

### 7.3.1 Threatened Flora

#### 7.3.1.1 *Caladenia huegelii*

One individual of the orchid *Caladenia huegelii* was recorded from one location, in *Banksia* woodland located to the east of the project area in the Ellenbrook area (Figure 13). The known location is approximately 60 m to the east of the project area. No direct impacts (i.e. the clearing of vegetation supporting *Caladenia huegelii*) on the habitat supporting the single individual will occur. The habitat is suitable for the recruitment of future populations of this orchid and propagules of the orchids and its symbiotic mycorrhizal fungus may be present in the soil seed bank.

The extent of critical habitat that may potentially be impacted is approximately 17.2% (or 39.3 ha) of the 228.3 ha of mapped critical habitat within the study area. The impact to the mapped critical habitat is considered to be moderate. Direct and indirect impacts will be managed accordingly, and vegetation will be retained and protected to ensure the viability of *Caladenia huegelii* within the study area.

According to the Interim Recovery Plan for the Grand Spider Orchid (*Caladenia huegelii*), the habitat surrounding the *Caladenia huegelii* location is critical and should be retained and protected from any direct and indirect disturbances. A buffer of native vegetation to a minimum of 50 m surrounding the individual should be retained (DEC, 2009).

Indirect impacts to *Caladenia huegelii* may include alterations to groundwater and surface water hydrology, introduction and proliferation of introduced weeds and dieback and activities that may indirectly impact on the symbiotic mycorrhizal fungus or the pollinating wasps crucial to the orchid's survival. This would include the ability of the pollinating wasps to move between populations. The retention of an appropriate vegetated buffer would assist in maintaining the viability of the vegetation supporting the population of *Caladenia huegelii*.

#### 7.3.1.2 *Grevillea curviloba* subsp. *incurva*

Three locations of *Grevillea curviloba* subsp. *incurva* occurs along Muchea Road South and the Brand near the project area. The design of the new highway will avoid all known locations, resulting in no direct impacts (i.e. clearing). No new populations or individuals were identified within the project area and are unlikely to occur.


Approximately 182.7 ha of critical habitat occurs near the project area (Figure F011). The project may potentially impact on 3.1% (or 5.7 ha) of the mapped critical habitat as a result of direct vegetation clearing. This is considered to be minor and the direct and indirect impacts will be managed accordingly.

The vegetation along Brand Highway and the adjacent rail reserve constitutes critical habitat for the Narrow Curved-leaved *Grevillea* (*Grevillea curviloba* subsp. *incurva*) (Phillimore and English, 2000). The project area is located approximately 10 m to the south of the known *Grevillea curviloba* subsp. *incurva* locations along Brand Highway. The clearing may have an indirect impact and include degradation of habitat, introduction of weeds and plant pathogens and altered hydrological regimes. The project may also directly impact the known locations through accidental clearing and burial of plants from the spoil and batters for the project. The demarcation and protection of the known locations of *Grevillea curviloba* subsp. *incurva* is considered high priority.

### 7.3.2 Priority Flora

Five of the eight recorded Priority flora are located within the project area (Table 31). The impact on *Cyathochaeta teretifolia*, *Ornduffia submersa* and *Stylidium striatum* is negligible with no known locations proposed to be directly impacted.

The potential impact to *Anigozanthos humilis* subsp. *chrysanthus*, *Hypolaena robusta* and *Poranthera moorokatta* is considered to be minor. The proportion to be impacted in the project area represents 0.15%,



0.10% and 0.04% of known individuals, respectively (Table 31). *Anigozanthos humilis* subsp. *chrysanthus* and *Hypolaena robusta* occur extensively in the northern Swan Coastal Plain and the Northern Sandplains IBRA bioregions (CHAH, 2014 and DPAW, 2014). *Poranthera moorokatta* is a small cryptic herb and may occur in larger numbers in the Ellenbrook region. To further refine the impact, additional targeted surveys should occur in the spring flowering season prior to any clearing.

The impact to the known populations of *Millotia tenuifolia* var. *laevis* is considered to be high with an estimate of 20% of individuals impacted by the project area. Previous records did not indicate the number of individuals recorded and so each record was treated as one individual. *Millotia tenuifolia* var. *laevis* is a small inconspicuous plant and it is highly likely that more individuals would be recorded following additional surveys in the appropriate season. As such, this would be considered the maximum potential impact. The impact for *Millotia tenuifolia* var. *laevis* is also considered regionally significant in the project area due to the atypical habitat from which it was recorded within the study area.

Only one population of two individuals of *Meeboldina decipiens* subsp. *decipiens* ms was recorded historically, the other nine populations did not indicate the number of individuals and so each record was treated as one individual. As such, the impact described is considered to be the maximum potential impact. *Meeboldina decipiens* subsp. *decipiens* ms was recorded from two locations in wetland habitat within the proposed Tonkin Highway and Reid Highway interchange. The two locations will be directly impacted by the project resulting in a 50% impact on all known individuals (Table 31). These locations represent the most northerly recorded extent of this taxon and are therefore considered to be significant.

The known locations of *Cyathochaeta teretifolia* are located outside the project area. The record within the Victoria Road bushland (proposed Tonkin Highway and Reid Highway interchange) may be indirectly impacted through alterations to the hydrological regime. The impacts of the project on the hydrological regime will be managed through a drainage strategy. The drainage strategy will ensure natural water flows (surface and underground) will be maintained where possible.

One historical location (DPAW, 2014) representing 30 individuals of *Cyathochaeta teretifolia* occurs within the project area; however, the vegetation at this location has been cleared removing the Priority taxon.

To reduce the impact on Priority flora, additional targeted surveys should be considered during the optimal flowering period (i.e. spring). The extent within the project area and adjacent habitat should be searched to further delineate the extent of populations and to search for additional populations, potentially lowering the impact on known populations via the identification of new populations and individuals outside of the project area.

## 7.4 Introduced Taxa

The four WONS (*\*Asparagus asparagoides*, *\*Eichhornia crassipes*, *\*Opuntia stricta* and *\*Rubus laudatus*) and six Declared Pests (*\*Moraea flaccida*, *\*Zantedeschia aethiopica* and the four WONS) are listed under the Federal and State legislation due to their propensity to establish and smother native vegetation and important waterways. If left unmanaged, these significant environmental weeds can create monocultures and increase the risk of local species extinctions, wildfires and loss of economic benefits.

Introduced taxa were located throughout the study area, however the majority of significant environmental weeds (WONS and Declared Pests) were located north of Maralla Road (Figure 9), on the highly modified palusplain.

Potential impacts of weeds on native flora and vegetation include:

- Spread of existing significant environmental weed infestations.
- Establishment of new populations of the existing significant environmental weeds.

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- Introduction of new significant environmental weeds.

Potential impacts associated with proposed development are low for the northern half (north of Maralla Road) of the project. Native vegetation in Good or better condition is sporadically located throughout this portion of the project area. The project will impact on approximately 4 ha of vegetation considered to be in good or better condition north of Maralla Road.

The potential impacts associated with the proposed development are moderate for the southern half (south of Maralla Road) of the project. This area supports conservation significant vegetation and native flora which may be significantly impacted by the introduction and spread of environmental weeds. Environmental weeds occur in the southern half of the project, however the density and diversity is not as high as in the northern portion of the project.

Impacts associated with the clearing of native vegetation during the construction phase of the project are higher than during the operation of the highway. An effective weed hygiene management plan needs to be developed and implemented prior to any clearing practices. The weed hygiene management plan should incorporate industry best practice with regards to the movement of vehicles, equipment and machinery and ensure hygiene facilities are available prior to entry into native vegetation. Standard procedures include wash-down stations when moving between *Phytophthora*-infected and *Phytophthora*-free areas, checking of vehicles for presence of weeds (vegetative matter and seeds), no earth movements when soil is wet, separate topsoil handling facilities for weed-free and weed-contaminated soil etc.

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## 8 RECOMMENDATIONS

The following recommendations are provided to mitigate impacts and reduce residual impacts to as low as reasonably practical.

- Avoid or minimise clearing of vegetation consistent with the three State TECs (Mound Springs SCP, SCP02 and SCP20a) located within and adjacent to the project area.
- Minimise the clearing of native vegetation consistent with the four known PECs located within the study area.
- Develop and implement a vegetation monitoring program before and after construction to observe impacts on the TECs and PECs adjacent to the project area.
- Minimise clearing within native vegetation of the Bassendean-Central and South, Reagan, Southern River and Yanga vegetation complexes.
- Conduct a targeted survey in spring 2015 to further identify and delineate the *Caladenia huegelii* population in the study area.
- Conduct additional targeted surveys within native vegetation that supports *Poranthera moorokatta* (P2) and *Millotia tenuifolia* var. *laevis* (P2) to further identify and delineate the population size and extent.
- Demarcate Threatened and Priority flora populations located adjacent to and within the project area before the construction phase.
- Develop and implement construction management plans to mitigate the potential direct and indirect impacts on *Caladenia huegelii* and *Grevillea curviloba* subsp. *incurva*. The management plan would include the monitoring of populations to determine if they are being impacted upon as a result of the project.
- Undertake additional targeted surveys for other Priority flora recorded within the study area to further define the population extent and size.
- Undertake additional sampling of the potential EPBC Act listed TEC Claypans of the Swan Coastal Plain (located in association with SVB086) to determine the presence and extent of the TEC. The additional sampling should be undertaken over two seasons, including early spring and late spring/early summer.
- Ensure final design and all site activities avoid the tentative location of the Federal TEC until confirmation of the EPBC Act listed TEC can be determined.
- Develop and implement an effective weed hygiene management plan prior to clearing and construction of the highway to reduce the spread and introduction of weeds, especially of WONS and Declared Pests.

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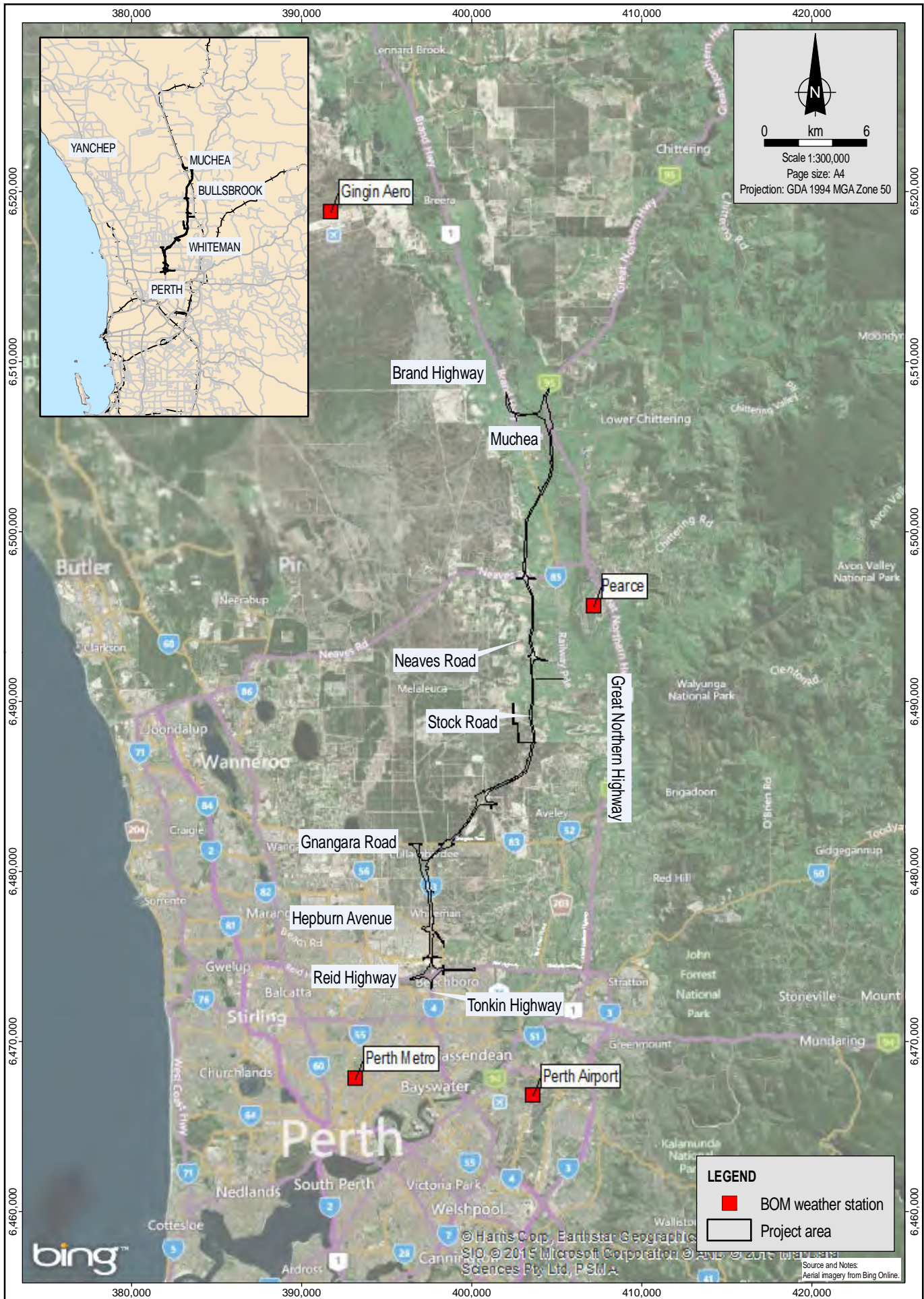
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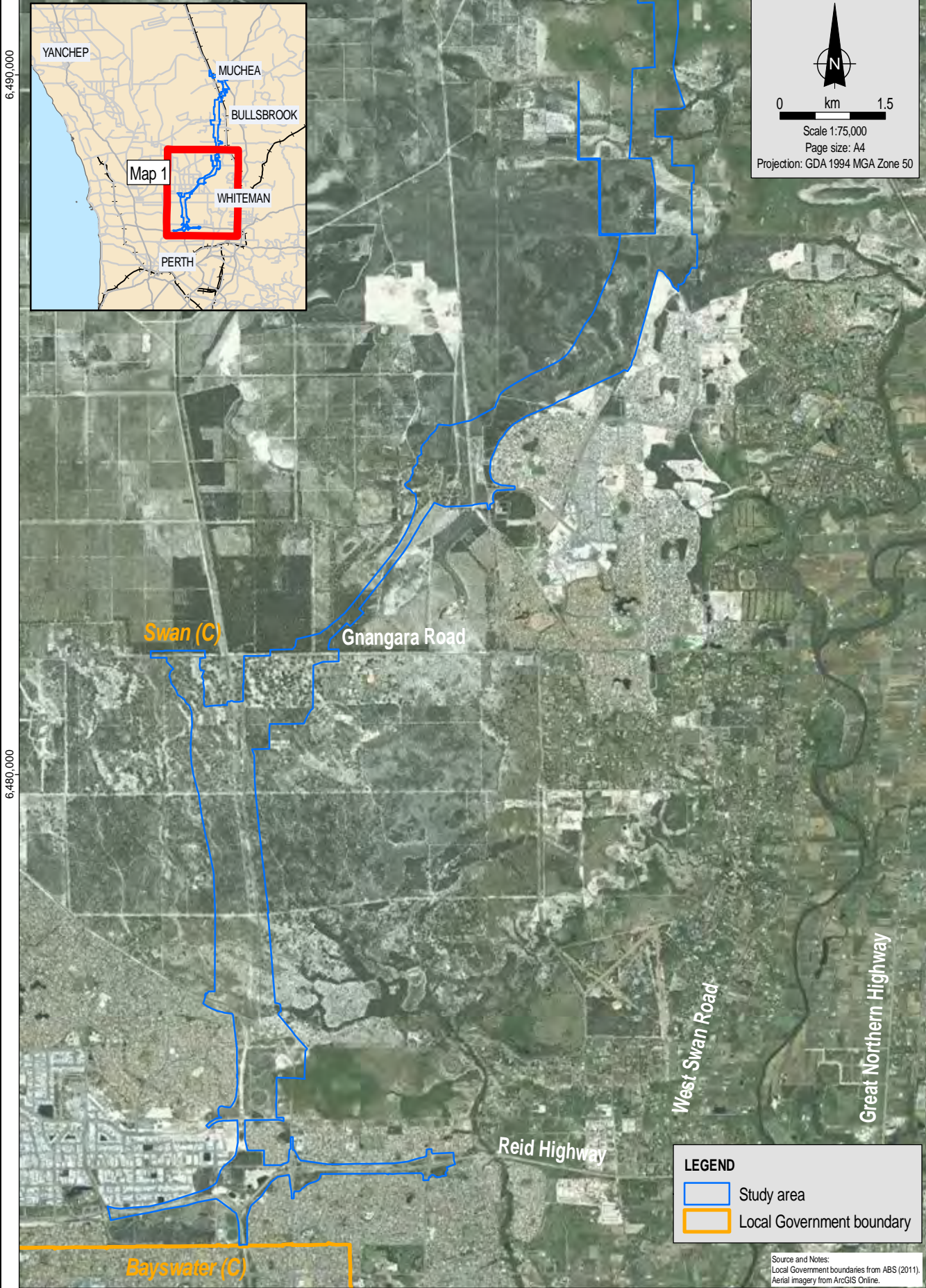
## FIGURES

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**LEGEND**

- Study area
- Local Government boundary

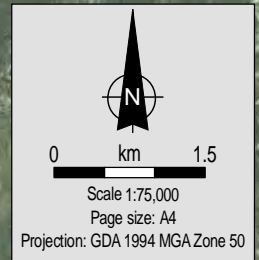
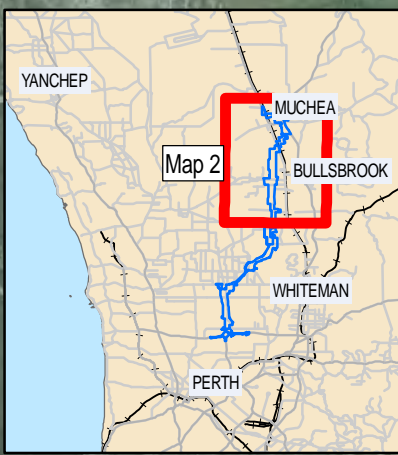
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Great Northern Highway

Rutland Road

Neaves Road

Swart (C)

Stock Road

**LEGEND**

-  Study area
-  Local Government boundary

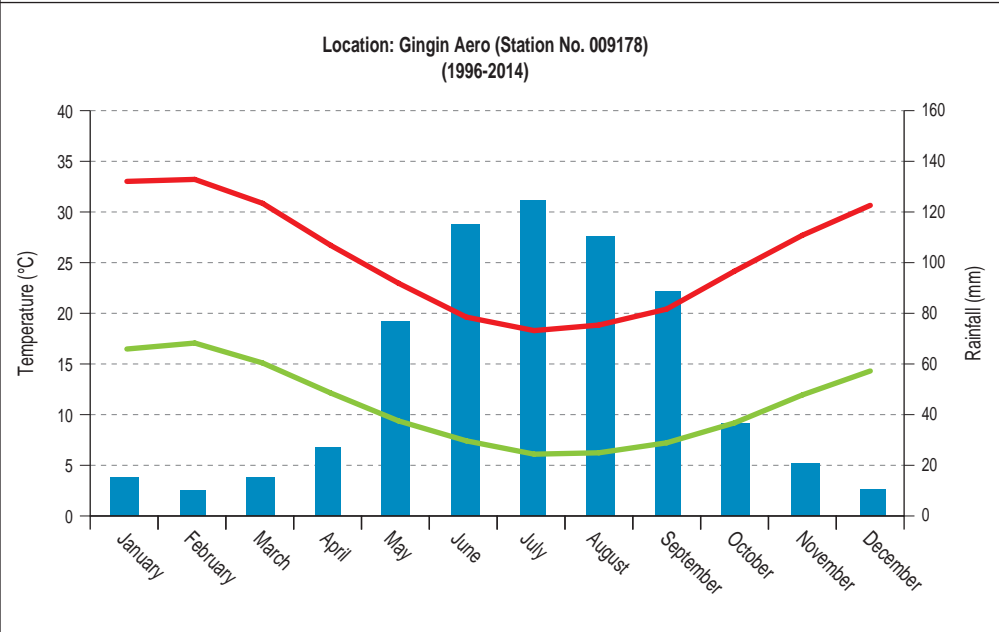
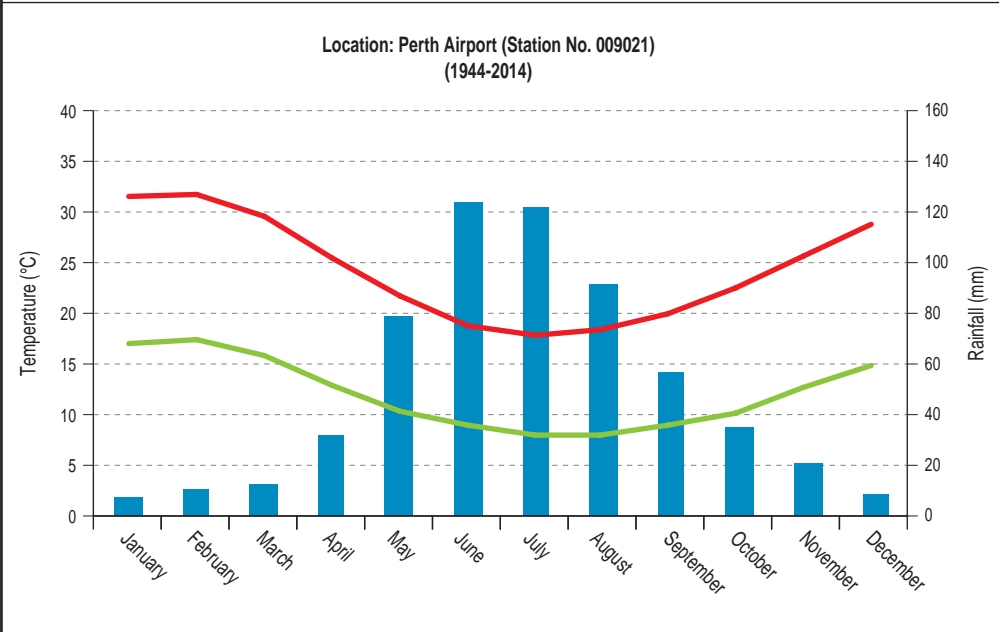
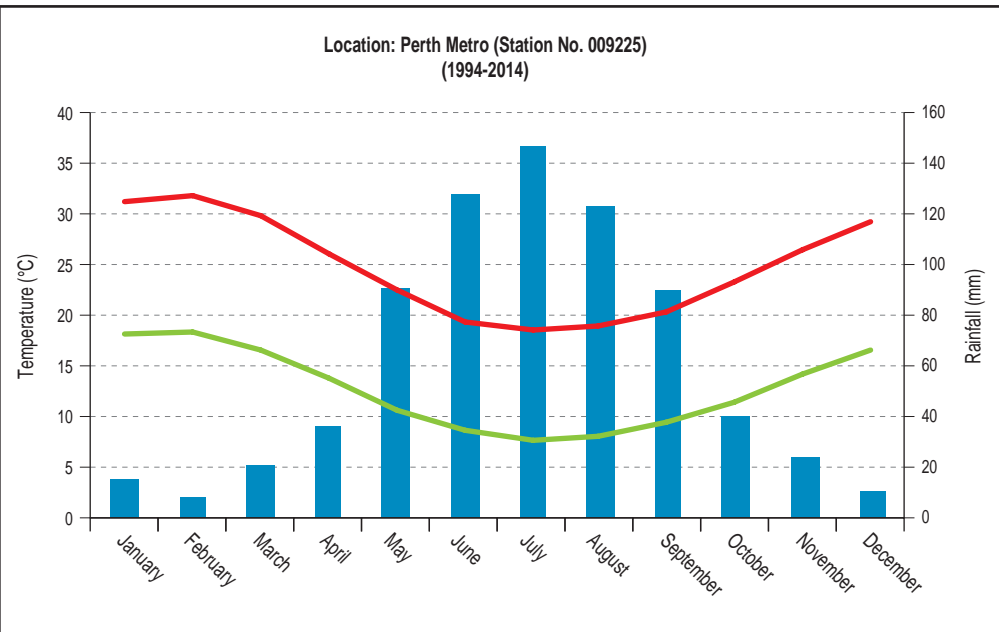
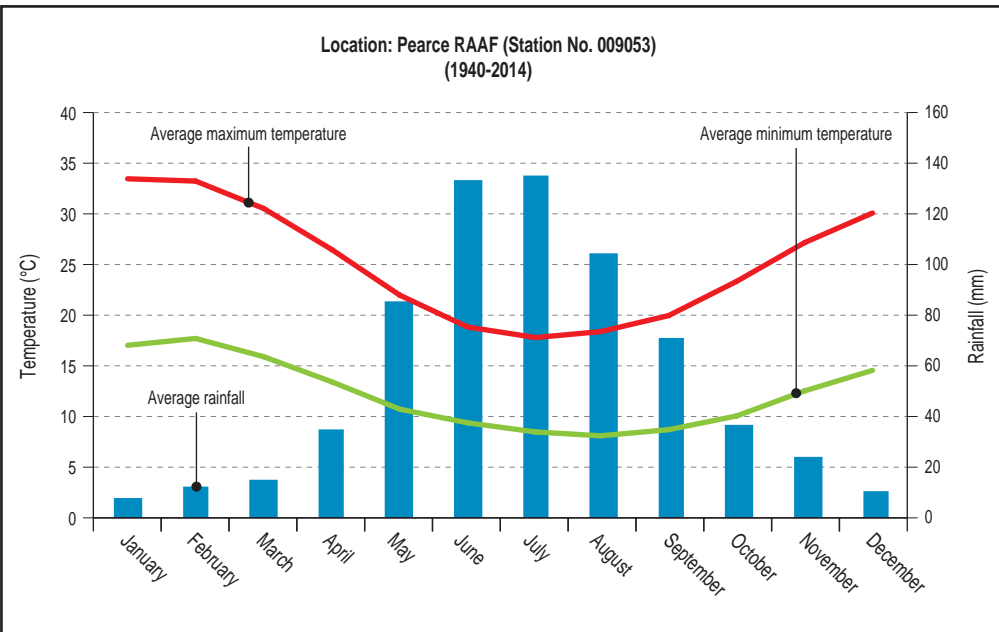
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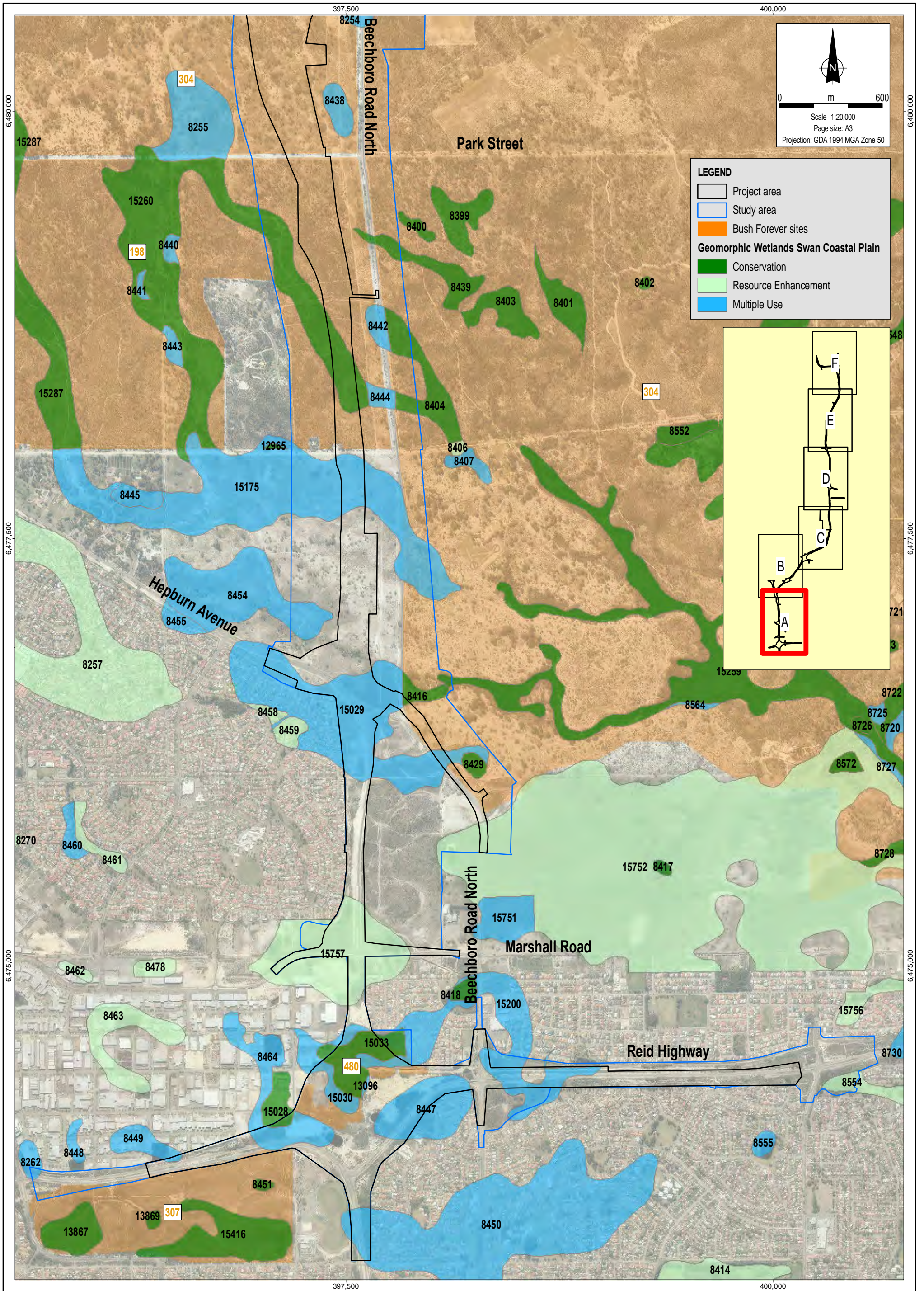
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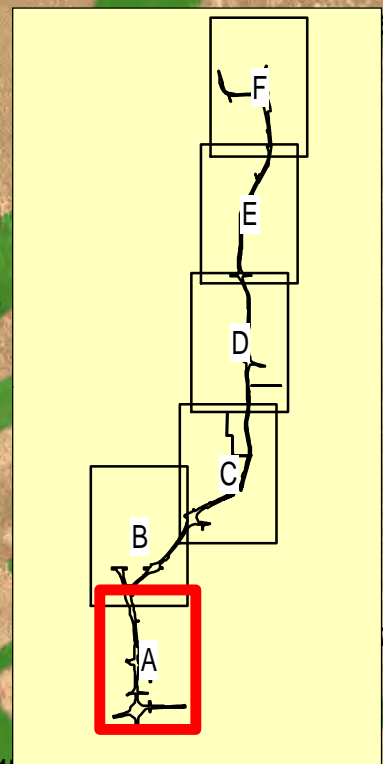
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**LEGEND**

- Project area
- Study area
- Bush Forever sites

**Geomorphic Wetlands Swan Coastal Plain**

- Conservation
- Resource Enhancement
- Multiple Use



Source & Notes  
Geomorphic Wetlands Swan Coastal Plain mapping from DPAW (January 2015)  
Bush Forever sites from DoP (January 2015)  
Aerial imagery from Landgate (August 2014)



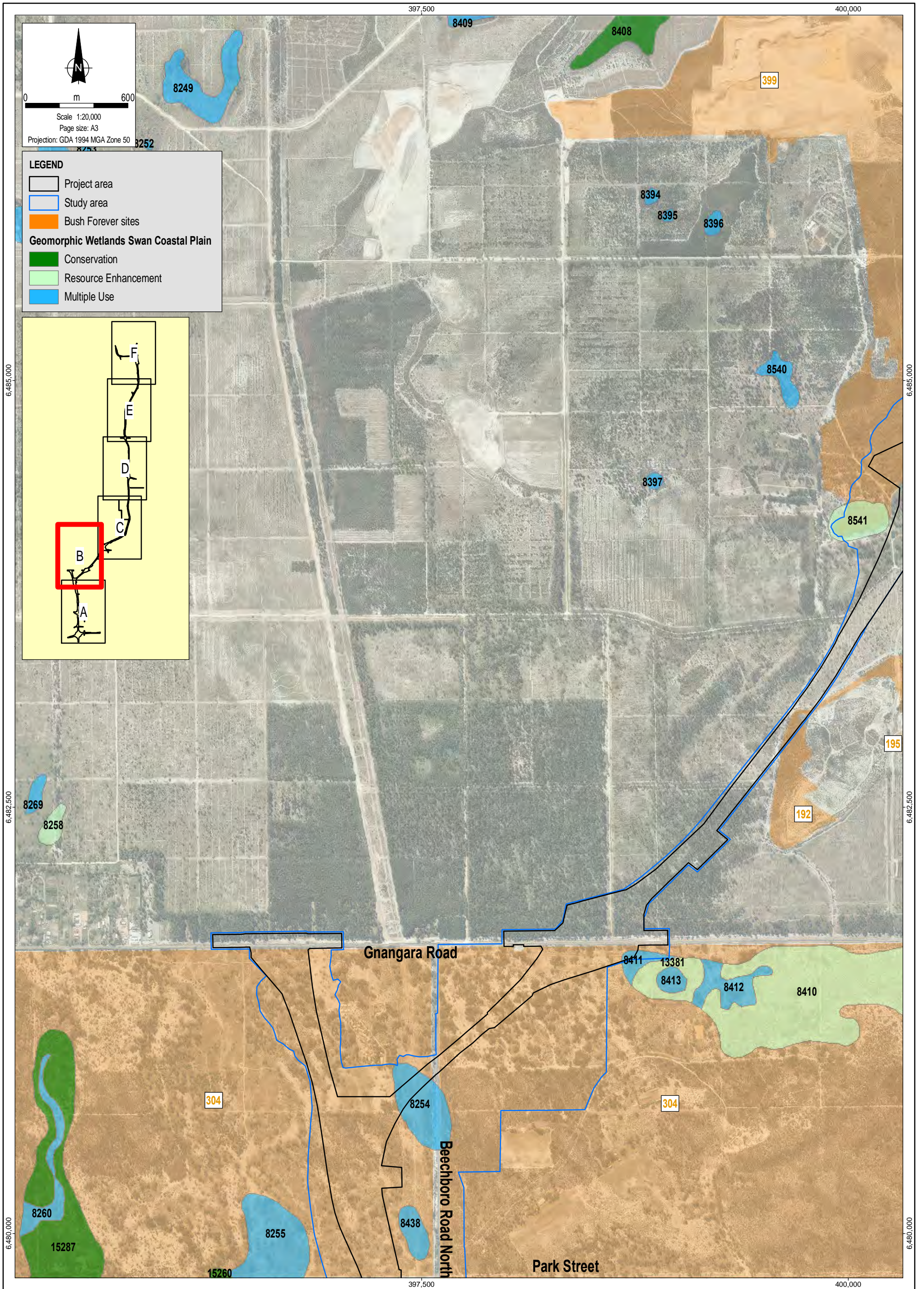
Date: 26.03.2015  
MKT:  
4483AA\_23 GIS004\_2  
File Name:  
4483AA\_23 F004A GIS


**Main Roads WA**  
Level 2 Flora and Vegetation Assessment  
Perth-Darwin National Highway

**Geomorphic Wetlands Swan Coastal Plain**  
and Bush Forever sites




Figure No:  
4A








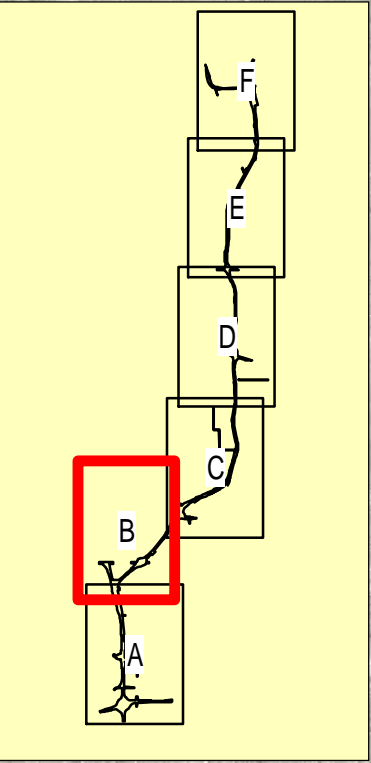
  
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 Page size: A3  
 Projection: GDA 1994 MGA Zone 50

**LEGEND**

-  Project area
-  Study area
-  Bush Forever sites

**Geomorphic Wetlands Swan Coastal Plain**

-  Conservation
-  Resource Enhancement
-  Multiple Use



Source & Notes  
 Geomorphic Wetlands Swan Coastal Plain mapping from DPAW (January 2015)  
 Bush Forever sites from DoP (January 2015)  
 Aerial imagery from Landgate (August 2014)

**NorthLinkWA**

**coffey**

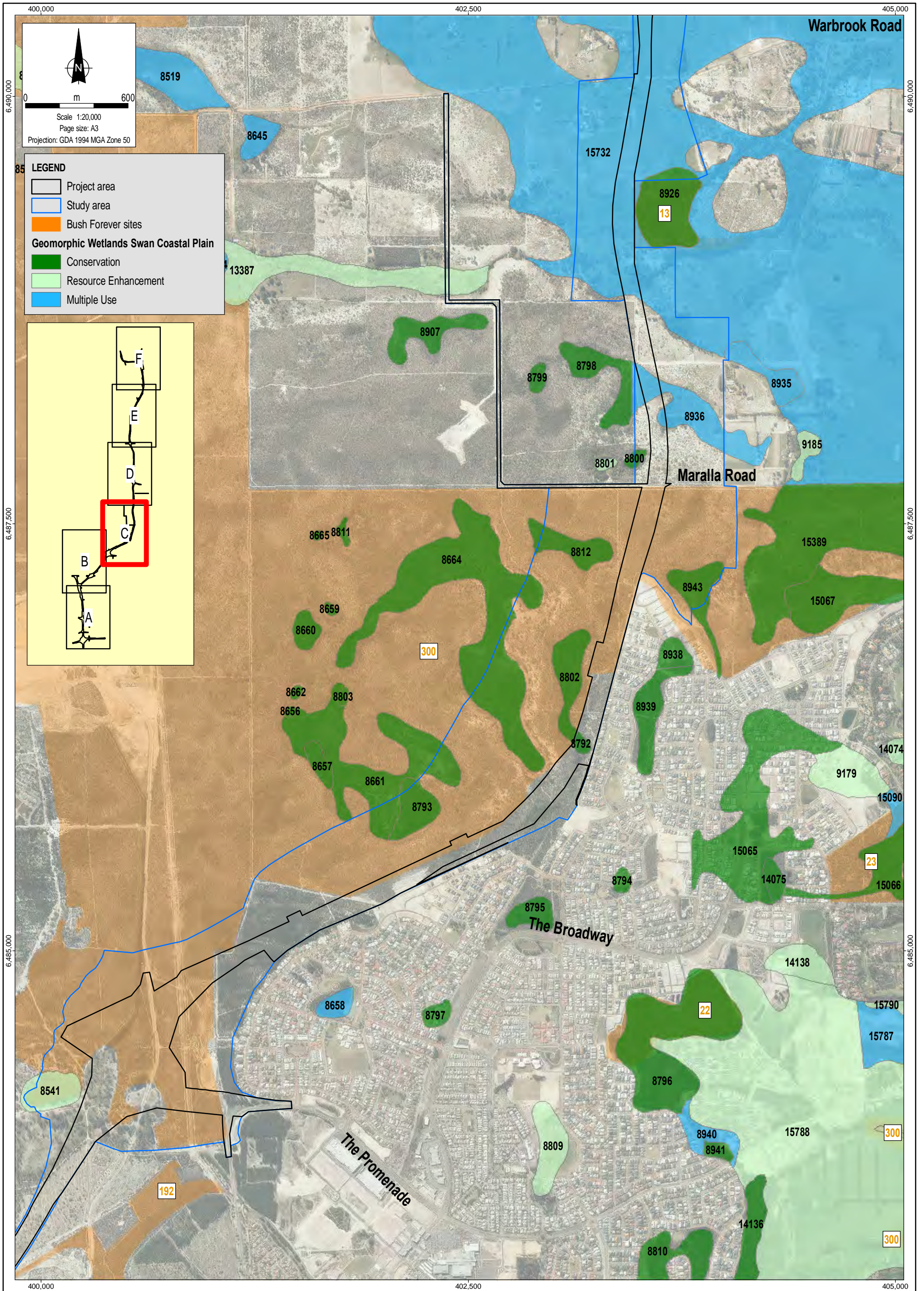
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 File Name:  
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**Main Roads WA**  
**Level 2 Flora and Vegetation Assessment**  
**Perth-Darwin National Highway**

**Geomorphic Wetlands Swan Coastal Plain**  
**and Bush Forever sites**

Figure No: 4B





Source & Notes  
 Geomorphic Wetlands Swan Coastal Plain mapping from DPAW (January 2015)  
 Bush Forever sites from DoP (January 2015)  
 Aerial imagery from Landgate (August 2014)



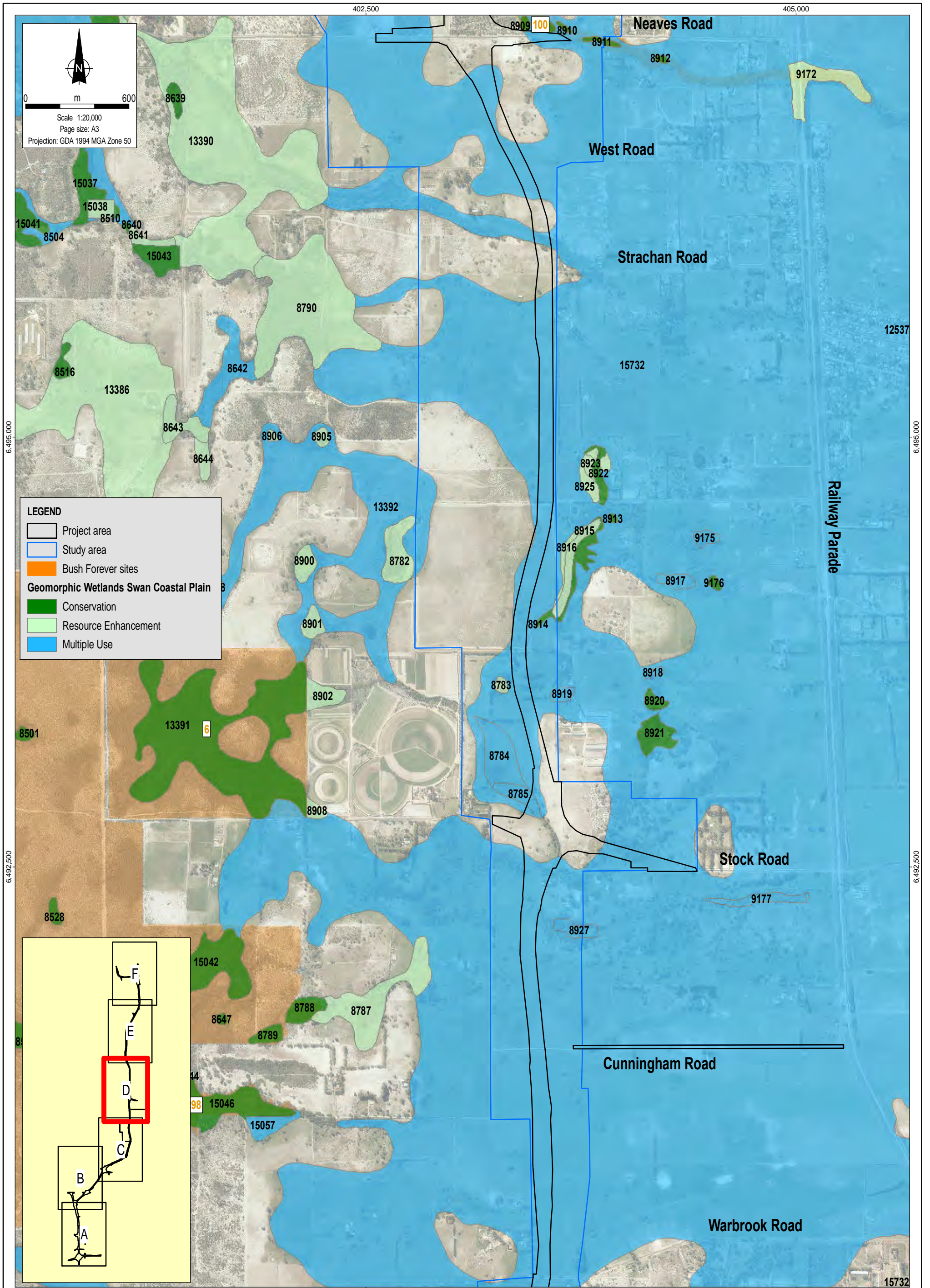
Date: 27.03.2015  
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 File Name: 4483AA\_23 F004C GIS

**Main Roads WA**  
 Level 2 Flora and Vegetation Assessment  
 Perth-Darwin National Highway

**Geomorphic Wetlands Swan Coastal Plain**  
 and Bush Forever sites

Figure No:  
 4C





Source & Notes  
 Geomorphic Wetlands Swan Coastal Plain mapping from DPAW (January 2015)  
 Bush Forever sites from DoP (January 2015)  
 Aerial imagery from Landgate (August 2014)

**NorthLinkWA**

**coffey**

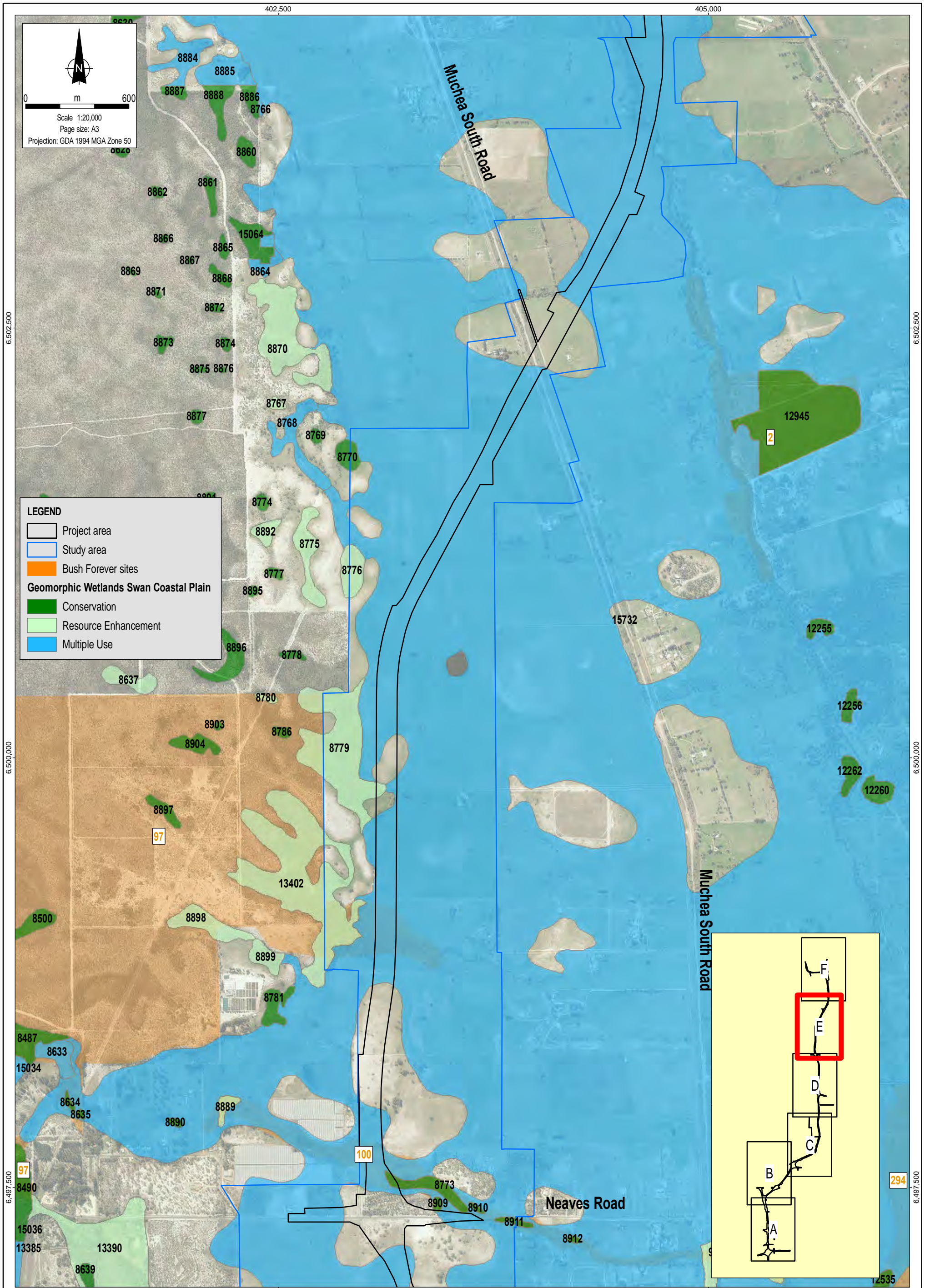
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 4483AA\_23 GIS004\_2  
 File Name:  
 4483AA\_23 F004D GIS

**Main Roads WA**  
 Level 2 Flora and Vegetation Assessment  
 Perth-Darwin National Highway

**Geomorphic Wetlands Swan Coastal Plain**  
 and Bush Forever sites

Figure No:  
 4D





**LEGEND**

- Project area
- Study area
- Bush Forever sites

**Geomorphic Wetlands Swan Coastal Plain**

- Conservation
- Resource Enhancement
- Multiple Use

Source & Notes  
 Geomorphic Wetlands Swan Coastal Plain mapping from DPAW (January 2015)  
 Bush Forever sites from DoP (January 2015)  
 Aerial imagery from Landgate (August 2014)



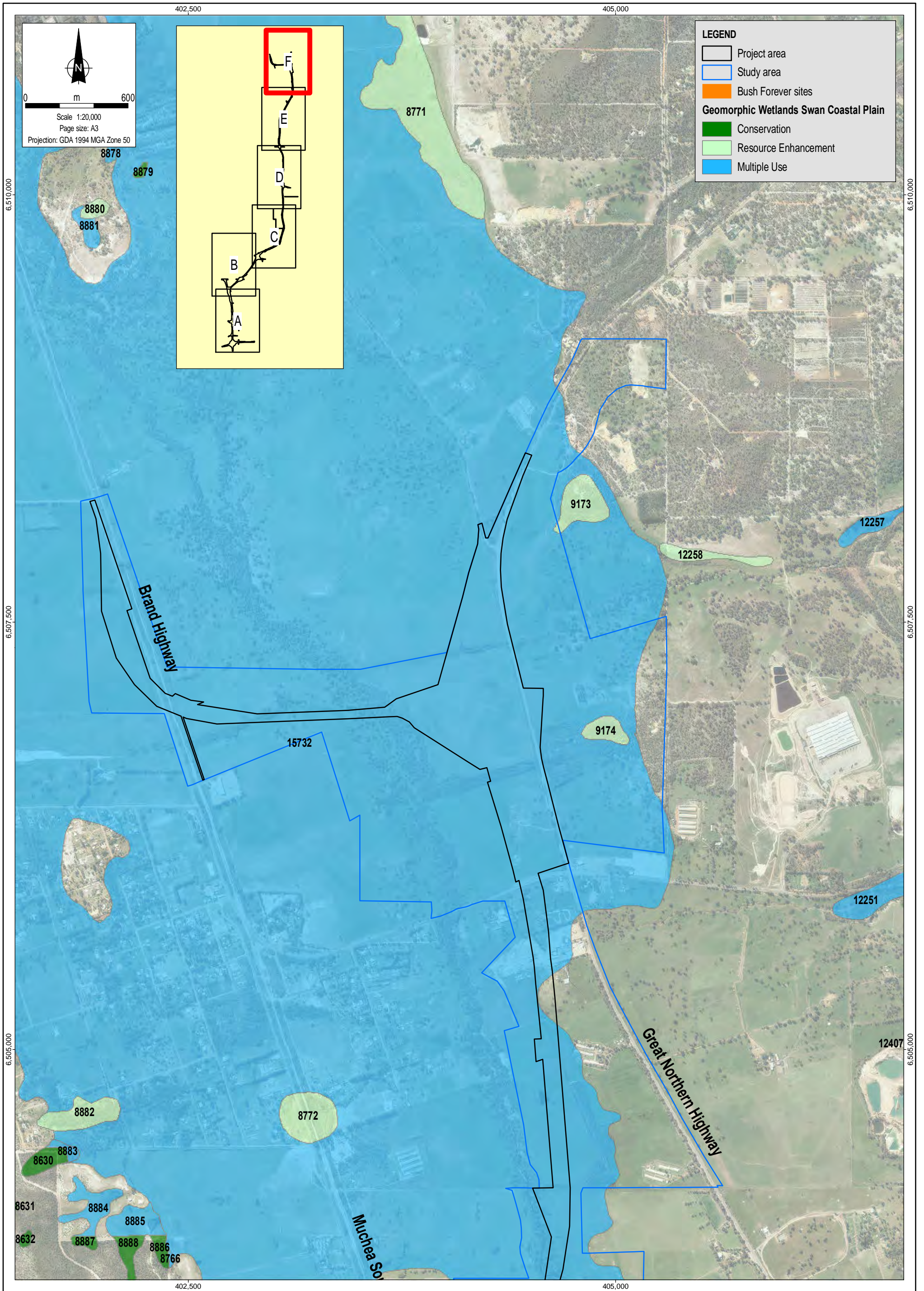
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 File Name: 4483AA\_23 F004E GIS

**Main Roads WA**  
 Level 2 Flora and Vegetation Assessment  
 Perth-Darwin National Highway

**Geomorphic Wetlands Swan Coastal Plain**  
 and Bush Forever sites

Figure No: 4E





**LEGEND**

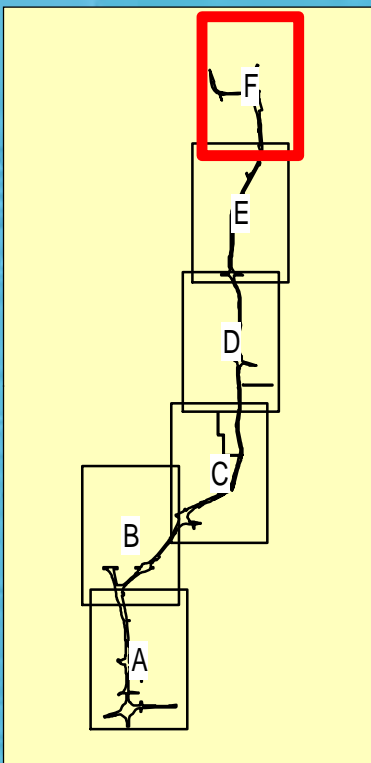
- Project area
- Study area
- Bush Forever sites

**Geomorphic Wetlands Swan Coastal Plain**

- Conservation
- Resource Enhancement
- Multiple Use

0 m 600

Scale 1:20,000  
Page size: A3  
Projection: GDA 1994 MGA Zone 50



6,507,500

6,505,000

6,510,000

6,507,500

Source & Notes  
Geomorphic Wetlands Swan Coastal Plain mapping from DPAW (January 2015)  
Bush Forever sites from DoP (January 2015)  
Aerial imagery from Landgate (August 2014)

**NorthLinkWA**

**coffey**

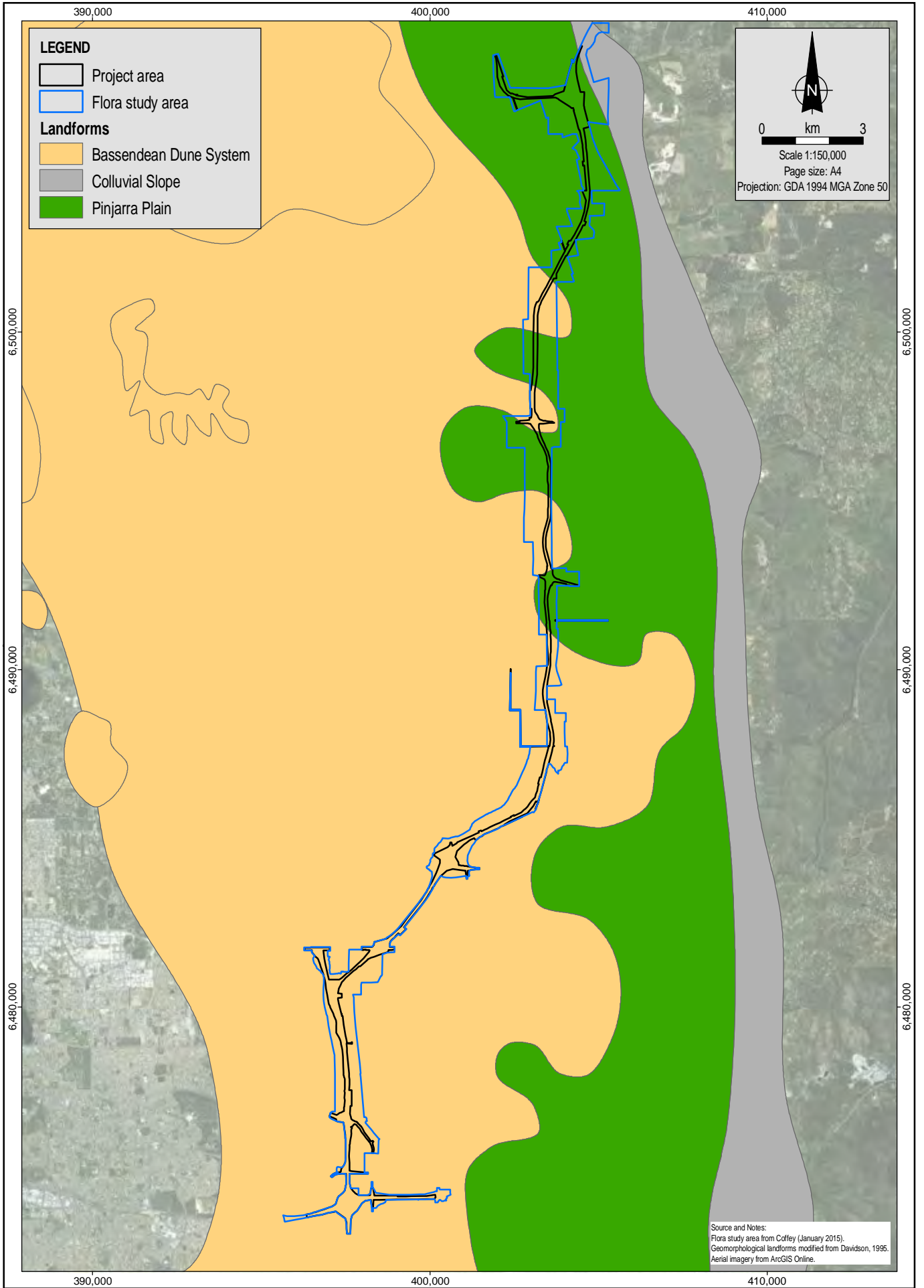
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File Name: 4483AA\_23 F004F GIS

**Main Roads WA**  
Level 2 Flora and Vegetation Assessment  
Perth-Darwin National Highway

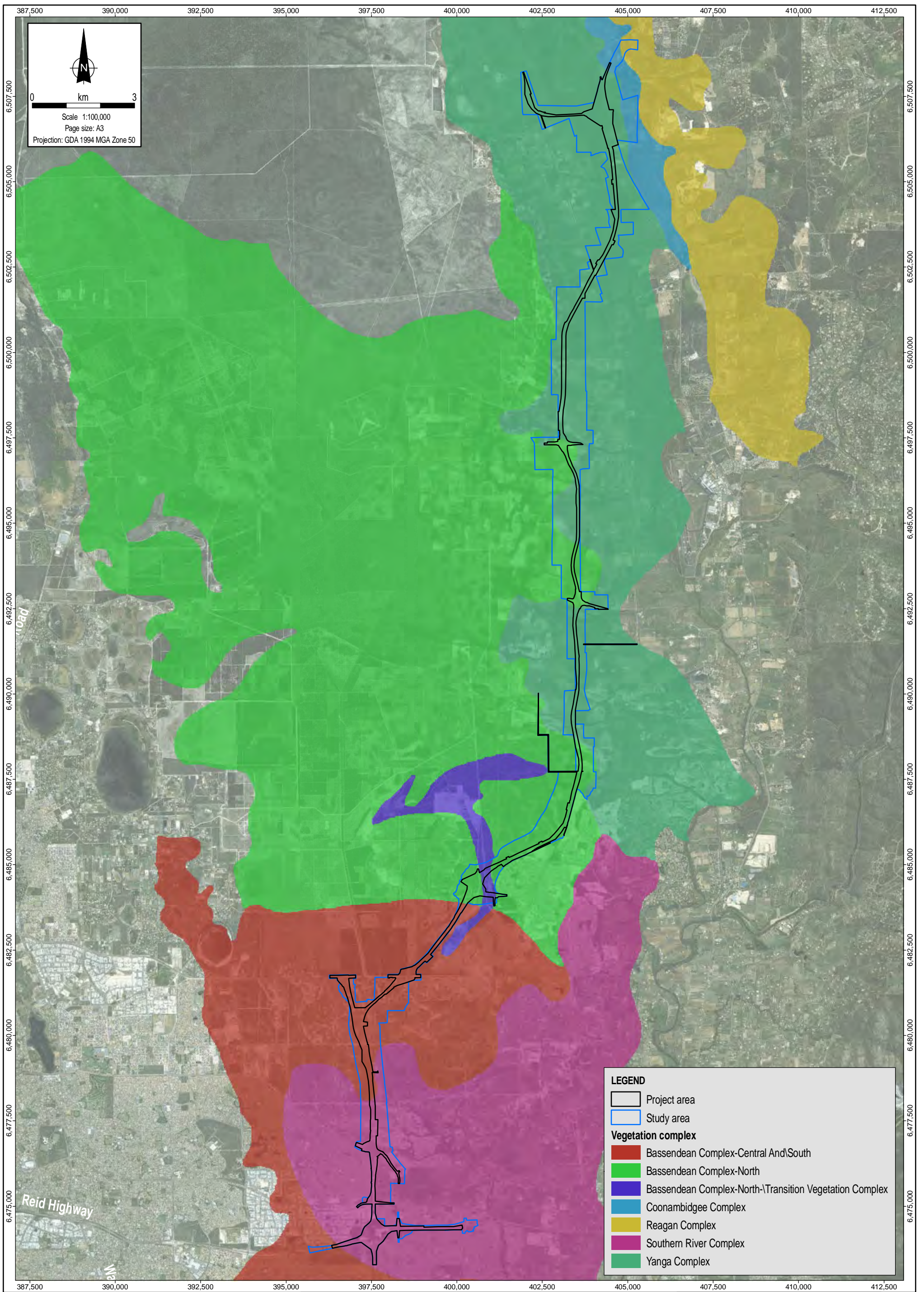
**Geomorphic Wetlands Swan Coastal Plain**  
and Bush Forever sites

Figure No: 4F









Source & Notes  
 Only vegetation complexes intersecting with study area are shown on this figure.  
 Vegetation complexes from DPAW (December 2014)  
 Aerial imagery from Landgate (September 2013)

**NorthLinkWA**

**coffey**

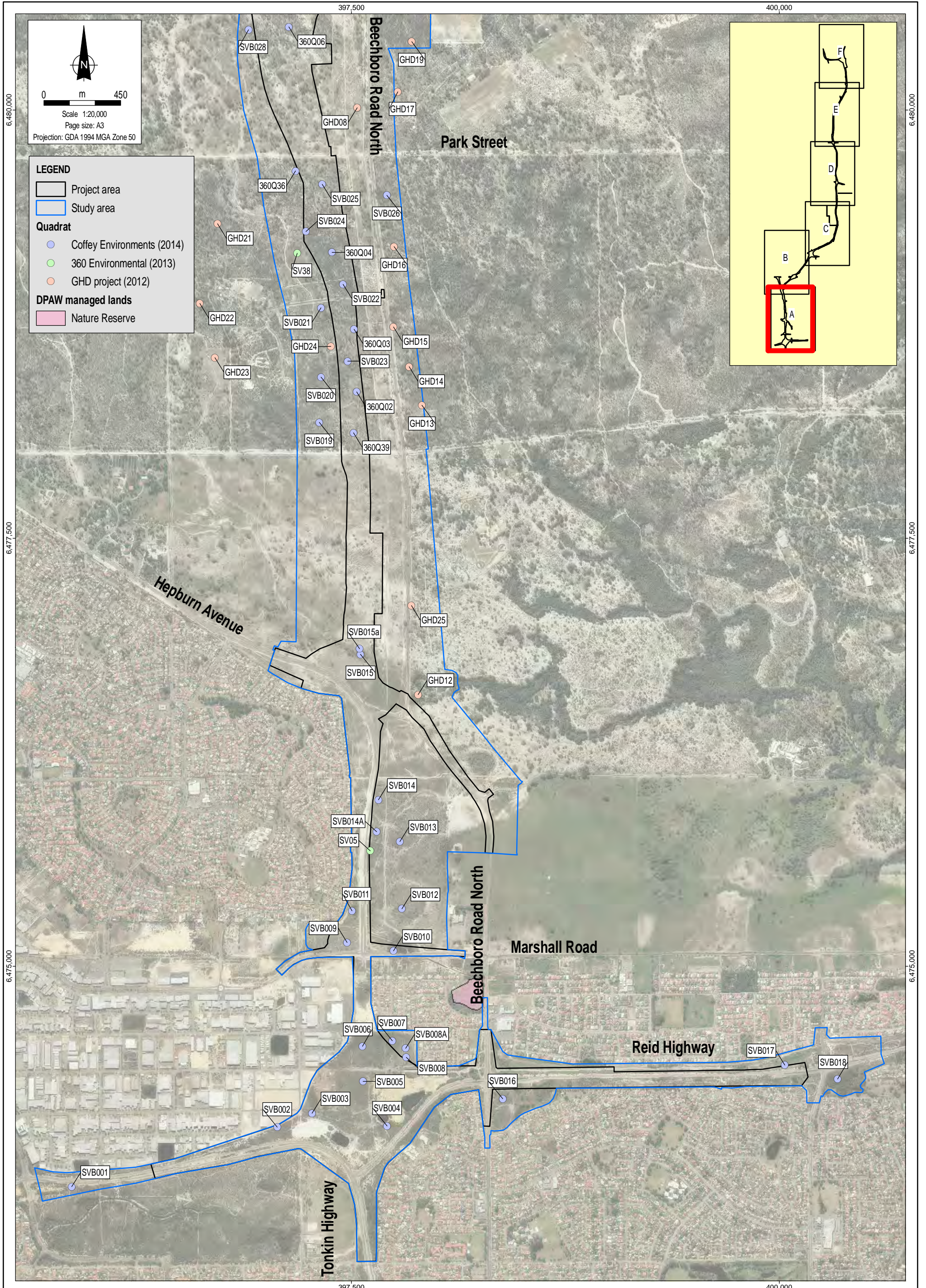
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 File Name:  
 4483AA\_23\_F006\_GIS

**Main Roads WA**  
**Level 2 Flora and Vegetation Assessment**  
**Perth-Darwin National Highway**

**Vegetation complexes**

Figure No:  
**6**





Scale 1:20,000
   
 Page size: A3
   
 Projection: GDA 1994 MGA Zone 50

**LEGEND**

- Project area
- Study area

**Quadrat**

- Coffey Environments (2014)
- 360 Environmental (2013)
- GHD project (2012)

**DPAW managed lands**

- Nature Reserve

Source & Notes  
 Conservation significant flora from Coffey (2014).  
 Managed lands from DPAW (January 2015).  
 Aerial imagery from Landgate (August 2014).



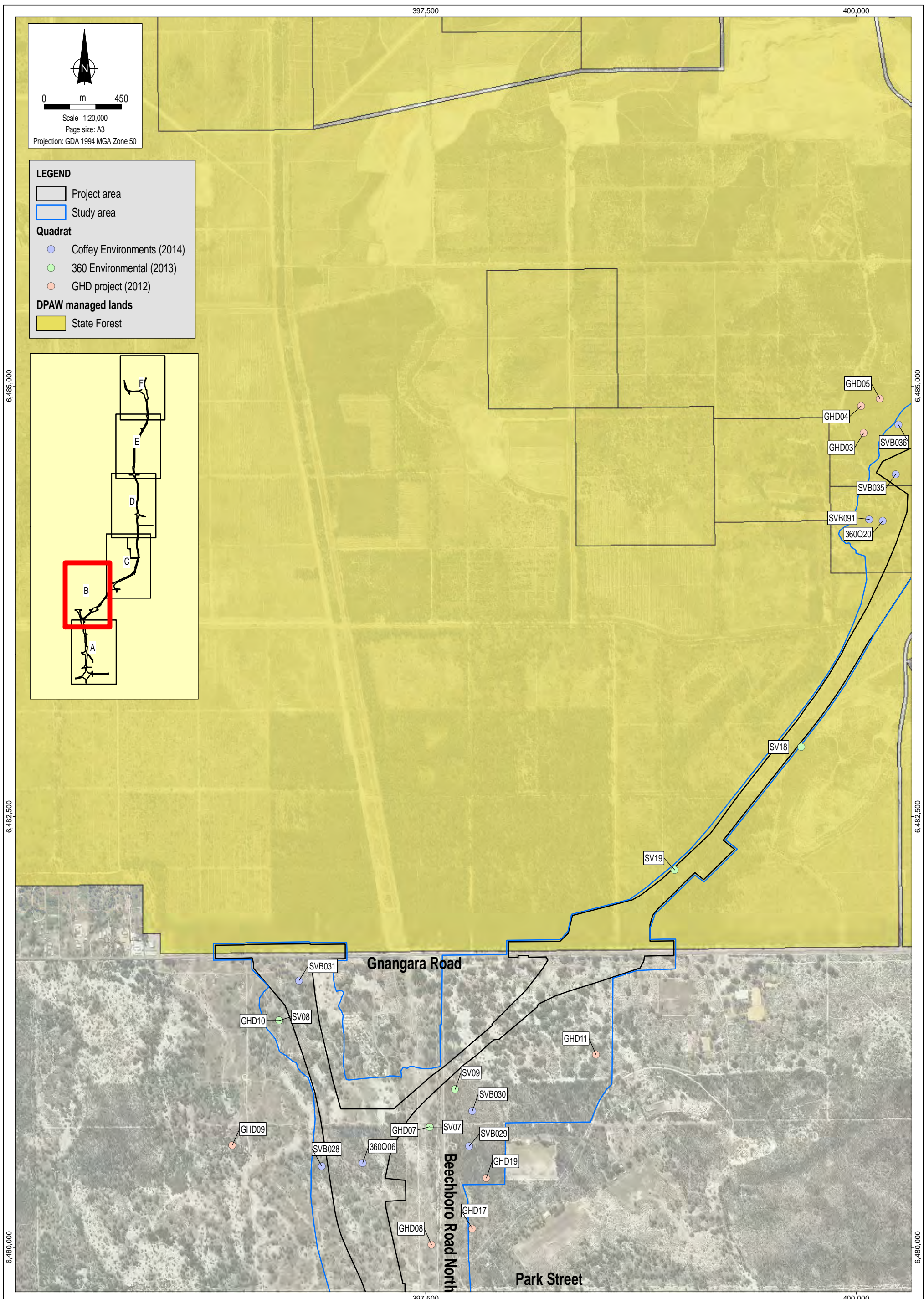
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 File Name:  
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**Main Roads WA**  
**Level 2 Flora and Vegetation Assessment**  
**Perth-Darwin National Highway**

Flora sampling sites

Figure No: 7A





**LEGEND**

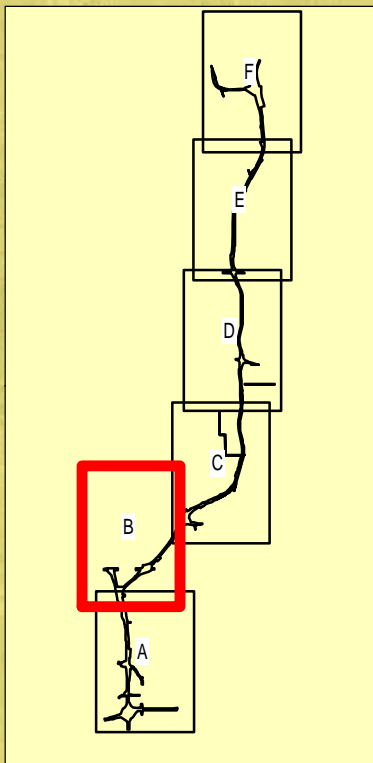
- Project area
- Study area

**Quadrat**

- Coffey Environments (2014)
- 360 Environmental (2013)
- GHD project (2012)

**DPAW managed lands**

- State Forest



Source & Notes  
 Conservation significant flora from Coffey (2014).  
 Managed lands from DPAW (January 2015).  
 Aerial imagery from Landgate (August 2014).



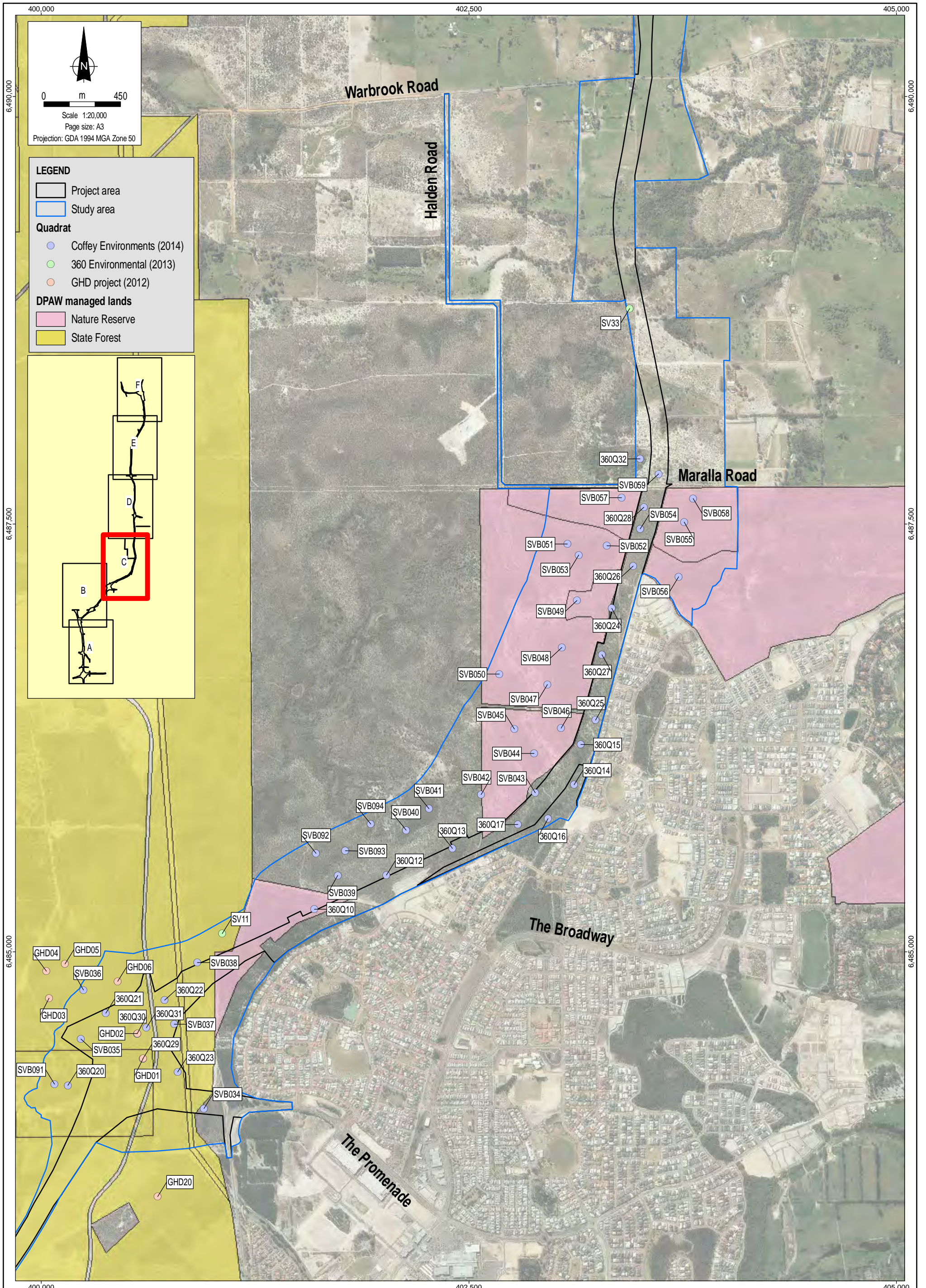
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 File Name:  
 4483AA\_23\_F007B\_GIS

**Main Roads WA**  
**Level 2 Flora and Vegetation Assessment**  
**Perth-Darwin National Highway**

**Flora sampling sites**

Figure No:  
**7B**





Scale 1:20,000
   
 Page size: A3
   
 Projection: GDA 1994 MGA Zone 50

**LEGEND**

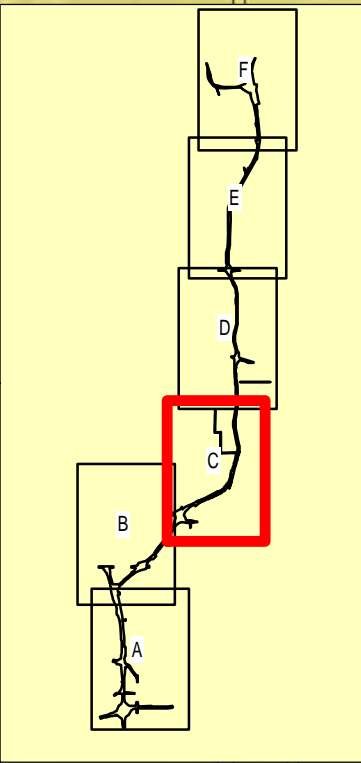
- Project area
- Study area

**Quadrat**

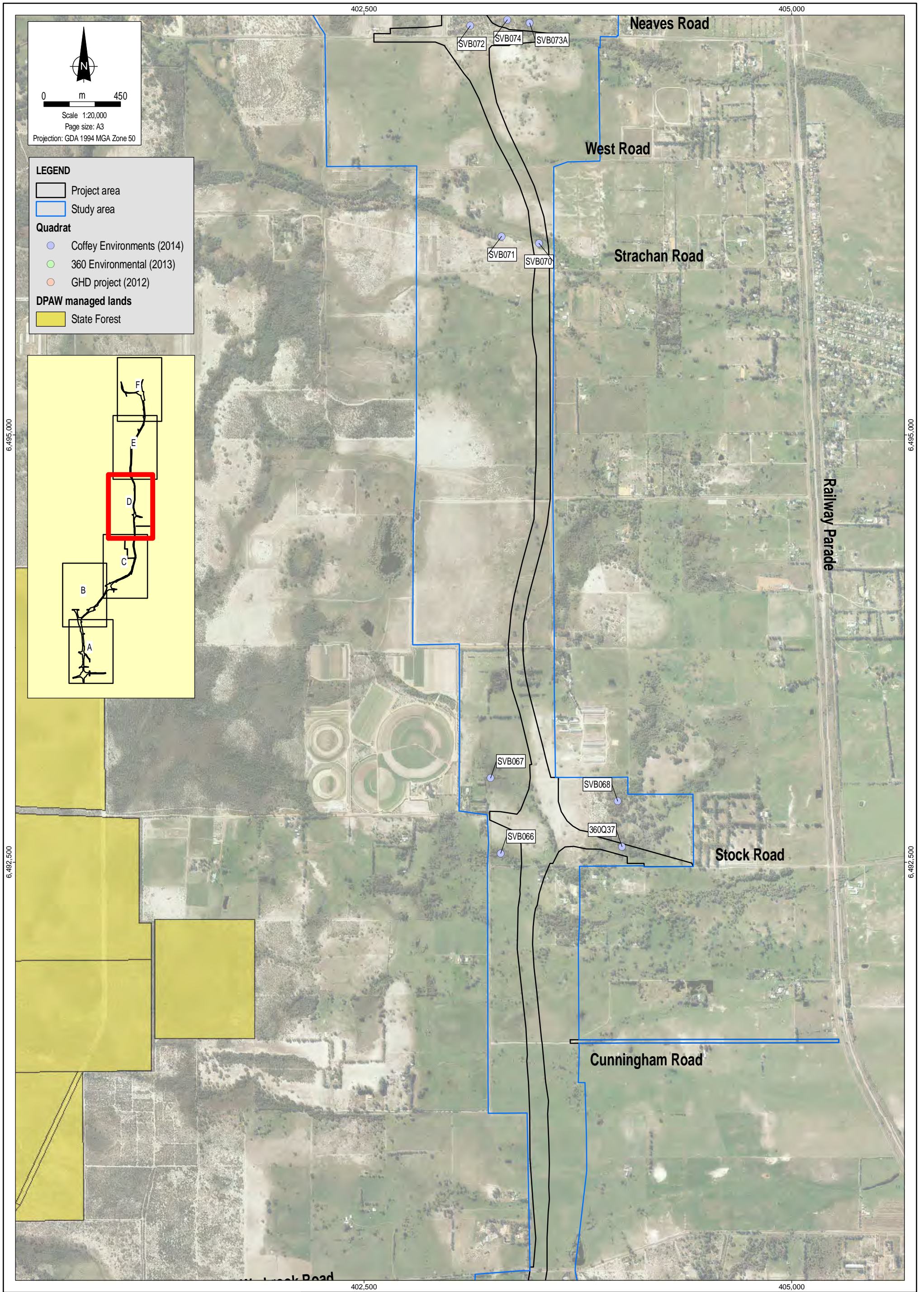
- Coffey Environments (2014)
- 360 Environmental (2013)
- GHD project (2012)


**DPAW managed lands**

- Nature Reserve
- State Forest












  
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 Projection: GDA 1994 MGA Zone 50


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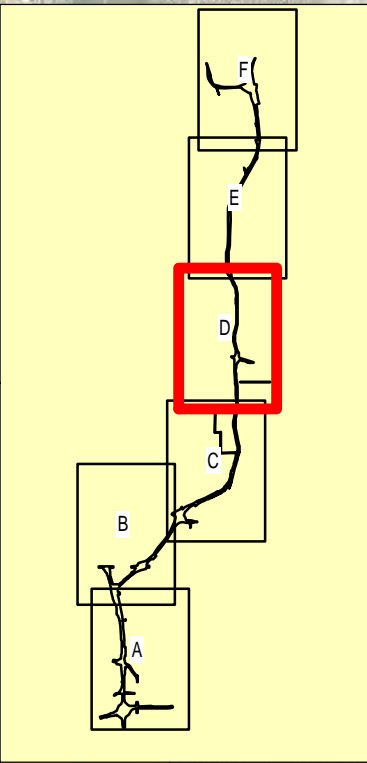
-  Project area
-  Study area

**Quadrat**

-  Coffey Environments (2014)
-  360 Environmental (2013)
-  GHD project (2012)

**DPAW managed lands**

-  State Forest



6,495,000

6,495,000

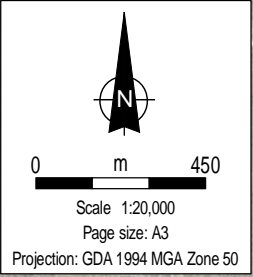
6,492,500

6,492,500



402,500

405,000

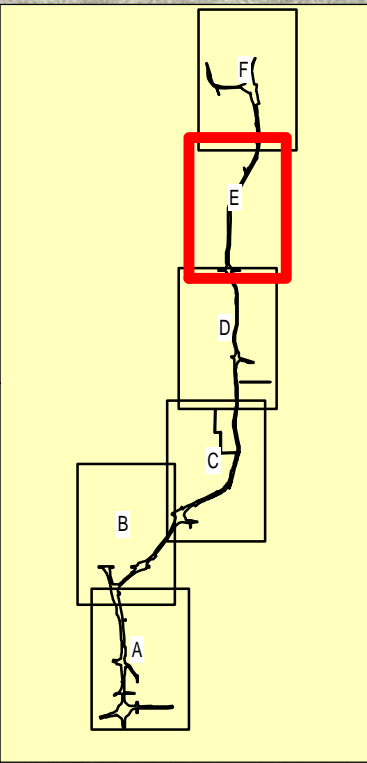


**LEGEND**

- Project area
- Study area

**Quadrat**

- Coffey Environments (2014)
- 360 Environmental (2013)
- GHD project (2012)



6,502,500

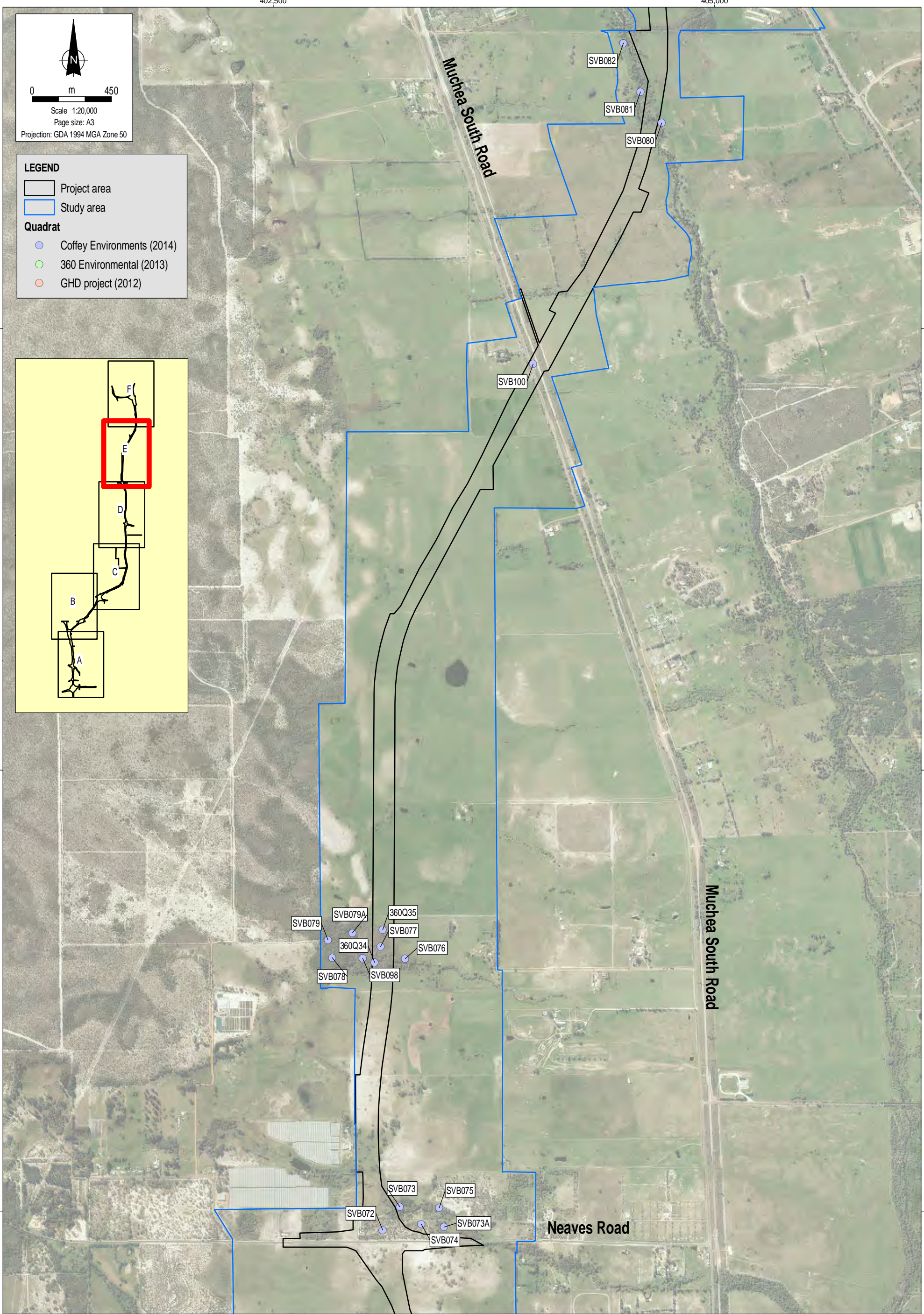
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6,500,000

6,500,000

6,497,500

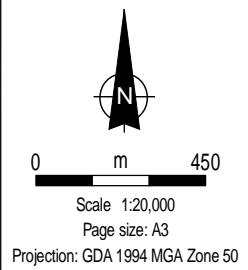
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402,500

405,000



**LEGEND**

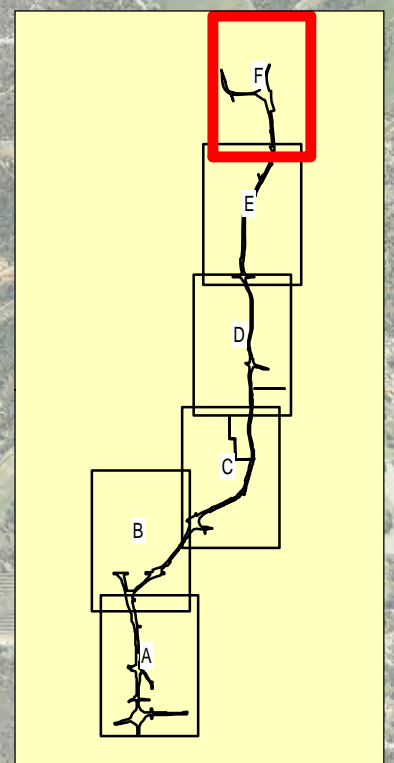
- Project area
- Study area

**Quadrat**

- Coffey Environments (2014)
- 360 Environmental (2013)
- GHD project (2012)

**DPAW managed lands**

- Nature Reserve



6,510,000

6,510,000

6,507,500

6,507,500

6,505,000

6,505,000

Brand Highway

Great Northern Highway

Muchea So

402,500

405,000

Source & Notes  
Conservation significant flora from Coffey (2014).  
Managed lands from DPAW (January 2015).  
Aerial imagery from Landgate (August 2014).



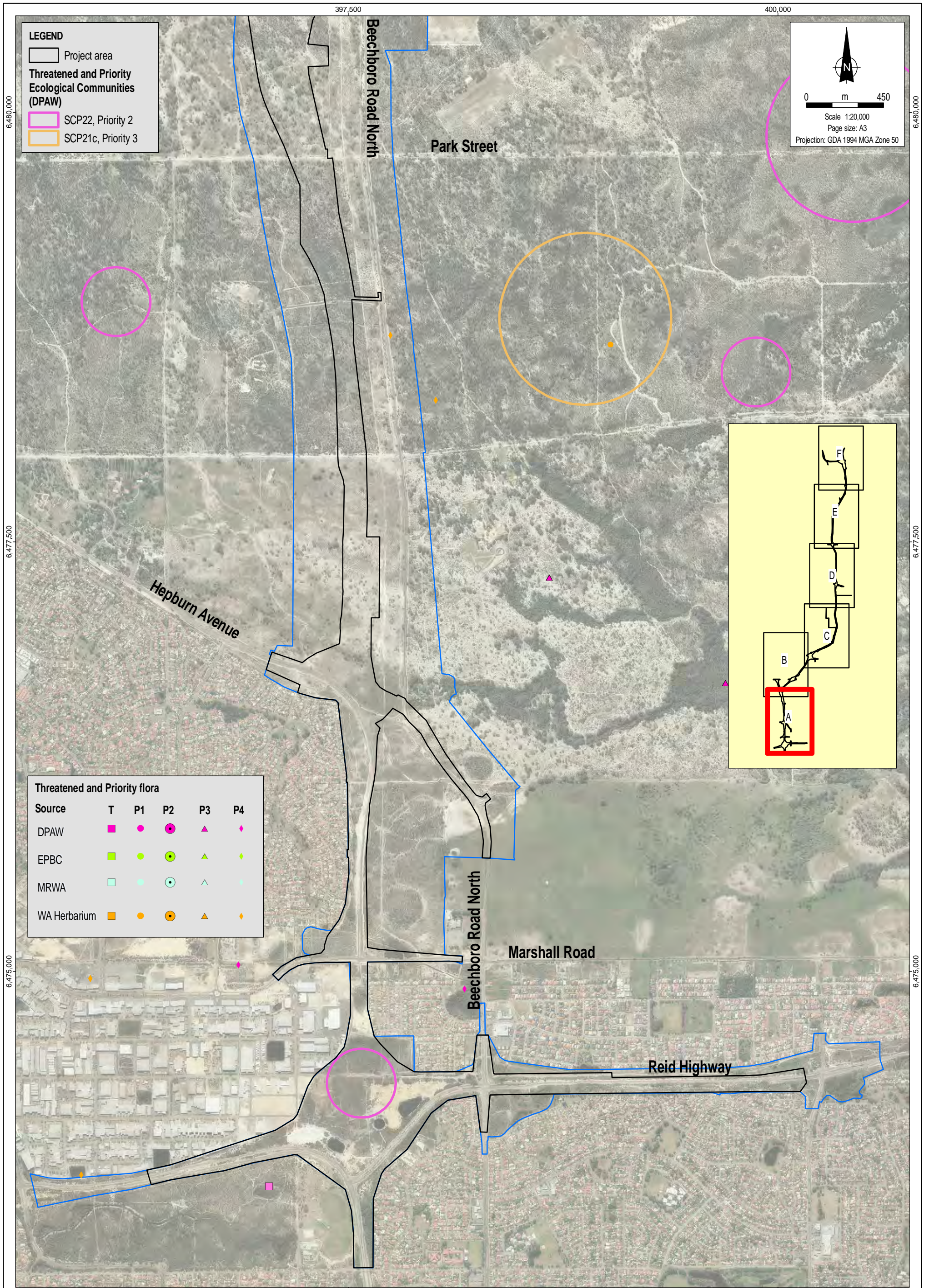
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File Name:  
4483AA\_23\_F007F\_GIS

**Main Roads WA**  
Level 2 Flora and Vegetation Assessment  
Perth-Darwin National Highway

Flora sampling sites

Figure No: 7F





**LEGEND**

Project area

**Threatened and Priority Ecological Communities (DPAW)**

SCP22, Priority 2

SCP21c, Priority 3

Scale 1:20,000  
Page size: A3  
Projection: GDA 1994 MGA Zone 50

**Threatened and Priority flora**

Source	T	P1	P2	P3	P4
DPAW	■	●	●	▲	◆
EPBC	■	●	●	▲	◆
MRWA	■	●	●	▲	◆
WA Herbarium	■	●	●	▲	◆

Source & Notes  
Threatened and Priority flora from DPAW and WA Herbarium (2013 and 2014).  
Threatened Ecological Communities from DPAW (2013 and 2014)  
Aerial imagery from Landgate (August 2014)

**NorthLinkWA**

**coffey**

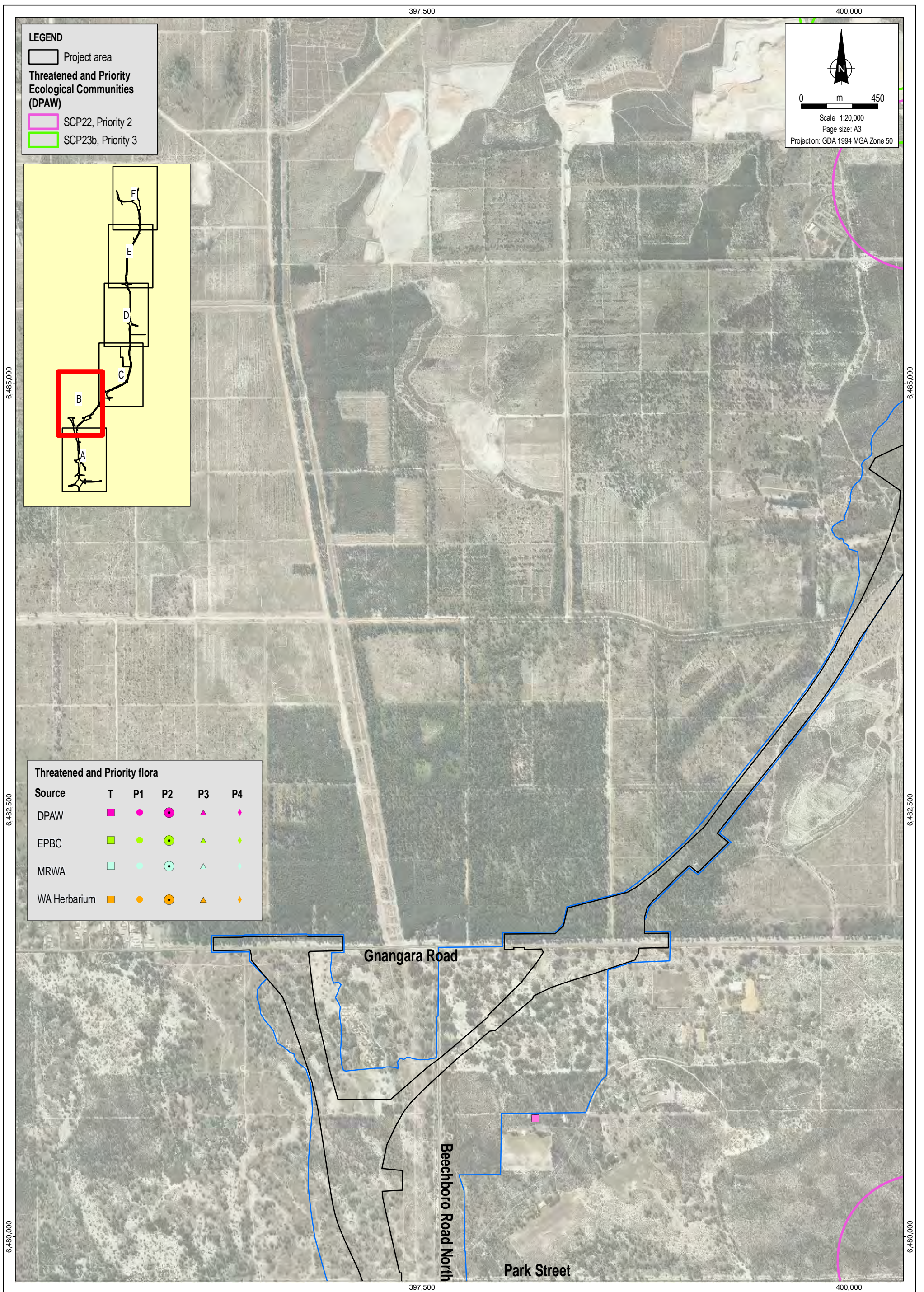
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MX: 4483AA\_23\_GIS014\_2  
File Name: 4483AA\_23\_F008A\_GIS

**Main Roads WA**  
Level 2 Flora and Vegetation Assessment  
Perth-Darwin National Highway

Environmental constraints

Figure No: 8A





**LEGEND**

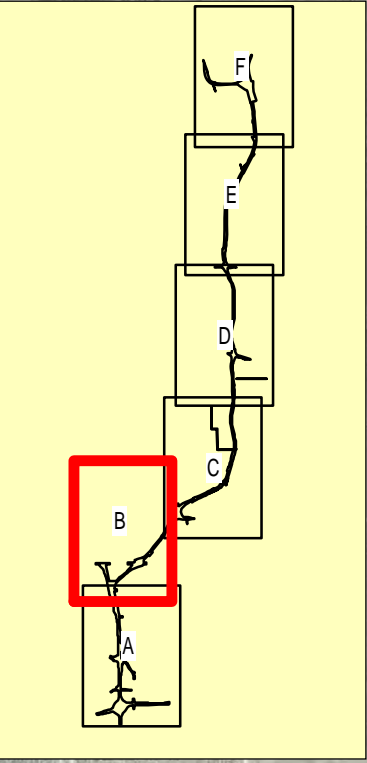
Project area

**Threatened and Priority Ecological Communities (DPAW)**

SCP22, Priority 2

SCP23b, Priority 3

Scale 1:20,000  
Page size: A3  
Projection: GDA 1994 MGA Zone 50



**Threatened and Priority flora**

Source	T	P1	P2	P3	P4
DPAW	■	●	●	▲	◆
EPBC	■	●	●	▲	◆
MRWA	■	●	●	▲	◆
WA Herbarium	■	●	●	▲	◆

6,485,000

6,482,500

6,480,000

6,485,000

6,482,500

6,480,000

397,500

400,000

397,500

400,000

Source & Notes  
Threatened and Priority flora from DPAW and WA Herbarium (2013 and 2014).  
Threatened Ecological Communities from DPAW (2013 and 2014)  
Aerial imagery from Landgate (August 2014)

**NorthLinkWA**

**coffey**

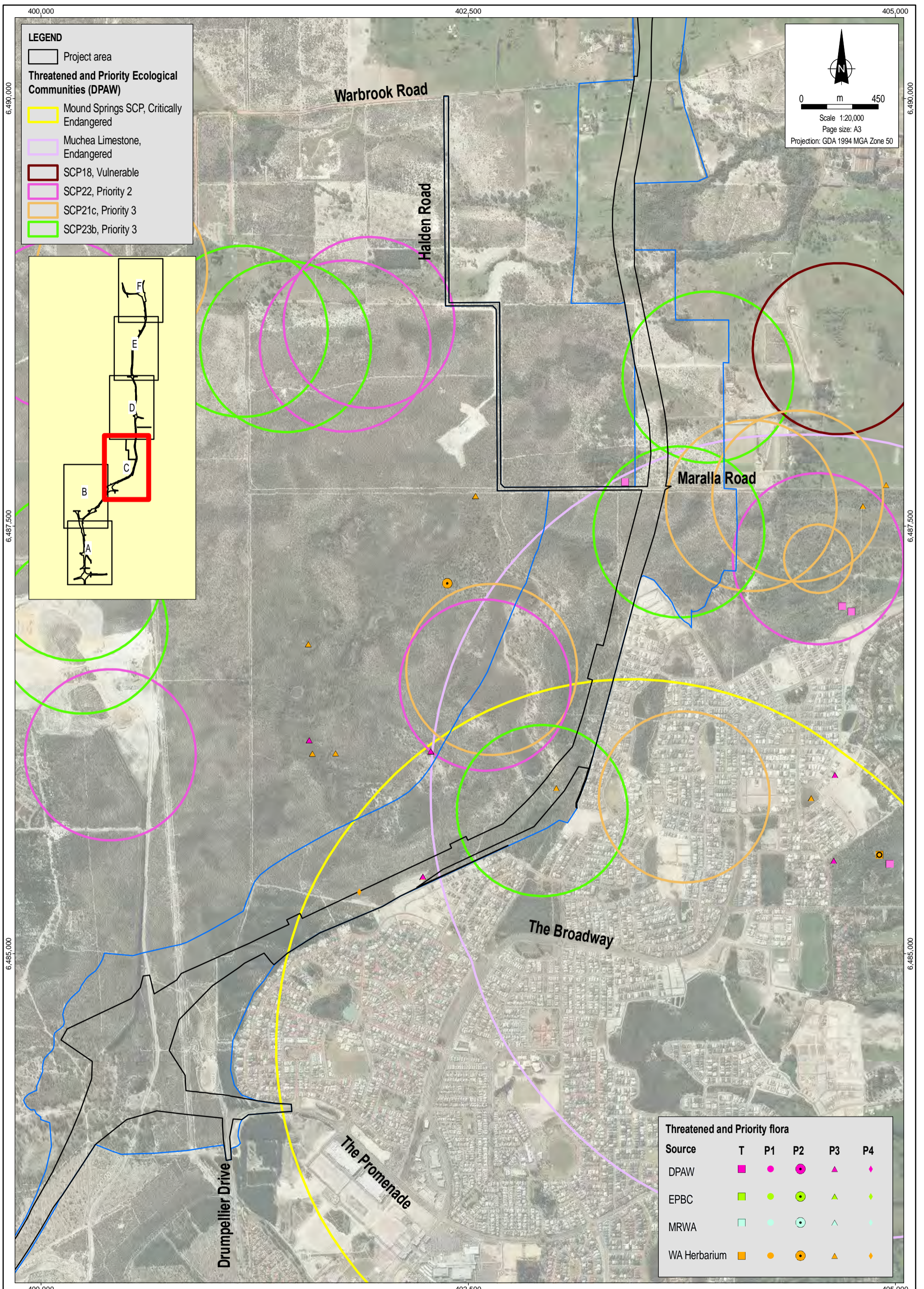
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File Name:  
4483AA\_23\_F008B\_GIS

**Main Roads WA**  
**Level 2 Flora and Vegetation Assessment**  
**Perth-Darwin National Highway**

**Environmental constraints**

Figure No:  
**8B**





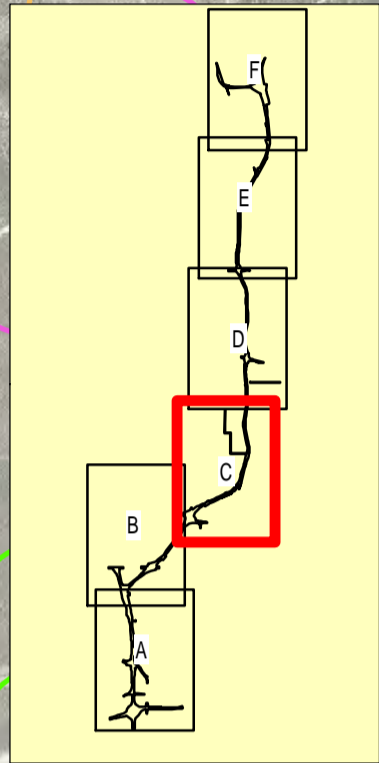
**LEGEND**

Project area

**Threatened and Priority Ecological Communities (DPAW)**

- Mound Springs SCP, Critically Endangered
- Muehea Limestone, Endangered
- SCP18, Vulnerable
- SCP22, Priority 2
- SCP21c, Priority 3
- SCP23b, Priority 3

Scale 1:20,000  
Page size: A3  
Projection: GDA 1994 MGA Zone 50



**Threatened and Priority flora**

Source	T	P1	P2	P3	P4
DPAW	■	●	●	▲	◆
EPBC	■	●	●	▲	◆
MRWA	■	●	●	▲	◆
WA Herbarium	■	●	●	▲	◆

Source & Notes  
Threatened and Priority flora from DPAW and WA Herbarium (2013 and 2014).  
Threatened Ecological Communities from DPAW (2013 and 2014)  
Aerial imagery from Landgate (August 2014)



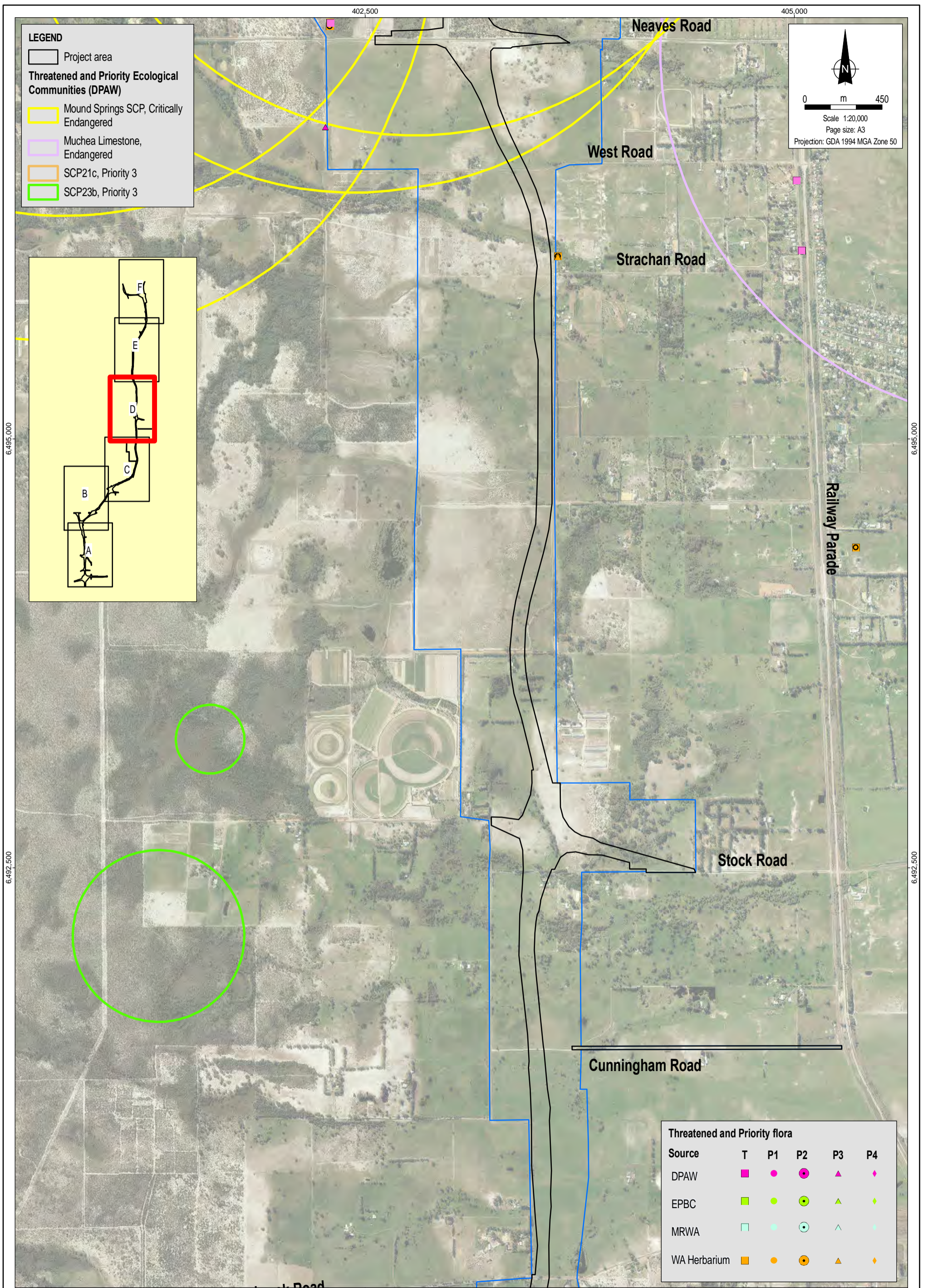
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File Name: 4483AA\_23 F008C GIS

**Main Roads WA**  
Level 2 Flora and Vegetation Assessment  
Perth-Darwin National Highway

Environmental constraints

Figure No: 8C





**LEGEND**

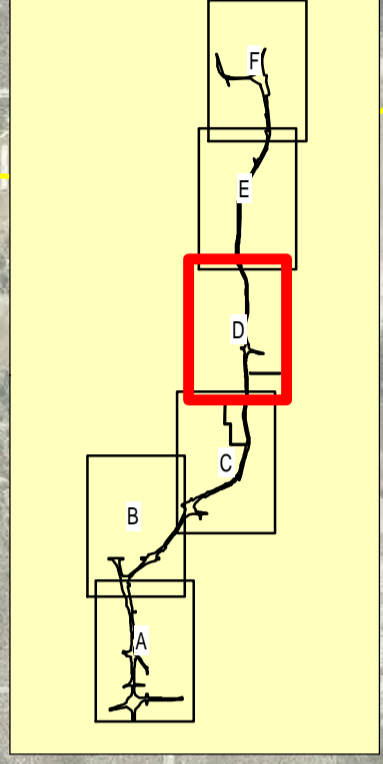
Project area

**Threatened and Priority Ecological Communities (DPAW)**

- Mound Springs SCP, Critically Endangered
- Muchea Limestone, Endangered
- SCP21c, Priority 3
- SCP23b, Priority 3

North Arrow

Scale: 1:20,000  
Page size: A3  
Projection: GDA 1994 MGA Zone 50



**Threatened and Priority flora**

Source	T	P1	P2	P3	P4
DPAW	■	●	●	▲	◆
EPBC	■	●	●	▲	◆
MRWA	■	●	●	▲	◆
WA Herbarium	■	●	●	▲	◆

Source & Notes  
Threatened and Priority flora from DPAW and WA Herbarium (2013 and 2014).  
Threatened Ecological Communities from DPAW (2013 and 2014).  
Aerial imagery from Landgate (August 2014)



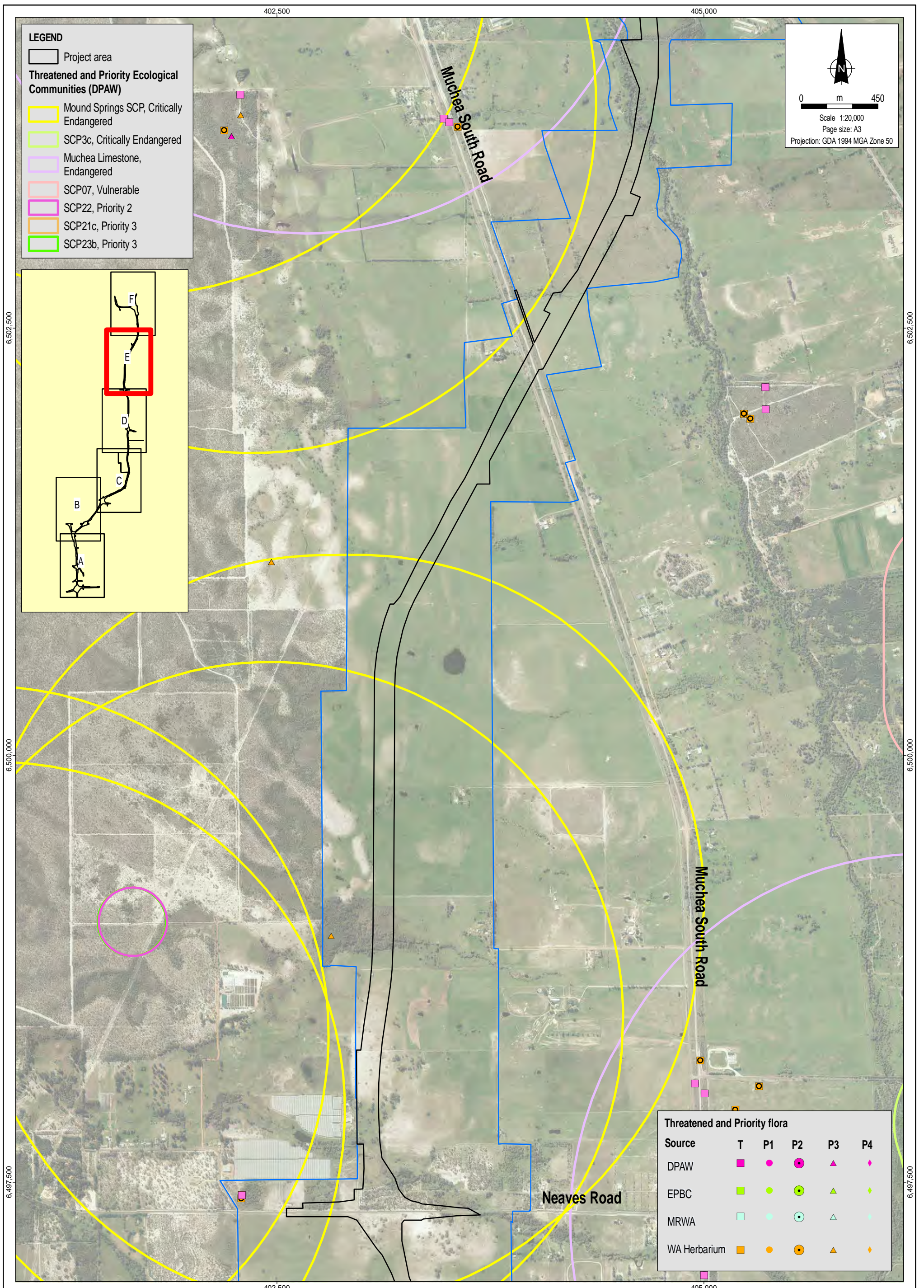
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File Name:  
4483AA\_23\_F008D\_GIS

**Main Roads WA**  
Level 2 Flora and Vegetation Assessment  
Perth-Darwin National Highway

**Environmental constraints**

Figure No:  
8D





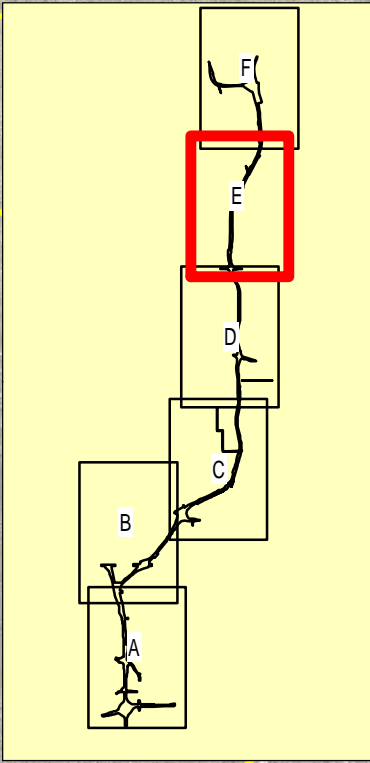
**LEGEND**

Project area

**Threatened and Priority Ecological Communities (DPAW)**

- Mound Springs SCP, Critically Endangered
- SCP3c, Critically Endangered
- Muechea Limestone, Endangered
- SCP07, Vulnerable
- SCP22, Priority 2
- SCP21c, Priority 3
- SCP23b, Priority 3

Scale 1:20,000  
 Page size: A3  
 Projection: GDA 1994 MGA Zone 50



**Threatened and Priority flora**

Source	T	P1	P2	P3	P4
DPAW	■	●	⊙	▲	◆
EPBC	■	●	⊙	▲	◆
MRWA	■	●	⊙	▲	◆
WA Herbarium	■	●	⊙	▲	◆

Source & Notes  
 Threatened and Priority flora from DPAW and WA Herbarium (2013 and 2014).  
 Threatened Ecological Communities from DPAW (2013 and 2014)  
 Aerial imagery from Landgate (August 2014)



Date: 24.03.2015  
 MXF: 4483AA\_23\_GIS014\_2  
 File Name: 4483AA\_23\_F008E\_GIS

**Main Roads WA**  
 Level 2 Flora and Vegetation Assessment  
 Perth-Darwin National Highway

**Environmental constraints**

Figure No: 8E