, samphire and associated shrubs (e.g. *Sesbania, Avicennia* and *Myoporum*) (Houston 2010). In the dry season, chats forage around the edges of dried swamps in tall grasses, samphire, low shrubs, on bare substrates and the margins of saltfield evaporation ponds. Dawson Yellow Chats typically forage close to vegetation, presumably for protection from predators.

Their dispersal requirements are not known but Dawson Yellow Chats move between breeding habitat and dry season grounds over distances of 10 km or less (Houston 2010). These sites are separated by mostly unvegetated saltflats, although these flats have small

patches of mangrove and saltmarsh embedded in them that could be used in a “stepping-stone” fashion. Also, the margins of these saltflats are bordered on the terrestrial side by the alluvial plain and the transition zone between the two, and on the marine side by mangroves. The grassy margins of the marine – alluvial plain transition zone also support grass-sedge swamps that may provide temporary habitat for dispersing birds.

Suboptimal habitat may be used in drought or flood years. Habitats of interest include those linked to known chat sites such as nearby alluvial plain wetlands or creek pools immediately upstream of marine plain habitats.

It is also likely that, with continuing search effort, chats will be reported in some areas currently regarded as unoccupied. This may be a consequence of climatic phase (e.g. a sequence of wetter years will enhance some wetland vegetation) or climatic change leading to loss of some existing habitat, but creation of new habitat.

2.3.5 Ecology

This section has been contributed by Wayne Houston from Central Queensland University.

Dawson Yellow Chats are thought to be primarily insectivorous, although they do have a brush tongue and may be capable of feeding on nectar as well. Analysis of stomach contents of Yellow Chats from inland Australia showed that flies (Diptera) comprised the greatest proportion, but with beetles (Coleoptera), homopteran bugs (Hemiptera), lacewing larvae (Neuroptera), caterpillars (Lepidoptera), ants (Formicidae: Hymenoptera) and spiders (Araneae) also present. Dawson Yellow Chats have been observed feeding on caterpillars, spiders, damsel flies (Odonata), moths and winged ants (Houston et al. 2004a; Houston et al. 2004b; Houston 2010).

Dawson Yellow Chats breed mainly in the wetter months corresponding to late spring, summer and early autumn but can breed in any season or month following substantial rainfall (Houston 2010; Houston 2013). Breeding commencement is correlated with rainfall and follows substantial inundation of their breeding habitat which may be a breeding cue (Houston 2010; Houston 2013). Dawson Yellow Chats return to the same areas to breed each year.

Pairs build concealed nests in low vegetation close to the ground, often in clumps of vegetation over shallow water. Two to four eggs are usually laid with both parents incubating and feeding the young (Houston 2010). The incubation period is estimated at 13-14 days and nestling duration at 12-14 days. Fledgling stage (time to independence following leaving the nest) is thought to be at least 13-14 days but may be longer. Nesting pairs defend a ‘territory’ around the nest site but, following fledging, family groups range more widely across the breeding grounds.

Post-breeding aggregations of up to 80 birds have been observed, typically in the late autumn-early winter period (Houston 2010).

Breeding season

Likely breeding season	Breeding unlikely

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

2.3.6 Activity period

The Dawson Yellow Chat has been observed to be most active during the wet season and is capable of dispersing over long distances in response to changes in weather patterns. They appear to be territorial during the breeding season with pairs and family groups of up to six being recorded.

2.3.7 Threats

This section has been contributed by Wayne Houston from Central Queensland University.

Dawson Yellow Chats are threatened by habitat loss or degradation due to industrial development (e.g. port facilities, rail corridors, pipelines), saltfield expansion and shale oil mining (Houston and Melzer 2008). Developments that reduce the amount of freshwater surface runoff reaching the marine plain breeding habitats, impacting on wetland productivity and vegetation structure, are of great concern (Houston 2010, Houston et al. in press).

Other threats include weed invasion by exotic pasture grasses leading to loss of sedge nesting habitat, over-grazing leading to loss of tall cover and reduction in sensitive plants such as samphire and sedges, changes in water quality, damage to groundwater aquifers and wildfires. Pigs can damage grass-sedge swamps by digging up and consuming food species such as *Schoenoplectus* and *Eleocharis*. Increases in predator numbers (e.g. cats and pigs) are also a threat to ground nesting species such as Dawson Yellow Chats.

Sea level rise was recently identified as a major threat to the subspecies with most Dawson Yellow Chat sightings averaging less than 2 m above current highest astronomical tidal influence. These sites will become tidal or be subject to regular storm surge influence under future modest predicted sea level rise scenarios of 0.5 m by 2100 (Houston et al. in press).

2.3.8 Recovery actions

The overall objective of the National Recovery Plan for Yellow Chat (Houston and Melzer, 2008) is to improve the conservation status of the Dawson Yellow Chat and manage its habitat. The plan has three main objectives:

- protect, enhance and manage Dawson Yellow Chat habitat
- address known threats, and identify and quantify potential threats
- increase knowledge and awareness of the Dawson Yellow Chat through the development of an extension program targeting the community, industry and landholders.

2.3.9 DSEWPaC recommended survey methods

The *Survey Guidelines for Australia's Threatened Birds* (Commonwealth of Australia, 2010) contains recommended guidelines for surveys of Dawson Yellow Chat. This species can be difficult to survey due to difficulty in accessing its preferred swampy grassland habitat. During the breeding season the males are often conspicuous while they are calling and engaging in display flights (Commonwealth of Australia, 2010). The species is much less conspicuous in the non-breeding season. Unfledged juveniles hide in reed beds and can be difficult to detect.

DSEWPaC recommends area searches and transect point surveys of all suitable habitat. The surveys should be conducted in the early morning or late afternoon particularly in the breeding season (Commonwealth of Australia, 2010).

The maximum area impacted by the ABP would be approximately 6.89 ha (assuming no avoidance by trenchless crossing, refer below - mitigation measures). For areas less than 50 ha, DSEWPaC recommends the following area searches and transect surveys for Dawson Yellow Chat.

Area searches

Area searches entail searching a defined area for a defined period of time. Each selected area is searched systematically, while investigating possible sightings, calls or signs of presence (Commonwealth of Australia, 2010). This method is likely to be the most suitable for surveying Dawson Yellow Chat as the habitat preferences of this species are specific and a meandering technique will allow these areas to be investigated fully. The recommended effort for Dawson Yellow Chat using this method is 12 hrs of searching in suitable habitat over 4 days.

Transect surveys

Transect surveys involve travelling along a pre-defined path between two points for a known distance and recording any birds heard or seen. These surveys can be done on foot or from a vehicle. The length of each transect generally depends on the width of habitat being surveyed. The recommended effort for Dawson Yellow Chat using this method is 10 hrs of survey in suitable habitat over 3 days.

2.3.10 Survey effort and methods undertaken for ABP

2.3.11 Field survey methods

Targeted surveys for Dawson Yellow Chat were undertaken in December 2011 and March 2012. A total of 18 locations between Rockhampton and Gladstone were surveyed for Dawson Yellow Chats (and other species) over approximately 9 hours. Surveys at these sites consisted of call playback and area searches.

2.3.12 ABP survey results

Yellow chats were recorded during two surveys conducted by EcoSM. Two birds were detected at Twelve Mile Creek in December 2011 and another two birds were recorded at a nearby location in March 2012. These sites are approximately 1 km north of the proposed ABP pipeline at KP 443.7. During both surveys, the presence of Dawson Yellow Chats was confirmed by both call identification and visual observation.

Dawson Yellow Chats are known to inhabit several Regional Ecosystems (REs) including 11.1.2b and 1.1.1 (supratidal saltmarshes) and 11.1.3, 11.3.27x1c and 11.3.27x1a (grass-sedge wetlands). However, Dawson Yellow Chats have also been observed in grass-sedge wetlands mapped as non-remnant under EHP RE mapping (mainly due to issues of the coarse scale of mapping or modification by sea walls).

Wetland mapping, both Wetland Management Areas (WMA) and Wetland Protection Areas (WPA), were used to estimate yellow chat habitat as it includes areas of palustrine, lacustrine, estuarine and riverine wetlands which contain both REs and non-remnant vegetation. Based on this mapping, there are approximately 5.41 ha of WPAs and 1.48 ha of WMAs in the ROW between KP 380 and KP 480 (Rockhampton to the end of the alignment) (Table 18). This equates to 0.07 % of the wetlands in the 5 km buffer. Important habitat (0.28 ha) also occurs on Twelve Mile Creek but none of this habitat is mapped as remnant vegetation or a WMA or WPA and therefore has not been included in the area calculation. Based on the information currently available, only the habitat on Raglan,Twelve Mile and Inkerman Creeks (1.24 ha including habitat on Twelve Mile Creek) could be considered habitat critical for the survival of Yellow Chat as this is known habitat for Yellow Chat. All of this habitat would be avoided if HDD is used to cross these creeks. Survey of potential Yellow Chat habitat in the corridor is planned for late 2013. These surveys will determine if any additional critical habitat for Yellow Chat is located within the corridor.

Table 18 Areas of wetlands in ROW and in 5km buffer between Rockhampton and the end of the ROW.

Wetland type	REs in the ROW	Area in 40 m ROW (ha)	Area in 5 km buffer (ha)	% cleared in 5 km buffer	Critical habitat (ha)
Wetland protection areas (WPAs)	11.3.27a, 11.3.27b, 11.3.27c, 11.3.27x1a, 11.3.27x1b, 11.3.3c, non-remnant	5.41	2499.38	0.21	0.32
Wetland management areas (WMAs)	11.1.4d, 11.1.4, 11.1.4b, 11.3.27x1b, non-remnant		6655.66	0.02	0.64
Totals		6.89*	9155.04	0.07	0.96*

* this area does not include approximately 0.28 ha of habitat on Twelve Mile Creek which is not mapped as wetland but is known to be used by Yellow Chat

Habitat mapping for this species will be ongoing throughout the pre-construction period with the data gathered contributing to our understanding of risks and mitigation strategies for this species. An assessment of the impacts on potential habitat is discussed in Section 1.1.11.

2.3.12.1 Other survey results

Birdlife Australia has 35 records for Dawson Yellow Chat in the vicinity of ABP. Most of these records lie approximately 1 km east of KP 443.8 in an area well known for the significant population of Dawson Yellow Chats. One record lies approximately 250 m upstream of the pipeline on KP 443.8 on Twelve Mile Creek. This bird is likely to belong to the population downstream of the line and would have travelled along Twelve Mile Creek. There are also records of Dawson Yellow Chat on Inkerman and Raglan Creeks. On Inkerman Creek a bird was recorded 4.3 km upstream of KP 435 (beside Bajool - Port Alma Rd) and on Raglan Creek birds were recorded 200 m north east of KP 451.5 and 1.6 km upstream of KP 452.

2.3.13 Impacts of ABP on Dawson Yellow Chat

2.3.13.1 Potential impacts without mitigation

If no mitigation measures are implemented, the ABP pipeline could potentially impact Yellow Chat populations through direct impacts to individual birds and indirectly through disturbance to potential habitat and introduction of weeds and pest animals. Direct impacts associated with trenching (both the ROW and the creek crossings) and no mitigation measures could include:

- loss of habitat
- mortality of nestlings and fledglings
- trenchfall of juveniles
- mortality of adults.

Indirect impacts associated with the proposed project could include:

- increase in weed abundance
- increase in pest animal abundance
- noise and disturbance

2.3.13.2 Assessment of potential impacts with mitigation

Table 2 summarises potential direct and indirect impacts of the project on Dawson Yellow Chat populations and proposed measures to mitigate potential impacts. It is likely that trenchless crossing techniques will be used to cross high quality habitat on Raglan, Twelve Mile and Inkerman Creeks. Traditional trenching techniques will be used for the remainder of Yellow Chat habitat. The table below provides a risk assessment for each impact, assuming trenchless crossing techniques will be used across creek crossings and trenching will be used in other habitat. In the unlikely event that crossings could not be safely achieved using trenchless techniques, Arrow will produce a revised significant species management plan which will assess the potential impacts of alternative crossing methods to this species and detail mitigation measures to reduce these impacts.

Table 19 Impacts and mitigation measures associated with construction of the ABP on Yellow Chat.

Potential Impact	Raw risk (before mitigation)	Mitigation measures	Residual risk (after mitigation)
Direct impacts			
Removal of habitat* Temporary removal of wetland habitat which could provide potential foraging, breeding and sheltering habitat	M	-use trenchless techniques to cross Inkerman, Raglan and Twelve Mile Creeks -use existing cleared corridors where possible -clearly mark out areas to be cleared and retained -rehabilitate the ROW following construction -develop a Significant Species Management Plan which includes Yellow Chat -all activities are to remain in the construction area or designated lay-down area -all ancillary areas (e.g., lay down areas, stockpiles etc.) are situated outside of suitable habitat and a buffer of at least 200 m is maintained -if possible, existing access roads will be used to cross creeks thus avoiding constructing new access points -the majority of the ROW (except for a 7 m wide track) will be rehabilitated after construction using native grasses, shrubs and trees.	L*
Mortality of nestlings Direct loss of individuals and loss of genetic diversity from loss of juveniles	M	-where possible, construction activities involving trenching will be planned for times when birds are least active, i.e. outside of dawn and dusk -pre-clearance surveys will be conducted to check for habitat and nests before construction commences -a spotter catcher will check the ROW for nests immediately before and during clearing -if a nest is found in the ROW, a 50 m buffer will be established and construction will not recommence within the buffer area until young have fledged: spotter-catchers will re-check the ROW before construction recommences	L
Trench fall of juveniles Death or stress of juveniles if they fall in the trench	L	-Avoid construction within 50m of active nests	L
Mortality of adults -direct loss of breeding individuals -loss of genetic diversity -reduction in recruitment for following breeding season	L	-use trenchless techniques to cross Inkerman, Raglan and Twelve Mile Creeks -reduce the speed limit for machinery and vehicles in the ROW in areas identified as Dawson Yellow Chat habitat -a spotter catcher will check the ROW for nests immediately before and during clearing -a spotter catcher will be present during clearing in case a Dawson Yellow Chat is injured	L
Indirect impacts			

Potential Impact	Raw risk (before mitigation)	Mitigation measures	Residual risk (after mitigation)
Long term changes in hydrology Changes in wet/ dry season cycle leading to changes in vegetation in Dawson Yellow Chat habitat	L	-use trenchless techniques to cross Inkerman, Raglan and Twelve Mile Creeks	I
Long term changes in water quality -sedimentation of the waterway caused by erosion in the ROW leading to changes in Dawson Yellow Chat habitat -pollution of waterways by hydrocarbons	L	-use trenchless techniques to cross Inkerman, Raglan and Twelve Mile Creeks -construction will be conducted outside the wet season -rainfall forecasts will be carefully monitored to enable management measures to be put in place before large rainfall events -acid sulfate soils will be managed in accordance with the acid sulfate soils management plan -chemical spills will be managed in accordance with the emergency response plan -conduct surveys prior to construction to determine the topography and morphology of the land and creek crossings so that they can be returned to a similar standard during rehabilitation	L
Noise and disturbance* -displacement of individuals into more marginal habitat leading to decreased survival and overall decline in population -abandonment of nests due to disturbance leading to mortality of juveniles	L	-use trenchless techniques to cross Inkerman, Raglan and Twelve Mile Creeks -pre-clearance surveys will be conducted to check for habitat and nests before construction commences -a spotter catcher will check the ROW for nests immediately before and during clearing -if a nest is found in the ROW, a 50 m buffer will be established and construction will not recommence within the buffer area until young have fledged: spotter-catchers will re-check the ROW before construction recommences -noise will be managed in accordance with the noise and vibration management plan. -to avoid disturbance exclude access by construction personnel, vehicles or plant to buffers established around nests	L*
Dust · -smothering of plants used for shelter and foraging -decline in bird health due to dust and pollution	I	-dust will be managed in accordance with the air quality management plan.	I
Increase in weed abundance Smothering of habitat vegetation by weeds potentially leading to loss of	M	- develop and implement a Weed Management Plan - control weeds in the ROW before, during and after construction - implement site weed hygiene protocols	L

Potential Impact	Raw risk (before mitigation)	Mitigation measures	Residual risk (after mitigation)
plant diversity and displacement of native plants			
Increase in pest animal abundance -introduction of exotic predators to habitat i.e. foxes, cats, dogs leading to increased predation on Dawson Yellow Chats -increased predation on eggs by introduced rodents and other predators -increased opportunity for competitors which prefer disturbed habitats	L	-develop and implement a Waste Management Plan -develop and implement a Pest Management Plan -educate staff about the importance of removing any food waste from the ROW - keep the work site clean of debris which could be used as shelter for introduced predators	L
Increase in fire frequency -increased chances of wildfire during construction, e.g. sparks from welding, personnel smoking	L	Implement a no –burning policy	I

* This risk rating will be reassessed following more field surveys.

The construction of the ABP may result in a temporary loss of potential habitat for Dawson Yellow Chat. Further surveys will to be conducted to determine the area and quality of habitat to be impacted. Based on aerial imagery, it is likely that the habitat within the ROW (outside of Raglan, Twelve Mile and Inkerman Creeks) is marginal habitat that would not be suitable for breeding although it may provide foraging habitat.

A total of 6.89 ha of potential wetland habitat occur within the ROW which represents only 0.07 % of the wetland habitat in the 5 km buffer. Another 0.28 ha of potential habitat occurs on Twelve Mile Creek but is not mapped as wetland or remnant vegetation. Arrow is committed to using trenchless techniques (such as HDD) to cross under Raglan, Twelve Mile and Inkerman Creeks, which will significantly reduce the impacts on habitat at these locations. In the unlikely event that crossing using these techniques is not possible, Arrow will produce a revised significant species management plan which will assess the potential impacts of alternative crossing methods to this species and detail mitigation measures to reduce these impacts.

Existing access ways will be used for movement of vehicles and equipment across these waterways, wherever possible, to further reduce disturbance on habitats. Other wetland habitats within the ROW that are disturbed by the project will be rehabilitated following

construction to restore habitat features that are suitable for Dawson Yellow Chat. Arrow is committed to the rehabilitation of the ROW and consequently any impacts to Dawson Yellow Chat habitat will be temporary.

There is a low risk that adult and juvenile Dawson Yellow Chats could be directly killed by vehicles and machinery during clearing or construction activities. However, this bird is mobile and is likely to avoid the construction area. In areas of potential Dawson Yellow Chat habitat the pipeline risk mitigation measures will include pre-clearing surveys to identify nests and the establishment of a 50 m buffer around active nests. Construction will not recommence within the buffer until young have fledged (estimated maximum time from egg to fledging is four weeks). Spotter catchers will re-check the ROW before construction recommences to ensure no additional nests have been established within the ROW. A reduced speed limit to 40 km/h within the ROW will further reduce the risk of collisions with animals. With these mitigation measures the impacts associated with direct mortality of Dawson Yellow Chat is likely to be **Low**.

Breeding by Dawson Yellow Chats is dependent on substantial wet season rainfall and inundation of marine plain wetland habitats (Houston 2010, Houston 2013). This period also corresponds to peaks in the abundance of invertebrates which provide food for adults and their dependent young (Houston 2010, Houston 2013). Thus, any changes in the wetting and drying cycle of wetlands has the potential to impact on Dawson Yellow Chats indirectly through changes in vegetation and associated productivity of invertebrate food. Arrow is committed to use HDD, if geology permits, to cross Twelve Mile Creek where the majority of Dawson Yellow Chat habitat is located. The use of trenchless techniques will avoid impact on the hydrology of Twelve Mile Creek. In the event that an alternative to trenchless techniques must be used then no impact on vegetation, or hydrology would be expected from short-term changes in water flow. Additionally, further mitigation may be provided by undertaking crossings in the dry season when flows in these ephemeral watercourses are minimal or absent.

Changes in water quality could potentially lead to changes in vegetation composition or cover in downstream habitats for Dawson Yellow Chats.

Arrow has committed to the implementation of management plans to manage potential impacts from erosion and sediment, acid sulphate soils and storage and use of chemicals, which will manage the risks associated with water quality. Therefore, the impact of changes in water quality on Dawson Yellow Chat is likely to be **Insignificant**.

The construction of the pipeline could potentially lead to disturbance of Dawson Yellow Chats through:

- noise of machinery including excavators, reversing alarms and cranes
- noise of vehicles including running vehicles and closing doors
- people approaching birds and their habitat
- people speaking and yelling
- lights at night.

Disturbance of Yellow Chats is most likely in areas of potential habitat associated with Raglan, Twelve Mile and Inkerman Creeks. Construction activities in wetland areas between KP 380 to 483, has the potential to disturb Dawson Yellow Chats. The risk mitigation measures identified in Table 2 above will be applied to manage risks associated with construction in these areas. Utilisation of these measures will reduce construction level impacts to Low.

Construction may result in a short term disturbance of Dawson Yellow Chat behaviour, and no significant long term impacts are expected. The use of trenchless techniques to cross Raglan, Twelve Mile and Inkerman Creeks will provide additional buffer between construction disturbance and habitat. The risk associated with construction disturbance on Dawson Yellow Chat is expected to be Low.

Construction of the pipeline is not expected to change the risks to Dawson Yellow Chat from the introduction of Pests. Introduced predators (such as foxes and cats) are present and active in the area. Reasonable management measures, such as the removal of food waste from the ROW or induction programs which stress non-feeding of animals will ensure a Low level of risk from pests.

2.3.14 Evaluation under MNES significant impact guidelines

Will the action lead to a long-term decrease in the size of a population?

Adoption of the management measures within Table 2 above would result in a low level of risk to the population. When combined with rehabilitation measures a long term decrease to the population would not be expected.

No long term effects are expected from operational activities as these activities will be low level impacts associated with periodic inspections along the pipeline.

Will the action reduce the area of occupancy of the species?

The majority of these wetlands are mapped as non-remnant and are likely to be heavily degraded by invasive species such as para grass. Provided that habitat and wetland areas within the ROW are rehabilitated after construction and other proposed measures to mitigate indirect impacts are implemented, the project is unlikely to significantly reduce the occupancy of Dawson Yellow Chats in the Fitzroy River Delta.

Will the action fragment an existing population into two or more populations?

Dawson Yellow Chats will be able to move freely across the ROW. Rehabilitation of disturbed wetland and habitat areas will restore connectivity to current levels and no fragmentation the existing population is considered likely.

Will the action adversely affect habitat critical to the survival of a species?

The National Recovery Plan for Dawson Yellow Chat suggests that wetlands and associated grasslands on seasonally inundated marine plains are critical habitat for Dawson Yellow

Chats. The Torilla Plain area (over 60 km north-east of the ABP) is likely to be especially critical for the species survival given that 75% of the population occurs there. No impact will occur in this critical habitat. Critical habitat is also likely to occur on Twelve Mile and Raglan Creeks where birds have been recorded nearby. HDD will be used to cross both Raglan and Twelve Mile Creeks so it is unlikely that the construction of the pipeline will have any impact on critical habitat for Yellow Chat.

Surveys in the ROW have not been completed but based on aerial imagery, RE mapping, survey results from nearby areas and information from Dawson Yellow Chat experts, the potential habitat outside of Raglan, Inkerman and Twelve Mile Creeks is unlikely to be critical habitat for this species.

Will the action disrupt the breeding cycle of a population?

The use of pre-clearance and spotter catcher surveys, combined with the establishment of buffer zones around identified nests will reduce any potential disruption of the breeding cycle for the population. Provided these measures are implemented, the project is unlikely to disrupt the breeding cycle of Dawson Yellow Chats.

Will the action modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?

No long term impact to habitat is expected from the construction or operation of this pipeline. The ROW is expected to contain marginal habitat degraded by invasive species (such as paragrass) and clearing to support construction will not remove significant amounts of habitat (conservative estimate of clearing is expected to be less than 0.2% of available habitat within 5 km of the ROW).

Inkerman Creek, Raglan Creek and particularly Twelve Mile Creek are considered to contain important habitat for Dawson Yellow Chats. Provided that proposed mitigation measures are implemented for these creeks, including HDD of crossings, sediment and erosion control, and rehabilitation after construction, impacts to these areas of habitat are likely to be negligible.

Habitat impacts from construction or operation of the pipeline are not likely to result in the decline of this species.

Will the action result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat?

The Action will not increase predator access to Yellow Chat habitat. Provided that food waste is removed from the ROW and a pest management plan is put in place, it is unlikely that the action will result in an introduced species becoming more abundant in the area.

Will the action introduce disease that may cause the species to decline?

There are no known diseases of Dawson Yellow Chats which could be introduced to the

area through construction.

Will the action interfere with the recovery of the species?

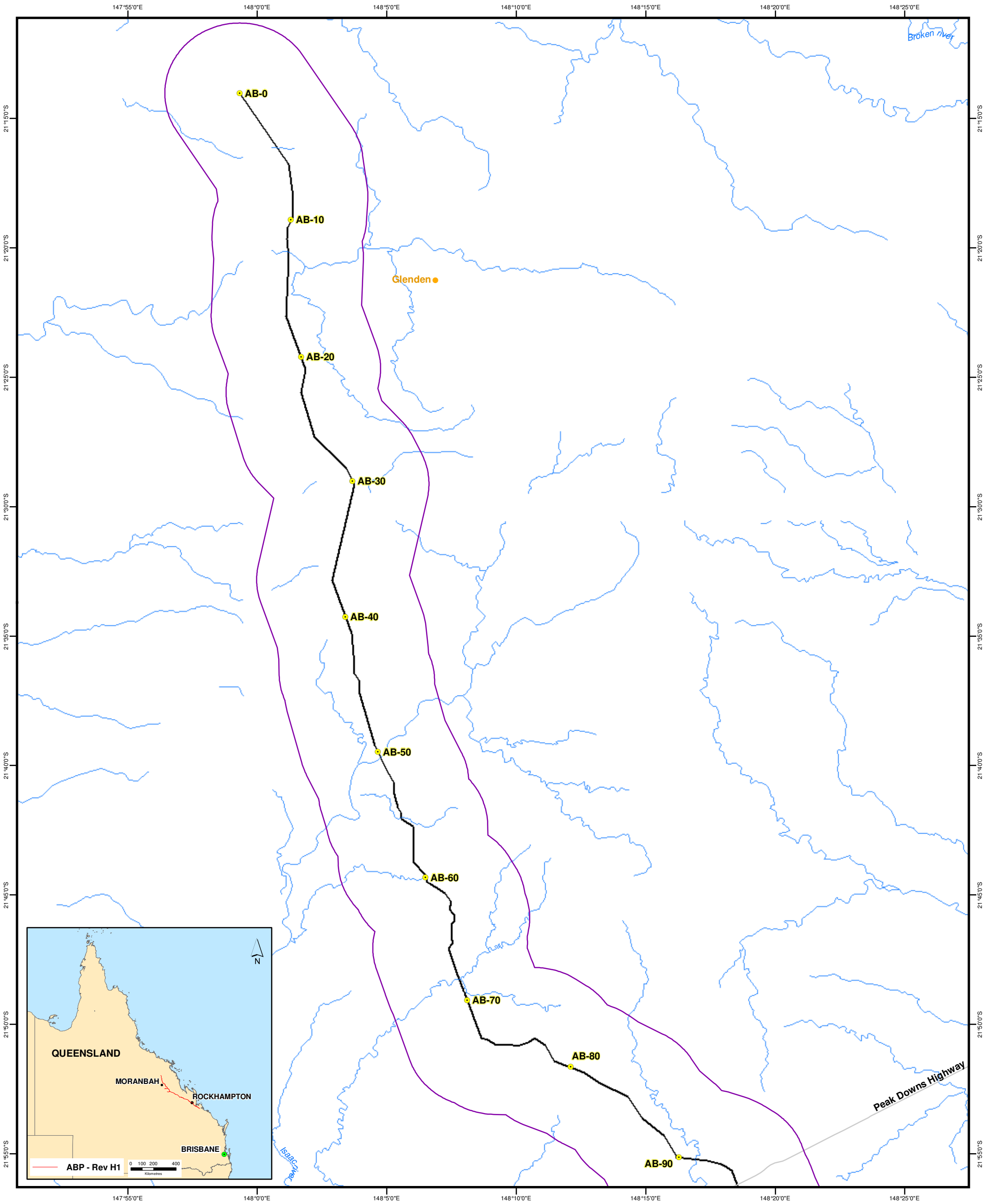
The overall objective of the National Recovery Plan for Dawson Yellow Chat (Houston and Melzer, 2008) is to improve the conservation status of the Dawson Yellow Chat and manage its habitat. The plan has three main objectives:

- protect, enhance and manage Dawson Yellow Chat habitat
- address known threats, and identify and quantify potential threats
- increase knowledge and awareness of the Dawson Yellow Chat throughout the community, industry and landholders.

The proposed pipeline may result in a small amount of potential Dawson Yellow Chat habitat being temporarily removed. The Provided that mitigation measures proposed are implemented, the temporary removal of a small amount of habitat in an area of already highly modified wetlands is unlikely to impact the species recovery.

2.3.15 Conclusion

The ABP pipeline is unlikely to reduce the amount of potential habitat available for Dawson Yellow Chat in the Fitzroy River Delta. Based on existing knowledge and proposed mitigation measures, impacts are expected to be low and short-lived, with no adverse effects on Yellow Chat populations. This species will be included in a significant species management plan for the ABP.



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- Kilometre Point
- Waterway or Coast Line
- Main roads
- ABP - Rev H1
- Buffer (5 km)

Yellow Chat

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Page 1 of 7

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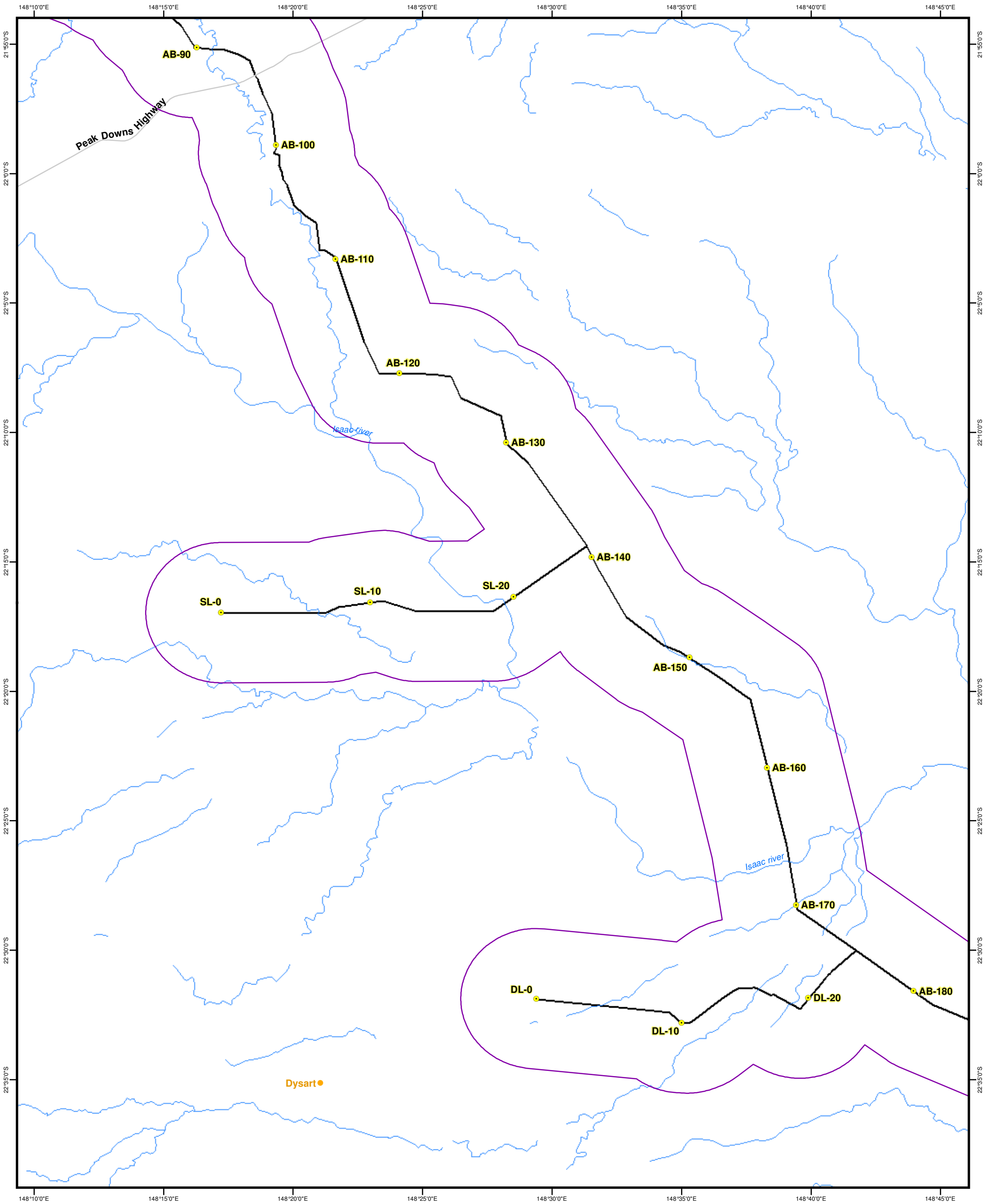

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Yellow Chat

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Arrow Bowen Pipeline
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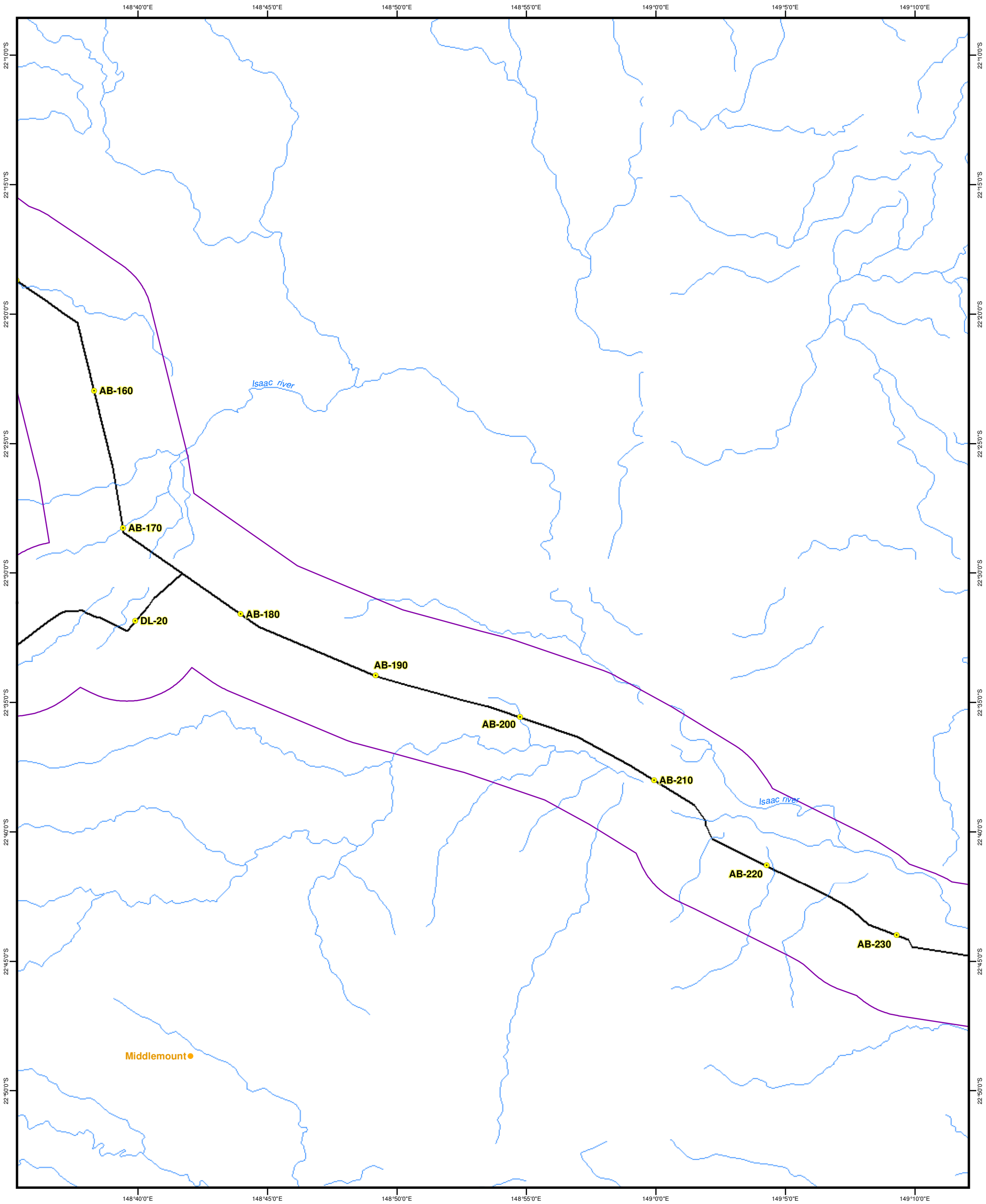

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Units: Degree

LEGEND

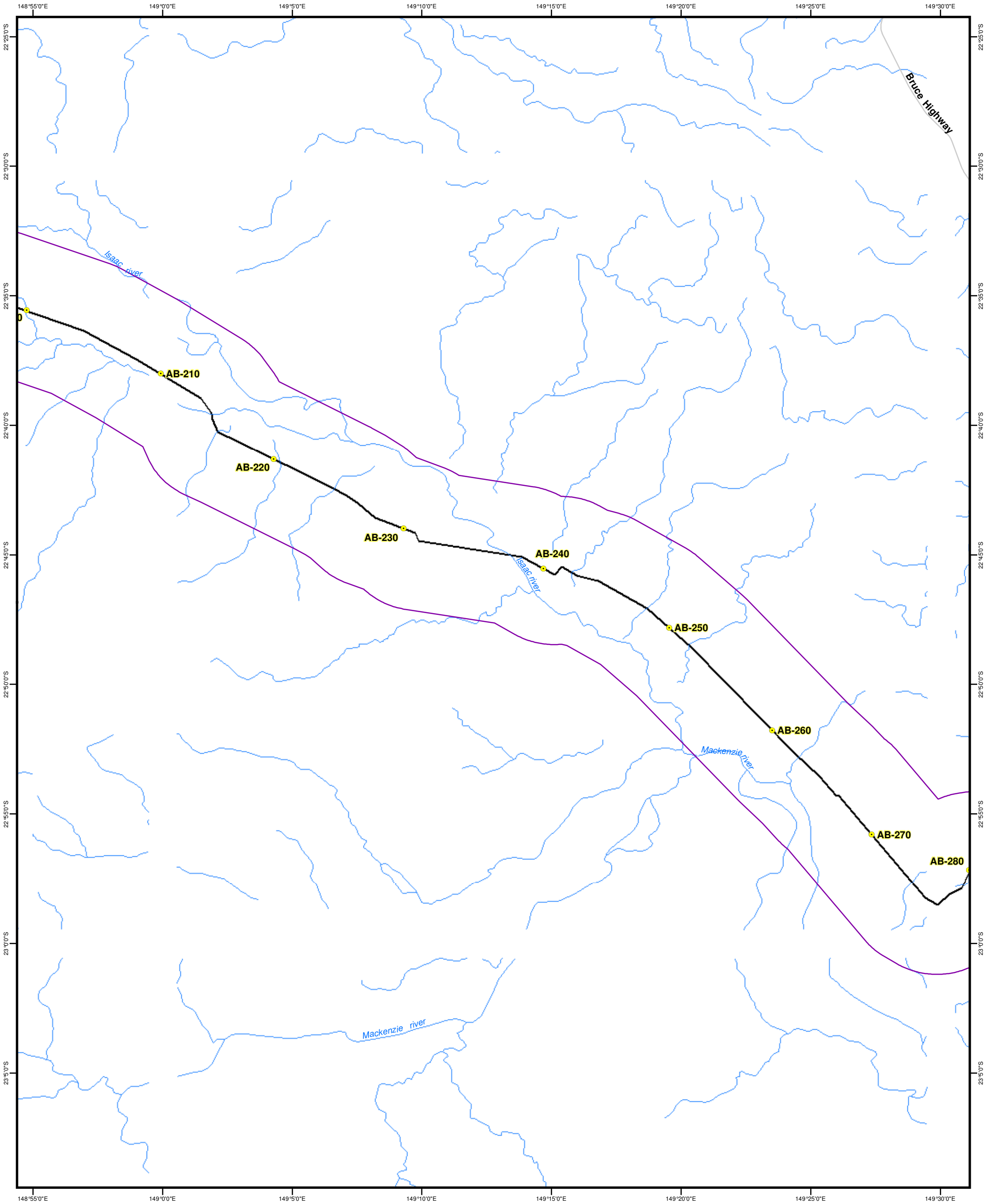
- City or town
- Kilometre Point
- Waterway or Coast Line
- ABP - Rev H1
- Buffer (5 km)

Yellow Chat

Arrow Energy Pty Ltd

Arrow Bowen Pipeline
Revision H1

A3



ecosure

Document
BE004_MP_006L_YellowChat_RevH1

Job Number: BE004

Approved GIS Team Leader		BN	30/08/2013
R0	BN	CF	ISSUED TO CLIENT	30/08/2013
REV	By	CHK	Description	Date

N
W E
S

0 2.5 5 10
Kilometres

Scale: 1:250,000 when printed at A3

Coordinate System:
GCS GDA 1994
Datum: GDA 1994
Units: Degree

LEGEND

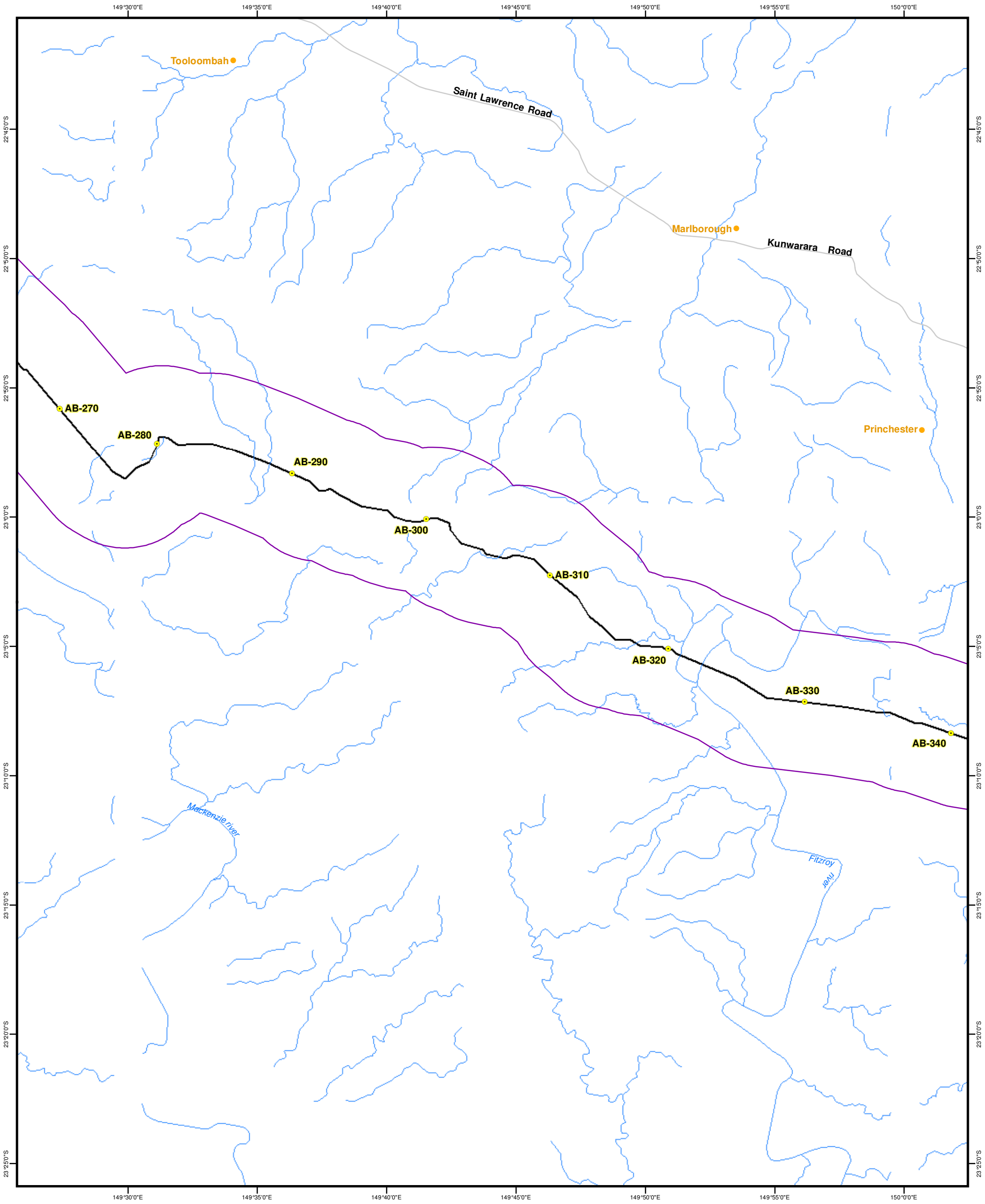
- Kilometre Point
- Waterway or Coast Line
- Main roads
- ABP - Rev H1
- Buffer (5 km)

Yellow Chat

Arrow Energy Pty Ltd

Arrow Bowen Pipeline
Revision H1

A3



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Document
BE004_MP_006L_YellowChat_RevH1

Job Number: BE004

Approved GIS Team Leader			BN	30/08/2013
R0	BN	CF	ISSUED TO CLIENT	30/08/2013
REV	By	CHK	Description	Date

N W E S

0 2.5 5 10
Kilometres

Scale: 1:250,000 when printed at A3

Coordinate System:
GCS GDA 1994
Datum: GDA 1994
Units: Degree

LEGEND

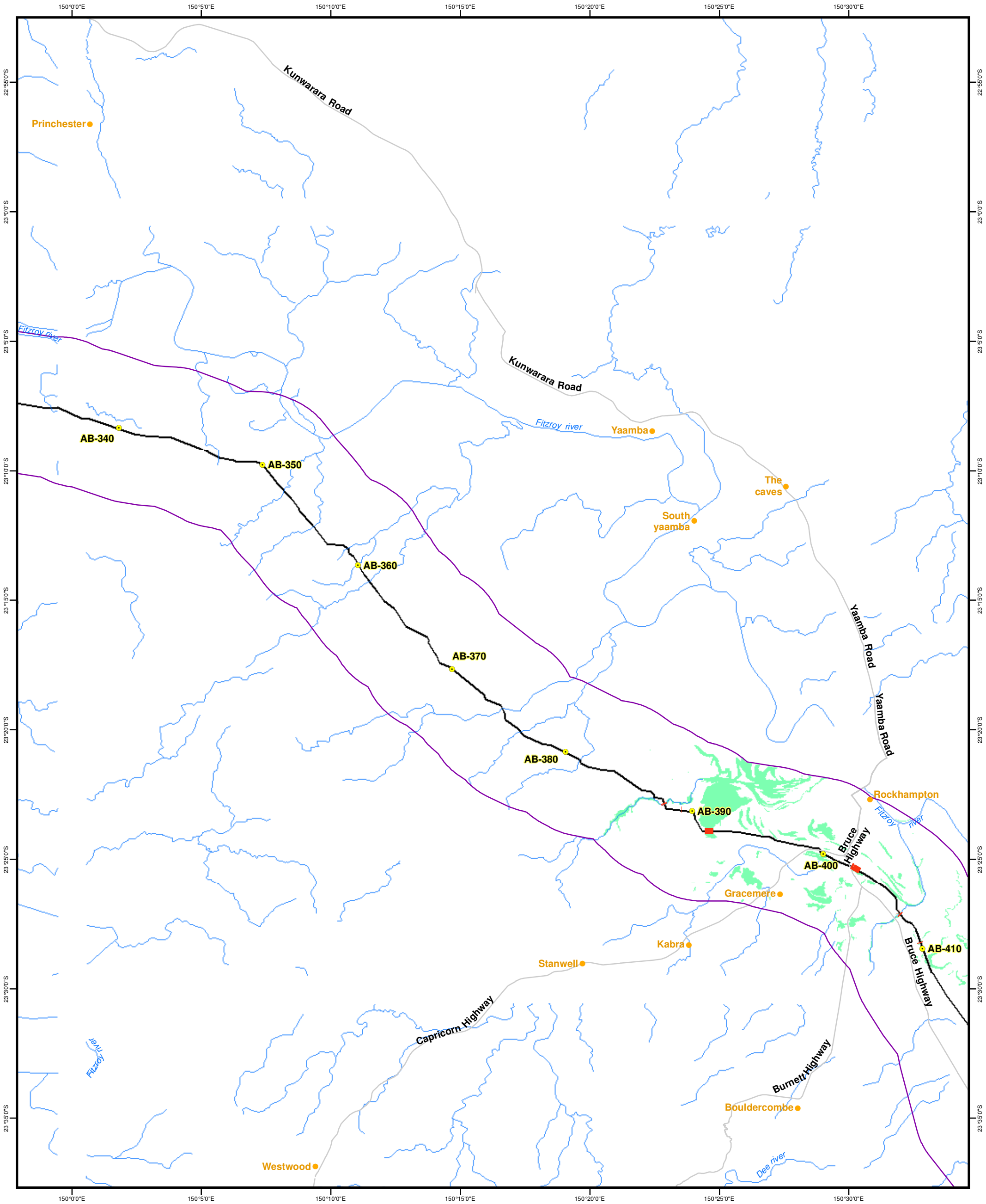
- City or town
- Kilometre Point
- Waterway or Coast Line
- Main roads
- ABP - Rev H1
- Buffer (5 km)

Yellow Chat

Arrow Energy Pty Ltd

Arrow Bowen Pipeline
Revision H1

A3



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Document
BE004_MP_006L_YellowChat_RevH1

Job Number: BE004

Approved GIS Team Leader			BN	30/08/2013
R0	BN	CF	ISSUED TO CLIENT	30/08/2013
REV	By	CHK	Description	Date

N W E S

0 2.5 5 10
Kilometres

Scale: 1:250,000 when printed at A3

Coordinate System:
GCS GDA 1994
Datum: GDA 1994
Units: Degree

LEGEND

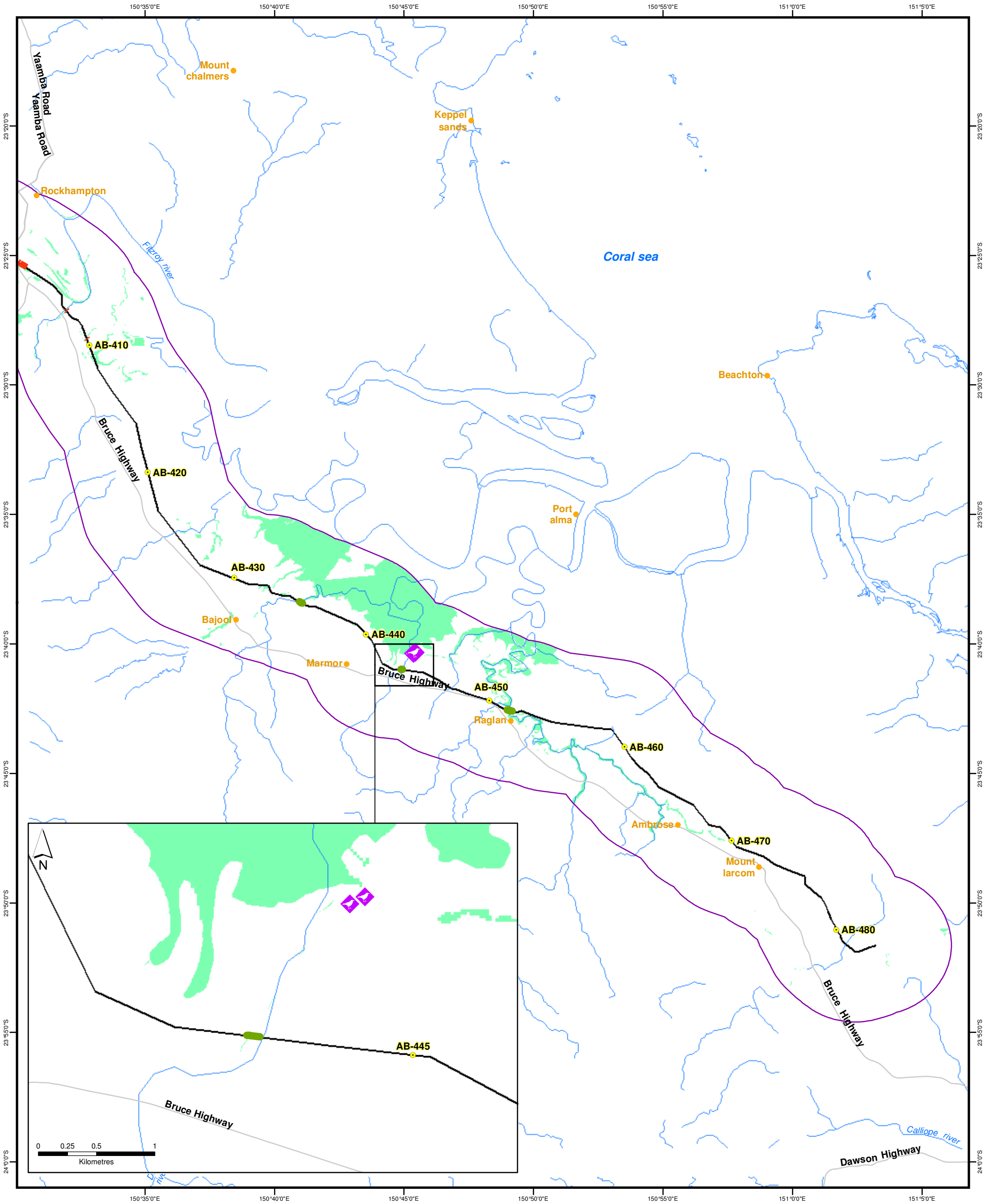
- City or town
- Kilometre Point
- Waterway or Coast Line
- Main roads
- ABP - Rev H1
- Potential Habitat in ROW (Field Verified)
- Potential Habitat in Buffer (from State RE Mapping)
- Buffer (5 km)

Yellow Chat

Arrow Energy Pty Ltd

Arrow Bowen Pipeline
Revision H1

A3



ecosure

Document
BE004_MP_006L_YellowChat_RevH1

Job Number: BE004

Approved GIS Team Leader			BN	30/08/2013
R0	BN	CF	ISSUED TO CLIENT	30/08/2013
REV	By	CHK	Description	Date

N W E S

0 2.5 5 10
Kilometres

Scale: 1:250,000 when printed at A3

Coordinate System:
GCS GDA 1994
Datum: GDA 1994
Units: Degree

LEGEND

- City or town
- Kilometre Point
- Yellow Chat Survey Records
- Waterway or Coast Line
- Main roads
- ABP - Rev H1
- Critical Habitat for Yellow Chat
- Potential Habitat in ROW (Field Verified)
- Potential Habitat in Buffer (from State RE Mapping)
- Buffer (5 km)

Yellow Chat

Arrow Energy Pty Ltd

Arrow Bowen Pipeline
Revision H1

A3