Bruce Highway

(Cooroy - Curra)

Strategic Planning Study

Recommended Corridor Report

July 2008

Australian Government
Department of Infrastructure, Transport, Regional Development and Local Government

AUSLINK
Building our National Transport Future

Main Roads
Queensland Government

ARUP

Department of Main Roads

Bruce Highway (Cooroy to Curra) Strategic Planning Study

Recommended Corridor Report

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Executive Summary

Scope of the study

The Australian government commissioned the study to:

- determine the needs for the 65km stretch of highway between Cooroy and Curra
- develop a strategy to progressively meet these needs for the next 30 years

The Bruce Highway has been progressively upgraded north from Brisbane in response to increased traffic volumes, higher freight demands and population growth. The highway has been constructed to a six-lane standard from Brisbane to Caboolture. North of Caboolture, the Bruce Highway has been constructed generally to a four-lane rural highway standard to Cooroy. Construction to a six-lane standard is currently underway between Caboolture and the Caboolture Northern Bypass. The section of highway north of Cooroy is the next two-lane section requiring duplication to the four –lane rural standard. Currently, an urban section of the Bruce Highway north of the Gympie-Brooloo Road (Kidgell Street) to Pine Street is being upgraded to four lanes, running through Gympie to address current congestion and safety issues.

The current highway north of Cooroy has been progressively improved over a long period. The route was established when traffic volumes and speed were significantly lower than today. Periodic alignment and safety improvements have attempted to keep pace with the relatively recent rapid traffic growth in the corridor. However, the road is still a two lane multiple access facility providing the functional requirements of a dual carriage way rural motorway.

At many locations through the study area, the existing Bruce Highway does not meet the performance expectations for the AusLink National Network.

Purpose of this Report

This report has been prepared to document the study's process since the release of proposed corridor in March 2007. This includes describing the:

- Public display of the proposed corridor;
- Options considered from community and stakeholder feedback; and
- The recommended corridor.

Stage A: Constraints and Deficiencies

The initial stage of the project focused on the collection of base data, identification of deficiencies of the existing highway and mapping of constraints to establish a new corridor. This included a household travel survey, distributed to select households within the local area, and a newsletter introducing the study. The outcome of this stage of the study was the release of the Constraints and Deficiencies Report in December 2004 and staffed displays outlining the data gathered. The report release was supported by Newsletter 1 which sought community feedback.

Stage B: Option Generation and assessment

The release of Newsletter 2 sought community input to assist with the ranking of assessment criteria. Using the baseline information gathered and analysed during Stage A, the study team generated a wide range of possible corridor options, which were then assessed against selection criteria. This led to a number of shortlisted corridor options. Maps of these options and supporting documentation including Newsletter 3 and the Shortlisting Report were released for public comment in November 2005 at displays in various locations throughout the study area. A 12-week consultation period followed.

Between 7 November 2005 and 27 January 2006, the study team received almost 1,600 individual written submissions from households and groups, more than 400 phone calls and thirteen petitions with in excess of 2,800 signatures.

Stage C: Selection of the Proposed Corridor

Community concerns about the shortlisted options led to a public meeting on the 19 November 2005 and the subsequent election and formation of a community group called the Cooroy Curra Community Committee (CCCC). The study team took the opportunity to directly liaise with the CCCC to better understand the views of the community throughout the study area.

As a result of the input that the CCCC and local council representatives provided to the study team, the original assessment criteria were put aside, and a set of guiding principles agreed. The new criteria significantly increased the importance of social issues.

In April 2006, the Queensland State Government announced the proposed Traveston Crossing Dam. This proposal had a significant impact on a number of the shortlisted options being investigated, and required the consideration of alternative corridors between Federal and Kybong.

In July 2006, the Federal Minister for Transport and Regional Services, The Hon. Warren Truss MP announced the study team would release a Refined Study Area (RSA).

The RSA covered an area of approximately 63km², compared to the original study area which covered an approximate area of 800km². The shortlisted options previously released for public comment in November 2005 were subsequently removed from the study due to the release of the refined study area.

Five Community Focus Groups were formed. The CFGs met with the study team a number of times in November and December 2006 and provided views and important information that assisted the study team in finalising the proposed corridor location. The meetings also enabled CFG representatives to gain a greater understanding of the issues and constraints surrounding the selection of the highway corridor. It was not the role of the CFGs to determine or approve the location of the proposed corridor.

Options were developed taking account of the community feedback and reducing social impacts and aligning to existing infrastructure corridors such as the existing Bruce Highway, high voltage powerlines and the North Coast Rail Line.

In March 2007, the proposed corridor was released to the public display, through a two-week display in Gympie and a mobile display visiting Cooroy, Federal, Kybong and Curra.

The study team received 308 items of feedback, including one petition of 316 signatures opposing the location of the Cudgerie Interchange and one 64-signature petition supporting the proposed corridor location at Kybong.

Stage D: Refinement of the Proposed Corridor

The proposed corridor was generally well received by the community. The principle issues raised were:

- Access to the highway corridor from other roads, overpasses and premises;
- Pollution – water table, airborne and water tank contamination;
- Noise and Noise barriers;
- Environmental concerns;
- Property resumptions – when and appropriate property values;
- Devaluation of property;
- Opposition to interchange locations – Cudgerie Drive and Gympie Connection Road;

- Excessive lighting at interchanges;
- Support for interchange locations – Cudgerie Drive, Mary River Road; and
- Support for the proposed corridor through Kybong, especially at Tandur Road.

The study team undertook extensive consultation and further research in respect of these issues. Further reporting was undertaken in respect of the 'Gympie Pyramid' and matters raised by Matilda Fuel Supplies.

The following changes are recommended to the proposed corridor placed on public display in March 2007;

- That the highway corridor incorporates additional north facing ramps for the industrial areas south of Gympie. These ramps include a northbound on ramp to the new corridor from the Penny Road/Noosa road intersection and a southbound off ramp from the new corridor to Flood Road.
- That the revised alignment through Curra State Forest be adopted as it reduces the number of affected landowners, eliminates the need to realign Old Maryborough Road and it has comparable environmental impacts to the proposed corridor.

It is also recommended that:

- An investigation be undertaken in the vicinity of Gympie Connection Road, when the project progresses at this location, to determine which local roads and intersections require upgrading to support the interchange.
- The remaining historic features of the 'Gympie Pyramid' be documented and that management measures for the construction phase of the project be implemented.
- At the detailed design stage investigations be undertaken to address potential noise and lighting impacts associated with the Cudgerie Drive/Cooroy Connection Road interchange.
- During detailed planning for the Traveston Crossing Dam the location and arrangement for the interchange is to be reviewed and opportunities investigated to achieve the best overall community benefit.
- The proposed highway corridor be subject to further environmental assessment and environmental and planning approvals processes. Targeted field surveys undertaken in 2006 have indicated the potential for the presence of threatened and endangered species listed under State and Federal legislation in certain areas along the proposed highway corridor. The proposed highway corridor also traverses numerous areas mapped as Regional Ecosystems (Not Of Concern, Of Concern, and Endangered), which are protected under the *Vegetation Management Act 1999*. In particular, further liaison with the Department of Natural Resources and Water, the Environmental Protection Agency and the Commonwealth Department of Environment and Water Resources should be undertaken to develop appropriate environmental assessment and management measures as each stage of the design and construction of the highway upgrade is implemented. A cultural heritage survey in accordance with the requirements of the Queensland Aboriginal Cultural Heritage Act will also be required at the appropriate stage.

The recommended corridor is shown on the **maps 1 to 5.**

Recommended Corridor Benefits

The recommended corridor was selected for the following key reasons:

- Provides the best overall balance sought by the community between functional, ecological, heritage, social and economic considerations and provides for staging opportunities south of Gympie.
- Best meets the objectives of the Cooroy-Curra Strategic Planning Study.
- Achieves high safety standards.
- Addresses the community concern about greater separation between communities and facilities and services that they rely on.
- Safer roads– separates high speed traffic from local traffic, pedestrians and other non-motorised forms of transport, restricts driveway access, maintains reasonable spacing between interchanges and divides the highway carriageways.
- Efficient and effective transport – limits access to the highway to promote high speed movement of passenger and freight vehicles, provide high level of flood immunity, designed for safe travel dynamics for heavy vehicles and road alignment standards promoting efficient movement of goods and people.
- Is relatively direct, making it attractive to longer distance freight and passenger traffic which provides a good outcome in terms of transport efficiency.
- Provides for greater use of public land and co-locates with existing infrastructure corridors, of the Bruce Highway, railway line and powerlines, where practical.
- Bypasses east of Gympie in a location that will serve the Gympie community by providing good access to local industry and business, better access to the developing coastal region and reasonable access from the highway through a service road system.
- Minimises proximity of heavy vehicles to populated areas, minimises noise and air quality impacts by not stopping or slowing heavy traffic in urban areas and separates high speed traffic from local traffic, pedestrians and other non motorised forms of transport.
- Allows for future growth areas by conforming with the Cooloola Shire Council planning scheme.
- Provides reasonable physical separation from existing and proposed major residential areas such that acceptable visual and traffic noise outcomes could be achieved with sensitive urban design.
- Minimises environmental impacts, by avoiding environmentally or culturally sensitive areas, minimising or mitigating environmental impacts.
- Retains the historic Traveston Homestead, Federal State School, local community halls and other historic sites.
- Retains the existing highway as a local road, to maintain property access and local road connectivity.
- Takes into account, wherever feasible, community views about the corridor location.

Recommended Corridor Summary

The recommended corridor duplicates the existing Bruce Highway between the Cooroy Bypass Interchange and Cooroy Connection Road. The duplication is to the western side of the existing carriageway and is generally within the existing highway reserve.

An all movements interchange utilising the existing underpass at Cooroy Connection Road/ Cudgerie Drive provides a northern access to Cooroy in addition to serving the township of Pomona and rural residential areas of Black Mountain. North of this interchange the proposed highway is separated from the existing highway corridor and the existing highway is retained to maintain the local road network.

North of Cooroy Connection Road the corridor aligns to the southern side of the existing highway reserve with significantly improved horizontal and vertical geometry. The recommended corridor crosses the existing highway near the Federal State School.

Within the area of the proposed Traveston Crossing dam the recommended corridor follows the dam's eastern buffer area. Should the dam not proceed then the location of the corridor may change to an alignment close to the existing Bruce Highway as originally favoured by the community. The existing highway will be inundated by the proposed dam; however a two lane service road aligning to the eastern side of the recommended corridor will continue to connect the local traffic which would otherwise have used the existing highway.

An all movements interchange on Traveston Road connects the service road around the dam and Traveston Road which link the corridor to the Federal, Coles Creek and Traveston areas. Additionally the interchange connects the area to the west of the proposed dam via Traveston Crossing Road.

North of the Traveston Interchange the corridor aligns to the eastern side of the high voltage powerlines up until Woondum Road, where it crosses back to the western side of the powerlines to provide the directional ramps of the Woondum Interchange. To provide priority and safety for the following major movements, this interchange includes south facing ramps only:

- Northbound from the new corridor into Gympie.
- Southbound out of Gympie onto the new corridor.

The corridor passes through the Woondum State Forest and then passes the industrial areas near Six Mile Creek (the Eldorado Gold Mine and Nolan's Meatworks) on its way to aligning to the eastern side of the existing North Coast Rail Line.

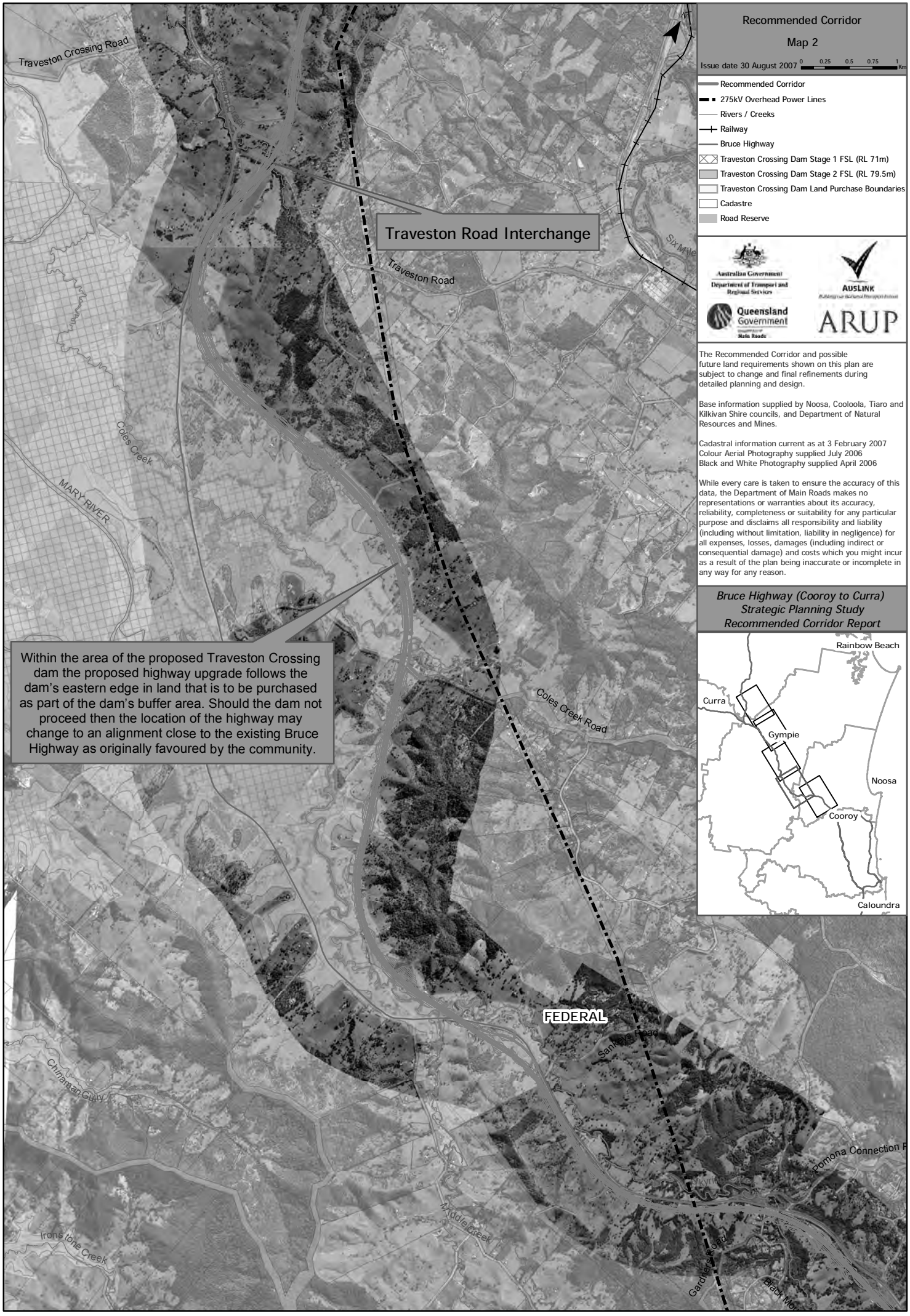
North facing ramps are provided near the industrial area south of Gympie to provide the movements which are not included in the Woondum interchange. These ramps include a northbound on ramp to the new corridor from the Penny Road/ Noosa Road intersection and a southbound off ramp from the new corridor to Flood Road. These ramps connect back to the existing Bruce highway via Hall Road.

An all movements interchange on Gympie Connection Road adjacent to the existing North Coast Rail Line provides significant flood immunity for an eastern access into Gympie and improved access to the developing coastal regions.

The corridor continues to align as close as feasible to the eastern side of the North Coast Rail Line until it reaches the Curra State Forest where the corridor moves to the east and aligns to the edge of the state forest. The corridor joins back to the existing highway at Curra approximately 1km north of the existing railway crossing. An all movements interchange links the corridor with the existing highway, Harvey Siding Road and Ashfords Road.

The recommended corridor is shown on the following **maps 1 to 5**


Recommended Corridor
Map 1
Issue date 30 August 2007
0 0.25 0.5 0.75 1 Km
Recommended Corridor
275kV Overhead Power Lines
Rivers / Creeks
Railway
Bruce Highway
Traveston Crossing Dam Stage 1 FSL (RL 71m)
Traveston Crossing Dam Stage 2 FSL (RL 79.5m)
Traveston Crossing Dam Land Purchase Boundaries
Cadastre
Road Reserve
Australian Government
Department of Transport and Regional Services
AUSLINK
Queensland Government
Main Roads
ARUP
The Recommended Corridor and possible future land requirements shown on this plan are subject to change and final refinements during detailed planning and design.
Base information supplied by Noosa, Cooloola, Tiaro and Kilkivan Shire councils, and Department of Natural Resources and Mines.
Cadastral information current as at 3 February 2007
Colour Aerial Photography supplied July 2006
Black and White Photography supplied April 2006
While every care is taken to ensure the accuracy of this data, the Department of Main Roads makes no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and disclaims all responsibility and liability (including without limitation, liability in negligence) for all expenses, losses, damages (including indirect or consequential damage) and costs which you might incur as a result of the plan being inaccurate or incomplete in any way for any reason.
Bruce Highway (Cooroy to Curra)
Strategic Planning Study
Recommended Corridor Report
Rainbow Beach
Curra
Gympie
Noosa
Cooroy
Caloundra
POMONA
COOROY
Existing highway remains to function as a service road
Cooroy Connection Road Interchange
Duplication of existing highway (generally within the existing reserve) between the existing Cooroy Interchange and Cooroy Connection Road Interchange
Existing Cooroy Interchange
Pomona Connection Road
Cooroy Connection Road
Pioneer Road
Gardners Road
Black Mountain Range Road
Sankeys Road
Coles Creek
Jam Pot Creek
Pinbarren Creek
Six Mile Creek
Six Mile Creek (Left Branch)
Miclyle Creek
Slate Creek


Recommended Corridor
Map 2
Issue date 30 August 2007
0 0.25 0.5 0.75 1 Km
Recommended Corridor
275kV Overhead Power Lines
Rivers / Creeks
Railway
Bruce Highway
Traveston Crossing Dam Stage 1 FSL (RL 71m)
Traveston Crossing Dam Stage 2 FSL (RL 79.5m)
Traveston Crossing Dam Land Purchase Boundaries
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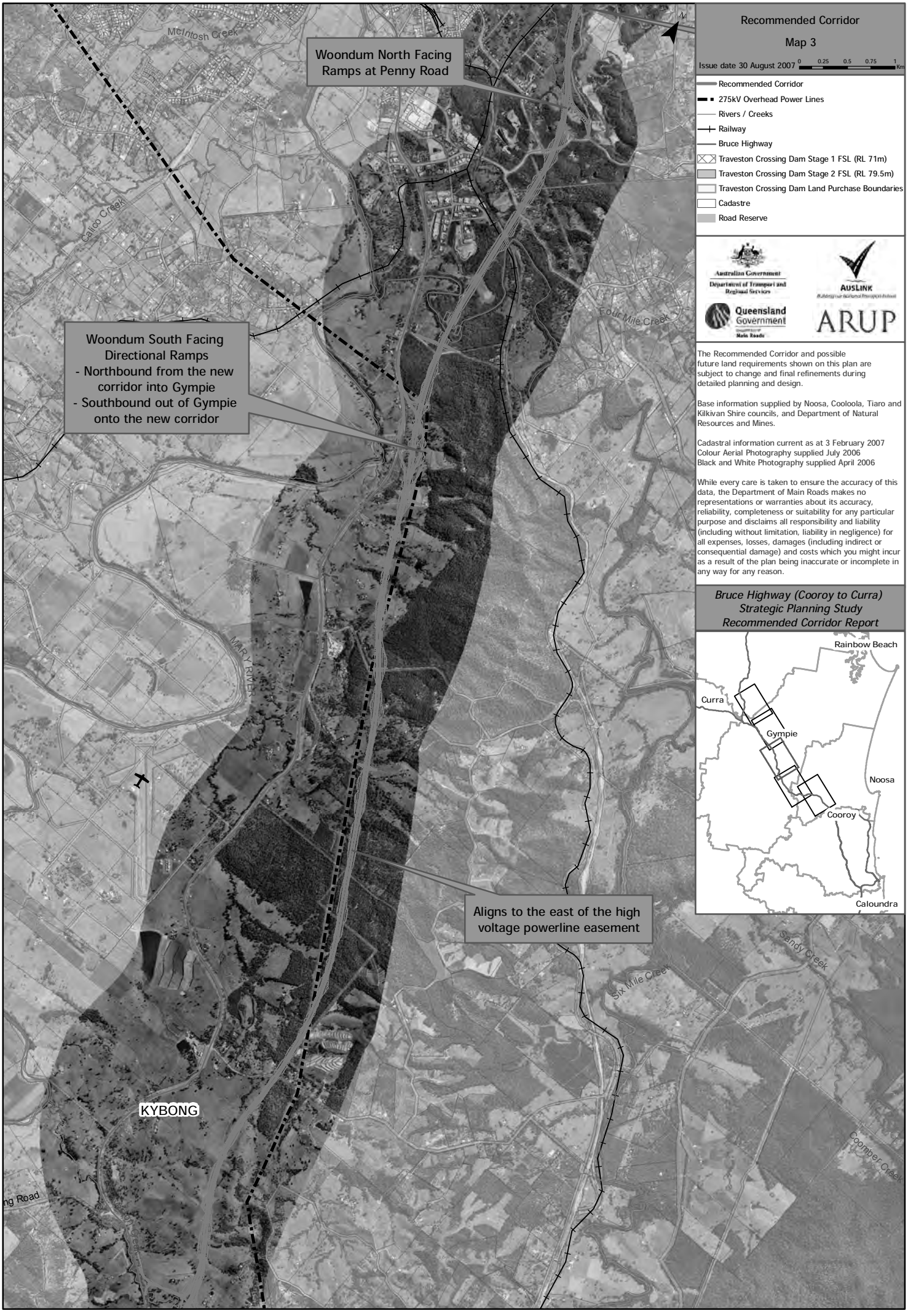
Strategic Planning Study
Recommended Corridor Report
Rainbow Beach
Curra
Gympie
Noosa
Cooroy
Caloundra
Traveston Road Interchange
Traveston Crossing Road
Traveston Road
Coles Creek
MARY RIVER
Coles Creek Road
Within the area of the proposed Traveston Crossing dam the proposed highway upgrade follows the dam's eastern edge in land that is to be purchased as part of the dam's buffer area. Should the dam not proceed then the location of the highway may change to an alignment close to the existing Bruce Highway as originally favoured by the community.
FEDERAL
Sankeys Road
Chinaman Gully
Ironstone Creek
Middle Creek
Gardens Road
Pomona Connection R


Recommended Corridor
Map 3
Issue date 30 August 2007
0 0.25 0.5 0.75 1 Km
Recommended Corridor
275kV Overhead Power Lines
Rivers / Creeks
Railway
Bruce Highway
Traveston Crossing Dam Stage 1 FSL (RL 71m)
Traveston Crossing Dam Stage 2 FSL (RL 79.5m)
Traveston Crossing Dam Land Purchase Boundaries
Cadastre
Road Reserve
Australian Government
Department of Transport and Regional Services
AUSLINK
Queensland Government
Main Roads
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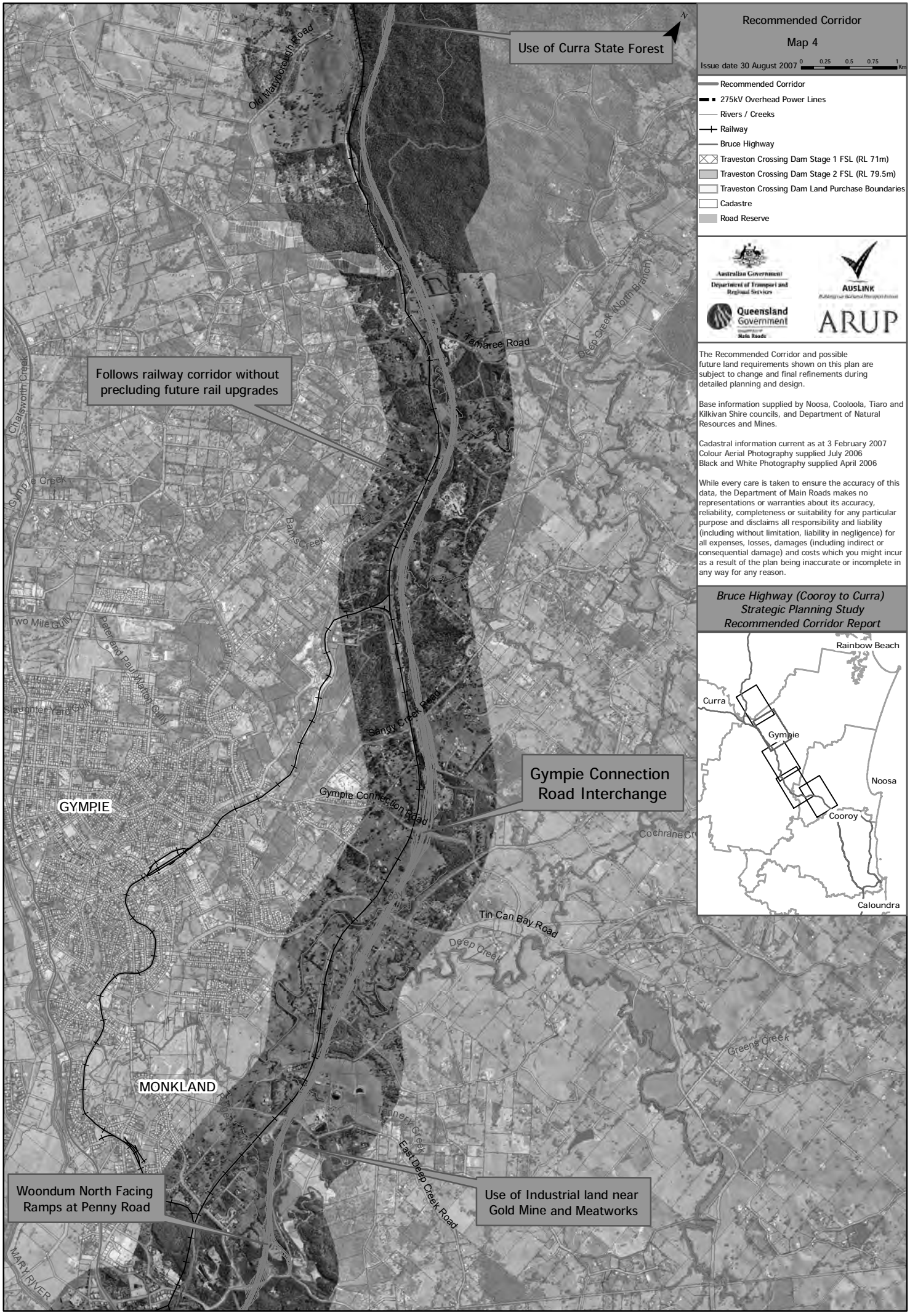
Bruce Highway (Cooroy to Curra)
Strategic Planning Study
Recommended Corridor Report
Rainbow Beach
Curra
Gympie
Noosa
Cooroy
Caloundra
Woondum North Facing Ramps at Penny Road
Woondum South Facing Directional Ramps
- Northbound from the new corridor into Gympie
- Southbound out of Gympie onto the new corridor
Aligns to the east of the high voltage powerline easement
McIntosh Creek
Calico Creek
Four Mile Creek
MARY RIVER
Sandy Creek
Six Mile Creek
Coomber Creek
KYBONG


Recommended Corridor
Map 4
Issue date 30 August 2007
0 0.25 0.5 0.75 1 Km
Recommended Corridor
275kV Overhead Power Lines
Rivers / Creeks
Railway
Bruce Highway
Traveston Crossing Dam Stage 1 FSL (RL 71m)
Traveston Crossing Dam Stage 2 FSL (RL 79.5m)
Traveston Crossing Dam Land Purchase Boundaries
Cadastre
Road Reserve
Australian Government
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AUSLINK
Queensland Government
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Bruce Highway (Cooroy to Curra)
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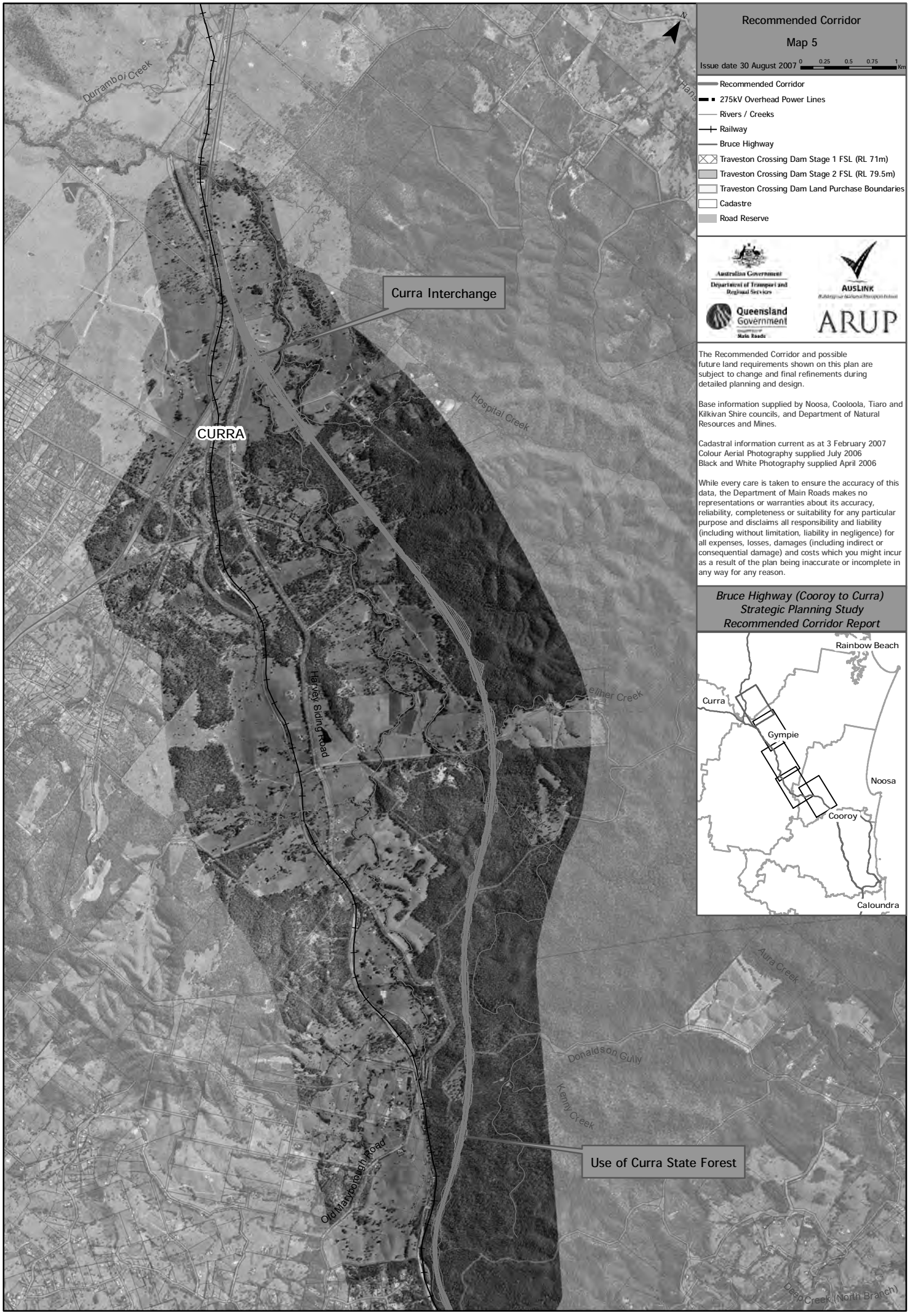
Recommended Corridor Report
Rainbow Beach
Curra
Gympie
Noosa
Cooroy
Caloundra
N
Use of Curra State Forest
Follows railway corridor without precluding future rail upgrades
Gympie Connection Road Interchange
Woondum North Facing Ramps at Penny Road
Use of Industrial land near Gold Mine and Meatworks
GYMPIE
MONKLAND
Old Maryborough Road
Tamaree Road
Deep Creek (North Branch)
Chatsworth Creek
Gympie Creek
Barnes Creek
Two Mile Gully
Peter and Paul Martin Gully
Slaughter Yard Gully
Sandy Creek Road
Gympie Connection Road
Cochrane Cr
Tin Can Bay Road
Deep Creek
Greens Creek
Tinnery Creek
East Deep Creek Road
MARY RIVER


Recommended Corridor
Map 5
Issue date 30 August 2007
0 0.25 0.5 0.75 1 Km
Recommended Corridor
275kV Overhead Power Lines
Rivers / Creeks
Railway
Bruce Highway
Traveston Crossing Dam Stage 1 FSL (RL 71m)
Traveston Crossing Dam Stage 2 FSL (RL 79.5m)
Traveston Crossing Dam Land Purchase Boundaries
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Curra
Gympie
Noosa
Cooroy
Caloundra
Curra Interchange
CURRA
Use of Curra State Forest
Durramboi Creek
Hospital Creek
Harvey Siding Road
Old Maryborough Road
Aura Creek
Donaldson Gully
Kenny Creek
Deep Creek (North Branch)

1 Introduction

The Australian government commissioned this study to:

- determine the needs for the 65km stretch of highway between Cooroy and Curra; and
- develop a strategy to progressively meet these needs for the next 30 years,

The Queensland and Australian governments appointed a study team to examine the long-term upgrade of the Bruce Highway between Cooroy and Curra. The Bruce Highway (Cooroy to Curra) Strategic Planning Study was initiated to investigate how best to improve safety, reduce delays and improve freight efficiency during the next 30 years whilst minimising impacts on existing communities and the environment.

The Bruce Highway has been progressively upgraded north from Brisbane in response to increased traffic volumes, higher freight demands and population growth. The highway has been constructed to a six-lane standard from Brisbane to Caboolture. North of Caboolture, the Bruce Highway has been constructed generally to a four-lane rural highway standard to Cooroy. Construction to a six-lane standard is currently underway between Caboolture and the Caboolture Northern Bypass. The section of highway north of Cooroy is the next two-lane section requiring duplication to the four –lane rural standard. Currently, an urban section of the Bruce Highway north of the Gympie-Brooloo Road (Kidgell Street) to Pine Street is being upgraded to four lanes, running through Gympie to address current congestion and safety issues.

The current highway north of Cooroy has been progressively improved over a long period. The route was established when traffic volumes and speed were significantly lower than today. Periodic alignment and safety improvements have attempted to keep pace with the relatively recent and rapid traffic growth in the corridor. However, the road is still a two lane multiple access facility undertaking the functional requirements of a dual carriage way rural motorway.

At many locations through the study area, the existing Bruce Highway does not meet the performance expectations for the AusLink National Network.

This study will identify the best corridor for the highway to provide a safe and efficient solution for the longer term, while minimising impacts on existing communities and the environment. The study commenced in 2004 and is expected to be completed in 2007. The original study area was very large, covering an area of approximately 800km². In August 2006 the study team reduced this to a refined study area from within which the new highway corridor was selected.

1.1 Purpose of This Report

This report has been prepared to document the study's process since the release of proposed corridor in March 2007. This includes describing the:

- Public display of the proposed corridor;
- Options considered from community and stakeholder feedback; and
- The recommended corridor.

1.2 Limitations of this Report

This report has been prepared in accordance with our client's particular instructions and requirements and addresses their priorities at this time. Arup does not accept any liability or responsibility whatsoever to any person other than the Queensland Department of Main Roads, including:

- Any use of this report by any third party; or
- Any third party whose interest may be affected (whether directly or indirectly) by any the contents of this report.

This Corridor Report is not an Environmental Impact Statement (EIS), and has taken environmental assessment to a level necessary to determine the location of the highway corridor. This report acknowledges that there are environmental issues that will need to be considered in greater detail than in this strategic level of investigation. This report provides recommendations for these issues to be appropriately addressed in future detailed planning and design stages.

Within the area of the proposed Traveston Crossing dam the refined study area follows the dam's eastern edge in land that will form part of the dam's buffer area. Options initially considered that traversed this area have not been progressed further in this report. Should the dam not proceed then the location of the highway may change to an alignment close to the existing Bruce Highway as originally favoured by the community.

This report is based on the information included in the Shortlisting Report (October 2005) and subsequent investigations by the study team. A number of key local and state government stakeholders have also provided considerable input to the corridor assessment process.

This process of corridor evaluation and selection has taken into account the views and concerns of those who have contacted the study team through submissions, phone calls or other means. Not all of the expectations have been met, however the study team considers that the recommended corridor presented in this report is a balanced result of consideration of a range of competing factors.

Data limitations and assumptions are summarised in Section 1.5 of this report.

1.3 Overview of the Study Process to date

The study is being delivered as a staged approach, as discussed below and shown in **Figure 1.3a**:

1.3.1 Stage A: Constraints and Deficiencies

The initial stage of the project focused on the collection of base data, identification of deficiencies of the existing highway and mapping of constraints to establish a new corridor. This included a household travel survey, distributed to select households within the local area, and a newsletter introducing the study. The outcome of this stage of the study was the release of the Constraints and Deficiencies Report in December 2004 and staffed displays outlining the data gathered. The report release was supported by Newsletter 1 which sought community feedback.

1.3.2 Stage B: Option Generation and assessment

The release of Newsletter 2 sought community input to assist with the ranking of assessment criteria. Using the baseline information gathered and analysed during Stage A, the study team generated a wide range of possible corridor options, which were then assessed against selection criteria. This led to a number of shortlisted corridor options. Maps of these options and supporting documentation including Newsletter 3 and the Shortlisting Report were released for public comment in November 2005 at displays in various locations throughout the study area. A 12-week consultation period followed. Between 7 November 2005 and 27 January 2006, the study team received almost 1,600 individual written submissions from households and groups, more than 400 phone calls and thirteen petitions with in excess of 2,800 signatures.

1.3.3 Stage C: Selection of Proposed Corridor

Concerns about the short listed options led to a public meeting on the 19 November 2005 and the subsequent election and formation of a community group called the Cooroy Curra Community Committee (CCCC).

From December 2005 to May 2006, the study team met with the CCCC and local council representatives to assess and discuss possible alternatives and to review the existing short-listed options. As a result of this input the CCCC and local council representatives provided to the study team, the original assessment criteria were put aside, and a set of guiding

principles agreed. The feedback received during the 12-week consultation period following the release of the short listed options in November 2005 was also analysed in conjunction with the input provided by the CCCC.

Using the agreed guiding principles a new set of assessment criteria were developed to compare and assess the performance of new and previous options. The new criteria significantly strengthened the importance of social issues.

One of the main community concerns was the need to bring certainty about the future location for the highway upgrade as quickly as possible. In response, a refined study area' (RSA) was determined, within which the study team could continue to develop and assess corridor options. The RSA was released in August 2006 and covered an area of approximately 63km², compared to the original study area of approximately 800km².

To assist in determining the corridor location within the RSA, nominations were sought from community members in or close to the refined study area to participate in Community Focus Groups (CFGs).

Five Community Focus Groups were formed to cover the RSA and met with the study team a number of times in November and December 2006 providing important information that assisted in finalising the corridor location. The meetings also enabled CFG representatives to gain a greater understanding of the issues surrounding the selection of the highway corridor.

Newsletter 4 also encouraged community feedback through written submissions. In addition to the input provided by the CFGs, approximately 343 comments and submissions were received and provided further information about areas within the refined study area, including environmental conditions, property impacts and land use concerns about potential corridor options within the refined study area.

After an intensive consultation period and investigatory process, and completion of further investigations the study team identified the proposed corridor, taking into account the following:

- Community feedback and submissions (including local business stakeholders);
- Guiding principles and new assessment criteria developed in conjunction with the CCCC;
- CFG submissions;
- Additional investigations into physical and environmental conditions;
- Input from key local and state government stakeholders;
- Submissions and discussions with other stakeholders who have approached the study team;
- Independent (of the study team) technical engineering review (conducted by DMR); and
- Refinement of engineering design.

The Queensland Department of Main Roads released Information Sheets 1 and 2 (October 2006) and 3 (December 2006) in direct response to community concerns about the effects of the RSA.

1.3.4 Stage D: Refinement of Proposed Corridor

In March 2007, the proposed corridor was placed on public display, with a two-week display in Gympie and a mobile display visiting Cooroy, Federal, Kybong and Curra. Newsletter 5 was distributed to the community showing a map of the proposed corridor and providing details of the displays.

The displays included a 12.5 metre long map of the entire proposed corridor, with aerial photography and cadastral data to ensure community members could identify their properties in relation to the proposed corridor.

The Queensland Department of Main Roads wrote to all landholders whose properties were directly affected by, or within 500 metres of, the proposed corridor and included a copy of Newsletter 5.

Directly affected landholders were encouraged to make appointments for one-on-one meetings with Department of Main Roads officers to discuss individual situations and issues such as property resumptions.

Newsletter 5 and the displays provided the community with the opportunity to make final submissions to the study team about the corridor location.

Community feedback opportunities included response forms available at the displays, toll free 1800 number Reply paid post address, dedicated email address and fax number.

By close of the comment period, on Friday 13 April 2007, the study team had received 96 requests for additional information; including an explanation of what it meant to be within 500 metres of the proposed corridor; requests for corridor maps, copies of the report on CD and copies of the corridor visualisation DVD.

The study team received 404 items of feedback, including one petition of 316 signatures opposing the location of the Cudgerie Interchange and one 64-signature petition supporting the proposed corridor location at Kybong. Each petition was recorded as one item of feedback for the purposes of statistical recording.

The major feedback issues related to opposition to the location of the proposed interchange at Cudgerie Drive and the impact of noise and the need for appropriate barriers. More detailed information is provided in Section 2.

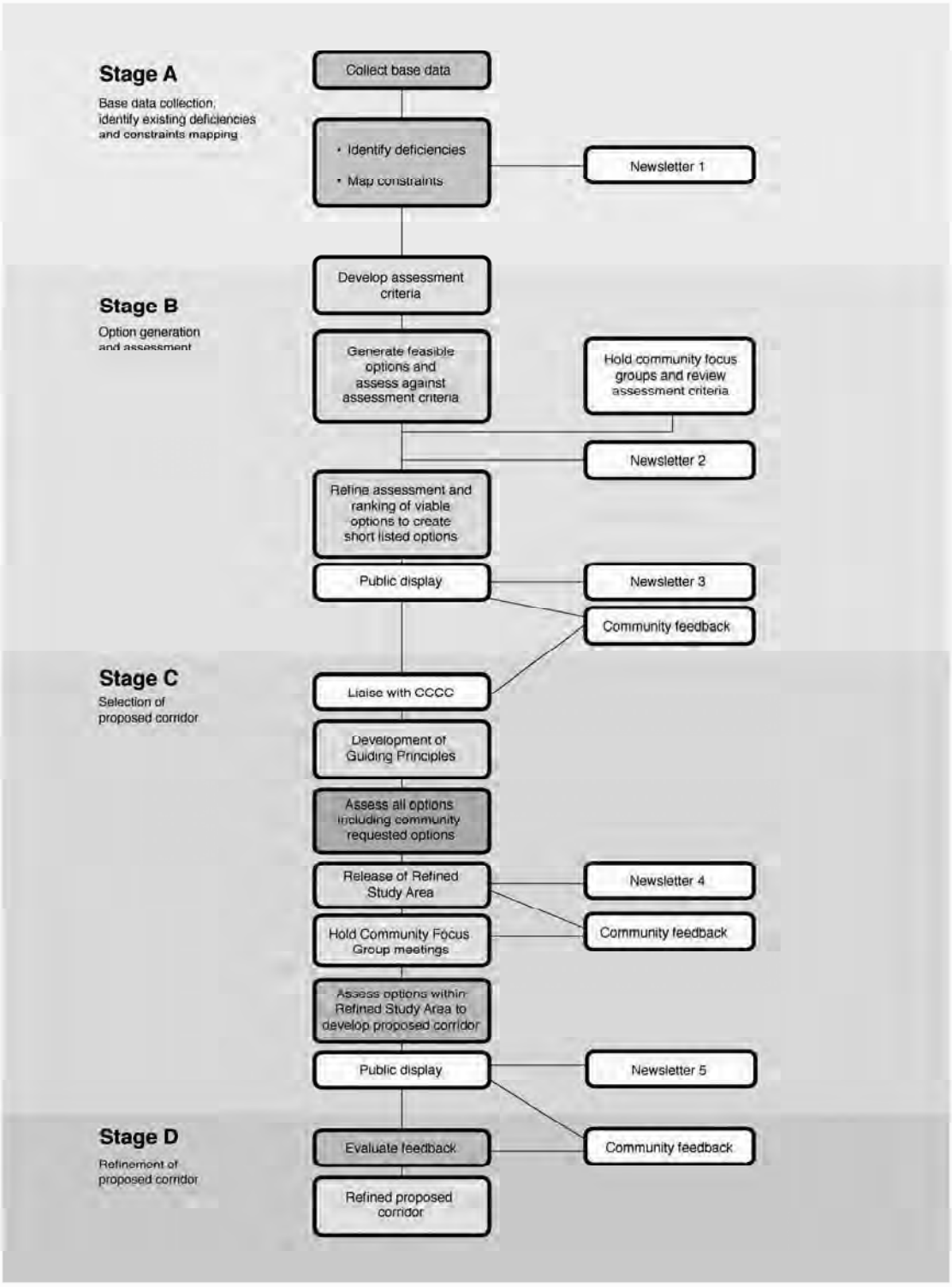

Figure 1.3a: The study process

1.4 Consultation Overview

Throughout the study process, contact has been maintained with the community by periodic media releases, the distribution of 5 newsletters, fact sheets, information sheets, displays and focus groups. A free call number and website have been available since the commencement of the project. Responses and feedback are regularly received via facsimile, post and email and are entered into the study database. Four community surveys have also been conducted during the course of the study.

1.5 Data Limitations and Assumptions

This is a strategic study, which has been carried out to a level of detail to provide the study team with sufficient information to assess and balance a range of competing factors to identify a highway corridor. It has been necessary for the study team to rely on a number of external data sources, including the following:

- The highway corridor presented in this report has been prepared on the basis of existing digital cadastre database (DCDB) information. This information has been checked and updated by reference to existing survey plans within the Refined Study Area. Actual survey of land boundaries will be required as part of the future design and property acquisition process.
- The digital terrain model (DTM) is made up of a combination of ridge and valley break lines and 5m contours. Checks at known locations indicate that the DTM can approximately be between 5m and 7m in error vertically. The options generally have earthworks batters slopes of 1 vertical to 2 horizontal. A vertical discrepancy of 5m means that the horizontal offset can be in error by approximately 10m. As such, further refinement of land requirements will occur in subsequent design phases when more accurate ground surveys are undertaken.
- Aerial photography has been updated periodically throughout the study. Aerial photography was last captured July 2006.
- Zoning and council overlay information has been updated periodically throughout this study.
- Land owner details are not static and have therefore been periodically updated throughout the course of the study. This information has been used to identify landowners with whom consultation during the course of this study was required. This information has been sourced directly from local councils and was last updated in mid January 2007.
- Environmental datasets were sourced from the Queensland Government. Datasets used in this study are subject to periodic updates. Updates have been sought as they have been made available. Disclaimers about the use and reliability of this data apply.
- Estimated construction costs have been prepared on a comparative basis to allow evaluation of corridor options and should not be used for budgetary purposes without further development. They do not account for GST, escalation, side tracking, traffic management, construction staging, unfavourable ground conditions, design fees, client charges, land issues, EPA requirements and approvals or costs and fees from any other required approvals.
- Detailed on-site systematic geotechnical investigations have not been carried out at this stage of the study. Detailed geotechnical investigations would be undertaken in later stages of design. As the geotechnical investigation did not encompass site specific investigations of sufficient detail to be able determine substructure requirements.
- The highway corridor design details, access arrangements and possible land requirements shown in this report are subject to change after landowner discussions and detailed planning and design.

- The highway corridor provides for a 6 lane configuration. Initial construction is anticipated to consist of dual two lane standard (divided four lanes). Adjustments to the corridor are anticipated when balancing the earthworks once stages of construction are identified.
- The environmental fieldwork program was developed to inform the corridor evaluation and highway corridor selection process. This fieldwork program was developed in consultation with the Queensland Environmental Protection Agency. Fieldwork was undertaken at representative sites across the study area to provide a broad overview of potential issues. This study does not rule out the need for a referral of the project (or stages of the project) under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) to the Commonwealth Department of Environment and Water Resources (previously the Commonwealth Department of Environment and Heritage). Accordingly, further environmental investigations and liaison between DMR and Department of Environment, Heritage and Arts (DEHA) will assist in the decision of whether referral of the project is required. Should the project be referred, DEHA is then required to consider the potential for impacts to matters of national environmental significance (NES) to result from the project, and decide whether the project is a 'controlled action' requiring further environmental assessment or approval (which may include an Environmental Impact Statement).
- Cultural Heritage information included in this study has been provided by the Gubbi Gubbi, who are the relevant Aboriginal Party for the area as recognised by the Queensland Aboriginal Cultural Heritage Act 2003. An Indigenous Cultural Heritage Survey has not been conducted as part of this investigation, however a review of the potential for sites and places of significance to be located in the project area has been carried out. Pursuant to the requirements of the Queensland Aboriginal Cultural Heritage Act 2003, a Cultural Heritage Survey and Cultural Heritage Management Plan and Agreement will be required as part of the future design and assessment process.
- Statistical interpretation of community feedback has been used to report back to the community on recurring themes and suggestions from the public, and to guide the investigation of options.

1.5.1 Corridor Assumptions

The highway corridor has been identified based on the following:

- Guiding principles (discussed in Stage C – Proposed Corridor Report) are representative of the broader community interest and supersede the previous criteria developed for this project.
- Constraints information- identified during previous stages of the study and updated and refined through subsequent field and other investigations.

The corridor has been developed with regard to the following project objectives:

- The existing highway is to remain as a local arterial road and maintain connectivity to most of the local roads and properties that currently have direct access to the existing highway.
- To improve safety, the highway will be a limited access road. This limits local roads and fronting properties having direct access to the highway. Access to and from the new highway to major roads will be at regular but widely spaced interchanges. These access arrangements help to separate fast moving highway traffic from slower moving local traffic, providing a safer more efficient road system.
- Access to properties to be maintained wherever possible through service roads, access ways and or overpasses/underpasses.
- Planning horizon of 30 years to cater for future needs. Progressive upgrades working north from Brisbane to Cooroy have bypassed town centres and made provision for a

fully grade separated route with a high standard of road geometry and high posted speeds. This is reflected in the geometric standards derived from the Department of Main Roads requirements (Roads Planning and Design Manual) and it is appropriate for the upgraded highway to continue this standard.

- To meet the strategic needs of the highway for the next 30 years, it is necessary to plan for the new highway corridor to be of rural motorway standard which caters for safe and high speed travel. Rural motorway standards require a minimum design speed environment of 120km/hr, based on posted speeds of 110km/hr.

Further details on the standards adopted are available in Section 1.6 of the Shortlisting Report – Baseline Report (Volume 3).

1.6 Report Structure

This report is structured in the following manner:

- Section 2: Public display of the proposed corridor;
- Section 3: Options considered from feedback;
- Section 4: The recommended corridor; and
- Section 5: The Next Stage.

2.0 Public Display of the Proposed Corridor

2.1 Community Response to Proposed Corridor

2.1.1 Public display

Commencing on Wednesday 14 March 2007, the Proposed Corridor was placed on public display for two weeks.

A fixed display was located at the Gympie Civic Centre for the entire period, while for one week a mobile display visited the following communities:

- Cooroy – two days;
- Federal – one day;
- Kybong – one day; and
- Curra – one day.

Each display included more than 12 metres of detailed maps showing the proposed corridor and properties, seven information panels covering the corridor benefits, study process, community consultation process, community input, community concerns and how various options were assessed.

Copies of the three-volume corridor report and more detailed property based maps were available for inspection at the display. In addition, a 3D computer generated corridor visualisation was played constantly for viewing at each display venue.

Approximately 1800 visited the two-week display at Gympie, while around 600 people attended the mobile displays.

Newsletter 5 (which included the map of the Proposed Corridor and details of the display venues) was issued to all levels of government for approval in February / March 2007.

Newsletter 5 was released on 12 March 2007 with approximately 27,000 distributed to community, libraries, Councils, local businesses. Additionally, 18 detailed maps covering the 65kms and showing properties and the Proposed Corridor were also uploaded to the Main Roads website.

2.1.2 Landowner meetings

The owners of directly affected properties and properties within 500 metres of the proposed corridor received letters from the Department of Main Roads advising them of their status and enclosing a copy of Newsletter 5.

Those landholders directly affected by the proposed corridor were asked to contact Main Roads to make an appointment for a one-on-one discussion in relation to their property and potential options.

2.1.3 Issues raised

The public was provided with multiple options for providing feedback about the proposed corridor. These options included:

- Toll Free dedicated 1800 phone line;
- Reply Paid postal address;
- Dedicated email address;
- Fax number; and
- Feedback sheets at each display.

The proposed corridor public comment period closed on Friday 13 April 2007.

At the close on the comment period, the study team had received 96 requests for additional information; including an explanation of what it meant to be within 500 metres of the

proposed corridor; requests for corridor maps, copies of the report on CD and copies of the corridor visualization DVD.

308 items of feedback were received by the study team, including one petition of 316 signatures opposing the location of the Cudgerie Interchange and one 64-signature petition supporting the proposed corridor location at Kybong. Each petition was recorded as one item of feedback for the purposes of statistical recording.

The issues raised by the community in the feedback provided to the study team can be summarised as follows:

- Access to the highway corridor from other roads, overpasses and premises;
- Pollution – water table, airborne and water tank contamination;
- Noise and Noise barriers;
- Environmental concerns;
- Property resumptions – when and appropriate property values;
- Devaluation of property;
- Opposition to interchange locations – Cudgerie Drive and Gympie Connection Road;
- Excessive lighting at interchanges;
- Support for interchange locations – Cudgerie Drive, Mary River Road; and
- Support for the proposed corridor through Kybong, especially at Tandur Road.

Of those, the following were mentioned in a significant number of the 308 feedback items:

Issue	Number Of Times Raised
Cudgerie Interchange – Opposition to location	68
Noise – impact on community, need of barriers	61
Tank water pollution	29
Impact on property	26
Impact of Increased traffic	25
Interchange at Mary River Road – proposed by Cudgerie opponents	19
Excessive interchange lighting	18
Air pollution	17
Child safety from increased traffic flows (Cudgerie Estate)	15
Gympie Connection Interchange – Opposition to location	12
Support proposed corridor at Tandur Road -	6
Cudgerie Interchange – Support for the proposed location	3
Interchange at Pomona Connection Road – proposed as an alternative to Cudgerie Drive	2
Interchange at Black Mountain Range Road - proposed as an alternative to Cudgerie Drive	2
Gympie Connection Road Interchange – Support for the proposed location	2

2.1.4 Matilda Kybong

The study team has extensively evaluated the location of the proposed corridor in relation to the Matilda Service Station at Kybong.

The study team has had several meetings with the operators of the service station during the development of the refined study area and during the establishment of the proposed corridor.

Matilda Fuel Supplies made its submission via letter, objecting to the proposed corridor on the basis of losing a business that provides around 110 jobs, loss of amenities for motorists, loss of community amenity, construction time, cost and vegetation loss. A subsequent submission raised the issue of an impact on fuel prices.

Community input was also sought by the study team, through the Kybong CFG.

Following the release of the proposed corridor, six responses were received from the community on Tandur Road and the Bruce Highway in the vicinity of the Matilda Service Station, including one petition of 64 signatures. The petition is in favour of, and supports, the proposed corridor. The petitioners do not wish to see it moved closer to the existing Bruce Highway.

The general view expressed by the community is that the proposed corridor is the best option, minimising the impacts on the community as a whole.

Further discussion of the issues in the Kybong area are included in section 3.2 of this report.

2.2 Local Government response

2.2.1 Noosa Council

A submission by Noosa Council focused on the location of the interchange near Cooroy. Several meetings were held with Noosa Council and included technical engineering officers/ transport planners and the local councillors and Mayor. Section 3.1 of this report outlines the issues and study team recommendations associated with the Noosa Council submission.

2.2.2 Cooloola Shire Council

A submission by Cooloola Shire Council's (CSC) had two main issues:

- Need for north facing ramps at the Woondum Interchange to facilitate access to the industrial estate and surrounding areas; and
- Resultant upgrades needed to the local network as result of the interchange location at Gympie Connection Road.

These issues and study team recommendations associated with these issues are outlined in sections 3.3 and 3.4 of the report.

2.3 State Government Departments

The study team engaged with all state government agencies to inform them of the study process. Individual meetings were held with Queensland Transport (QT), Queensland Rail (QR), State Development, Education Queensland and Powerlink. No major issues were raised during these agency discussions.

The following sections outline issues raised with specific agencies.

2.3.1 Queensland Water Infrastructure

Discussions with Queensland Water Infrastructure (QWI) highlighted the benefits to the community that could be achieved by aligning the road corridor within the dam's buffer zone. Further discussion on the issues in the Kybong area are included in section 3.2 of this report.

2.3.2 Environmental Protection Agency

During the course of the study, several submissions were received relating to the 'Gympie Pyramid'. It was deemed appropriate to address the concerns raised in these submissions, through the conduct of additional archaeological heritage investigations at the site in question.

In accordance with the requirements of the *Queensland Heritage Act 1992*, a permit was obtained prior to conducting the archaeological heritage investigations. The Environmental Protection Agency approved the method and signed off on the approach and were kept appraised of the outcomes of the investigations as they were completed.

The outcome of this investigation is documented in the '*Cultural Heritage Survey of Rocky Ridge, Gympie*' (Archaeo Cultural Heritage Services), which is included as **Appendix A**.

2.3.3 Queensland Parks and Wildlife Service

The EPA and the Queensland Parks and Wildlife Service were consulted further in relation to the proposed realignment of the corridor through a section of the Curra State Forest.

There will still be a requirement to conduct further environmental assessment to identify appropriate mitigation measures during the development and design of this section of the corridor, at the appropriate time.

2.4 Commonwealth Departments

2.4.1 Department of Transport and Regional Services

The Department of Transport and Regional Services (DoTaRS) were kept informed throughout the study process via frequent briefings. As the funding authority of the study DoTaRs was represented on the project steering group.

2.4.2 Department of Environment, Heritage and Arts

Previously the former Department of Environment and Water Resources (DEHA) had written to DMR requesting an update on the status of the project. Given that the strategic planning study was nearing completion, an update will be provided to the DEHA for their further information about the project outcomes and future potential environmental assessment considerations as the sections of the corridor progress to the design development phase.

3.0 Options considered from feedback

3.1 North Cooroy Interchange

Issues were raised from the community and Noosa Council regarding the location of an interchange at Cudgerie Drive/Cooroy Connection Road. These issues include;

- Increased traffic along Cudgerie Drive;
- Increased noise for residents of Cudgerie Estate;
- Excessive lighting in proximity to Cudgerie Estate;
- Doesn't relieve heavy vehicle traffic through the Cooroy town centre/main street;
- Congestion of the intersection adjacent to the north coast rail overpass (Myall St);
- Congestion of Diamond St/Cooroy Connection Road intersection.

3.1.1 Alternative options

The study team investigated numerous locations and alternative configurations for interchanges to service the area north of Cooroy including;

a) The proposed corridor with interchange located at Cudgerie Drive;

b) An interchange at Mary River Road Overpass, linked to Cudgerie Drive via a new service road (Refer Figure 3.1a);

c) An interchange located in the Yurol State Forest, linked to Cudgerie Drive via a new service road; and

d) Split interchange which includes north facing ramps at Cudgerie Drive and south facing ramps at Mary River Road, linked via a new service road.

The performance of these options was assessed in comparison to the Cudgerie Drive/Cooroy Connection Road interchange location as shown on the proposed corridor.

3.1.2 Validity of Traffic Model Use

The traffic model developed for the purposes of the planning study was based on an extensive amount of strategic traffic data collected specifically for model development including household travel surveys and observed origin and destination data. Model validation focused primarily on strategic Bruce Highway movements in, around and through the Gympie township. The base year (2004) modelled daily traffic volumes correlated with observed data for strategic traffic movements with sufficient accuracy as to provide input into the assessment of the relative differences between different Bruce Highway upgrade options and interchange locations. Nonetheless, the strategic traffic model can also be used as a valuable tool for more detailed and localised traffic studies providing an adequate review of the particular local traffic movements within the model.

3.1.3 Traffic performance

Any amendments to the proposed interchange location need to be justified from a traffic network viewpoint as a key objective of this strategic study is to deliver the optimal road transport solution. The traffic modelling shows that the location best suited for the interchange is at Cudgerie Drive/ Cooroy Connection Road. This location would function best as it is able to attract the largest volumes of traffic to the new high standard corridor and reduce the numbers of vehicles using lower standard roads.

The hierarchy limitations in the existing road network at Cooroy are a significant factor to the functionality of an interchange at Mary River Road. Traffic from the interchange would be led into the town centre rather than a network that will serve the broader communities.

Figure 3.1b shows the forecast 2026 average daily traffic volumes on the Cooroy network for options a and b described in section 3.1.1.

The inclusion of a service road in option b switches some traffic from the new corridor to the new service road, however this is not restricted to the 2.5km length of new service road. As the access point (interchange) is also moved, the traffic must decide to exit/enter the new corridor at less desirable locations. Most of the vehicles switching to the service road are undertaking long distance trips and should have the ability to use the new high standard corridor. All interchange options incorporating a new service road have fewer vehicles on the new corridor due to their inability to access the required locations using the new corridor.

Locating the interchange at Cudgerie Drive/ Cooroy Connection Road provides the greatest opportunity to maximise the utilisation of the corridor and increase safety.

Unlike Cooroy Connection Road, Cudgerie Drive is not designed to cater for large traffic volumes or heavy vehicles. Its steep grades, frequent intersections and current road width are deterrents to 'rat running' through the estate. With the interchange located at Cudgerie, the traffic on Cudgerie Drive will increase from 720 to 1120 per day (based on 2026 volumes). During future design phases Mains Roads will investigate methods to improve safety along Cudgerie Drive.

The issue regarding heavy vehicles passing through the Cooroy CBD is a result of the industrial estate being located on the western side of the town centre without an adequate road hierarchy in place. Council have advised that the origins/destinations of the heavy vehicles using the industrial estate are approximately split 50% to/from the east (Noosa/Sunshine Coast), 40% heading south (Bruce Hwy) and 10% heading north (Bruce Hwy). The current volume of heavy vehicles created by the industrial estate is considered to be relatively small. Locating south facing ramps at Mary River Road will remove approximately 40% of the heavy vehicles through the town. Council are continuing to investigate alternative options, however the future expansion of the industrial estate may warrant the inclusion of south facing ramps. This option can be considered in detail later if required.

None of the options that were raised by Council address the issues of congestion at the intersection adjacent to the north coast rail overpass (Myall St) or at the Diamond St/Cooroy Connection Road intersection. Other traffic network solutions to meet Cooroy's needs are likely to provide better overall solutions. A traffic network study is needed to address movements to, from and through Cooroy to determine the local road network needs. Main Roads would work with Noosa Council to consider road network options to serve Cooroy and surrounding areas.

3.1.4 Interchange spacing

The desirable minimum spacing of interchanges on a rural highway is 5 to 8km. It is undesirable to have successive entry and exit ramps closely spaced as this results in vehicles needing to weave between lanes. Weaving introduces an additional element of conflict and has a negative effect on both levels of service and safety. To satisfy safe weaving of vehicles across 3 travel lanes, a minimum distance of 1200m is required between the entry and exit manoeuvres of the existing Cooroy Interchange and any proposed interchange to the north. Mary River Road and Cudgerie Drive are positioned approximately 2.5km and 5km to the north of the existing Cooroy interchange respectively. The inclusion of south facing ramps at Mary River Road provides distances of 1100m and 1300m between the entry and exit manoeuvres for the northbound and southbound carriageways respectively. If proposed in the future these configurations would be investigated further to determine the arrangements needed to be safe and provide adequate levels of service.

3.1.5 Noise and lighting issues

It is considered that the noise and lighting issues associated with the interchange can be managed. Examples of designing to minimise noise emissions are, the use of a quiet asphalt surfaces and the construction of noise barriers/earth bunds which help to ameliorate the noise on nearby residences.

Similarly the use of aeroscreens and strategic placement of light poles can reduce the effects of interchange lighting. Further consultation with landowners and residents near interchange locations will need to be undertaken as the design process progresses, to identify appropriate solutions for these issues.

3.1.6 Environmental

The introduction of the service road option passing through the edge of Yurol State Forest generates additional land requirements, and widens an existing corridor through an area of habitat significance. These additional land requirements may also compound existing environmental effects already experienced at this location (fauna passage etc).

3.1.7 Recommendation

It is recommended that the proposed interchange at Cudgerie Drive/ Cooroy Connection road be retained. Although south facing ramps at Mary River Road are not required from a strategic transport perspective and their spacing to the Cooroy Interchange ramps may be undesirable the decision does not preclude construction of these ramps if they are warranted in the future and investigations determine that they can provide an adequate level of service in a safe environment.


Cooroy Connection Road
North Coast Rail Line
Cudgerie Drive
Blueberry Drive
Black Mountain Range Road
Lawnville Road
Mary River Road
Garnet Street
Six Mile Creek (Le
Figure 3.1a
North Cooroy Interchange
- Mary River Road Option
Issue date 30 August 2007
0 40 80 120 160
Meters
Mary River Road Interchange
Proposed Corridor
Possible Future Land Requirements
Rivers / Creeks
Railway
Cadastre
Road Reserve
N
Australian Government
Department of Transport and Regional Services
Queensland Government
Department of Main Roads
AUSLINK
ARUP
The Recommended Corridor and possible future land requirements shown on this plan are subject to change and final refinements during detailed planning and design.
Base information supplied by Noosa, Cooloola, Tiaro and Kilkivan Shire councils, and Department of Natural Resources and Mines.
Cadastral information current as at 3 February 2007
Colour Aerial Photography supplied July 2006
Black and White Photography supplied April 2006
While every care is taken to ensure the accuracy of this data, the Department of Main Roads makes no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and disclaims all responsibility and liability (including without limitation, liability in negligence) for all expenses, losses, damages (including indirect or consequential damage) and costs which you might incur as a result of the plan being inaccurate or incomplete in any way for any reason.
Bruce Highway (Cooroy to Curra)
Strategic Planning Study
Recommended Corridor Report
Rainbow Beach
Curra
Gympie
Noosa
Cooroy
Caloundra

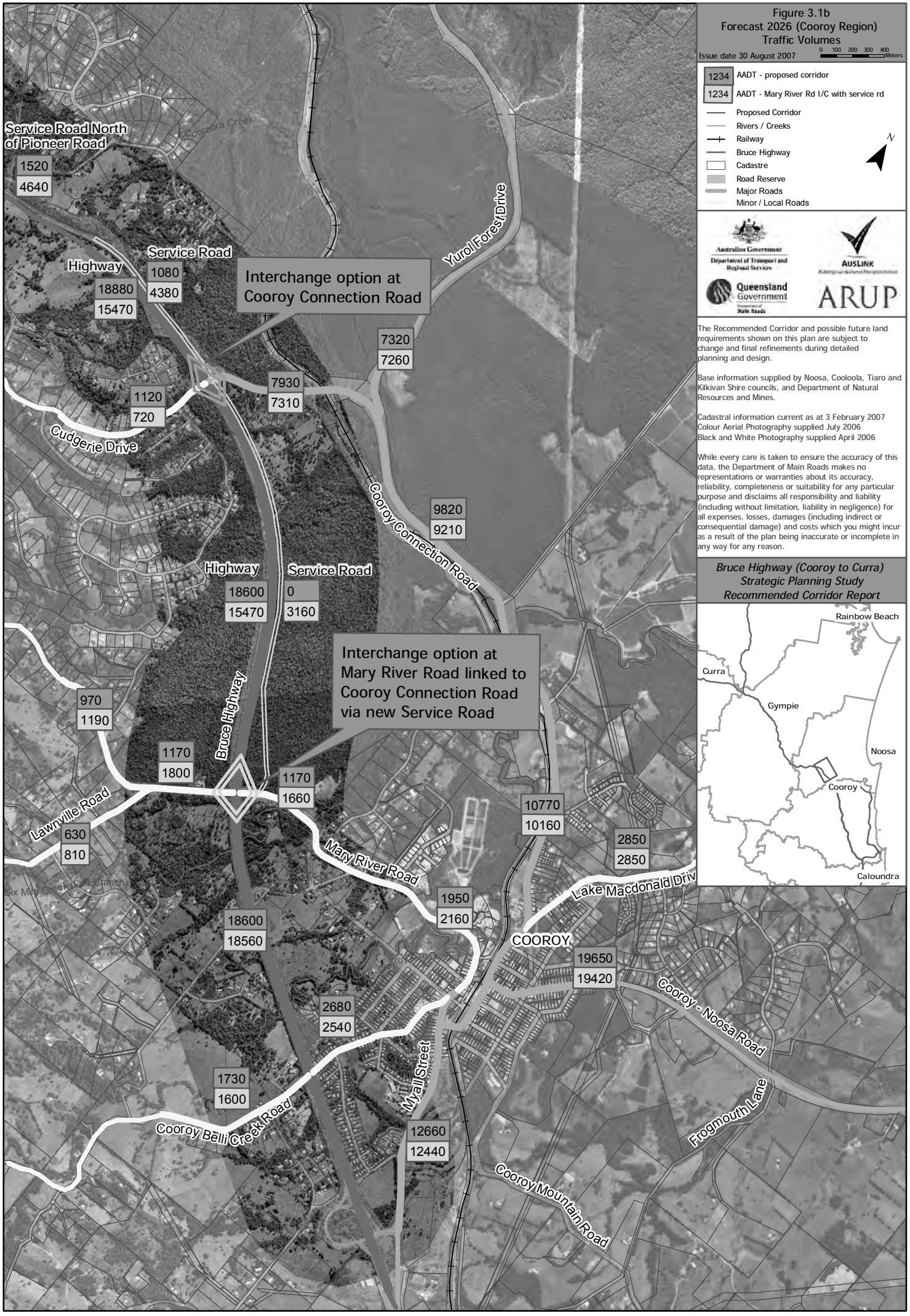
Figure 3.1b
Forecast 2026 (Cooroy Region)
Traffic Volumes
Issue date 30 August 2007
0 100 200 300 400 Meters
1234 AADT - proposed corridor
1234 AADT - Mary River Rd I/C with service rd
Proposed Corridor
Rivers / Creeks
Railway
Bruce Highway
Cadastre
Road Reserve
Major Roads
Minor / Local Roads
N
Australian Government
Department of Transport and Regional Services
AUSLINK
Queensland Government
Main Roads
ARUP
The Recommended Corridor and possible future land requirements shown on this plan are subject to change and final refinements during detailed planning and design.
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Bruce Highway (Cooroy to Curra)
Strategic Planning Study
Recommended Corridor Report
Rainbow Beach
Curra
Gympie
Noosa
Cooroy
Caloundra
Service Road North of Pioneer Road
1520
4640
Coooora Creek
Yurol Forest Drive
Service Road
Highway
1080
4380
18880
15470
Interchange option at Cooroy Connection Road
7320
7260
7930
7310
1120
720
Cudgerie Drive
Cooroy Connection Road
9820
9210
Highway
Service Road
18600
15470
0
3160
Interchange option at Mary River Road linked to Cooroy Connection Road via new Service Road
970
1190
Bruce Highway
1170
1800
1170
1660
Lawnville Road
630
810
Mary River Road
10770
10160
2850
2850
Lake Macdonald Drive
Six Mile Creek (Cat Branch)
1950
2160
18600
18560
COOROY
19650
19420
Cooroy - Noosa Road
2680
2540
Myall Street
1730
1600
Cooroy Belli Creek Road
12660
12440
Frogmouth Lane
Cooroy Mountain Road

3.2 Kybong

Since the public display of the proposed corridor in March 2007, significant interest has focused on the corridor and interchange location in the Kybong area.

3.2.1 Queensland Water Infrastructure

Discussions with Queensland Water Infrastructure (QWI) has highlighted the benefits to community of co-ordinating the Dam access road and associated dam infrastructure with the Kybong Interchange. QWI are in the process of designing an overpass of the existing highway to enable construction access for the proposed dam. Opportunity exists for detailed planning of the interchange to;

- Provide direct access to the dam, the proposed Freshwater Species Conservation Centre and associated recreational facilities (a significant generator of vehicle trips);
- make use of properties already acquired for dam purposes;
- make use of the proposed overpass bridge;
- provide connectivity for the area including Traveston Road and Traveston Crossing Road; and
- improved access to the Bruce Highway in times of large floods.

3.2.2 Feedback

The study team received a 64-signature petition supporting the proposed corridor location from the local community. Additionally, Matilda Fuel Supplies have expressed concerns regarding access to their Kybong site from the proposed corridor. Regular discussions have taken place with Matilda to better understand their issues and determine what changes to the proposed corridor, if any, may be recommended by the study team.

Matilda has advised of two main issues;

1) The economic implications to their business and the impact on fuel prices in Queensland based on the proposed corridor access.
2) The provision of an alternative alignment and interchange to achieve, what Matilda advocates to be a better engineering solution and provide improved access to their Kybong site. The alternative alignment is directly in front of the Matilda Kybong site and involves moving the Traveston Road interchange north (by approximately 2km) to immediately south of Tandur Road.

3.2.3 Matilda Issue 1 – Effect on Fuel Prices

An independent report was undertaken by PricewaterhouseCoopers to understand the economic implications on the Matilda business and fuel prices in Queensland. PricewaterhouseCoopers found that:

- If the new Bruce Highway is constructed on the proposed corridor, it is unlikely that Matilda Kybong would continue to operate in its current capacity as a supplier of fuel and other services to highway traffic.
- Matilda Fuel Supplies currently receives a number of volume discounts on fuel and non-fuel products. Matilda Kybong is the major Matilda outlet and its closure, or scaling back, would reduce the company's terms of trade.
- Matilda's fuel prices are consistently cheaper than the market average and it is positioned to exert some influence over fuel prices. However, its sales are not significant compared with the total sales in Queensland.
- At present, two Matilda sites have earnings below normal viability and, with the potential reduction in terms of trade for Matilda Fuel Supplies, two to eight of its other sites may be come unviable.

Main Roads acknowledges that the highway corridor alignment will have significant impact on the Matilda Kybong site and a potential flow on to the Matilda Fuel Supplies network. The importance of Matilda Fuel Supplies as an independent in the fuel supply network is also acknowledged. The Matilda Kybong site also provides service centre functions which provide a benefit to the travelling public in fatigue management. Main Roads has considered in detail the options that may be available to service the continued operation of Matilda Kybong. Particular issues have been additional costs, continued viability as a service centre, community views and additional land requirements. Since the PricewaterhouseCoopers report was prepared, Matilda Fuel Supplies has become part of Neumann Petroleum and consequently the report may not reflect the present condition.

3.2.4 Matilda Issue 2 – Better Alignment

The study team has reviewed Matilda's alternative alignment and modified it to achieve the study's technical highway engineering requirements in terms of sight distances, access arrangements and intersection forms. Figure 3.2a shows the study team's version of the Matilda proposal for a Kybong Interchange.

Standards

The alignment of the Matilda proposal and the proposed corridor are similar in regards to standards by way of horizontal and vertical curves and vertical grades. When considering the stageable section for construction (leaving the existing highway at Kybong and reconnecting to the existing highway via the Woondum interchange) both options have similar earthworks, construction costs and environmental impacts. The Matilda proposal is considered further below:

Access and Land Requirements

For the new highway corridor to pass in front of the Matilda site, the existing road reserve (generally 60m wide; 75m directly in front of Matilda) must be increased significantly. The road corridor would need to provide interchange entry/exit ramps and service roads on both sides of the corridor in this vicinity. This combined with the earthworks required to achieve the high standard alignment, requires the corridor to be at least 130m wide. Therefore the Matilda proposal generally creates a land requirement 70m wider than the existing highway reserve.

Matilda's proposal aligns the new corridor as far to the east as possible without resumptions on the eastern side (ie within the highway reserve).

This creates a land requirement on the properties fronting the western side of the existing highway, including Matilda's site. Other properties with land implications on the western side include a large ginger seed farm and long narrow rural properties which back onto the Mary River.

The land take on Matilda's site requires the relocation of the fuel bowsers, associated covered structure and parking hardstand areas. The bowser relocation and amended access/circulation would require significant reinvestment to develop the site and allow it to function at an acceptable standard as a service centre (ie. circulation of traffic flow between bowsers, payment for fuel, dining facilities and rest stop amenities).

The potential implications to Main Roads of a significant impact on the existing Matilda Kybong outlet both financially and on program timing/flexibility would need to be considered in detail.

Additional Costs

The new corridor has limited access, with movements onto and off the new corridor at widely spaced interchanges. The Matilda alignment uses the existing highway reserve; therefore the existing highway needs to be reinstated to continue to perform the functions of a local service road. Additional costs in the order of $10M (in today's dollars) are associated with this road relocation and related works.

Interchange location

One of the differentiators between the Matilda proposal and the proposed corridor is the location of the interchange. Interchange locations are primarily determined by the road network requirements for accessibility and route interconnectivity. However, there are limits to the number of interchanges that can be accommodated and the spacing of ramp terminals without compromising the capacity and safety of the road.

Having the interchange located at Traveston Road connects the local arterial road around the proposed Traveston Crossing dam, Traveston Road and Traveston Connection Road. These roads link surrounding areas of Federal, Coles Creek, Traveston and the area to the west of the proposed dam (including Gympie-Woolooga Road) and provide access to the proposed corridor. If the interchange was moved to Tandur Road, significant volumes of traffic would stay on the existing highway for an additional 2km. The predicted volumes in 2026 include 2400vpd from the new service road, 3800vpd on Traveston Road and 4600vpd on Traveston Crossing Road. In comparison Tandur Road carries approximately 600vpd. Typically interchanges are located at intersections with the more significant roads in the road network. From a road network perspective, the interchange at Traveston Road best meets this requirement.

Visibility vs. Site Viability

One of the key considerations in determining a service centre's viability is its visibility from the highway and accessibility. It would be generally expected that a site would not be successful if the advertising/petrol pricing sign is not visible from the highway prior to the exit ramp. Visibility for southbound motorists is achieved with the Matilda proposal. However, the nose of the northbound exit ramp is required to be set back so far to achieve the desired sight distance for 120km/h design speed that motorists will not see the site before making the decision to exit the highway. Highway signage in the form of advanced directional signs can provide some guidance for motorists; however this is seen as less of a benefit than direct visibility from the highway to the site. The site access arrangements will be compromised which is likely to affect its ability to function in a manner as envisaged by Main Roads service centre policy.

The preferred layout for service centres involves separate exit and entry ramps for northbound and southbound service centres located opposite each other on the highway.

However where traffic volumes are sufficiently low enough not to warrant service centres on both sides of the highway, the preferred location for the site would be immediately adjacent to the interchange to minimise the distance travelled.

With the Matilda proposal, access to the site is less than ideal due to the interchange location. It requires northbound motorists to exit the highway and travel approximate 800m on the exit ramp, negotiate a roundabout, travel a further 400m on the service road to enter the site. To rejoin the highway motorists must backtrack approx 400m to reach the interchange. The reciprocal movements are required for southbound motorists.

Social Impact

One of the major influences identified through the community consultation, CCCCs and shortlisting processes was the evaluation criteria weighting allocated to the social/residential impact. This was a pivotal driver in the selection of the proposed corridor and why it follows existing severances wherever possible. This section of the proposed corridor is a transition between running adjacent to the Traveston dam and aligning to the high voltage powerlines. This Matilda proposal is marginally different from the options R(R) and R(S) considered during Stage C. As reported in table 14.5 of the Stage C report, these options had the highest social impact and the proposed corridor had the lowest. Table 3.2a below compares the social impact of the new Matilda option and the proposed corridor.

Table 3.2a: comparison of social impacts

Description	Approximate number of impacted properties	% increase compared to best performing option
Proposed Corridor – Interchange at Traveston Road and align to the powerlines	14	0% (best performing)
Matilda proposal – Interchange immediately south of Tandur Road	21	50%

Based on the evaluation criteria agreed through previous stages of the study, the Matilda proposal has greater social impact on properties than the proposed corridor. The Matilda proposal also affects properties that were not previously impacted by the proposed corridor. Additionally, the proposed corridor has significant community support with the study team receiving a petition from the local Kybong/Tandur Road community which included 64 signatures.

The new Matilda proposal has comparable environmental effects to the proposed corridor option. Creek crossing requirements differ, but are of a similar scale. Both options avoid direct impacts on the Traveston Homestead complex.

Possible Alternative Service Centre Locations

The Matilda site is located within sections BH1 and BH2 (northbound and southbound carriageways between Coles Creek and Jackass Creek) of the existing Main Roads Service Centre Strategy No1/97.

This strategy was developed in 1996, which is 8 years prior to the commencement of the strategic planning study and as such the strategy not able to predict the location of a realigned highway corridor. However the strategy states that:

- No new service facilities will be permitted while the highway remains in the present location and as a single carriageway road.
- Upgrading of the highway ultimately to four lanes will permit up to one centre in each direction.
- Permission for white on blue signs at Matilda until a service centre is established in zones BH1 and BH2.

The strategy needs to be reviewed to account for the new opportunities created by the proposed corridor. There are many locations that may perform the fatigue management functions required by the service centre:

a) North eastern side of Traveston Road Interchange;
b) Traveston Crossing Dam access interchange (if the dam proceeds);
c) Caltex Gold Nugget near Woodum Interchange (vicinity of Keefton Road); and
d) Gympie Connection Road Interchange

Consultation with Matilda Fuel Supplies

The study team recognised the importance of the Matilda Kybong facility in providing for the public and commercial traveller and the investment that has been made by Matilda Fuel Supplies. The study team met with Matilda Fuel Supplies numerous times to listen and consider their concerns and viewpoint. Matters raised and discussed were more extensive and detailed than addressed above.

3.2.5 Recommendation

Given the need to provide rest stops along the highway, Main Roads intends to review the current service centre strategy and policy once the highway corridor is finalised. It is recommended that the proposed corridor and interchange between Coles Creek Road and the Woondum Interchange be retained. During detailed planning for the Traveston Crossing

Dam the location and arrangement for the interchange is to be reviewed and opportunities investigated to achieve the best overall community benefit.

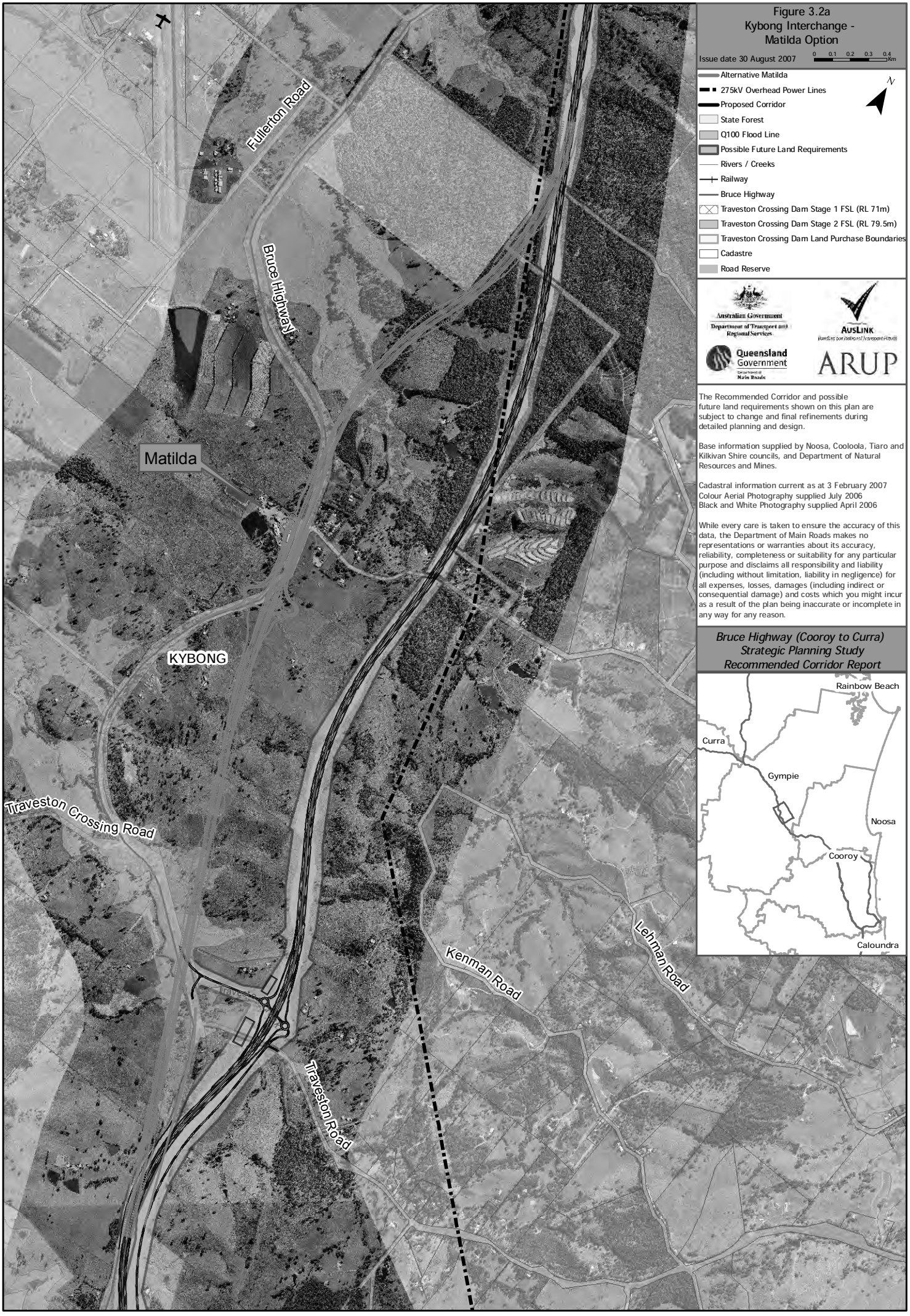

Figure 3.2a
Kybong Interchange -
Matilda Option

Issue date 30 August 2007

0 0.1 0.2 0.3 0.4 Km

- Alternative Matilda
- 275kV Overhead Power Lines
- Proposed Corridor
- State Forest
- Q100 Flood Line
- Possible Future Land Requirements
- Rivers / Creeks
- Railway
- Bruce Highway
- Traveston Crossing Dam Stage 1 FSL (RL 71m)
- Traveston Crossing Dam Stage 2 FSL (RL 79.5m)
- Traveston Crossing Dam Land Purchase Boundaries
- Cadastre
- Road Reserve

Australian Government
Department of Transport and Regional Services

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Queensland Government
Department of Main Roads

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The Recommended Corridor and possible future land requirements shown on this plan are subject to change and final refinements during detailed planning and design.

Base information supplied by Noosa, Cooloola, Tiaro and Kilkivan Shire councils, and Department of Natural Resources and Mines.

Cadastral information current as at 3 February 2007
Colour Aerial Photography supplied July 2006
Black and White Photography supplied April 2006

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Bruce Highway (Cooroy to Curra)
Strategic Planning Study
Recommended Corridor Report

3.3 South Gympie Industrial Access

The proposed interchange immediately to the south of Gympie provides high speed ramps to serve motorists heading to or from the south on the new corridor. The north facing ramps were not included in the proposed highway upgrade due to predicted low traffic volumes not warranting the cost of the associated infrastructure. It was envisaged that these would be reassessed at the time the detailed project development was undertaken. A key issue will be the industrial estate expansion and other future land use changes in the surrounding area.

Submissions were received, including from Cooloola Shire Council, requesting that the interchange have all movements and thus cater for motorists heading north, or coming from the north on the new corridor.

The study team investigated numerous possible ramp configurations including additional ramps to the proposed Woondum interchange and north facing ramps at Keefton Road. However these options were excessively costly due to significant bridging requirements to maintain priority for the high volume movements on the Woondum interchange and to span the flood extents of Deep Creek.

Figure 3.3a shows the preferred location of additional ramps to provide access for the south Gympie industrial estate.

Motorists with origins north of Gympie wanting to access the industrial estate (or areas immediately south of Gympie) will exit the new corridor adjacent to the existing gold mine tailings dams. The ramp will intersect with Flood Road in the form of a roundabout and link to Penny Road which provides direct access to the industrial areas and the existing Bruce Highway via Hall Road.

The ramp that provides for motorists from southern Gympie and the industrial area wanting to travel north, involves a roundabout at the intersection of Penny Road and Noosa Road. Another leg is introduced to the roundabout to create the northbound on ramp to the new corridor.

3.3.1 Recommendation

It is recommended that the highway corridor incorporates additional north facing ramps for the industrial areas south of Gympie. These ramps include a northbound on ramp to the new corridor from the Penny Road/ Noosa Road intersection and a southbound off ramp from the new corridor to Flood Road.


Figure 3.3a
South Gympie Industrial Access
Issue date 2 October 2007
0 0.1 0.2 0.3 0.4 Km
Recommended Corridor
275kV Overhead Power Lines
132kV Overhead Power Lines
Possible Future Land Requirements
Rivers / Creeks
Railway
Bruce Highway
Traveston Crossing Dam Stage 1 FSL (RL 71m)
Traveston Crossing Dam Stage 2 FSL (RL 79.5m)
Traveston Crossing Dam Land Purchase Boundaries
Cadastre
Road Reserve
Australian Government
Department of Transport and Regional Services
AUSLINK
Queensland Government
Department of Main Roads
ARUP
The Recommended Corridor and possible future land requirements shown on this plan are subject to change and final refinements during detailed planning and design.
Base information supplied by Noosa, Cooloola, Tiaro and Kilkivan Shire councils, and Department of Natural Resources and Mines.
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Bruce Highway (Cooroy to Curra)
Strategic Planning Study
Recommended Corridor Report
Rainbow Beach
Curra
Gympie
Noosa
Cooroy
Caloundra
MONKLAND
Deep Creek
Deep Creek Road
East Deep Creek
North Coast Rail Line
Brisbane Road
Noosa Road
MARY RIVER
Old Imbil Road
Flood Road
Southbound exit ramp to Flood Road
Northbound entry ramp from Noosa Road
Penny Road
Hall Road
Mary Valley Heritage Rail Line
Noosa Road
Four Mile Creek
Bruce Highway
Keefton Road
North Coast Rail Line
South facing ramps at Woondum

3.4 Gympie Connection Road interchange

The interchange to the east of Gympie needs to provide access into both the town of Gympie and to the developing coastal regions.

Tin Can Bay Road currently has the higher order in the local road network. It links traffic from the existing highway in South Gympie (via Brisbane Road and Cootharaba Road) with the coastal regions. Tin Can Bay Road is the main east west connection to Rainbow Beach and Tin Can Bay. However the function of part of this road will change once the proposed corridor is constructed. The traffic that currently uses the link from the existing highway (Brisbane Road and Cootharaba Road) will now be travelling on the proposed corridor. This change in function provides a benefit to this section of road, especially for schools which are located on this section of the road (Gympie State High, Gympie Special School, One Mile State School and Monkland State School). The section of Tin Can Bay Road near the railway line is inundated by the Q100 flood. To improve the flood immunity of the interchange on Tin Can Bay road would be difficult and expensive.

In contrast, the interchange at Gympie Connection Road is located above the Q100 flood level. This means that access to the CBD and most of Gympie would be provided during times of large floods.

The proposed traffic marginally varies between the two options; however Gympie Connection Road generates approximately 600 more vehicles per day due the more direct line into the CBD (forecast 2026 volumes). This is a relatively small increase in road volumes which is considered to be manageable.

The proposed corridor included an all movements interchange to the east of Gympie, on Gympie Connection Road, adjacent to the north coast rail line. Feedback from the community has been mixed with some preferring Tin Can Bay Road for the interchange location. Changes to the existing network are similar for both interchange options. Cooloola Shire Council did not oppose the interchange proposed at Gympie Connection Road but raised issues regarding road network upgrades associated with the change in road hierarchy.

3.4.1 Recommendation

It is recommended that the proposed interchange at Gympie Connection Road be retained as it provides access to the CBD and northern suburbs of Gympie during the times of flood. An investigation should be undertaken, when the project progresses at this location, to determine which local roads and intersections require upgrading to support the interchange.

3.5 Curra State Forest

Feedback was received in the general vicinity of the Curra State Forest indicating that the proposed corridor alignment impacted freehold properties more than was needed and that the corridor be moved further to the east.

The study team refined the proposed corridor alignment to achieve a marginal shift to the east which still provides acceptable grades and reasonable earthworks construction. Additionally the new corridor realignment avoids Old Maryborough Road and eliminates the need for its relocation. Land requirement impacts to 11 private properties are avoided by moving the alignment slightly to the east, however two additional properties are now impacted. Refer to Figure 3.5a for plan of the Curra Forest realignment.

The revised alignment moves east into the State Forest, but still has a similar footprint in terms of earthworks and environmental impacts. Discussions between DMR and the QPWS representative indicated that the proposed change in the alignment did not introduce a significant change in the impact level or effect and has not indicated any additional specific issues.

The proposed highway corridor and the revised alignment both traverse areas identified as presenting significant fauna habitat potential. Section 3.7 of this report discusses fauna movement provisions, and identifies the Curra State Forest area as one of the key sites where fauna passage will need to be specifically facilitated.

The proposed highway corridor and revised alignment traverse numerous areas mapped as Regional Ecosystems (Not Of Concern, Of Concern, and Endangered), which are protected under the *Vegetation Management Act 1999*. In particular, further liaison with the Department of Natural Resources and Water, the Environmental Protection Agency and the Commonwealth Department of Environment and Water Resources should be undertaken to develop appropriate environmental assessment and management measures as this and other stages of the design and construction of the highway upgrade are implemented.

3.5.1 Recommendation

It is recommended that prior to confirmation of the revised alignment, any newly affected landowners are contacted by DMR and provided the same level of information that other directly affected landowners have been provided. Should there be no further significant issues raised, it is recommended that the revised alignment be adopted on the basis of:

- It reduces the number of affected landowners
- It eliminates the need to realign Old Maryborough Road
- It has comparable environmental impacts to the proposed corridor.

3.6 Further Cultural Heritage Investigation

As noted in section 2.3, a specific cultural heritage investigation was undertaken to address the issue of the ‘Gympie Pyramid’. This was in direct response to issues raised in submissions from the community. The cultural heritage investigation was undertaken by Archaeo Cultural Heritage Services. The approach and outcome of this investigation is detailed in **Appendix A**.

Ultimately, whilst the site was considered to have moderate local historic and social significance, it was found to have ‘low’ aesthetic and ‘none-little’ scientific significance. This is based on significance criteria established by the *Burra Charter* (Marquis- Kyle and Walker 1999). These can be summarised as:

Table 3.6: Criteria for historic sites directly affected by the project

Value	Rating	Legislative Status
Aesthetic	Low	May satisfy criteria for listing on the Local Heritage Register (currently unlisted). Unlikely to satisfy listing on the Queensland Heritage Register.
Historic	Moderate (locally)	May satisfy criteria for listing on the Local Heritage Register (currently unlisted). Unlikely to satisfy listing on the Queensland Heritage Register.
Scientific	None-Little	Does not satisfy criteria for listing on the Local or State Heritage Register (Currently unlisted).
Social	Moderate (locally)	May satisfy criteria for listing on the Local Heritage Register (currently unlisted). Unlikely to satisfy listing on the Queensland Heritage Register.

Summarised from the *Burra Charter* (Marquis- Kyle and Walker 1999).

From a heritage perspective, this report has concluded that the study area contains, at best, low-moderate levels of local cultural heritage significance.

Its local historic significance was justified on the basis of:

> *Representing homestead lease and settlement activities commonplace to the area in the 1870s, including the many challenges and activities associated with agricultural pursuits from this time and it's occupation in the late nineteenth century by Swiss immigrant William Cauper who built a vineyard there. Limited evidence of significant scale of works and level of disturbance of historic elements remaining on the site further diminishes this value;*

(Archaeo: 2007)

Its social significance was justified on the basis of:

> *The historic nature of the study area has been the focal point of discussion and colourful conjecture between members of the local community for many decades now, Much of this discussion has taken place via local newspapers and other public forums.*

(Archaeo: 2007)

The cultural heritage investigation has confirmed that the nature of the site does not warrant realignment of the proposed corridor. Therefore no change is recommended in this area. The investigation recommended that:

- Detailed recording of all remaining historic features should be undertaken; and
- Suitable management procedures be established should construction uncover unexpected finds.

The assessment of significance and these recommendations are further discussed in **Appendix A**.

3.7 Fauna movement provisions

Given the strategic nature of this study, it was considered appropriate to consider the requirements at the strategic/ regional level for facilitation of fauna movement. **Appendix B** contains a report prepared by Biodiversity Assessment and Management, discussing the requirements and general arrangements that should be considered during future stages of the design and evaluation process.

Based on a preliminary habitat assessment, carried out for the strategic study area, the following four locations were identified as areas requiring special consideration with regard to fauna movement. These were:

- Yurol State Forest.
- Traveston State Forest.
- Woondum State Forest.
- Curra State Forest.

The report suggests a crossing structure spacing of no more than 500m apart, in appropriate locations along the corridor (not just in the four primary areas noted). This may include

- Underpasses: either as culverts or road bridges; and/or
- Overpasses: such as land bridges or rope bridges.

These are recommended in association with appropriate fencing, taking into consideration habitat type (and species likely to be present), vegetation structure, topography, and maintenance requirements.

Fauna crossing provisions and landscaping elements and roadside maintenance issues will also need to be considered carefully.

Figure 3.5a
Curra Forest Realignment

Issue date 30 August 2007

0 0.1 0.2 0.3 0.4 Km

- Recommended Corridor
- Proposed Corridor
- 275kV Overhead Power Lines
- Rivers / Creeks
- Railway
- Bruce Highway
- State Forest
- Traveston Crossing Dam Stage 1 FSL (RL 71m)
- Traveston Crossing Dam Stage 2 FSL (RL 79.5m)
- Traveston Crossing Dam Land Purchase Boundaries
- Cadastre
- Road Reserve

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The Recommended Corridor and possible future land requirements shown on this plan are subject to change and final refinements during detailed planning and design.

Base information supplied by Noosa, Cooloola, Tiaro and Kilkivan Shire councils, and Department of Natural Resources and Mines.

Cadastral information current as at 3 February 2007
Colour Aerial Photography supplied July 2006
Black and White Photography supplied April 2006

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Bruce Highway (Cooroy to Curra)
Strategic Planning Study
Recommended Corridor Report

4.0 Recommended Corridor

4.1 Implications on the proposed corridor

After considering the community feedback and further assessing critical issues the following outcomes are recommended for the proposed corridor that was displayed in March 2007;

- That the proposed interchange at Cudgerie Drive/ Cooroy Connection road be retained. Although south facing ramps at Mary River Road are not required from a strategic transport perspective and their spacing to the Cooroy Interchange ramps may be undesirable, the decision does not preclude construction of these ramps if they are warranted in the future and investigations determine that they can provide an adequate level of service in a safe environment.
- That the proposed corridor and interchange between Coles Creek Road and the Woondum Interchange be retained. During detailed planning for the Traveston Crossing Dam the location and arrangement for the interchange is to be reviewed and opportunities investigated to achieve the best overall community benefit.
- That the highway corridor incorporates additional north facing ramps for the industrial areas south of Gympie. These ramps include a northbound on ramp to the new corridor from the Penny Road/ Noosa Road intersection and a southbound off ramp from the new corridor to Flood Road.
- That the proposed interchange at Gympie Connection Road be retained, and an investigation is undertaken, when the project progresses at this location, to determine which local roads and intersections require upgrading to support the interchange.
- That the proposed corridor location be retained in the vicinity of the 'Gympie Pyramid'. The remaining historic features of the 'Gympie Pyramid' are to be documented and that management measures for the construction phase of the project be implemented.
- That the revised alignment through Curra State Forest be adopted as it reduces the number of affected landowners, eliminates the need to realign Old Maryborough Road and it has comparable environmental impacts to the proposed corridor.
- That the proposed highway corridor be subject to further environmental assessment and environmental and planning approvals processes. Targeted field surveys undertaken in 2006 have indicated the potential for the presence of threatened and endangered species listed under State and Federal legislation in certain areas along the proposed highway corridor. The proposed highway corridor also traverses numerous areas mapped as Regional Ecosystems (Not Of Concern, Of Concern, and Endangered), which are protected under the *Vegetation Management Act 1999*. In particular, further liaison with the Department of Natural Resources and Water, the Environmental Protection Agency and the Commonwealth Department of Environment and Water Resources should be undertaken to develop appropriate environmental assessment and management measures as each stage of the design and construction of the highway upgrade is implemented. In addition, cultural heritage survey in accordance with the requirements of the Queensland Aboriginal Cultural Heritage Act will also be required at the appropriate stage.

4.2 Advantages of recommended corridor

The recommended corridor was selected for the following key reasons:

- Provides the best overall balance sought by the community between functional, ecological, heritage, social and economic considerations and provides for staging opportunities south of Gympie.
- Best meets the objectives of the Cooroy-Curra Strategic Planning Study.
- Achieves high safety standards.

- Addresses the community concern about greater separation between communities and facilities and services that they rely on.
- Safer roads– separates high speed traffic from local traffic, pedestrians and other non-motorised forms of transport, restricts driveway access, maintains reasonable spacing between interchanges and divides the highway carriageways.
- Efficient and effective transport – limits access to the highway to promote high speed movement of passenger and freight vehicles, provide high level of flood immunity, designed for safe travel dynamics for heavy vehicles and road alignment standards promoting efficient movement of goods and people.
- Is relatively direct, making it attractive to longer distance freight and passenger traffic which provides a good outcome in terms of transport efficiency.
- Provides for greater use of public land and aligns with the proposed Traveston Crossing Dam, and existing infrastructure corridors, of the Bruce Highway, railway line and powerlines, where practical.
- Bypasses east of Gympie in a location that will serve the Gympie community by providing good access to local industry and business, better access to the developing coastal region and reasonable access from the highway through a service road system.
- Minimises proximity of heavy vehicles to populated areas, minimises noise and air quality impacts by not stopping or slowing heavy traffic in urban areas and separates high speed traffic from local traffic, pedestrians and other non motorised forms of transport.
- Allows for future growth areas by conforming with the Cooloola Shire Council planning scheme.
- Provides reasonable physical separation from existing and proposed major residential areas such that acceptable visual and traffic noise outcomes could be achieved with sensitive urban design.
- Minimises environmental impacts, by avoiding environmentally or culturally sensitive areas, minimising or mitigating environmental impacts and adopting best practice during construction and operation of the highway.
- Retains the historic Traveston Homestead, Federal State School, local community halls and other historic sites.
- Retains the existing highway as a local road, to maintain property access and local road connectivity.
- Takes into account, wherever feasible, community views about the corridor location.

4.3 Corridor Design Intent

To meet the strategic needs of the highway for the next 30 years and beyond, it is necessary to plan for the new highway corridor to be of rural motorway standard which caters for safe and high speed travel.

To improve safety the highway will be a limited access road. This prevents local roads and fronting properties having direct access to the highway. Access to and from the new highway to major roads will be at regular but widely spaced interchanges. The highway corridor will cater for an initial four-lane divided highway, providing two lanes in each direction with a wide central median.

The existing highway will remain as a local arterial road and maintain connectivity and provide access to most of the local roads and properties that currently have direct access to the existing highway. The connections of existing network and local roads will be maintained by under/overpasses where feasible.

4.4 Recommended Corridor Summary

The recommended corridor duplicates the existing Bruce Highway between the Cooroy Bypass Interchange and Cooroy Connection Road. The duplication is to the western side of the existing carriageway and is generally within the existing highway reserve.

An all movements interchange utilising the existing underpass at Cooroy Connection Road/ Cudgerie Drive provides a northern access to Cooroy in addition to serving the township of

Pomona and rural residential areas of Black Mountain. The existing highway is retained north of this interchange to maintain the local road network.

North of Cooroy Connection Road the corridor aligns to the southern side of the existing highway reserve with significantly improved horizontal and vertical geometry. The recommended corridor crosses the existing highway near the Federal State School. Within the area of the proposed Traveston Crossing dam the recommended corridor follows the dam's eastern buffer area. Should the dam not proceed then the location of the corridor may change to an alignment close to the existing Bruce Highway as originally favoured by the community. The existing highway will be inundated by the proposed dam; however a two lane service road aligning to the eastern side of the recommended corridor will continue to connect the local traffic which would otherwise have used the existing highway.

An all movements interchange on Traveston Road connects the service road around the dam and Traveston Road which link the corridor to the Federal, Coles Creek and Traveston areas. Additionally the interchange connects the area to the west of the proposed dam via Traveston Crossing Road.

North of the Traveston Interchange the corridor aligns to the eastern side of the high voltage powerlines up until Woondum Road, where it crosses back to the western side of the powerlines to provide the directional ramps of the Woondum Interchange. To provide priority and safety for the following major movements, this interchange includes south facing ramps only:

- Northbound from the new corridor into Gympie; and
- Southbound out of Gympie onto the new corridor.

The corridor passes through the Woondum State Forest and then passes the industrial areas near Six Mile Creek (the Eldorado Gold Mine and Nolan's Meatworks) on its way to aligning to the eastern side of the existing North Coast Rail Line.

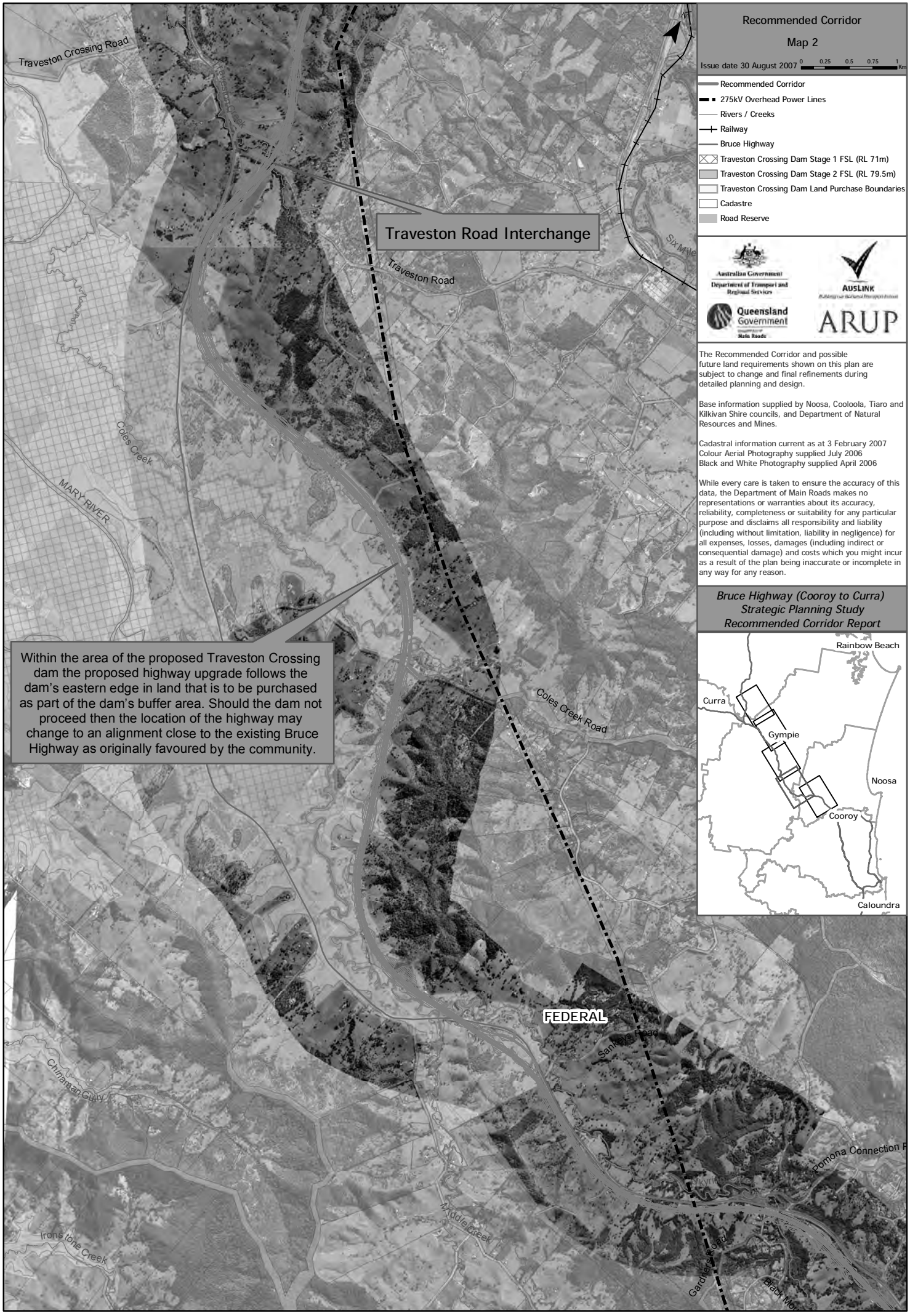
North facing ramps are provided near the industrial area south of Gympie to provide the movements which were restricted from the Woondum interchange. These ramps include a northbound on ramp to the new corridor from the Penny Road/ Noosa Road intersection and a southbound off ramp from the new corridor to Flood Road. These ramps connect back to the existing Bruce highway via Hall Road.

An all movements interchange on Gympie Connection Road adjacent to the existing North Coast Rail Line provides significant flood immunity for an eastern access into Gympie and improved access to the developing coastal regions.

The corridor continues to align as close as feasible to the eastern side of the North Coast Rail Line until it reaches the Curra State Forest where the corridor moves to the east and aligns to the edge of the state forest. The corridor joins back to the existing highway at Curra approximately 1km north of the existing railway crossing. An all movements interchange links the corridor with the existing highway, Harvey Siding Road and Ashfords Road.

The recommended corridor is shown on the following **maps 1 to 5.**


Recommended Corridor
Map 1
Issue date 30 August 2007
0 0.25 0.5 0.75 1 Km
Recommended Corridor
275kV Overhead Power Lines
Rivers / Creeks
Railway
Bruce Highway
Traveston Crossing Dam Stage 1 FSL (RL 71m)
Traveston Crossing Dam Stage 2 FSL (RL 79.5m)
Traveston Crossing Dam Land Purchase Boundaries
Cadastre
Road Reserve
Australian Government
Department of Transport and Regional Services
AUSLINK
Queensland Government
Main Roads
ARUP
The Recommended Corridor and possible future land requirements shown on this plan are subject to change and final refinements during detailed planning and design.
Base information supplied by Noosa, Cooloola, Tiaro and Kilkivan Shire councils, and Department of Natural Resources and Mines.
Cadastral information current as at 3 February 2007
Colour Aerial Photography supplied July 2006
Black and White Photography supplied April 2006
While every care is taken to ensure the accuracy of this data, the Department of Main Roads makes no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and disclaims all responsibility and liability (including without limitation, liability in negligence) for all expenses, losses, damages (including indirect or consequential damage) and costs which you might incur as a result of the plan being inaccurate or incomplete in any way for any reason.
Bruce Highway (Cooroy to Curra)
Strategic Planning Study
Recommended Corridor Report
Rainbow Beach
Curra
Gympie
Noosa
Cooroy
Caloundra
N
Pinbarren Creek
Six Mile Creek
Coles Creek
Jam Pot Creek
Sankeys Road
POMONA
Pomona Connection Road
Gardners Road
Pioneer Road
Black Mountain Range Road
Existing highway remains to function as a service road
Cooroy Connection Road
Mickie Creek
State Creek
Cooroy Connection Road Interchange
Duplication of existing highway (generally within the existing reserve) between the existing Cooroy Interchange and Cooroy Connection Road Interchange
Six Mile Creek (Left Branch)
COOROY
Existing Cooroy Interchange


Recommended Corridor
Map 2
Issue date 30 August 2007
0 0.25 0.5 0.75 1 Km
Recommended Corridor
275kV Overhead Power Lines
Rivers / Creeks
Railway
Bruce Highway
Traveston Crossing Dam Stage 1 FSL (RL 71m)
Traveston Crossing Dam Stage 2 FSL (RL 79.5m)
Traveston Crossing Dam Land Purchase Boundaries
Cadastre
Road Reserve
Australian Government
Department of Transport and Regional Services
AUSLINK
Queensland Government
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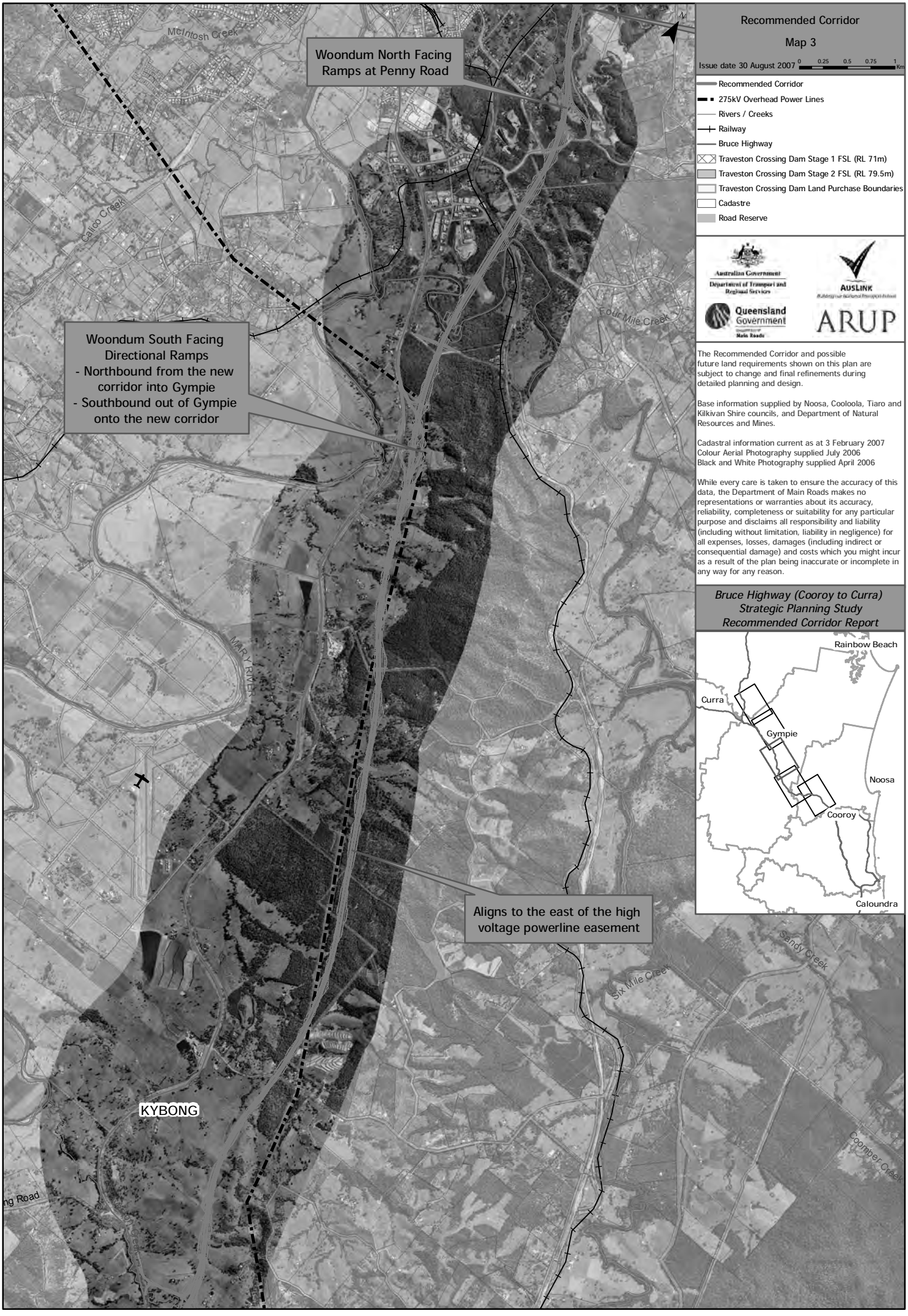
Bruce Highway (Cooroy to Curra)
Strategic Planning Study
Recommended Corridor Report
Rainbow Beach
Curra
Gympie
Noosa
Cooroy
Caloundra
Traveston Road Interchange
Traveston Crossing Road
Traveston Road
Coles Creek
MARY RIVER
Coles Creek Road
Within the area of the proposed Traveston Crossing dam the proposed highway upgrade follows the dam's eastern edge in land that is to be purchased as part of the dam's buffer area. Should the dam not proceed then the location of the highway may change to an alignment close to the existing Bruce Highway as originally favoured by the community.
FEDERAL
Sankeys Road
Chinaman Gully
Ironstone Creek
Middle Creek
Gardens Road
Pomona Connection R


Recommended Corridor
Map 3
Issue date 30 August 2007
0 0.25 0.5 0.75 1 Km
Recommended Corridor
275kV Overhead Power Lines
Rivers / Creeks
Railway
Bruce Highway
Traveston Crossing Dam Stage 1 FSL (RL 71m)
Traveston Crossing Dam Stage 2 FSL (RL 79.5m)
Traveston Crossing Dam Land Purchase Boundaries
Cadastre
Road Reserve
Australian Government
Department of Transport and Regional Services
AUSLINK
Queensland Government
Main Roads
ARUP
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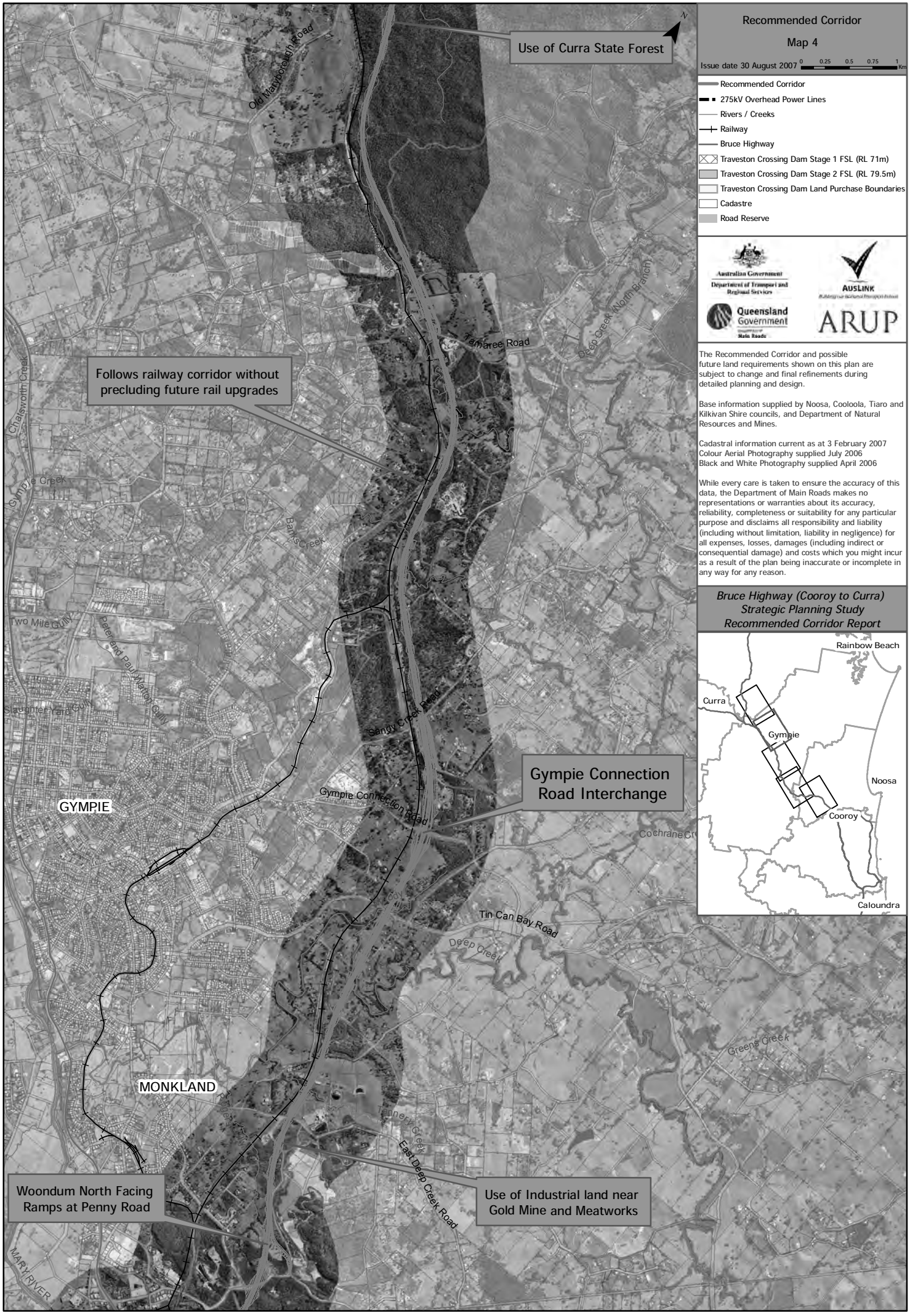
Bruce Highway (Cooroy to Curra)
Strategic Planning Study
Recommended Corridor Report
Rainbow Beach
Curra
Gympie
Noosa
Cooroy
Caloundra
Woondum North Facing Ramps at Penny Road
Woondum South Facing Directional Ramps
- Northbound from the new corridor into Gympie
- Southbound out of Gympie onto the new corridor
Aligns to the east of the high voltage powerline easement
McIntosh Creek
Calico Creek
Four Mile Creek
MARY RIVER
Sandy Creek
Six Mile Creek
Coomber Creek
KYBONG


Recommended Corridor
Map 4
Issue date 30 August 2007
0 0.25 0.5 0.75 1 Km
Recommended Corridor
275kV Overhead Power Lines
Rivers / Creeks
Railway
Bruce Highway
Traveston Crossing Dam Stage 1 FSL (RL 71m)
Traveston Crossing Dam Stage 2 FSL (RL 79.5m)
Traveston Crossing Dam Land Purchase Boundaries
Cadastre
Road Reserve
Australian Government
Department of Transport and Regional Services
AUSLINK
Queensland Government
Main Roads
ARUP
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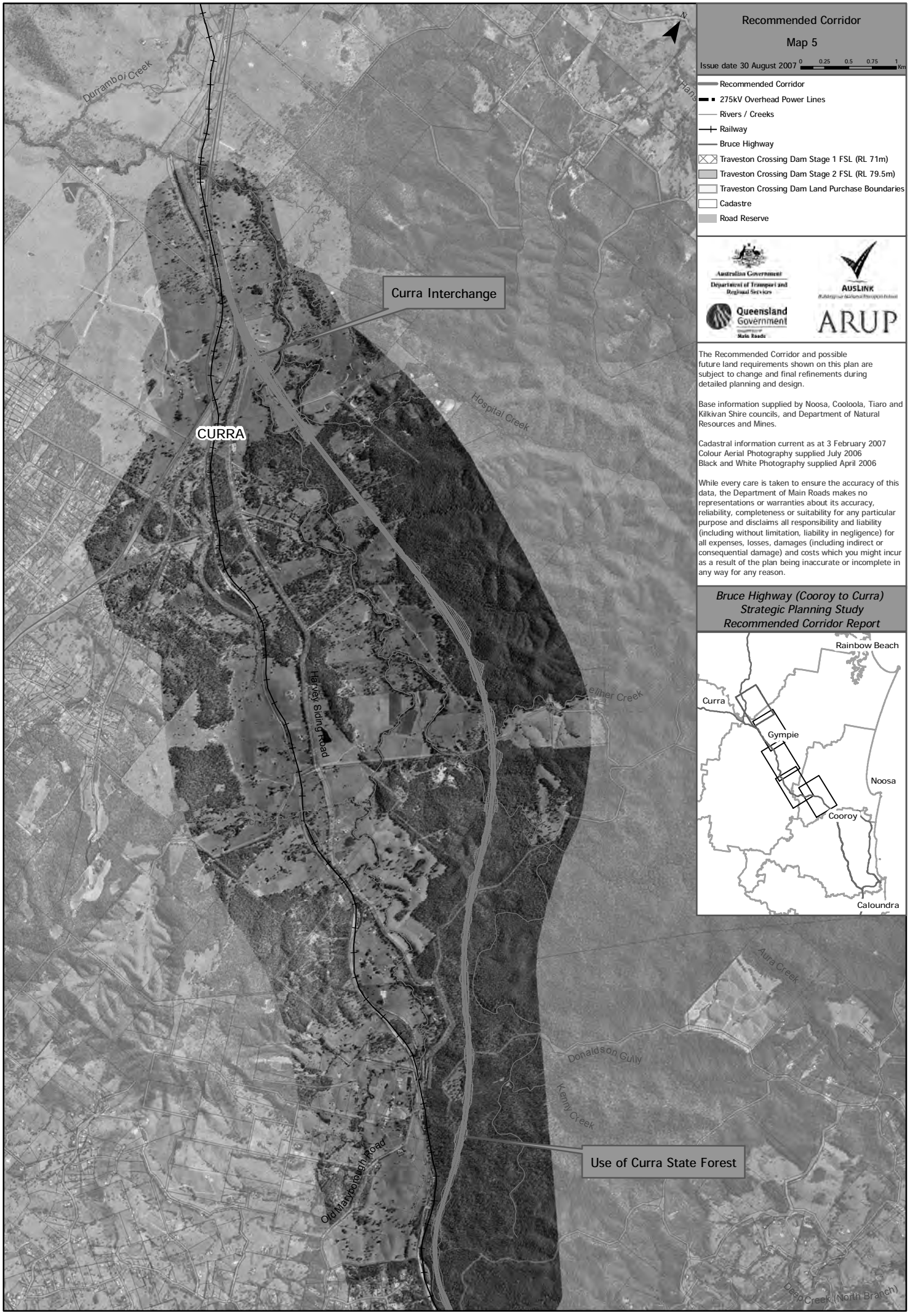
Bruce Highway (Cooroy to Curra)
Strategic Planning Study
Recommended Corridor Report
Rainbow Beach
Curra
Gympie
Noosa
Cooroy
Caloundra
N
Use of Curra State Forest
Follows railway corridor without precluding future rail upgrades
Gympie Connection Road Interchange
Woondum North Facing Ramps at Penny Road
Use of Industrial land near Gold Mine and Meatworks
GYMPIE
MONKLAND
Old Maryborough Road
Tamaree Road
Deep Creek (North Branch)
Chatsworth Creek
Gympie Creek
Barnes Creek
Two Mile Gully
Peter and Paul Martin Gully
Slaughter Yard Gully
Sandy Creek Road
Gympie Connection Road
Cochrane Cr
Tin Can Bay Road
Deep Creek
Greens Creek
Tinnery Creek
East Deep Creek Road
MARY RIVER


Recommended Corridor
Map 5
Issue date 30 August 2007
0 0.25 0.5 0.75 1 Km
Recommended Corridor
275kV Overhead Power Lines
Rivers / Creeks
Railway
Bruce Highway
Traveston Crossing Dam Stage 1 FSL (RL 71m)
Traveston Crossing Dam Stage 2 FSL (RL 79.5m)
Traveston Crossing Dam Land Purchase Boundaries
Cadastre
Road Reserve
Australian Government
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Strategic Planning Study
Recommended Corridor Report
Rainbow Beach
Curra
Gympie
Noosa
Cooroy
Caloundra
Curra Interchange
CURRA
Use of Curra State Forest
Durramboi Creek
Hospital Creek
Harvey Siding Road
Old Maryborough Road
Aura Creek
Donaldson Gully
Kenny Creek
Deep Creek (North Branch)

5.0 The next stage

5.1 Project Approval

The Queensland Minister for Main Roads will consider the Project Report and make a decision on the recommended corridor in consultation with the Australian Government. Once a decision is made, the implementation strategy can then be considered.

5.2 Implementation

Priorities for construction will be assessed by government, considering the implementation strategy and AusLink priorities. Subject to further decisions by government the main phases of project development are:

Table 5.2: project phases

Phase	Stages	Description
Concept	Project Proposal Options Analysis Business Case	A three stage delivery process which requires a sequential project build-up from network planning to a project budget and inclusion on the Road implementation Program (RIP)
Development	Design Development (Preliminary Design) Design Detailing (Detailed Design)	A two stage process to suit RIP timing and Right-of-Way acquisitions.
Implementation	Construction	To construct the works.

These phases would follow on from the current strategic planning study phase of this project.

The Concept and Development Stages will require further technical and environmental investigations on matters such as noise impacts, geotechnical and flora and fauna issues. Project development will also require liaison with relevant state agencies and the Australian Government Department of Environment and Water Resources to determine the additional assessment processes that may be necessary e.g. possible EIS.

Consultation will be undertaken with potentially directly affected landowners during these future design stages. The consultation will focus more on local issues such as property access, accommodation works and noise amelioration.

5.3 Referral of project to Commonwealth Department of Environment, Heritage and Arts

Based on the environmental investigations conducted to date, there is the potential requirement to refer this project to the Australian Government Department of Environment Heritage, and Arts under the provisions of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Approval under the EPBC is required for actions that are likely to have a significant impact on:

- a matter of national environmental significance (NES);
- the environment of Commonwealth land (even if taken outside Commonwealth land); and
- the environment anywhere in the world (if the action is undertaken by the Commonwealth).

5.3.1 Matters of National Environmental Significance (NES) and the project:

The following matters of NES have been identified through the conduct of an EPBC Act Protected Matters Search[1]

Table 5.3: Matters of National Environmental Significance

NES	Impacted by project?	Detail*
World Heritage	No	None
National Heritage	No	None
Ramsar Wetlands	No	None, but closest are Great Sandy Strait & Moreton Bay
Threatened Species and Ecological Communities	Potentially	Potentially 38 threatened species
Migratory Species	Potentially	Potentially 13 migratory species
Commonwealth Marine Area	No	None

*Note: Over time species listed under the EPBC Act may change. Therefore updated EPBC Act protected matters searches should be carried out at the appropriate point in time.

To decide if there is a significant impact on matters of NES, future stages will need to consider:

- Onsite and offsite impacts;
- Direct and indirect impacts;
- Frequency and duration;
- Total impact over time;
- Sensitivity of receiving environment; and
- Confidence with which impacts are known and understood.

The ecological investigations conducted to date have not ruled out the potential for matters of NES to be significantly impacted by the project, therefore further investigations will be required. It is recommended that DEHA are consulted prior to the completion of the strategic planning study, to ensure that the recommended approach is suitable. The implementation of this project (future planning and design) will require consideration of matters of NES.

5.4 Road design issues for future design phases

Main Roads and the study team acknowledge that more investigations need to be carried out as the corridor progresses through future planning and design phases. These investigations will not only focus on improving the corridor for engineering issues and value for money but also coordinate wider network changes and updates required due to the implementation of this new corridor.

5.5 Environmental Assessment and Management Requirements for future design phases

It is acknowledged that further environmental investigations will need to be carried out to inform future stages of planning and design. This will include the development and implementation of appropriate mitigation strategies, such as a project specific offset policy, to address the requirements under the Vegetation Management Act for the removal of endangered, of concern, or not of concern regional ecosystems. The development of noise mitigation measures, and water and air quality monitoring and modelling. Given the likely timeframes for delivery of this major highway upgrade, a staged yet coordinated approach to environmental assessment and management is recommended.

[1] http://www.environment.gov.au/erin/ert/epbc/index.html

Early involvement with the Commonwealth Department of Environment and Water Resources, and other relevant State Government agencies is recommended to address the various environmental assessment requirements, and the identification and management of cumulative effects of the project.

The following issues will require further consideration in future planning and design phases of the project, in addition to the need for further investigations to determine the need for an EPBC referral as discussed above:

- Cultural Heritage Survey and preparation of a Cultural Heritage Management Plan, at an appropriate Phase of the project.
- Analysis of additional feedback from the March 2007 public display period in relation to environmental issues.
- Landscape and visual design (incorporating lighting, noise treatments and revegetation).
- Water quality investigations (with respect to bridge crossings, management of erosion and sediment control and potential for impacts on tank and private water storages).
- Contaminated land investigations- particularly in the vicinity of the Gold mine and industrial areas, as well as agricultural areas.
- Development of a project specific environmental policy for the life of the project (i.e. all stages of planning and design) that gives guidance on the development of mitigation, compensatory planting/ vegetation offsets and identification of suitable offset areas, CO_2 emissions, community involvement in the development of design and mitigation.
- Consultation and agreement with relevant government departments (i.e. NRW) to determine a whole of project approach for the management of vegetation offsets under the *Vegetation Management Act 1999 (VMA).* Although some exemptions may apply to DMR, the following criteria adapted from the VMA should be considered when determining potential areas for offsets:

    1) *Vegetation must not be currently protected – (a) the area cannot currently be mapped as remnant vegetation (unless it has been approved to be cleared or is falling victim to an immediate threatening process), and (b) the area cannot be protected by conditions within a DA and (c) the area must not be subject to a PMAV identifying it as protected vegetation and (d) the area must not be protected already by any other legislation.*
    2) *Vegetation must be in the same geographical area (i.e. same bioregion) and be the same RE if the vegetation is endangered or essential habitat or at least have the same status in other scenarios.*
    3) *Vegetation must be at least 2 hectares in area and be capable of attaining remnant status within a maximum of 20 years.*
    4) *Vegetation must be 'Ecologically Equivalent to the remnant cleared'. This considers all things that make a patch of vegetation self-sustaining, i.e. area to perimeter ratio, condition, age, connectivity, size.*
    5) *A Vegetation Management Plan must be presented to describe how the offset will be managed to ensure it attains and retains remnant status.*
    6) *Offset must be legally secured, i.e. purchased and subject to a covenant, under an agreement or handed to State or Local government as conservation area (like a park contribution). However, if it is in the form of a park contribution it is likely that the developer will have to do the work to get the vegetation to a certain standard before local or State government will manage it.*
    7) *A financial contribution is not considered an offset.*

- Development of fauna underpasses/overpasses at appropriate places along the corridor particularly in the vicinity of Yurol State Forest, Traveston State Forest, Woondum State Forest and Curra State Forest. Also consider placement of crossing structures at spacing of no more than 500m apart, in appropriate locations along the corridor (not just in the four primary areas noted). This may include underpasses: either as culverts or road bridges; and/or overpasses: such as land bridges or rope bridges.
- Ongoing consultation and liaison with affected landowners, and landowners adjacent to the highway corridor to manage the significant social effects of this project (including communication of the overall strategy for implementation over the next 20 years)

Appendix A

Cultural Heritage Survey of Rocky Ridge, Gympie (Archaeo Cultural Heritage Services)

ARCHAEO
CULTURAL HERITAGE SERVICES

CULTURAL HERITAGE SURVEY

OF

Rocky Ridge, Gympie

South East Queensland

REPORT TO

Arup

ARCHAEO Cultural Heritage Services
369 Waterworks Road
Ashgrove, Brisbane
(07 3366 8488)

Permit Number – CHST00221007
MAY 2008

Contact details are:

ARCHAEO Cultural Heritage Services
369 Waterworks Road, Ashgrove, Brisbane
PO Box 333, The Gap, Brisbane, 4061
Tel: 07-3366 8488
Fax: 07-3366 0255
Email: bgall@archaeo.com.au

DOCUMENT VERIFICATION

ARCHAEO Project: Gympie Cultural Heritage Survey

Document Title:
'Rocky Ridge' Gympie - Cultural Heritage Survey

Verification:

ARCHAEO Project Number: A0803

File location:
F:\Projects\A0803 Gympie/Historic/Reporting

Revision	Date	Nature of revision	Prepared by	Authorised by
0	26/09/2007	Draft working paper	BG	SG
1	03/10/2007	Review	BG	SG
2	04/10/2007	Final revision	-	BG
3	21/05/2008	Report for issue	-	BG
4				

CONTENTS

CONTENTS

ACKNOWLEDGEMENTS

A special thanks to the following people who assisted with this assessment:

- Representatives of the Dhamurian Society for their assistance during stage one of the field survey. Their assistance enabled the field survey team to gain an additional layer of understanding for the site; and
- Department of Main Roads staff who assisted in securing access to the site during the field survey.

EXECUTIVE SUMMARY

This assessment has undertaken a series of careful investigations to clarify the nature of cultural heritage significance relevant to the study area along with the potential impacts and required mitigation as a result of the Bruce Highway Upgrade, Cooroy to Curra, This assessment includes:

- a review of existing research completed by Dr Elaine Brown for the study area;
- further research as required from the abovementioned review;
- the results of the cultural heritage field survey;
- the nature of cultural heritage significance within the study area and the potential impacts of the Project in relation to the study area;
- specific management recommendations for the protection of potential areas of cultural heritage significance.

A critical review of the work of historical analysis presented in the 'Report on the Gympie Pyramid' by Dr Elaine Brown was conducted and found to be sound according to the orthodox 'historical method', and is demonstrably reasonable in its use of evidence, its inferences and conclusions.

Secondly, explanation for the features present at the site contained in this report (that they are associated with terracing for agricultural purposes) is supported by the historical evidence presented. This explanation, insofar as it is a conclusion grounded in historical (rather than archaeological or geological) evidence and reasoning, was considered a more reasonable and thus more likely explanation than others not supported by evidence or logical reasoning.

The field survey component of this study found that historic features were clearly restricted to the southern and south-western slopes of the sandstone ridge that dominates the study area (see Section 3.5.1). This site can best be described as representing a series of low retaining walls incorporating small 'steps' or 'banks' faced with loosely stacked stone most likely collected from adjacent areas and that these features were considered likely to have been created during initial clearing and partial levelling of the slope for agriculture.

Whilst this site has been highly disturbed by a number of more recent historic activities and factors, the investigations carried out as part of this assessment show that none of the features noted during the survey appear to reflect the use of a significant or skilled labour force. Predictions are that these features could easily have been constructed by an individual or small number of individuals in a relatively short timeframe.

The explanation for historic features present at the site (that they are associated with terracing for small scale agricultural purposes such as a vineyard) is therefore not only supported by the abovementioned historical evidence reviewed in this assessment, but also the physical evidence (archaeological and geological) provided by this field survey.

This report has identified one (1) site of cultural heritage significance within the study area (Table A: Historic sites directly affected by the project), which is subsequently affected by the proposed project). This is further discussed in Section 3.5.1.

Impact type (likely)	Impacted site/s or places
Direct impact	Site Complex 1

Table A: Historic sites directly affected by the project

The exact nature of cultural heritage significance of this site was evaluated using recognised benchmarks such as *The Burra Charter* and *Queensland Heritage Act 1992.* These findings are summarised as:

Value	Rating	Legislative Status
Aesthetic	Low	• May satisfy criteria for listing on the Local Heritage Register (currently unlisted). • Unlikely to satisfy listing on the Queensland Heritage Register.
Historic	Moderate (locally)	• May satisfy criteria for listing on the Local Heritage Register (currently unlisted). • Unlikely to satisfy listing on the Queensland Heritage Register.
Scientific	None-Little	• Does not satisfy criteria for listing on the Local or State Heritage Register (Currently unlisted).
Social	Moderate (locally)	• May satisfy criteria for listing on the Local Heritage Register (currently unlisted). • Unlikely to satisfy listing on the Queensland Heritage Register.

Table A: Historic sites directly affected by the project

From a heritage perspective, this report has concluded that the study area contains, at best, low-moderate levels of local cultural heritage significance. In light of this conclusion and the proposed project, the following recommendations have been made:

Recommendation 1 – Recording of Site Complex 1

Detailed recording of all remaining historic features located within Site Complex 1 (described in Section 3.5.1) should be undertaken prior to the commencement of development. This process may incorporate utilising an arbitrary grid system for reference to enable production of detailed scale drawings of features along with photographic recording to acceptable professional standards. Improving visibility by removing undergrowth may also be required.

As part of this recording process, it is recommended that a series of machine survey trenches be excavated running perpendicular to Features F1-F10. These trenches should focus on the better preserved sections to allow for detailed recording of any potential construction techniques that may not have been immediately apparent during the field survey (e.g. evidence of footings and/or cutting and filling).

Recommendation 2 - Unexpected finds as part of the Project

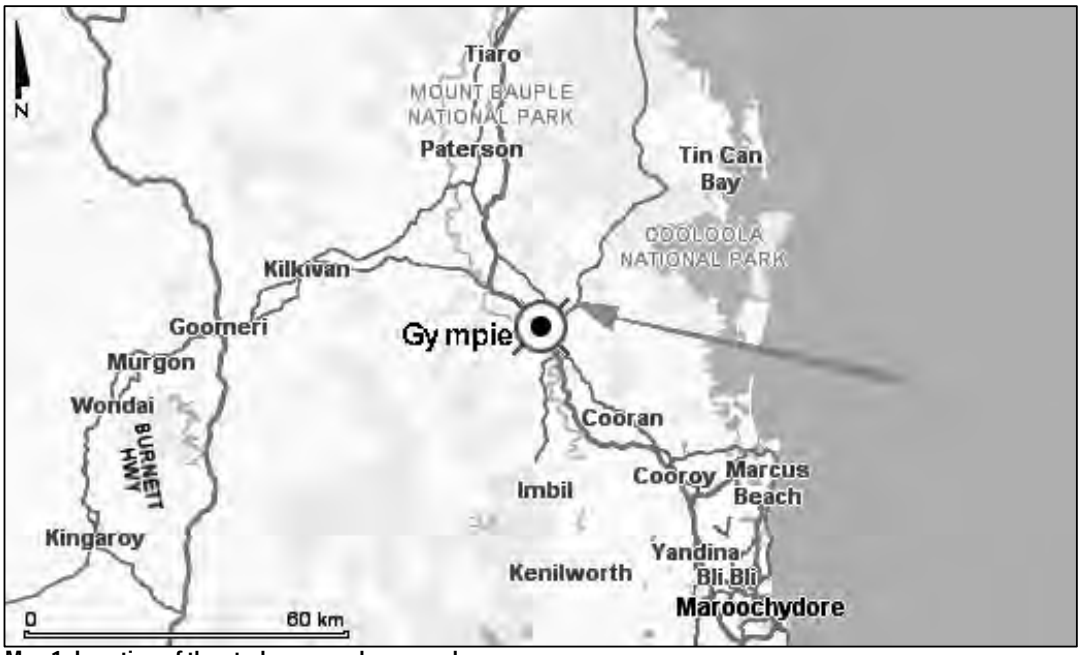
Unexpected cultural heritage material or sites found during the construction stage of the project should be managed using the following measures:

- All work at the location of the find must cease and reasonable efforts to secure the site should be made – a buffer zone of ten metres is recommended;
- Work can continue at the distance of twenty metres from a find area. Note that the material should not be removed or disturbed further but barriers or temporary fences may be erected as a buffer around the find if required;
- The Cultural Heritage Coordinator and relevant Site Manager should be notified. They should then notify the Historical Archaeologist appointed to the Project; and
- The Historical Archaeologist will provide a management recommendation to the Environment-Team Leader, and will undertake approved actions, as outlined in the associated *EPA Guidelines for Archaeological Survey*.

Assuming the recommendations made in this report are suitably completed, this report finds the nature and level of impact by the project is acceptable in terms of impact to appropriately significant cultural heritage sites and places discussed within the study area and therefore acceptable.

1 INTRODUCTION

ARCHAEO Cultural Heritage Services was commissioned by Arup to undertake a Historic Cultural Heritage Survey of a section of the Bruce Highway Project, Cooroy to Curra, approximately 7km east of Gympie, Southern Queensland.



Map 1: Location of the study area and surrounds.

The results of this survey will be submitted to the Environmental Protection Agency (EPA) and evaluated under Section 7 of the Queensland Heritage And Other Legislation Amendment Act 2003. (Areas and objects that relate to Queensland's historic heritage are managed under Part 7 of the Queensland Heritage And Other Legislation Amendment Act 2003).

1.1 Purpose of the Study

The purpose of this report is to qualify the level of cultural heritage significance relevant to the site known as Rocky Ridge and sometime referred to as the "Gympie Pyramid" (hereafter referred to as the study area) and recommend the suitable management of these heritage values. Contextual research will be undertaken to determine the existence, extent and probable levels of significance of the area prior to the field survey taking place.

This report presents the results of the Historical Cultural Heritage Survey, and includes:

- a critical review of existing research completed by Dr Elaine Brown for the study area;
- further contextual research;
- the results of the cultural heritage field survey;
- the nature of cultural heritage significance within the study area and the potential impacts of the Project in relation to the study area;
- specific management recommendations for the protection of potential areas of cultural heritage significance.

The scope of this study acknowledges that the archaeological record is both fragile and non-renewable, and any major disturbance of the environment potentially poses a threat to this valuable cultural resource.

1.2 Dates and Duration of the Work

Arup commissioned ARCHAEO to complete the survey and review at the end of July 2007. The research and field survey components of the study were undertaken over three days on August 13, 14 and 17, 2007.

The report was completed in September 2007.

1.3 Personnel

The critical review of documentary evidence and historical analysis presented by Dr. Elaine Brown for the site was conducted by Dr Geoff Ginn. Geoff also undertook additional research relating to historical land use in the study area and adjoining allotments and attended the second stage of site survey.

Simon Gall and Bridget Walker (ARCHAEO) undertook the field survey with the assistance of Dr. John Pickard (Macquarie University). Benjamin Gall (ARCHAEO) attended the second stage of the field survey and completed the significance statement and recommendations and final draft of the report.

This work was completed under EPA Archaeological Survey Permit No **CHST00221007**.

1.4 The Study Area

The study area discussed (Table 1 - Summary description of the study area).
is described accordingly:

Property Description	Property Name (if applicable)
731MCH5309 **4MCH806656** **730MCH5309** **725MCH5306 AND** **10MCH806657** **5MPH5013** **1 MPH35291** **7MCH80665**	**Rocky Ridge** **(Sections of the study area are sometimes referred to as the 'Gympie Pyramid').**

Table 1 - Summary description of the study area.

The area consists of a number of rural residential blocks, the majority of which feature improvements such as fences, driveways, residences and ancillary buildings and other infrastructure including turkey nest dams. The study area is bordered to the west by the main coastal railway line and associated reserve, to the north by Rocky Ridge Road and Samara Crescent and to the south by the Gympie Connection Road. A sandstone ridge capped by outcropping sandstone (referred to as Rocky Ridge in older literature) dominates the study area.

That section of the study area incorporating features, both natural and historic, sometimes referred to as the "Gympie Pyramid" is restricted to the steeper, southern side of this ridge. Apart from various small outcrops of sandstone (or exposed faces of floating boulders) near the crest, the majority of this slope is not rocky. North of the sandstone cap, the ridge has a gentle slope, covered with sandy material, presumably derived from *in situ* weathering of the sandstone. The southernmost section of the study area below the ridge and adjacent to the Gympie Connection Road is comparatively flat and contains a small creek gully incorporating several deeper waterholes (This area is noted as a reliable water source in early survey maps). Please refer to Map 2 on the following page for further detail.

Map 2: Location of the study area in relation to the local area

2 BACKGROUND INFORMATION

Dr Elaine Brown has previously prepared a historical analysis of the study area for Queensland Department of Main Roads in 2006 entitled *Report on the "Gympie Pyramid" (see Appendix 1)*.

The brief for this assessment includes:

- A critical review of the documentary evidence and historical analysis presented by Dr. Elaine Brown for the site; and
- To undertake additional research relating to historical land use in the study area and adjoining allotments.

A critique of the documentary evidence and historical analysis contained in Dr Elaine Brown's report (The Report) is presented in Section 2.1. Further to this, Section 2.2 presents additional research findings relating to the site, established by checks on the sources used for the original report, and the sourcing of additional documentation where appropriate.

2.1 Critical Review of the *Report on the 'Gympie Pyramid'*

Part of the project brief was to conduct a critical review of The Report. Conclusions of this review suggest that it can be readily demonstrated that the *Report on the 'Gympie Pyramid*' utilises evidence-based techniques of source analysis that are entirely orthodox in (and consistent with) the historical method required for such a site as the study area.

Additionally, the author is diligent in referencing her historical evidence. The use of footnotes or endnotes is the fundamental scholarly technique for presenting historical evidence and analysis and has ensured that the work is verifiable at all points by other historians or interested readers.

2.1.1 Critical Review of Historical Evidence and Analysis

A range of historical evidence of both a primary and secondary nature is examined in The Report. Discussion, evaluation and analysis relating to this evidence is presented in four parts, described below:

Part 1: Introduction
Part 2: Claims about the 'Gympie Pyramid'
Part 3: Post-settlement land-use at Rocky Ridge/McPherson's Paddock
Part 4: Conclusion

Through this analysis of the site's environmental context (principally in terms of geography, geology and topography in Part 1, and its environmental history in Part 3), its historiography (i.e. the critical review in Part 2 of the various interpretations that have been presented about its history and significance) and its documented history (as far as the surviving evidence located by the author's research allows – presented in Part 3) a number of inferences are drawn to develop the substantive conclusions of the report in Part 4.

These points can be elaborated by examining the elements of the Report in turn.

2.1.2 Analysis of Environmental History (in Parts 1 and 3)

The geographic character of the Rocky Ridge outcrop is discussed in Part 1 utilising a generalised topographical description, a commonly available 'City of Gympie' map to relate the site to various local features, and an official Department of Mines and Energy geological map dating from 1999. The specific geology of Rocky Ridge is identified using the commentary accompanying the 1999 map.

Later in the report, in Part 3, further environmental analysis of the site is provided in discussing the site's history since the onset of European settlement. The published reports of government geologists such as Aplin and Rands contain early geological descriptions of the sandstone outcrop at Rocky Ridge. At the end of that section, a description based on the authors' own observations at the site in the early 1970s suggests the regrowth (gums, wattles) and exotic infestations (prickly pear, lantana) that were visible then and since. Additional observations indicate the impact of recent developments such as housing and the 1989 railway deviation in a generalised way.

2.1.3 Historiographical Analysis (in Part 2)

Part 2 of the report presents an overview and evaluation of the various claims made about the 'Gympie Pyramid' alleged to be situated at Rocky Ridge. The claims of four individuals (Gilroy, c. 1975; Pye c.1983; Green c. 1995-1999 and 2000; Menzies c.2002) expressed in either published articles or in book form are examined in turn.

The comments point out a number of key issues that need to be considered in determining the value or veracity of each of these claims. While the points made might be considered arguable, they are difficult to acknowledge as demonstrably reasonable statements.
In the case of Rex Gilroy's claims, these include the observation that his opinion that the so-called 'Gympie Ape' is of Egyptian origin is purely conjectural; and that there is no geo-morphological or geological basis for his claims of a 'great harbour' at Tin Can Bay.

Similarly reasonable comments are also presented in relation to Marilyn Pye's claim in c.1983 that stones from the 'pyramid' had been removed to construct a dry stone wall at

the Surface Hill Uniting Church. Brown provides references to published and oral sources that document the construction of the retaining wall at Surface Hill "by depression labour in 1938 with stones obtained from the property of Mrs Patience Mulholland." (Brown, 2006: 2). She also observes that two secondary historical accounts have discredited the claims made. Again, while this evidence is not above dispute, the contentions made would seem to be reasonable.

Reasonable comments are also made with respect to claims in self-published works by Brett Green. Brown notes that the diaries upon which (purportedly) Green's *Tales of a Warrior* series are based, of which is containing various references to the 'Gympie Pyramid', have allegedly been destroyed in a fire, and that they cannot therefore be authenticated.

The claims cannot thus be verified or corroborated by independent analysis. More generally, Brown points out that Green's publications contain factual inaccuracies about the history of the Wide bay district, (these however are not provided), that accounts of Aboriginal legends and customs that are inconsistent with other sources, and that the photographic material produced as evidence in Green's books contain apparent inconsistencies. It is also noted that other family history researchers maintain that John Green was illiterate and never came to Queensland. This observation is supported by a reference to a Green family history published in 1999.

Finally, Brown makes the demonstrably reasonable observation that the views of Gavin Menzies in his book *1421: The year China discovered the world* are controversial. This is substantiated by the critical treatment of Menzies' theories in the ABC current affairs program *Four Corners* (in a story titled 'Junk History' broadcast in July 2006). Any search of the internet under Menzies' title will demonstrate the liveliness of this debate among readers, historical scholars and the general community.

In each of these cases, it is demonstrable that Brown's commentary on the various sources for the 'Gympie Pyramid' hypothesis is presented in fair and reasonable terms.

2.1.4 Documentary Evidence and Analysis of Land-Use (in Part 3)

As is conventional in historical consultancy, The Report presents a short narrative history of key historical developments in the Gympie district since European settlement. This overview provides a necessary contextual background to the site-specific research and analysis subsequently presented in the report. It also provides an opportunity to review to what extent the stone features at Rocky Ridge have been observed or commented upon by historical figures that have used or surveyed the site since the late 1840s.

The overview is presented in three paragraphs on page 3, and outlines broad local developments in pastoral occupation from the late 1840s, early road surveys by Bidwill and Buchanan in the 1850s, and gold prospecting and mining from the late 1860s.

The discussion presented here is orthodox historical analysis. Specific historical evidence presented in this section relates directly to the documented history of the Rocky Ridge site, and demonstrates that known and verifiable historical sources (such as reports by government geologists, and the accounts of early surveyors and administrators such as Bidwill and Buchanan) contain no reference to an alleged 'pyramid' at the Rocky Ridge site or similar unusual remains or stone structures. Brown draws upon her own familiarity with the broad range of relevant historical sources to present her conclusion that "neither Bidwill nor Buchanan, nor the mailmen, timber-getters, stockmen, bullock-drivers or travellers who followed this route after them (except the elusive John Green) reported finding unusual remains or pre-settlement stone structures in the vicinity of the track." (Brown 2006: 3). This statement might be contradicted on the basis of relevant evidence, but is nevertheless a sound example of historical reasoning based on the historian's familiarity with the sources.

2.1.5 Historical Inferences and Conclusions

No major conclusions are drawn in the report in relation to the site's geological character or its environmental history in a broad sense.

The conclusions relating to the site's historiography are presented cumulatively via a dot-point "comment" in each sub-section of Section 2. Aspects of this commentary are simply statements or discussion, while others are supported with referenced evidence (as discussed above).

The commentary underpins a broad conclusion presented in Section 4 that there is "no evidence to support claims that:

- the terraces on Rocky Ridge were part of a 'pyramid' built by ancient Egyptian, Phonecian, Extra-terrestrial, Mayan or Chinese visitors;
- gold was mined at Gympie before 1867; or
- a great harbour or a creek once connected Tin Can bay and the Mary River." (Brown, 2006, p.4)

These conclusions are then placed alongside an alternative interpretation or explanatory hypothesis of the site's history and the likely origin of its features based upon documentary evidence of its environmental history in the post-settlement era (post-1849).

The analysis and documentary evidence presented is orthodox in terms of the historical method. As well as presenting fairly broad inferences from her own specialist knowledge of the historical documents (as in statement such as) "Diggers scoured the countryside looking for alluvial gold and gold-bearing quartz reefs, but I have not found any mention of evidence of earlier diggings in the gullies or tunneling in the ridges, or of a pre-settlement structure of sandstone blocks at Rocky Ridge"), Brown presents more direct and verifiable statements based on specific documentary evidence. Cauper's residence at Rocky Ridge,

for example, is supported by an 1884 letter published in the Gympie Times, by a reference locally published in 1905, and by Cauper's presence on the local electoral roll in 1890.

The basic character of the earthworks and retaining potentially undertaken by settlers such as Cauper is suggested by another primary source, a handbook for Queensland settlers published in 1888. The quotation provided in Brown's report (p.4) is strong evidence that the terracing visible today at the Rocky Ridge site was a commonplace solution to the challenges of farming on sloping and stony ground in colonial Queensland. There is no reason not to draw the inference that Cauper followed this practice when faced with the difficulties of farming at the Rocky Ridge site.

Importantly, Brown's use of historical sources in this way (in order to develop a reasonable inference on the balance of demonstrable historical evidence) is fundamentally verifiable. References (endnotes) are provided and the evidence thus identified can be consulted by independent researchers in the public libraries and repositories concerned. The lack of a footnote documenting the source of Brown's evidence for Cauper's occupation of the four Goldfields Homestead Leases between 1875 and 1877, however, or the specific source for the 1890 electoral roll, can be considered as lapses in the otherwise scrupulous referencing standard of her report.

Ultimately, the explanatory hypothesis based on this evidence is presented in the report as a statement:

> "There is evidence that John William Cauper took up land at Rocky Ridge/McPherson's Paddock in the period 1875-1877 and that he established a vineyard there. Furthermore, horticultural practices of the period support a local oral tradition that the terraces were constructed to provide well-drained sites for Cauper's grapevines." (Brown, 2006: 4)

This explanatory hypothesis is thus an inference resulting from a critical evaluation of verifiable evidence relating to the site and its documented history. It is not established in the report as "fact", but (as is discussed above) its status as an inference does not disqualify it from being a reasonable historical hypothesis or conclusion (if all available evidence has been incorporated or otherwise explained by the hypothesis). On the contrary, given that it is directly supported by documentary and circumstantial evidence, this inference is a stronger hypothesis (in the sense that it is more reasonable and more likely) than the alternative hypotheses reviewed in Section 2 of the report.

2.2 Corroborating Research

Additional research was undertaken in the course of preparing this report in order to verify or corroborate the evidential basis underpinning the 'Report on the "Gympie Pyramid"'.

Searches at the Titles Office (Queensland Department of Natural Resources and Water) indicated that the relevant Deeds of Grant for the parcels of land contained in the study area were issued in March and June 1995 (title reference numbers 18827218 and 17762024). This indicates that the land parcels concerned have only been freehold title since that time. Further research to clarify earlier ownership, occupation and title status was necessary using records held at the Gympie office of the Department of Natural Resources and Water.

Research at the Gympie office indicated that the two parcels of land containing the Rocky Ridge site were leased as Miners Homestead Leases to George Preston (No. 2968, in an application dated September 7, 1903) and, in the case of the block known as 'Macpherson's Paddock', to Richard H. James (No 1484, in an application dated August 28, 1891).

Leasing arrangements for the parcels prior to these dates, including the Goldfields Homestead Leases (GML) Nos. 215, 337 and 338 were taken up by John William Cauper according to Brown's analysis. Research in records held at the Queensland State Archives indicated that on February 16 1876, Cauper successfully applied for a 40 acre block described as in the locality "120 chains from Bridge over Deep Creek" (Application number 215). He paid rent on this property until 1890. (QSA: Register of Applications to Lease Crown Land Under the Goldfields Homestead Act of 1870, 1871-1887 - QSA Item #84834) Original survey maps showing the location of these GML's is provided in Appendix 2.

In addition to this title and leasehold research, basic verification of documentary sources used in the report was undertaken, including articles published in the *Gympie Times* and the 1905 publication *Gympie and District Farming and Grazing Industries*. The latter source is an anthology of descriptions of the Gympie district published in the *Gympie Times* in 1905 (and reprinted in 1995). It supports Brown's contention that the Rocky Ridge site was occupied and farmed by Cauper:

> The first settler's home [the traveller comes to] is the neat cottage owned by Mr. Rich[ard] Edwards, known as the old Vineyard. Over 20 years ago part of this land was taken up by a Mr. Kauper [*sic*] and laid out as a vineyard, and hence the name. (*Gympie and District Farming and Grazing Industries*, 1905: 49)

The general veracity of this account is corroborated by the appearance of Richard Edwards' name on the Miner's Homestead lease card (No. 1484, Gympie field; Department of Natural Resources and Water, Gympie Office). He successfully applied for occupation of the lease on February 26, 1903, and thus occupied the property at the time of the 1905 report.

2.3 Conclusion

On the basis of the foregoing discussion, several clear conclusions can be drawn from this chapter.

Firstly, the work of historical analysis presented in the 'Report on the Gympie Pyramid' by Dr Elaine Brown is sound according to the orthodox 'historical method', and is demonstrably reasonable in its use of evidence, its inferences and conclusions.

Secondly, the explanation for the features present at the site contained in this report (that they are associated with terracing for agricultural purposes) is supported by the historical evidence presented. This explanation, insofar as it is a conclusion grounded in historical (rather than archaeological or geological) evidence and reasoning, must be considered a more reasonable and thus more likely explanation than others not supported by evidence or logical reasoning.

Further discussion relating to this explanation is provided in the following sections, and more specifically at the conclusion of the field survey results for the study area in the following chapter.

3 CULTURAL HERITAGE INVESTIGATION

This chapter provides an overview of the design, methodology and overall results of the field survey component of the study. This discussion is based heavily on the results discussed in Section 2 of this report and provides further conclusions relating to the evidence found in this physical assessment of the study area.

This information, along with the historical review completed in the previous chapter, will be used to determine the potential cultural heritage significance of the study area in the following chapter.

3.1 Survey Methodology

Archaeologists utilise a series of clearly defined steps when conducting cultural heritage surveys. These steps include:

- **A site specific sampling and survey strategy**
  Establishing the best survey approach requires consideration of factors such as the scope of the study, the physical nature and size of the study area and on the results of any historical background research;
- **A field survey**
  Physically examining the study area for cultural features in accordance with the sampling and survey strategy;
- **Evaluation of constraints**
  Evaluating the levels of constraints such as ground integrity (GI) and ground surface visibility (GSV) encountered during the survey provides an overview of the comprehensiveness of the survey result;
- **Site evaluation and recording**
  Documenting and assessing all relevant features located during the survey with an appropriate level of detail to allow appropriate assessment and any subsequent management and/or mitigation; and
- **Impact assessments and management recommendations**
  Exploring each documented feature and how each can best be managed in light of the individual feature type combined with the likely impacts of the proposed project.

3.2 Sampling Strategy

The first step in the development of any cultural heritage survey should be to consider what sampling strategy/ies (where to look) will be applied to the survey. Sampling strategies can be either:

- **Purposive**
  Where specific areas are targeted (generally based on sound contextual research), as is done with predictive modeling; or
- **Probabilistic**
  Where decisions are made to survey without any prior knowledge or predictive model of what heritage resources might exist in the landscape to be surveyed.

So it is that archaeological survey strategies usually involve transects across the study area chosen at random (*probabilistic*) to avoid possible bias in the results; or transects within areas (*purposive*) known to be culturally sensitive and/or those designated areas specifically earmarked for development. Due to the relatively small size of the survey area it was possible to adopt a *purposive* survey approach that incorporated a pedestrian survey program covering the entire study area, described in Section 1. This survey component was then divided into two stages as outlined below:

Stage 1
Stage 1 comprised the primary survey component of the study and was conducted over two days (August 13th and 14th, 2007) by Simon Gall and Bridget Walker (archaeologists) of ARCHAEO Cultural Heritage Services. While all sections of the study area were examined during Stage 1, a particular focus of the Stage 1 survey was to conduct a detailed examination of all elevated sections of the study area in combination with any other areas considered to hold a higher potential for the presence of historic features. This focus was based primarily on the results of a pre-survey review of existing literature relating to the site along with discussions held with members of the local Dhamurian Society (Brett Green along with other members).

These latter discussions were conducted to ensure essentially, that the survey incorporated an inspection of all historical features known by the group. A representative of the Dhamurian Society accompanied the survey team for several hours on the second day of the Stage 1 surveys. Whilst the primary purpose of this consultation process was to ensure the thoroughness of the survey, it is important to note that opinions were not directly sought as to the possible function or type of noted historic features.

Stage 2
A further site inspection occurred on August 16, 2007. Bridget Walker and Benjamin Gall of ARCHAEO Cultural Heritage Services accompanied Dr John Pickard (Macquarie University) and Dr Geoff Ginn (University of Queensland) the latter two of whom were invited to provide expert opinions on the study area, with a particular focus on the construction methods associated with the historic stone elements of the site and comparative analysis with other sites. This second inspection was also *purposive*, in methodology, focusing on those historic features noted during the Stage 1 survey.

3.3 Recording Methodology

As standard practice all data noted during the survey component of this study was recorded in field notebooks with physical locations taken using a hand-held global positioning system (GPS) receiver accurate to ± 4 metres [Position format = UTM/UPS grid, Grid Zone 56J. Geodetic datum = AGD84]. This information was then utilised to create maps outlining the location of sites and features noted during the survey. All features were recorded with reference to noted levels of both landscape integrity (GI) and ground surface visibility (GSV) [see Section 5.2 below]. All areas of interest were sketched and photographed using a digital camera (*Nikon CoolPix 5400*) with 5.1 effective mega-pixels, and all photographs were logged in a field notebook. Upon completion of the report all photographs, maps, field notes and associated data are stored in the ARCHAEO office.

3.4 Constraints to the Survey

Two major constraints affect archaeological surveys:

- **Ground integrity (GI)** provides an indicator of the degree of disturbance the ground surface has been subjected to; whether or not the landscape has been modified, and to what degree this modification might influence the context (and therefore integrity) of any sites located.
- **Ground surface visibility (GSV)** determines how much of the ground surface can be seen, and therefore, by implication, what cannot be seen.

Identifying GI and GSV levels provides a foundation for assessing the representativeness of overall field survey outcomes.

3.4.1 Ground Surface Visibility (GSV)

Archaeologists record ground surface visibility (GSV) in order to assess the level of visibility of the landscape surface within the study area. Ground surface visibility (GSV) is most commonly inhibited by vegetation, particularly thick grass or leaf litter and thick undergrowth along with artificial or imported surfaces such as concrete, gravel and bitumen. Basically, the better the visibility, the more potential there is for locating cultural/archaeological material.

Levels are determined using a percentage scale similar to that used for the calculation of GI, in that 0% represents zero visibility and 100% represents maximum visibility (bare ground). Therefore: **Zero - 10%; Poor - 10-25%; Fair - 25- 50 %; Medium - 50-75 %; Good - 75-100%**. The better the visibility, the more potential there is for locating surface artefact scatters - the most common indicator of Aboriginal heritage.

Across the study area GSV levels varied considerably, with the majority of the study area exhibiting low to fair levels (0 – 50%), with leaf litter and ground cover being a major limiting factor in the majority of areas, particularly in those areas where features were historic features were observed. Higher GSV levels were primarily restricted to cleared and eroded areas on ridges, along access tracks and driveways and in those areas recently impacted on by machinery.

3.4.2 Ground Integrity (GI)

Ground surface or landscape integrity (GI) needs to be approached on two levels because it can be crucial to an understanding of the local archaeological record. Whereas Indigenous human occupation of the land had minimal short-term impact, non-Indigenous impact was immediate and has changed the surface of Australia in the long-term. Activities, such as vegetation clearance, ploughing, farms, houses, towns and roads contribute to the destruction of the pre-European archaeological record of human occupation. Ironically, however, when assessing areas of historical (non-Indigenous) archaeological significance these very agents of destruction can become archaeological evidence. Where the land surface has been recently distorted or heavily modified the possibility of archaeological material surviving is dramatically reduced and the potential of archaeological material remaining *in situ* is even more remote.

As with GSV levels of GI are determined using a percentage scale where 0% indicates all integrity is gone, to 100%, which represents excellent preservation of the original context within which the items of interest are located. Thus: **Zero - 10%; Poor - 10-25%; Fair - 25- 50 %; Moderate - 50-75 %; Good - 75-100%**.

The study area exists within a primarily rural setting and appears to have been almost completely cleared since the arrival of Europeans with large sections remaining almost completely devoid of vegetation. Vegetation on the southern and south-western slopes consisted primarily of regrowth eucalypt woodland including blue gum, bloodwood, melaleuca, Banksia and grass tree. Exotics included camphor laurel and prickly pear.

The lower to mid-slopes of the southern side support woodland of eucalypts up to 300 mm diameter, but old cut stumps show that trees up to 0.8 m diameter grew here previously. There is essentially no understorey to the vegetation except on the western and north-western sides where scrubby regrowth is heavily infested with lantana. The rocky outcrops on the summit of the hill support mixed vegetation with a range of shrubs, vines and exotic cactus. The size of the extant vegetation on and below the southern and south-western slopes of the ridge would, with a few exceptions, appear to be a maximum of around thirty years of age, subsequently corresponding with Elaine Brown's observation that the site was almost completely devoid of vegetation in the early 1970's.

Other historic impacts within the larger study area include the construction of a number of houses and their associated infrastructure such as sheds, driveways, landscaping and fences. Other notable impacts include the train line which cuts through the western section of the study area; several turkey nest dams and even included evidence of several hand dug trenches on the western slope believed to be associated with recent prospecting.

All historical features noted during the course of the survey exhibited evidence of having undergone fairly high levels of disturbance since their original construction. This disturbance is likely to have included erosion, stock movement, vegetation clearance, the growth of vegetation through or adjacent to the stone features and the apparent deliberate removal of stone originally comprising sections of the noted features (possibly by people living adjacent to the site or further a field for purposes such as landscaping).

Recent activities conducted by the local Dhamurian Society and their associates incorporating a program of excavation in conjunction with the removal of vegetation in the vicinity of some stone features, has had significant impact on the archaeological integrity of the site and it is considered that these activities may have destroyed sections of a number of historic features. In particular, large portions of the southern and south-western sections of study area within the vicinity of Features F1-F10 were highly disturbed as a result of a recent machine excavation with stone removed from recently excavated areas, particularly in the vicinity of Feature T3, subsequently stacked onto pre-existing sections of the historic stone features. These activities, while well-intended, have further complicated the assessment and recording process of this assessment.

In conclusion, GI levels noted during the survey ranged from zero to fair with all sections of the study area exhibiting at least moderate levels of historic disturbance, much of which appeared to post-date the construction of the historic features outlined in Section 5.3 below. Despite these constraints, it is important to note that it remained possible to record sufficient information during the survey component of the study to allow clear conclusions to be drawn regarding the characteristics and probable function of noted historic features.

3.5 Field Survey Outcomes

The following section outlines all historical features noted during the field survey component of this study.

3.5.1 Historical Features

A number of historic features were recorded during the course of the field survey. These features were restricted entirely to the southern and south-western slopes of the sandstone ridge that dominates the study area (on properties 10MCH806657, 1MPH35291 and 4MCH806656).

It was decided to refer to these finds collectively as Site Complex 1 (SC1), which includes what can best be described as a series of shallow 'terrace-like' features (F1, F3-6, F8-10) comprised of linear sections of low, loosely stacked local sandstone in combination with low earth banks or cutaway sections that vary considerably in height, length, and the number of courses of stones in their construction (generally no more than 40 - 50 cm or 3-4 courses). Stone utilised in these features was of varying size and most would appear to have been of a scale that would have been moveable a short distance by one or two people. Similarly these features appear to utilise readily-available stones from the adjacent soil surface, with no stones showing any evidence of splitting, dressing, or other attempts at working to improve their flatness.

Figure 1: Looking northwest across Feature F1 from its easternmost point at F1A. Sections of Feature F3 are also visible in the background. These features are separated by approximately 15 metes.

The majority of these features ran roughly parallel and approximately east-west at varying intervals up the southern slope, stopping below the outcrop of large sandstone boulders that forms the high point of the ridge in this area. These intervals appeared not to follow any particular pattern beyond the fact that the distance separating these features decreased the further up the slope they occurred [the widest gap being approximately 15 metres between Feature F1 and Feature F3 (F1A-D and F3A-D)]. The primary exceptions to this pattern appear to be Feature F2, an isolated stone wall that, although similar in construction to the other stone features at the site, differs in that it is more curved than linear, exhibits a more pronounced earth mound or fill section behind the stone, runs roughly north-south rather than east-west and consists of up to six courses of stones arranged to enclosing a slight depression perhaps 2.5 m diameter. Features F7 and F1A also differ from this general pattern by incorporating 'L' shaped sections featuring short segments running perpendicular (north-south) to the majority of similar features.

Other features noted in this general area included a number of multi-trunked camphor laurel trees associated with and running parallel to Features F1 (F1D) and F4, and a number of timber fence posts running immediately below and parallel to Feature F1 (F1D). Several large stones exhibiting evidence of impact marks from an implement (most likely steel) were also noted on the middle and upper sections of the southern and south-western slopes, primarily in the vicinity of areas where considerable amounts of sandstone boulders were located (i.e. near the summit). Other more minor features included small amounts of historic material such as fragments of bottle glass of varying ages, corroded metal (mostly old fencing wire) and corrugated iron. Although these features may not necessarily all be contemporary (particularly the latter few).

The main features of SC1 are outlined in the following table (Table 2 – Survey Features for SC1):

Feature Number	Feature Type	Material & Construction	Condition	Wpt ID	Waypoint Location	GPS Co-ordinates*		Comments
						Easting	Northing	
F1A	East-west linear stacked stone 'bank' with possible L shaped corner	Loosely stacked stones backing on to earth bank/fill	**Poor** Impacted on by erosion, stock and recent vegetation removal	331	eastern extent	469312	7105509	Longest and easternmost section of remnant stacked stone of lowest 'terrace-like' feature (F1) incorporating a low earth eroded cut 'wall' featuring short L shaped 'corner' at western end. Between 1 and 3 stones in height (approximately 10-50cm) and roughly 15 metres in length
				334	western extent	469306	7105506	
F1B	East-west linear stacked stone 'bank'	Loosely stacked stones backing on to cutaway earth bank/fill	**Poor** Impacted on by erosion, stock and recent vegetation removal	335	eastern extent	469303	7105501	Roughly 5 metre section of east-west remnant stacked stone of lowest 'terrace-like' feature (F1), separated by approx. 3metres from F1A and incorporating a low earth eroded cut 'wall'
				336	western extent	469294	7105509	
F1C	East-west linear stacked stone 'bank'	Loosely stacked stones backing on to cutaway earth bank/fill	**Poor** Impacted on by erosion, stock and recent vegetation removal	337	western extent	469286	7105505	Roughly 7 metre section of east-west remnant stacked stone of lowest 'terrace-like' feature (F1), separated by approx. 2 metres from F1B and incorporating a low earth eroded cut 'bank'
F1D	East-west earth bank with possible stacked stone	Cut step with possible loose stone	**Poor** Impacted on by erosion, stock and recent vegetation removal	339	western extent of earth 'bank'/'terrace'	469248	7105508	GSV and recent disturbance made it impossible to determine whether this was in fact an historical feature and whether small sections of stacked stone exist in association with this feature. Exact extent of F1D unable to be determined as western extent may have continued into recently dozed area.

Feature Number	Feature Type	Material & Construction	Condition	Wpt ID	Waypoint Location	GPS Co-ordinates*		Comments
						Easting	Northing	
F2	North-south curved loose stone 'wall' and associated earth bank'	Loosely stacked stone supporting an earth mound or bank	**Poor – Fair** Impacted on by erosion, stock and relatively recent excavation into earth bank along with recent vegetation clearance and piling of further rocks onto existing feature	340	central point	469221	7105557	Located on the south-western slope this feature differs from all other earth and stone features in its height, orientation, shape (curved not linear) and location – separated from other features by reasonable distance. Function unknown. Maximum height 80 cm and roughly 3.8 metres in length.
F3A	East-west linear stacked stone 'bank'	Loosely stacked stones backing on to cutaway earth bank	**Poor** Impacted on by erosion, stock, vegetation and recent excavation including piling of further rocks onto existing feature	341	central point	469325	7105525	Approximately 15m up-slope from F1 (A-D) this feature comprises a section of the larger F3 feature (F3A-D). 1-2 stones high and approximately 6 metres in length. Impacted on by manual excavation immediately adjacent to feature – this included stacking of excavated stone onto existing feature.

Feature Number	Feature Type	Material & Construction	Condition	Wpt ID	Waypoint Location	GPS Co-ordinates*		Comments
F3B	East-west linear stacked stone 'bank'	Loosely stacked stones backing on to cutaway earth bank	**Poor** Impacted on by erosion, stock, vegetation and recent excavation including piling of further rocks onto existing feature	342	central point	469304	7105514	Approximately 15m up-slope from F1 (A-D) this feature comprises a section of the larger F3 feature (F3A-D). 1-2 stones high and approximately 4.8 metres in length. Impacted on by manual excavation immediately adjacent to feature – this included stacking of excavated stone onto existing feature. Separated from F3A by 2.5 metres.
F3C	East-west linear stacked stone 'bank'	Loosely stacked stones backing on to cutaway earth bank	**Poor** Impacted on by erosion, stock, vegetation and recent excavation including piling of further rocks onto existing feature	343	central point	469303	7105520	Approximately 15m up-slope from F1 (A-D) this feature comprises a section of the larger F3 feature (F3A-D). 1-3 stones high and approximately 4 metres in length. Impacted on by manual excavation immediately adjacent to feature – this included stacking of excavated stone onto existing feature to increase length to approximately 7 metres. Separated from F3B by 2. metres
F3D	East-west linear stacked stone 'bank'?	Loosely stacked stones backing on to cutaway earth bank	**Poor** impacted on by erosion, stock and recent excavations	344	central point	469293	7105521	Only 5 stones in linear formation (in line with F3C) – possibly remnant section of stone feature associated with F3A-C. GSV low.

Feature Number	Feature Type	Material & Construction	Condition	Wpt ID	Waypoint Location	GPS Co-ordinates*		Comments
						Easting	Northing	
F4	East-west linear stacked stone 'bank'	Loosely stacked stones backing on to cutaway earth bank, possibly utilising some *in situ* stone	**Poor** impacted on by erosion, stock, and vegetation. One large rock recently collapsed.	362	western extent	469243	7105546	Condition. Some Camphor Laurel trees have grown in and in close proximity to feature, disturbing its integrity. Utilises larger stones than features further down the slopes.
				362	western extent	469243	7105546	Condition. Some Camphor Laurel trees have grown in and in close proximity to feature, disturbing its integrity. Utilises larger stones than features further down the slopes.
F5	East-west linear stacked stone 'bank'	Loosely stacked stones backing on to cutaway earth bank, possibly utilising some *in situ* stone	**Fair** Impacted on by erosion, stock, vegetation and partial collapse in places	357	eastern extent	469314	7105550	At least 15 metres in length, this feature is the highest of all the stone 'terrace-like' features and is in close proximity to the summit and the associated large quantities of sandstone outcrops and loose stone. Poor condition, Low GSV and possible collapsed sections made it difficult to determine the overall dimensions of this particular feature. Topsoil in this area was much thinner than in lower areas and there were much larger quantities of loose stone. Subsequently it is considered unlikely that areas above this terrace would not have been suitable for agriculture.
				358	western extent	469304	7105543	
F6	East-west linear stacked stone 'bank'	Loosely stacked stones backing on to cutaway earth bank, possibly utilising some *in situ* stone	**Poor – Fair** impacted on by erosion, stock, vegetation and partial collapse in places	359	eastern extent	469283	7105553	Approximately 8 metres in length and 3-4 stones in height, this feature is the second highest of all the stone 'terrace-like' features and is in close proximity to the summit and the associated large quantities of sandstone outcrops and loose stone. Poor condition, Low GSV and possible collapsed sections made it difficult to determine the overall dimensions of this particular feature.
				360	western extent	469267	7105557	

Feature Number	Feature Type	Material & Construction	Condition	Wpt ID	Waypoint Location	GPS Co-ordinates*		Comments
						Easting	Northing	
F7	L shaped loosely stacked stone feature	Stacked stone backing onto possible earth fill	**Poor** Showing low levels of integrity, most likely disturbed by stock and vegetation	363	western extent	469235	7105561	L shaped shallow stone feature situated on upper slope of maximum 2 stones (mostly 1) in height and 2-3 metres in length, with sections running both east-west and north-south. Located towards western extent of terrace-like features an immediately above F10. Feature F1A also exhibited a similar feature.
F8	Earth bank/step	Possible cut earth bank//or step created by partial cut and fill process	**Poor** Eroded and obscured by vegetation	366	eastern extent	469298	7105521	Eroded step-like bank of up to 5 -60 metres in length. GSV and recent disturbance made it impossible to determine whether this was in fact an historical feature and whether small sections of stacked stone exist in association with this Feature. Only considered to be a possible historic feature and may be result of erosion caused by factors such as overgrazing and movement of stock.
				365	western extent	469243	7105527	
F9	East-west linear stacked stone 'bank'	Loosely stacked stones backing on to cutaway earth bank, possibly utilising some *in situ* stone	**Fair** Impacted on by erosion, stock, vegetation and partial collapse in places	367	eastern extent	469296	7105533	Approximately 7-8 metres in length and 3-4 stones high. Low GSV made it difficult to determine extent and overall condition.
				368	western extent	469283	7105535	

Feature Number	Feature Type	Material & Construction	Condition	Wpt ID	Waypoint Location	GPS Co-ordinates*		Comments
						Easting	Northing	
F10	East-west linear stacked stone 'bank'	Loosely stacked stones backing on to cutaway earth bank	**Poor** Impacted on by erosion, stock, vegetation and partial collapse in places	369	eastern extent	469238	7105551	Due to poor GSV it was not possible to record the length of this feature, however it appears to run for approximately 4-5 metres east of and immediately below F7 and consists of 1 to 3 stones in height
				370	western extent	469233	7105551	
F11	Row of timber fence posts and Camphor Laurel trees	Timber fence posts	**Poor** Fence posts in poor condition due to termites and fire damage. Some protruding from tree trunks, others possibly missing	338	Easternmost post of row	469267	7105505	Row of timber fence posts 1.5m below and parallel with F1 located in conjunction with a small number of Camphor Laurel trees growing along fence line. This feature consists of 5 fence posts, situated at 3, 9, 12 and 18 metres west of the easternmost post. Predictions are that posts would originally have been place at 3m/10foot intervals but that several posts have disappeared over time. The exact age of these posts is not known, however it is interesting to note that they appear to run below and parallel with the lowest observed 'terrace-like' feature (F1).
F12	Boulder with possible chisel or gad marks	Local sandstone	**Good**	352		469290	7105592	Most likely the result of efforts to split the rock into two or more smaller, more manageable pieces
F13	Boulder with two possible chisel or gad marks	Local sandstone	**Good**	355		469302	7105551	Most likely the result of efforts to split the rock into two or more smaller, more manageable pieces
F14	Boulder with possible chisel or gad marks	Local sandstone	**Good**	356		469327	7105551	Most likely the result of efforts to split the rock into two or more smaller, more manageable pieces

Table 2: Survey Features for Site Complex 1 (SC1)

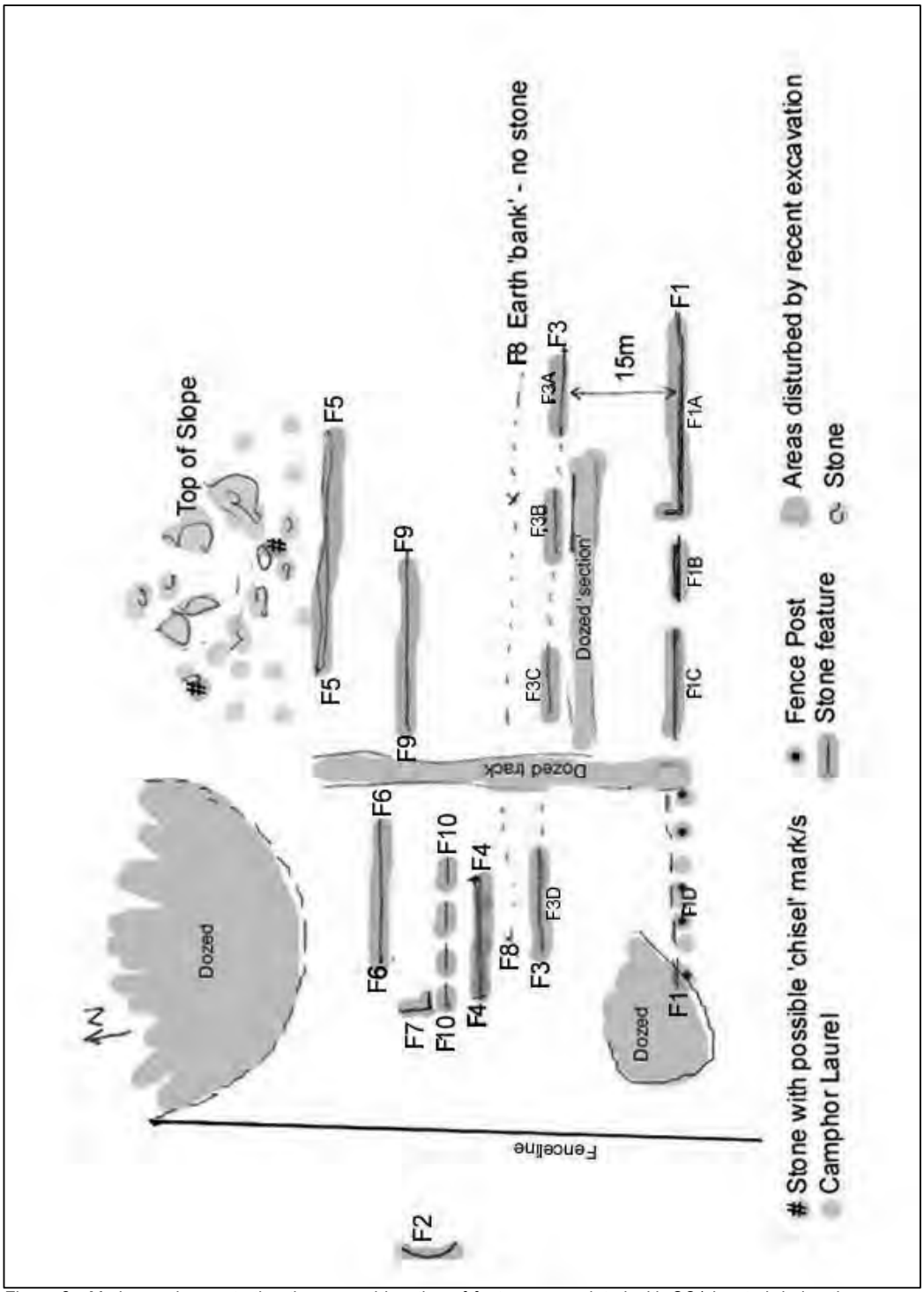


Figure 2: Mud map demonstrating the general location of features associated with SC1 located during the survey and referred to in the text.

Figure 3: Aerial photograph of the general study area showing areas examined highlighted in yellow overlaid with the mud map demonstrating the general location of SC1 located during the survey.

3.5.2 Further discussion

The previous section (3.5.1) reported the various features found to be existing in SC1 during the field surveys focusing primarily on their observed characteristics and avoiding the use of all but the lowest levels of contextual interpretation or purpose. This section will now discuss these noted features along with the aid of higher levels of interpretation in an attempt to draw some conclusions regarding the possible type and function of these features. For the sake of brevity, where possible this discussion will be restricted to simple dot points:

3.5.2.1 Stone and Earth Features (F1-F10)

In the previous section the term 'terrace-like' was utilised in an attempt to describe the stacked stone features that were encountered during the survey. The use of this term was primarily due to the apparent lack of a more appropriate term to describe the stone

features. However, the use of this term is problematic as these features only superficially resemble terraces. Subsequently, at this stage it is considered useful to enter into a brief discussion regarding terraces and other, similar agrarian structures and to examine how they compare with features noted during the survey.

3.5.2.2 Dry Stone Walls

A dry stone wall is simply a wall that is constructed from stones without any mortar to bind them together and is held up by the interlocking of the stones. In Australia dry stone walling dates back to the middle of the 19th century and was a construction technique favoured by both Anglo Celtic and European migrants. Representing one of the most economic forms of fencing, stonewalls were common in areas with a proliferation of stone. Several methods of constructing dry stone walls exist, with each dependant on the quantity and type of stones available, with most walls being constructed from stones and boulders cleared from the fields during preparation for agriculture.

This first alternative can be discount for several reasons:

- Dry stone walls are designed primarily to contain or exclude animals, i.e. to act as fences. There are too many “terraces” for all of them to have been fences.
- Dry stone walls are typically 1.5 m high and when partially collapsed through damage and lack of maintenance, the stones cascade over the adjacent land. This is not the case here.
- Dry stone walls are always built on a prepared base designed to take the substantial load of the wall. Such bases are typically 0.8 – 1.0 m wide. No such base exists here.
- Finally, a few metres of a traditional dry stone wall contains many more rocks than are present in Features F1-F10 combined. Even if some rocks have been removed, the quantities of rocks in question are far less than could realistically be expected from even a single dry stone wall designed to contain or exclude animals.

Figure 4 - Western face of Feature F2 shows the dry-stone wall of the structure

3.5.2.3 Contour Banks

Contour banks or ridges represent a common erosion-reducing agricultural practice used widely throughout Queensland. Contour banks generally consist of earthen banks that are either dozed or built up along the natural contours around a hillside. As with traditional terracing, contour banks effectively cut a long slope into shorter slopes and preventing water from building to a highly erosive force.

This alternative can be discounted as Features F1-F10 do not incorporate substantial earthworks in the form of earth and/or stone banks.

3.5.2.4 Terraces and Retaining Walls

Agricultural terraces consist of levelled sections of slopes and are primarily designed as a method of soil conservation and/or to slow the rapid surface runoff of irrigation water by shortening a long slope into a series of shorter, more level steps. Generally terrace construction incorporates a process of cutting and filling, where soil from the upper section of the terrace is moved to the lower end in order to level out the area to form a horizontal terrace, with the steepness of the slope often dictating the final wall height i.e. the walls need to be high enough so that the land between them is fairly level. The 'step' of any significant terrace will require a retaining wall of a material and construction method that is strong enough and anchored well enough to stay in place despite such factors as heavy rainstorms as the pressure of water-logged soil behind a wall can be considerable and easily cause improperly constructed walls to bulge or collapse. Substantial terraces need to be built with proper drainage and to be tied back into the slope properly.

Figure 5 - View looking uphill of Feature F4 showing irregular construction, low height, and partial collapse with block on left rolling down the slope. Camphor Laurel trees on left and right are planted on the line of the "terrace".

With the above points in mind, the following observations can be made in relation to Features F1-F10:

- Structures noted during the survey would not appear to have been capable of supporting the significant down slope pressures associated with traditional large scale terracing. For example, the larger of the two recent machine cut sections associated with Feature F3 reveals that the stones were originally laid directly onto the pre-existing soil surface, with apparently no attempt at placing them in pre-dug footings..;
- When compared with dry stone features seen elsewhere in Australia (NSW, Victoria, Tasmania and South Australia), the stacked stone features here are very poorly made, with apparently little consideration to ensuring lateral strength by locking the stones together. This suggests that the “terraces” were not intended to be retaining walls of great strength and in turn suggests that any such walls were only intended to retain less than 0.5 m of soil material.
- Likewise, although there may have been some effort to reduce the steepness of the slope by levelling, such efforts did not result in horizontal areas that are a feature of traditional terracing but at best have resulted in an ‘evening out’ of or slight reduction in the slope of the hillside.

In conclusion, at best the stacked stone features (Features F1-F10) noted during the survey represent a series of low stone retaining walls placed adjacent to shallow earth steps of a maximum height of 50-60 centimetres that were most likely created as a result of limited cutting and filling techniques, possibly associated with preparing the slope for agricultural purposes. Although no direct trace remains, review of historical information related to the site (see Section 2 and Appendix 1) indicates that the section of the study area containing SC1 was used as a vineyard in the latter half of the nineteenth century. Vines are frequently cultivated in Europe on steep slopes and in many cases these slopes are reduced by flights of terraces held back by retaining walls of various heights. The areas behind the walls need not be level, merely at a more convenient, reduced gradient. Similarly, the walls need not be very high to achieve the desired effect.

3.5.2.5 Stone Working (Features F1-F10 and F12-14)

Sandstone noted during the survey displayed a mixed grain size, with most particles less than 1 cm in size. A few clasts of rounded pebbles of up to 120 mm across were located, but there was no prominent outcrop of conglomerate of this type. The sandstone outcrops are broken with deep cracks, most likely weathered out joints. Horizontal jointing is weak and there are few bedding planes and boulders and blocks are irregular in both shape and size. The coarseness of the sandstone and the lack of bedding planes preclude the rock being suitable for splitting into flagstones, or parallel-sided blocks. Despite these characteristics a number of boulders were noted exhibiting possible 'gad' marks (see below) that were indicative of possible efforts to split rocks into smaller sizes. Likewise this raises the possibility that some stone associated with stacked stone features (F1-10) may have been sourced from further up the slope. However, it should also be noted that it is unable to be determined whether these features are contemporary with the 'terrace-like' stacked stone features observed during the survey.

Figure 6. Sandstone block with triangular hole. The upper section of the hole is cratered, but the obvious triangular section has semi-vertical flat sides about 3 cm wide. Note the cracks leading out from each apex of the hole.

In one block, a blind triangular hole (Figure 6) appears to be man-made, but a more likely explanation is that the hole is a weathering feature on the junction of three cracks in the sandstone. Although it is unusual to see triangular weathering holes, such a shape is not unexpected under such circumstances.

Figure 7. Sandstone block with rectangular holes possibly the result of attempts to split the blocks with gads.

Figure 8. Sandstone block with rectangular hole possibly the result of attempts to split the block with gads. This hole is cratered at its upper edges, typical of the damage done when using gads.

Two separate blocks have elongate blind holes that appear to be the result of attempts to split the blocks with gads (Figure 7). A very old technique for splitting rock involves scratching the desired line across the rock, chipping an interrupted series of shallow holes along the line with a pick or similar tool, and then hammering gads into the holes. Each gad is progressively hammered into the rock, setting up a stress concentration, causing the rock to fracture along the line of gads. Typically such holes are narrow rectangular with a cratered top, such as shown in the two images.

However, as noted above, the sandstone has no clear bedding planes and would be difficult to split into flagstones with parallel sides. The block with two holes (Figure 7) is typical of the site: essentially massive sandstone, with seemingly random short cracks running in various directions. The block is probably too heavy for one man to move, and the holes may have been intended to split the block into smaller pieces for ease of handling. There is no obvious reason for the single hole in Figure 8.

Despite careful examination no stone associated with Features F1-F10 exhibited any evidence of scars and/or relatively fresh faces that would indicate working or splitting. Subsequently it is considered likely that Features F1-F10 were constructed incorporating loosely stacked stone most likely collected from adjacent areas during initial clearing and partial levelling of the slope. Equally, some stone features incorporating larger stones (e.g. F4, F5 and F9) may have utilised stone that either remained in situ or was only moved very short distances to form the base of such stone features.

3.5.2.6 Timber Fence and Camphor Laurels (F11)

A number of wooden posts mark the line of a fence running roughly east – west along Feature F1D. The posts are sawn, square cross-section, and although none exhibited holes for wire, most have either one or two rebates cut into them. The lack of holes or evidence of rusted-out staples suggests that the fence did not incorporate wire. The rebates suggest that the fence may have been post-and-board, but as some posts have two rebates, and others only have one, this interpretation is uncertain. Board fences may be constructed in several ways.

The easiest and least labour-intensive is to simply bolt or wire boards to posts. The absence of holes shows that the boards were not bolted onto the posts. Using rebates to locate boards on posts is more labour-intensive and thus expensive. Generally this form is found close to houses, or lining driveways or other areas mostly for aesthetic reasons. However, the rebates on the posts are not consistent from one post to another suggesting that the posts may be re-used from another site. Adjacent posts may not have either or both rebates for retaining the boards.

Figure 9. Westerly view along the line of Feature F1D showing remains of fence. The sawn square post has two distinct rebates cut into it on the downhill face. The obvious black line down the post is a crack, not evidence of construction by nailing several pieces together.

Figure 10. At some time, this fence post fell into the crutch of two trunks of a Camphor Laurel. Subsequent growth has fully enclosed the post.

Irregular lines of multi-stemmed Camphor Laurel trees occur on or adjacent to two of the historic stone features (F1D and F4). The trees are fairly widely spaced, and are restricted to the south-western side of the slope. The linear arrangement of the trees suggests two origins. The first is that the trees were deliberately planted along the line. Alternatively, they could have grown from seeds voided by birds sitting on the fence. Given that the trees are essentially restricted to these lines, this latter explanation is unlikely. Why the trees were planted is unknown. They are too widely-spaced to serve as hedges designed to retain or exclude stock and therefore may have been intended as shelter-belts or windbreaks for some crop, however this latter explanation is purely speculation.

Figure 11. Interrupted line of Camphor Laurel along F1D. The image is an oblique westerly view from above the line, and shows posts from a derelict fence.

3.6 Comparative Analysis

Comparative analysis is commonly used during a cultural heritage assessment as an additional measure in the understanding the degree of cultural heritage value relevant to a site. In the case of the study area, comparative analysis of sites which utilises stone elements has been chosen. These sites (with the exception of a dressed sandstone wall at Gympie's Surface Hill Uniting Church) have been chosen as they utilise stone as a key component of agricultural practice.

This analysis includes the following sites:

- Gympie's Surface Hill Uniting Church;
- Stone Walls in the Bundaberg region; and
- Stone terracing and walls in the Maryborough region.

3.6.1 Gympie's Surface Hill Uniting Church

Constructed in 1890, the Surface Hill Uniting Church is an important landmark in the Gympie townscape. It is an imposing building on a prominent site, one of a family of churches located on top of the hills of Gympie.

The site boundary for part of Barter Street and all of Channon and Reef Streets is finished with a squared but uncoursed rubble retaining wall. This is a suitable example of a dressed and well constructed stone feature and a relevant point of difference to the quality and workmanship involved in the stone elements identified in the study area (Qld Heritage Register Citation: 601529).

Figure 12. Boundary wall at Surface Hill Uniting Church, Gympie.

3.6.2 Stone walls in the Bundaberg region

The dry-rubble boundary walls such as those at Mon Repose and Sunnyside Plantation in the Bundaberg were recently inspected by ARCHAEO staff. These walls were more than likely constructed in the 1880s by indentured South Sea Islanders working to clear the land for sugar cane cultivation.

In the case of the boundary wall at Sunnyside Plantation, which is approximately 200 metres in length, it remains as one of the more intact examples of its type in the Bundaberg district, which around the turn-of-the-century was chequered with such structures. Large scale stone walls from this era, such as those at Sunnyside and Mon Repose are now considered rare to Queensland. Comparatively, the stone elements featured in the study area are of similar construction method and purpose to those at Bundaberg, however those at Gympie clearly do not display the same degree of scale or use of comparable labour force in their construction to those structures abovementioned in the Bundaberg region (Qld Heritage Register Citation: 601700).

Figure 13. Significant stone wall at Mon Repose near Bundaberg (ARCHAEO 2007).

3.6.3 Stone terracing and walls in the Maryborough region

A site previously assessed in the Maryborough region consists of a larger number of ‘stone elements compared with the study area. These comprising primarily of loosely stacked basalt stones of varying dimensions in combination with earthen banks forming ‘terraces’ that appear to utilise natural contours of steeper sections of the slopes. They do not follow any established property boundaries, unlike South Sea Islander dry stone walls in nearby Bundaberg.

Figure 14. Significant stone terracing and walls on hill slopes near Maryborough (ARCHAEO 2007).

The 'terraces' are of impressive dimensions measuring as much as 200 metres long (maybe more), 1 – 1.5 metres in height and as much as 3 – 4 metres in width at their widest point, indicating the involvement of a significant labour force (possible South Sea Islander labour as large numbers of whom came through the Port of Maryborough in the second half of the 19th century). Other features include several stone and earthen 'mounds' of varying shapes and dimensions, the most notable being roughly circular and measuring approximately 6.5 metres in diameter and 1.5 metres at its highest point.

The site in the Maryborough region is most similar to the study area at Gympie, as the stones are used as terrace like features along the steeper sections of hill slope and for the purpose of agricultural pursuit. Again, the site at Gympie clearly does not display a significant comparison in its size and scale, nor the labour force that would have been required in their construction to those at Maryborough. (Reference withheld for confidentiality reasons).

3.7 Conclusion

The results of the field survey component of this study have found that historic features were clearly restricted to the southern and south-western slopes of the sandstone ridge that dominates the study area [on properties 10MCH806657, 1MPH35291 and 4MCH806656] described as Site Complex 1 (SC1) in Section 3.5.1 This site can best be described as representing a series of low retaining walls incorporating small 'steps' or 'banks' faced with loosely stacked stone most likely collected from adjacent areas and that these features were probably created during initial clearing and partial levelling of the slope for agriculture.

Whilst this site has been highly disturbed by a number of more recent historic activities and factors, it is felt that the points outlined in the above section clearly show that none of the features noted during the survey appear to reflect the use of a significant or skilled labour force and predictions are that these features could easily have been constructed by an individual or small number of individuals in a relatively short time.

The explanation for historic features present at the site (that they are associated with terracing for small scale agricultural purposes such as a vineyard) is therefore not only supported by the historical evidence discussed in Section 2, but also the physical evidence, both archaeological and geological, provided by this field survey. Additionally, Comparative analysis of three similar and relatively local sites concludes that the study area does not provide any significant qualities or attributes of great value related to stone elements related to agricultural pursuit.

4 CULTURAL HERITAGE SIGNIFICANCE

4.1 Determining Cultural Heritage Significance

Cultural heritage significance relates to people's perspective of place and sense of value, within the context of history, environment, aesthetics and social organisation.

A range of standards and criteria are available to assist with determining cultural heritage significance. The following sections discuss *the Burra Charter (ICOMOS Australia*) and incorporate aspects from the recognised legislative frameworks, such as the *Queensland Heritage Act 1992 (and subsequent amendments).* This discussion enables an insight into the discussions made in relation to significance levels discussed in the following section.

4.1.1 Cultural Heritage Significance

The Burra Charter (Marquis-Kyle and Walker 1999) guides cultural heritage management in Australia. First adopted in 1979 by Australia ICOMOS (International Council on Monuments and Sites), the charter was initially designed for the conservation and management of historic heritage. However, after the addition of further guidelines that defined cultural significance and conservation policy, use of the charter was extended to Indigenous studies.

The charter defines conservation as 'the processes of looking after a place so as to retain its cultural significance' (Article 1.4). A place is considered significant if it possesses aesthetic, historic, scientific or social value for past, present or future generations (Article 1.2). The definition given for each of these values is as follows (Articles 2.2 to 2.5).

Aesthetic value includes aspects of sensory perception for which criteria can and should be stated. Such criteria may include consideration of the form, scale, colour, texture and material of the fabric; the smells and sounds associated with the place and its use.

Historic value encompasses the history of aesthetics, science and society, and therefore to a large extent underlies all of the terms set out in this section. A place may have historic value because it has influenced, or has been influenced by, an historic figure, event, phase or activity. It may also have historic value as the site of an important event. For any given place the significance will be greater where evidence of the association or event survives in situ, or where the settings are substantially intact, than where it has been changed or evidence does not survive. However, some events or associations may be so important that the place retains significance regardless of subsequent treatment.

Scientific research value of a place will depend upon the importance of the data involved, on its rarity, quality or representativeness, and on the degree to which the place may contribute further substantial information.

Social value embraces the qualities for which a place has become a focus of spiritual, political, national or other cultural sentiment to a majority or minority group.

Article 2.6 of the Guidelines notes that other categories of cultural significance may become apparent during the course of assessment of particular sites, places or precincts. A range of cultural significance values may apply.

Every place has a history, aesthetic value or a social meaning to some member of a community. Most places therefore meet some of the criteria prescribed above. It is, however, neither possible nor desirable to conserve every place. Some measures must be applied to these broad criteria in order to determine the degree of significance. The degree to which a place is significant will determine the appropriate forms of conservation management for that place.

Assessing cultural heritage significance against set criteria is a widely recognised method of achieving consistent, rational and unbiased assessments. Various authorities and bodies involved in heritage conservation adopt assessment criteria including the Australian Heritage Council, the National Trust, Australia, ICOMOS, the Queensland Environmental Protection Agency and the Queensland Heritage Council.

4.1.2 Significance Assessment and Relevant Legislation

Whilst consistent with the notions of cultural heritage significance inherent in these bodies' criteria, the *Queensland Heritage Act 1992* sets out specific tests for considering places of State heritage value. Under Section 23(1) of this Act, a place may be entered in the register if it is of cultural heritage significance in accordance with Section 4 of the Act and satisfies one or more of the following criteria:

a) If the place is important in demonstrating the evolution or pattern of Queensland's history;
b) If the place demonstrates rare, uncommon or endangered aspects of Queensland's cultural heritage;
c) If the place has potential to yield information that will contribute to an understanding of Queensland's history;
d) If the place is important in demonstrating the principal characteristics of a particular class of cultural places;
e) If the place is important because of its aesthetic significance;
f) If the place is important in demonstrating a high degree of creative or technical achievement at a particular period;
g) If the place has a strong or special association with a particular community or cultural group for social, cultural or spiritual reasons;
h) If the place has a special association with the life or work of a particular person, group or organisation of importance in Queensland's history.

4.2 Levels of Site Significance for Historic Sites and Places

Sites and places located during the field survey will be evaluated accordingly using the following criteria:

Rating	Justification	Status
Exceptional	Rare or outstanding element directly contributing to an item's local and State significance	Fulfils criteria for local or State listing
High	High degree of original fabric. Demonstrates a key element of the item's significance. Alterations do not detract from significance	Fulfils criteria for local or State listing
Moderate	Altered or modified elements. Elements with little heritage value, but which contribute to the overall significance of the item.	Fulfils criteria for local or State listing
Low	Alterations detract from significance or contain limited heritage value individually and within the site's broader context	Does not fulfil criteria for local or State listing
None	Introduced items of no relevance or items clearly not demonstrating any level of cultural heritage value	Does not fulfil criteria for local or State listing.
Intrusive	Damaging to the item's heritage significance	Does not fulfil criteria for local or State listing.

Table 3 – Adapted from Grades of internal site significance (NSW Heritage Office: 11).

5 ASSESSMENT OF SIGNIFICANCE

As discussed in the previous section, assessing cultural heritage significance against set criteria is a widely recognised method of achieving consistent, rational and unbiased assessments of cultural heritage sites and places. Results from previous chapters confirm that historic features were clearly restricted to the southern and south-western slopes of the sandstone ridge that dominates the study area [on properties 10MCH806657, 1MPH35291 and 4MCH806656] described as SC1 in Section 3.5.1

This section therefore discusses the relevant levels of cultural heritage significance for the study area, concluding with a statement of cultural heritage significance for the site. This significance assessment provides the final layer for the management discussion outlined in Section 7.

5.1 Nature of Significance

5.1.1 Aesthetic Value

Surviving today as what has remained a relatively remote and rural setting post settlement, the study area presents a basic level of aesthetic qualities including, but not limited to:

- evidence of a former pastoral and agricultural pursuits, including remaining stone terracing, fencing and associated elements;
- recent regrowth of eucalypt woodland;
- exotic plantings including camphor laurel and prickly pear;
- a naturally occurring and dominating sandstone ridge incorporating views and vistas to and from the surrounding area; and
- Moody Creek.

In light of these observations, this assessment considers the study area to have low levels of aesthetic value.

5.1.2 Historic Value

Swiss immigrant, William Cauper, took up four goldfield leases in the 1870s and, according to historical sources, appears to have established a vineyard on this land. Although the area has more recently been highly disturbed, stone like terraces located during this assessment are most likely the remains of Cauper's early agricultural pursuits to grow grapes on steep and rocky slopes located within the leases.

Whilst it is unclear whether or not Cauper's venture succeeded, the remnant features remaining within the study area most likely demonstrates the nature of agricultural practices attempted by new, non-Anglo Celtic settlers during the middle to late nineteenth century in the Gympie area.

In conclusion, and again relating to the limited scale, comparative analysis and level of disturbance of historic elements existing on the site, the site is considered by this report to have low to moderate levels of historic value to the local area.

5.1.3 Scientific Value

Most likely the site of an early vineyard or similar agricultural pursuit, the post settlement features within the study area display at best a rudimentary attempt to make the land suitable for agriculture with the use of shallow stone retaining walls placed adjacent to shallow earth steps or banks.

Comparative to other sites reviewed in Section 3, none of the features noted during the survey appear to reflect the use of a significant or skilled labour force and predictions are that these features could easily have been constructed by an individual or small number of individuals in a relatively short time.

In conclusion, although demonstrating early agricultural pursuits, no elements of the study area display any level of technical flare or ingenuity for their time. The study area is therefore considered by this report to have none-low levels of scientific value to the local area.

5.1.4 Social value

The historic nature of the study area has been the focal point of discussion and colorful conjecture between members of the local community for many decades. Much of this discussion has taken place via local newspapers and other public forums and therefore recognised by members of the wider community.

Although this report clearly demonstrates the historic nature of the site is attributed to early agricultural endeavors, it also acknowledges a level of community involvement over many years in reaching this conclusion.

For this reason, this report considers the study area to display moderate levels of social significance to the local community.

5.2 Statement of Cultural Heritage Significance

The following statement of significance has been provided to reflect the sites status within the current legislative frameworks existing today.

The site is therefore significant because:

- Representing settlement and agricultural activities in the area since the 1870s, including the many challenges and activities associated with cultivating stony ridges and slopes for a vineyard, *the place is important in demonstrating the evolution or pattern of the local areas history;*
- Surviving today as a relatively remote and rural setting, including the remaining stone terracing, fencing and associated elements from early agricultural pursuits incorporated in a naturally occurring and dominating sandstone ridge with localised views to and from the site, the study area exhibits a limited amount of *aesthetic* value *considered important to the local community;*
- The focus of a longstanding local debate regarding its historic nature, the study area has a strong association with a number of local community members and groups, and is therefore considered *important to those members of the local community for social and cultural reasons*;

5.3 Conclusion

Using the methodology for significance assessment outlined in Section 4, the study area has been assessed by this report to have the following levels cultural heritage significance:

Value	Rating	Justification	Legislative Status
Aesthetic	Low	Surviving today as what has remained a relatively remote and rural setting, the study area presents some level of aesthetic qualities related to natural and historic nature of the site (relevant to the local community).	May satisfy criteria for listing on the Local Heritage Register (currently unlisted). Unlikely to satisfy listing on the Queensland Heritage Register.
Historic	Moderate (locally)	Representing homestead lease and settlement activities commonplace to the area in the 1870s, including the many challenges and activities associated with agricultural pursuits from this time and its occupation in the late nineteenth century by Swiss immigrant William Cauper who built a vineyard there. Limited evidence of significant scale of works and level of disturbance of historic elements remaining on the site further diminishes this value.	May Satisfy criteria for listing on the Local Heritage Register (currently unlisted). Unlikely to satisfy listing on the Queensland Heritage Register.
Scientific	None-Little	None of the features noted during the survey appear to reflect the use of a significant or skilled labour force. No elements of the study area display any level of technical flare or ingenuity for their time. Comparatively of lesser value to other sites discussed within the region.	Does not satisfy criteria for listing on the Local or State Heritage Register (Currently unlisted).
Social	Moderate (locally)	The historic nature of the study area has been the focal point of discussion and colorful conjecture between members of the local community for many decades now. Much of this discussion has taken place via local newspapers and other public forums.	May satisfy criteria for listing on the Local Heritage Register (currently unlisted). Unlikely to satisfy listing on the Queensland Heritage Register.

Table 4 – Summary of cultural heritage significance for the study area

6 PROPOSED DEVELOPMENT

The Australian government commissioned the Bruce Highway (Cooroy to Curra) Strategic Planning study to:

- Determine the needs for the 65km stretch of highway between Cooroy and Curra; and
- Develop a strategy to progressively meet these needs for the next 30 years.

The Queensland and Australian governments appointed a study team to examine the long-term upgrade of the Bruce Highway between Cooroy and Curra. The Bruce Highway (Cooroy to Curra) Strategic Planning Study was initiated to investigate how best to improve safety, reduce delays and improve freight efficiency during the next 30 years whilst minimising impacts on existing communities and the environment.

To meet the strategic needs of the highway for the next 30 years and beyond, it is necessary to plan for the new highway corridor to be of rural motorway standard which caters for safe and high speed travel.

To improve safety the highway will be a limited access road. This prevents local roads and fronting properties having direct access to the highway. Access to and from the new highway to major roads will be at regular but widely spaced interchanges. The highway corridor will cater for an initial four-lane divided highway, providing two lanes in each direction with a wide central median.

The existing highway will remain as a local arterial road and maintain connectivity and provide access to most of the local roads and properties that currently have direct access to the existing highway. The connections of existing network and local roads will be maintained by under/overpasses where feasible.

6.1 The Nature of the Proposed Development

The highway upgrade corridor has been developed to include the following:

- 15m central median between northbound and southbound carriageways;
- 3m outside shoulder and 1m inside shoulder;
- 1 on 2 earthworks cut and fill batters with 3m wide benches every 7m in height;
- Allowance for bridge structures over named waterways;
- Allowance for landscaping and noise treatments where required (exact requirements to be defined during later stages of design);
- Provision for service roads; and
- Access to properties where required (but not directly from the upgraded highway).

Figure 15 on the following page provides a suitable overview of the project in relation to the study area.

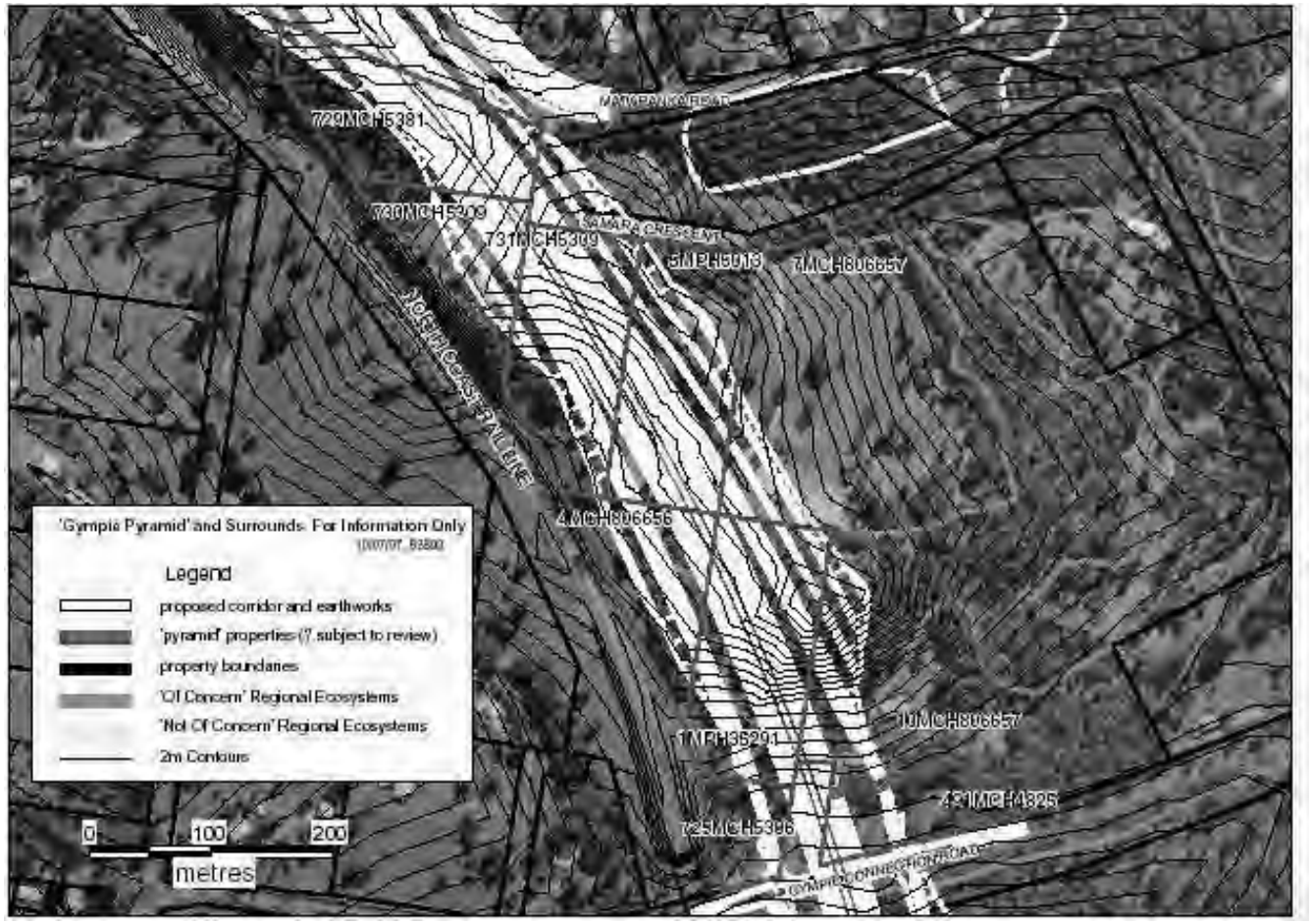


Figure15: Proposed project area in relation to the study area

6.2 Types of Potential Impacts

Impacts likely to be generated during the construction and operation of the highway upgrade in this location include:

- Excavation and ground disturbance (cut and fill);
- Road Construction Activities;
- Noise; and
- Changes to the landscape.

These impacts have been broadly identified in the Strategic Planning Study, and will be investigated in greater detail as part of future stages of the highway upgrade. Mitigations measures identified include landscaping, sensitive design, and noise treatments. Suitable management of relevant heritage values if discussed further in the following sections.

6.3 Project timeframes

The upgrade of the Bruce Highway from Cooroy to Curra will be progressed in stages over the next 30 years. This is subject to upon funding availability and future design processes so therefore it is not possible to provide a more specific timeframe for construction for this section of the upgrade.

6.4 Consultation

Arup have undertaken a Strategic Planning Study for the Bruce Highway (Cooroy to Curra) Project, which has involved a detailed public consultation and communication process involving a range of key stakeholders and community members. Consultation has engaged 'affected persons' (which comprise near neighbours to the project and surrounding communities) and 'interested persons', as defined within the *Environment Protection Act 1994* (EP Act).

The public consultation process has supported the study's development by identifying key issues and areas of concern to relevant stakeholders and community members. The study has responded to these issues and identified ways to minimise potential impacts and maximise potential benefits of the project.

Objectives of the communication and consultation program for the project development included:

- An open and accountable community consultation program which meets and, where possible, exceeds, all requirements under the State Development and Public Works Organisation Act 1971 and Environmental Protection and Biodiversity Conservation Act 1999;

- Opportunities for 'affected' and 'interested' persons to contribute to the process;
- Qualitative measures of community support and relative levels of concern about particular issues;
- Understand and respond to community issues where necessary; and
- Feedback is captured and incorporated into the EIS and supplementary material.

The consultation process has sought to encourage and facilitate active community involvement in the EIS process and provide ongoing information about the proposed development. The approach has been to assist 'affected' and 'interested' persons to explore project benefits, impacts and issues by facilitating community participation in reviewing project plans and enabling review of project documentation (i.e. Draft Terms of Reference, Draft EIS, etc.).

Those people likely to be directly affected by the project (e.g. nearby landowners, local government etc) have been provided with correspondence and opportunities for specific consultation.

6.5 Project Impact on sites and places of cultural heritage significance

The field survey has identified one site of localised cultural heritage significance within the study area. Review of the proposed project clearly indicates that SC1 (described in Section 3.5.1) is directly impacted by the proposed project.

Impact type	Impacted site/s
Direct impact	SC1

Table 4: Historic sites impacted by the project

Direct impact on potential sites of cultural heritage significance by the Project will generally be in the nature of surface and sub-surface excavation, clearing of vegetation, ground preparation and other associated activities related with road construction. Indirect impacts will most likely occur in adjoining areas for works sites, access and lay down areas associated with the project.

This report suggests that there is little potential for further historic items to exist within the study area. Detailed discussion relating to impact on items and potential items of cultural heritage significance by the Project will be discussed in the **Section 7 - Recommendations**.

7 RECOMMENDATIONS

This section provides specific recommendations to manage identified areas impacted by the Project, along with general mitigation measures for potential impact on unknown sites within the study area.

From a heritage perspective, this report has concluded that the study area contains, at best, low-moderate levels of local cultural heritage significance. Assuming the recommendations of this report are implemented, this report finds the nature and level of impact by the Project is acceptable.

7.1 Recommendation 1 – Recording of Site Complex 1

Detailed recording of all remaining historic features located within Site Complex 1 (described in Section 3.5.1) should be undertaken prior to the commencement of development. This process may incorporate utilising an arbitrary grid system for reference to enable production of detailed scale drawings of features along with photographic recording to acceptable professional standards. Improving visibility by removing undergrowth may also be required.

As part of this recording process, it is recommended that a series of machine survey trenches be excavated running perpendicular to Features F1-F10. These trenches should focus on the better preserved sections to allow for detailed recording of any potential construction techniques that may not have been immediately apparent during the field survey (e.g. evidence of footings and/or cutting and filling).

7.2 Recommendation 2 - Unexpected finds as part of the Project

Unexpected cultural heritage material or sites found during the construction stage of the project should be managed using the following measures:

- All work at the location of the find must cease and reasonable efforts to secure the site should be made – a buffer zone of ten metres is recommended;
- Work can continue at the distance of twenty metres from a find area. Note that the material should not be removed or disturbed further but barriers or temporary fences may be erected as a buffer around the find if required;
- The Cultural Heritage Coordinator and relevant Site Manager should be notified. They should then notify the Historical Archaeologist appointed to the Project; and
- The Historical Archaeologist will provide a management recommendation to the Environment-Team Leader, and will undertake approved actions, as outlined in the associated *EPA Guidelines for Archaeological Survey*.

Additionally, this study recommends that diligence should be practiced during works conducted within the study area, particularly during any clearing or construction phases associated with initial preparation of the project area. This diligence should include specifically instructing crews of their obligations to look for cultural heritage material, and handing out educational leaflets at Workplace Health and Safety meetings. These leaflets should inform the workers what archaeological material may look like, and give them clear instructions on what to do if they find anything.

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9 APPENDICES

The following Appendices are provided with this report:

Appendix 1 Appendix *G: Report on the "Gympie Pyramid" by Dr Elaine Brown* 2006.

Appendix 2 Survey Plan of Goldfield Homestead Leases 209, 215 & 232 at Gympie (1876).

REPORT ON THE 'GYMPIE PYRAMID'

Elaine Brown PhD (UQ)

Introduction

The site of the so-called 'Gympie Pyramid' is at Rocky Ridge, east of Gympie.

Rocky Ridge is the peak of an outcrop of sandstone that is cut by the Gympie Connection Road and by the railway deviation just south of the Gympie North Railway Station. On the Gympie Special Geological Map (1999), this outcrop is classed RJdm – quartoze sandstone, orthoquartzite, sublabile to labile sandstone, siltstone, shale – and is part of the Myrtle Creek Sandstones.[1] (See extract from Gympie Special Map.)

The outcrop is dissected by Moody Creek, which drains several gullies then flows along the southern base of Rocky Ridge. The creek turns sharply under the Gympie Connection Road, flows through an area of land that was for many years Camping and Water Reserve R491, and passes under Cootharaba Road before entering Deep Creek, a tributary of the Mary River. (See City of Gympie map.)

Since 1975, various claims have been made that Rocky Ridge was the site of an ancient 'pyramid' of Egyptian, Phonecian, Extra-terrestrial, Mayan or Chinese origin. These claims are based on the existence on some slopes of distinct terraces, supported by dry stone walls, mostly on blocks MPH35291, formerly MHL1484, and MCH806657, formerly MHL2968.

Claims about the 'Gympie Pyramid'

1. In 1975, **Rex Gilroy**,[2] a self-styled archaeologist, visited Gympie to examine the 'Gympie Ape', a crudely carved piece of stone, which Dallas Berry claimed to have unearthed when ploughing a paddock on the Gympie Connection Road opposite Rocky Ridge. Gilroy declared the stone to be a likeness of the Egyptian god Thoth and suggested that Gympie gold had been mined by ancient visitors, probably Egyptians. He asserted that a 'great harbour' once extended inland from Tin Can Bay to Gympie, 'which would have allowed ancient vessels to sail within a short distance of the site from which the ape statue was recovered'.[3]

Gilroy 'discovered' the terraces on Rocky Ridge and declared that they formed an Egyptian or Phonecian 'pyramid'. He has continued to promote this view.[4]

COMMENT:

- Gilroy's opinion of the Egyptian origin of the 'Gympie Ape' is pure conjecture.
- In geomorphological terms, his claim about a 'great harbour' is baseless.
- There is no geological evidence that in historic times sea levels along the Cooloola Coast were higher than they are today.
- Tin Can Bay is enclosed on the west and south by an escarpment. Inland from this escarpment, watersheds separate creeks which flow into Tinana Creek, which flows north and joins the Mary River at Maryborough. Moody and Deep Creeks are part of the main Mary River drainage basin, which is separated by a watershed from the Tinana Creek drainage basin all the way to Maryborough.
- A sea level high enough to form Gilroy's 'great harbour' would have drowned Gympie and its gold.

- A tradition that the hillside at Rocky Ridge had been terraced for grapevines was known in the district at the time, but Gilroy did not ask long-time residents about the origins of the terraces, or consider alternative explanations for their existence.

2. In 1983, **Marilyn Pye** visited Gympie, declared that the 'pyramid' had been built by extra-terrestrials or Mayans, and asserted that its stones had been removed to make the dry stone wall around the Surface Hill Uniting Church in Gympie.[5]

COMMENT:

- The building of the Surface Hill wall is documented in photographs, Church records, the *Gympie Times*, and a book on the history of the Surface Hill Church.[6]
- The wall was built by depression labour in 1938 with stones obtained from the property of Mrs Patience Mulholland at Southside. Many older Gympie people remember the wall being built.
- Clyde Kunst, who worked on the truck that brought the stones from Southside to Gympie, has described how the project was carried out.[7]
- In 1984, R.J. Gould published a refutation of claims about the 'pyramid' and the wall in the *Quarterly Journal of the Gympie and District Historical Society.*[8]
- In 1986, Tony Wheeler investigated and discounted the 'pyramid' stories. After further investigations, he published a more comprehensive article on the Internet.[9]

3. From 1995 to 1999, **Brett J. Green** self-published six books in the series *Tales of a Warrior.*[10] These books are purportedly based on the diaries of his ancestors, John and James Green, and contain references to the 'Gympie Pyramid'. Green claims that the original diaries were destroyed in a fire, and they cannot therefore be authenticated.

In 2000, Green published *The Gympie Pyramid Story.*[11] In 2001, he established the Dhamurian Society, which promotes his books and CDs and reports its activities on a website: www.dhamurian.org.au/.

In May 2005, MPH35291, the block on Rocky Ridge near the railway line which contains some of the terraces, was purchased by 'a friend of the Dhamurian Society', who permitted members of the Society to clean up and search the site. This land was advertised for sale in January 2006.

COMMENT:

In April-May 1998, the *Gympie Times* published articles questioning the reliability of Brett Green's publications in relation to local history, Aboriginal history and the history of the Green family.[12]

- The books contain many factual inaccuracies about the history of the Wide Bay District.
- Green's recounting of Aboriginal legends and his descriptions of Aboriginal customs and territories are inconsistent with other sources. His Aboriginal vocabularies are variations on words from known lists, with some additions.
- Most of the photographs of Aborigines in the books are not of people from the Wide Bay District. Other photographs appear to have been digitally altered.
- Green family historians say that John Green was illiterate and never came to Queensland.[13]

4. In 2002, **Gavin Menzies** published *1421: The year China discovered the world.* In this book, he used information from Rex Gilroy and Brett Green to establish Tin Can Bay as a place entered by a fleet of Chinese ships, and Gympie as a place where the Chinese mined gold. Menzies stated that the Chinese sailed up a creek and into Gympie's harbour in 'ships shaped like birds'. He speculated that the 'Gympie Pyramid' was a 'Ming dynasty observation platform', which would 'help [the Chinese] to determine precisely the location

of the phenomenal riches they had discovered, so that future fleets could return to the same place'.[14]

COMMENT:

- Menzies' theories are controversial. The ABC television program *Four Corners* presented 'Junk History', a critical assessment of Menzies' book and ideas on 31 July 2006.[15] This program suggested that Menzies and his publisher had not thoroughly checked his sources, which is certainly the case in regard to Gympie.

Post-settlement landuse at Rocky Ridge/McPherson's Paddock

The Gympie goldfield is an area of hard ridges and rainforested gullies located close to the Mary River in its middle tract. Rocky Ridge lies to the east of the goldfield.

From 1849, squatters arrived with livestock and established large runs – Widgee (1849) to the west of the river, Traverston (1858) to the south of Gympie, and Curra (1859) to the north. The boundaries of these runs were not well-defined, and stockmen tended to avoid the broken country at Gympie. In the documents relating to the establishment of these runs and in descriptions of life on the early stations, I have found no mention of pre-settlement stone structures or unusual remains.

In 1852, John Carne Bidwell, Crown Lands Commissioner at Maryborough, was instructed to mark a treeline track through the Mary Valley from Maryborough to the Brisbane Valley. On this trip, he became lost south of Gympie and was rescued by Aborigines. Bidwill's track was completed in 1859 by surveyor James Buchanan. At Gympie, the track followed the tops of the ridges to avoid the gullies and came closest to the river at Pilcher's Hill, on what is still called the Old Maryborough Road. Rocky Ridge is not far to the east of Pilcher's Hill. (See City of Gympie map.) Neither Bidwill nor Buchanan, nor the mailmen, timber-getters, stockmen, bullock-drivers or travellers who followed this route after them (except the elusive John Green) reported finding unusual remains or pre-settlement stone structures in the vicinity of the track.

In September 1867, prospector James Nash, while following Buchanan's track, discovered alluvial gold in a steep-sided gully that runs into the Mary River not far south-west of Pilcher's Hill. The subsequent gold rush was reported in Maryborough and Brisbane newspapers, and after February 1868 in a local newspaper, the *Nashville (Gympie) Times*. Diggers scoured the countryside looking for alluvial gold and gold-bearing quartz reefs, but I have not found any mention of evidence of earlier diggings in the gullies or tunnelling in the ridges, or of a pre-settlement structure of sandstone blocks at Rocky Ridge.

In 1868, the geologist D'Oyley Aplin identified the sandstone outcrop at Rocky Ridge, describing it as 'a stratified quartz pebble drift of older date than the existing valleys ... in a large pocket of the creek known as McPherson's Paddock'.[16] Aplin did not report seeing a 'pyramid' at McPherson's Paddock, which was named after John and Russell McPherson, who by February 1868 were using the 'pocket' of open forest land enclosed by Moody Creek as a holding paddock for horses.[17]

In 1889, the geologist W. H. Rands described the sandstone outcrop as 'a drift of large, waterworn pebbles ... consisting of quartz and of hardened, waterworn sandstone' with 'layers of ferruginous grit and conglomerate'.[18]

Between 1875 and 1877, John William Cauper, a Swiss nurseryman, took up four Goldfields Homestead Leases (130, 215, 337 and 338) at McPherson's Paddock. He established a vineyard there and supplied grafted plant material to local growers and householders.

The most plausible explanation for the terraces on Rocky Ridge is that Cauper terraced some slopes to provide accessible, well-drained sites for his vines. This is confirmed by the oral traditions of local settler families, by a letter Cauper wrote to the *Gympie Times* in 1884,[19] and by a published reference in 1905 to 'a Mr Kauper' who grew grapes in what was then known as 'The Old Vineyard'.[20]

An 1888 handbook for Queensland settlers pointed out that 'there are hundreds of stony ridges admirably suited for the purposes of vineyards if trenched and the largest stones taken out. If the incline be so steep as to necessitate terracing, the largest stones could be used to form walls on the lower side of each terrace.'[21] This is an accurate description of the terracing at Rocky Ridge.

Cauper was still on the electoral roll at McPherson's Paddock in 1890. Then, possibly due to very wet summers and an economic recession, he abandoned the land, which was resumed, sub-divided and reselected. MPH35291 (MHL1484) was taken up by Richard Henry James in 1892 and MCH806657 (MHL2968) was taken up by George Preston in 1903.

In the 1920s, ownership of these blocks passed to a succession of Gympie butchers, who used them as holding paddocks for their nearby slaughteryard. The hoofs of cattle, sheep and horses accentuated the terraces and dislodged stones and soil, and when I first noticed Rocky Ridge in 1971, its slopes were eaten bare.

After the slaughteryard closed in 1973, wattles, gum trees, prickly pear and lantana covered the ridge and a fringe of trees grew up along the creek. Houses have been built on the old vineyard and slaughteryard sites, and in 1989 the railway deviation was cut through the western edge of Rocky Ridge.

Conclusion[22]

There is **no** evidence to support claims that

- the terraces on Rocky Ridge were part of a 'pyramid' built by ancient Egyptian, Phonecian, Extra-terrestrial, Mayan or Chinese visitors.
- gold was mined at Gympie before 1867.
- a great harbour or a creek once connected Tin Can Bay and the Mary River.

There is evidence that John William Cauper took up land at Rocky Ridge/McPherson's Paddock in the period 1875-1877 and that he established a vineyard there. Furthermore, horticultural practices of the period support a local oral tradition that the terraces were constructed to provide well-drained sites for Cauper's grapevines.

ENDNOTES

[1] Gympie Special Geological Map 1:1000 000, Sheet 9445, Department of Mines and Energy, Brisbane, 1999. See map commentary, p. 6.

[2] Robert Holden, *Crackpots, Ratbags and Rebels: A Swag of Aussie Eccentrics* (ABC Books, 2005), pp. 215-217; 'The Rex Files', *Australian Story*, ABC Television, 20 September 2004.

[3] 'Archaeologist to visit Gympie', *Gympie Times*, 20 September 1975; 'Eerie Statue Arouses Australia-wide Interest: Gympie Link with Ancient Egypt?', *GT*, 30 October 1975; 'Ape Statue finder is seeking other historical items', *GT*, 8 November 1975,'; 'Wider interest in Gympie 'Ape' statue', *GT*, 27 November 1975.

[4] 'Gilroy defends theory that Egyptians colonised Gympie area', *Gympie Times*, 1 May, 1976; 'Evidence grows Egyptians were in Australia', *GT*, 24 June 1976; 'Controversial archaeologist is returning', *GT*, 5 March 1977; 'Gilroy planning fourth visit to Gympie area', *GT*, 5 November 1977; 'Research points to two ancient Egyptian colonies in Queensland', *GT*, 22 September 1979; 'Gilroy spreads theory of Gympie 'pyramids', *GT*, 5 August 1980.

[5] 'Gympie 'pyramid' gets film star treatment', 3 September 1983; 'Minister refutes pyramid claims', 6 September 1983; 'Writer wants pyramid excavated.' 25 November 1983.

[6] Marjorie J. Head, *Surface Hill Uniting Church Gympie 1890-1990.*

[7] 'A job well done', *The Bush Telegraph*, Vol. 6, No. 2, 1999.

[8] R.J. Gould, 'The Gympie Pyramid – Fact or Fiction?', *Gympie and District Historical Society Journal*, January 1984. This account refers to a tradition in the Buchanan family of Goomboorian that the property at Rocky Ridge was terraced for grapevines.

[9] Tony Wheeler, 'In Quest of Australia's Lost Pyramids', *Omega Digest*, November 1985; Dr Anthony G.Wheeler, 'Australian pyramids – a draft report', www.awarenessquest.com/wheeler.htm.

[10] Brett J. Green, *The Legend of Gympie: Tales of a Warrior: Kabi Legends of the Central Mary River, Gympie, Qld, transcribed from the diaries and notes of John and James Green (1820-1938)* (1995); *The Clans of Kippandingi* (1995); *The Clans of Yuludara* (1996); *The Great Holes of Kugululu and the New Lands* (1996); *Land of Legend* (1997); *The Spiritual Journey* (1999).

[11] Brett J. Green, *The Gympie Pyramid Story* (2000).

[12] 'The Green Diaries: Author's Claims Disputed', *Gympie Times*, 25 April 1998; 'Aborigines dismiss diaries', *GT*, 19 May 1998.

[13] Grayeme and Lynne Bone, *The Green Book: A History and Geneaology of the family of John Green (c. 1816-1889)* (Glenreagh, NSW, 1999).

[14] Gavin Menzies, *1421: The year China discovered the world* (London: Bantam Books, 2002), pp. 221-222 and map p. 205.

[15] Quentin McDermott, 'Junk History', *Four Corners*, ABC Television, 31 July 2006.

[16] D'Oyley H. Aplin, *Report on the Geological and Mining Features of the Gympie Gold Field* (Brisbane: by Authority, 1868).

[17] Elaine Brown, 'Brothers linked to horse scam', *Gympie Times*, 21 October 2006.

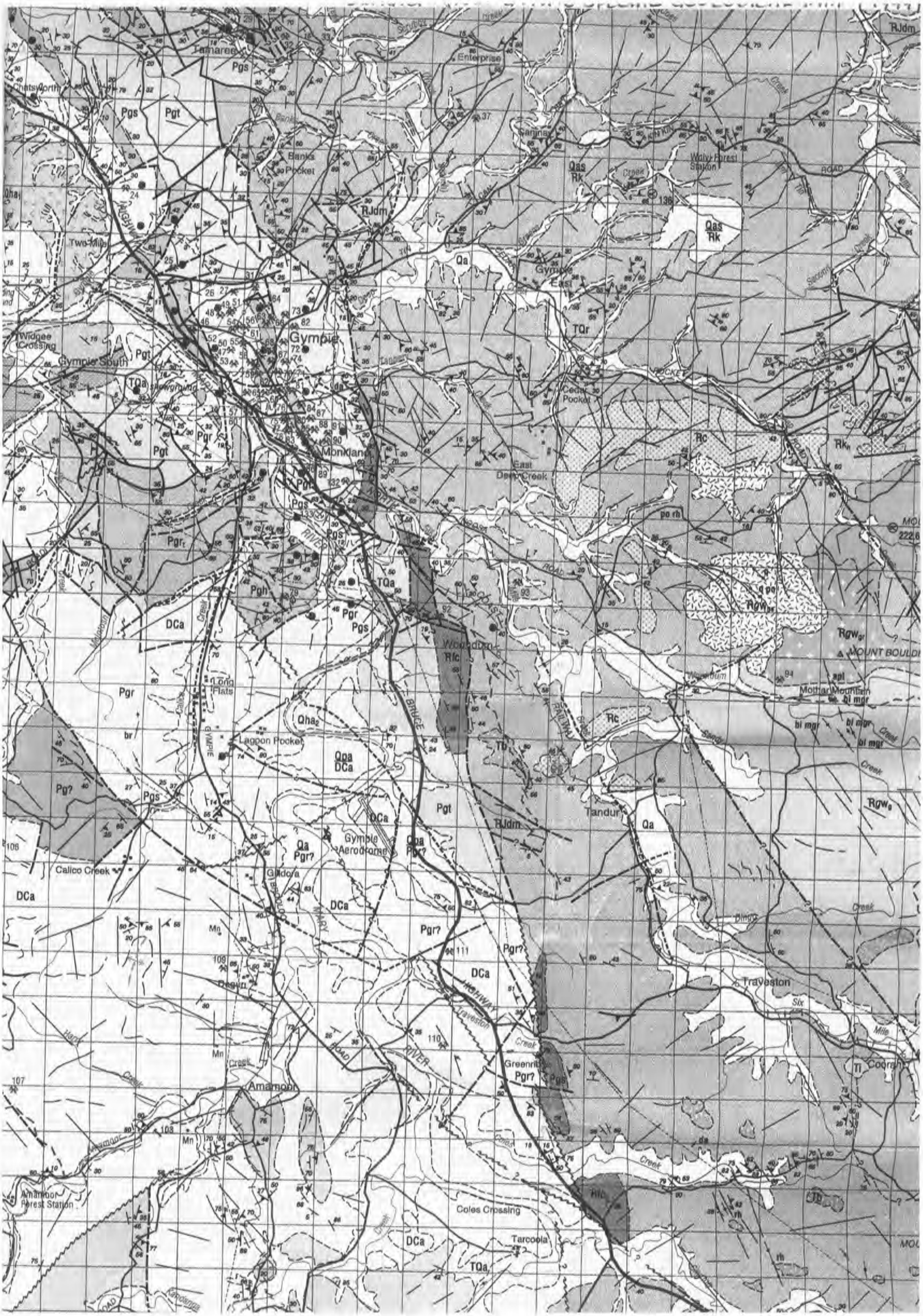
[18] William H. Rands, *Report on the Gympie Gold Field* (Brisbane: by Authority, 1889).

[19] J. W. Cauper to *Gympie Times*, 18 October 1884.

[20] Walter Woolgar, *Gympie and District Farming and Grazing Industries* (Gympie Times, 1905), p. 49.

[21] *The Queensland Guide* (Brisbane: Government Printer, 1888), pp. 202-203.

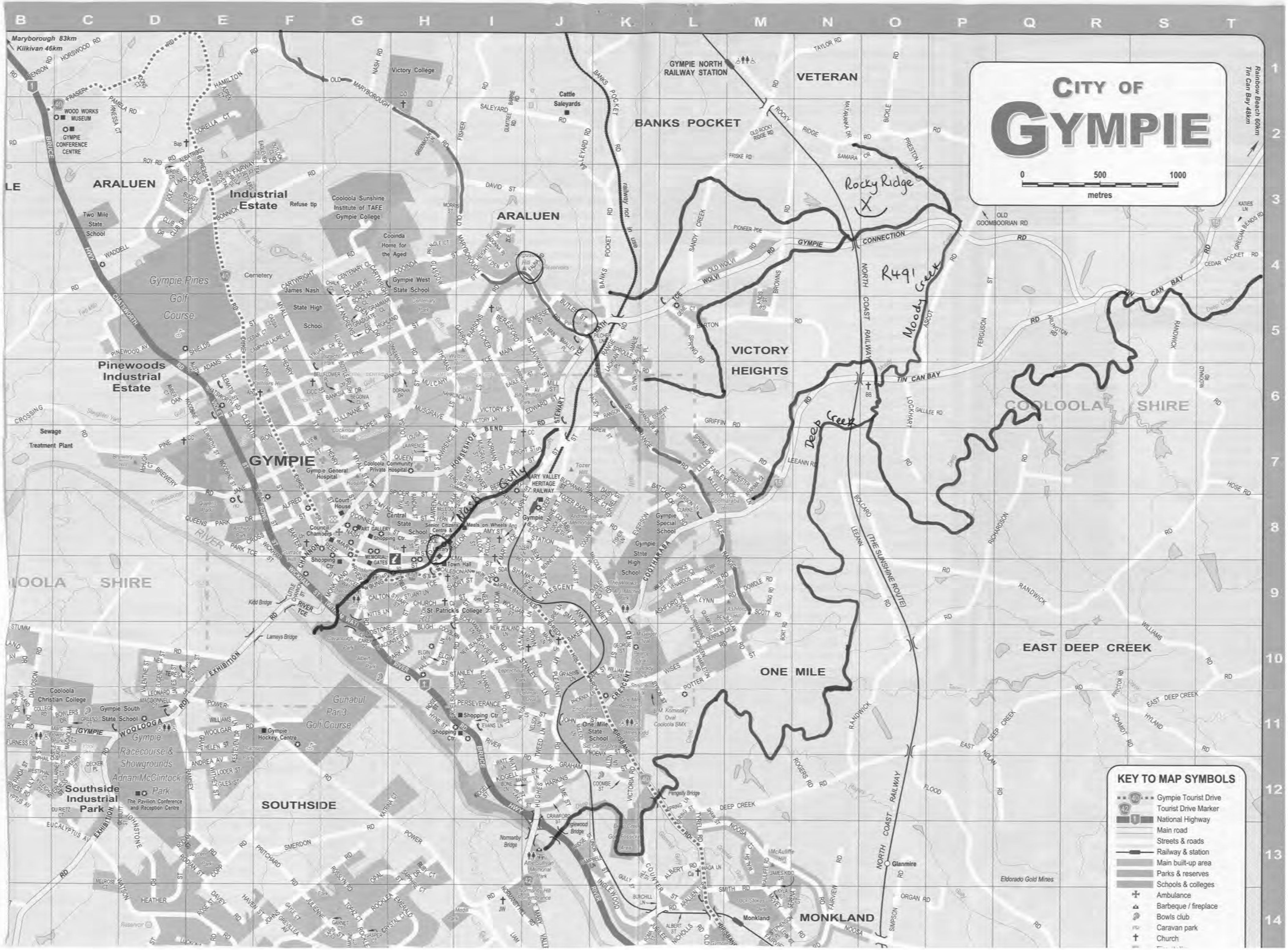
[22] Elaine Brown, 'Pyramid doesn't add up', *Gympie Times*, 9 September 2006.

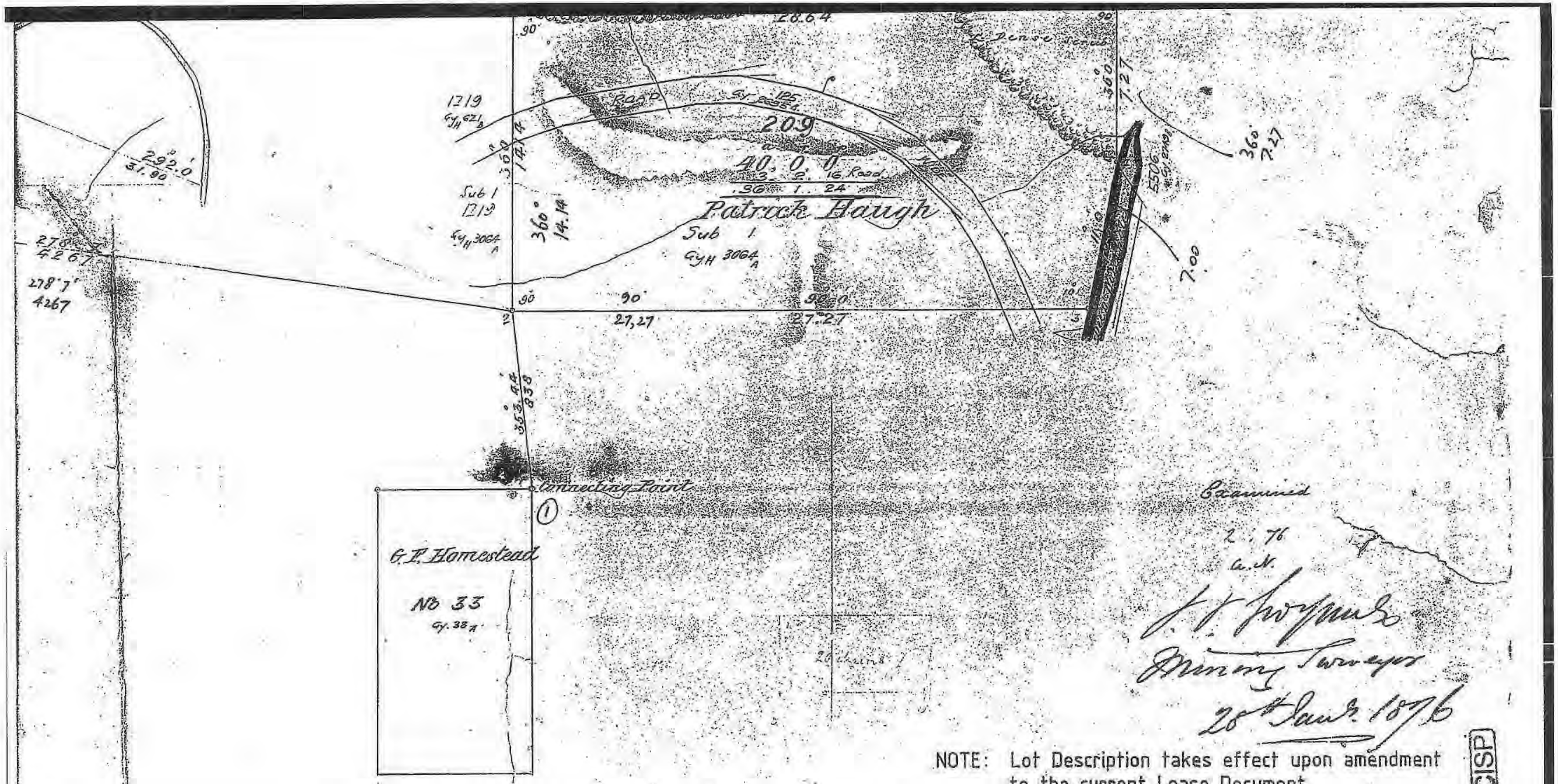


Tamaree
Chatsworth
Enterprise
Banks Pocket
Two Mile
Widgee Crossing
Gympie South
Gympie
Monkland
Gympie East
Cedar Pocket
East Deep Creek
Woondum
Long Flats
Lagoon Pocket
Gympie Aerodrome
Calico Creek
Tandur
Traveston
Mothar Mountain
Amamoor
Amamoor Forest Station
Coles Crossing
Tarcoola
BRUCE
HIGHWAY
MARY
RIVER
Pgs
Pgt
Pgr
RJdm
Qa
TQr
TQa
Rc
DCa
Qha

Table 1: Stratigraphy

PROVINCE	SUB-PROVINCE	UNIT/MAP SYMBOL	LITHOLOGY
		Duricrust Td	Pisolitic ironstone or mottled and pallid zones.
Main Range Volcanic		Tertiary Volcanics Tv	Dark grey to black, amygdaloidal, olivine basalt consisting of plagioclase and olivine phenocrysts in a fine-grained ground mass of similar composition: Dominantly reversely magnetically polarised.
Tertiary Basins	Elliott Basin	Elliott Formation Te	Poorly sorted sandstone, minor siltstone, conglomerate. Conglomerate and sandstone comprise quartz, jasper and feldspar clasts in a white to grey locally ferruginised clay matrix.
Tertiary Basins	Pomona Basin	Pomona beds Tp	Poorly exposed mud, siltstone, minor conglomerate and sandstone. Sandstone from the unit is quartzose and moderately well sorted, and the conglomerate contains clasts of mainly quartz and jasper clasts. Mudstone form the unit is grey to dark grey and contains plant fossils. Olivine basalt flows are interbedded with sediments near Pomona.
Great Australian Basin	Maryborough Basin	Duckinwilla Group RJd	Green, quartz-rich, volcaniclastic sandstone, quartzose sandstone, rare siltstone and shale, carbonaceous shale, rare coal and concretionary ironstone; ferruginous oolite marker.
Great Australian Basin	Maryborough Basin	Tiaro Coal Measures Jdt	Lower green, quartz-rich, volcaniclastic sandstone, rare siltstone and shale interbeds; upper siltstone, shale, carbonaceous shale, rare coal and concretionary ironstone. A lower sequence of green, quartz-rich, volcaniclastic sandstone with relatively rare siltstone and shale interbeds, and an upper interbedded sequence of siltstone, shale, carbonaceous shale, rare coal and concretionary ironstone. Clasts in sandstone include quartz, abundant altered (?andesite) and rare feldspar. Interbedded siltstone and shale are generally thin-bedded and comprise about 30% of the upper Tiaro Coal Measures. The overlying shale, siltstone and carbonaceous shale are generally thin-bedded to laminated, and contain thin concretionary ironstone interbeds and rare coal (Plate 3c). A ferruginous oolite marker bed forms a 30 to 40 cm thick bed close to the middle of the upper unit. Ooids consist of quartz, minor halloysite and siderite in a fine grained ferruginous (haematite or goethite) cement.
Great Australian Basin	Maryborough Basin	Myrtle Creek Sandstone Rjdm	Quartzose sandstone, orthoquartzite, sublabile to labile sandstone, siltstone, shale. The lower part of the Myrtle Creek Sandstone is well exposed in a fault block in railway cuttings immediately south of Gympie North Railway Station. Here a basal conglomerate contains clasts of vein quartz and phyllite in a dark grey muddy matrix. The conglomerate is sheared parallel to bedding, unconformably overlies, and is locally derived from the Kin Kin beds. The conglomerate is also partly offset by later south-block-down normal faulting. Other sections of the basal conglomerate are present near Black Knob (AMG 4660 71210) and adjacent to Mount Wolvi (AMG 4842 71058). The overlying section at Gympie North Railway Station comprises medium to coarse-grained lithic sublabile to labile sandstone (with quartz and rare volcanic clasts) in a fine grained clay matrix, siltstone and carbonaceous shale to mudstone. The proportion of carbonaceous shale and siltstone decreases upwards. The top of the sequence in these cuttings is a coarse grained, well-sorted crossbedded quartz sandstone with well developed lisegang rings. The top of the Myrtle Creek Sandstone in other areas is a well-sorted coarse to very coarse quartzose sandstone and granule conglomerate. This sandstone is the typical cliff forming part of the unit in the western part of the outcrop area in the Brooyar State Forest (eg, Eagle Nest lookout)
Great Australian Basin	Maryborough Basin	Myrtle Creek Sandstone $RJdm_q$	Quartzose sandstone
Great Australian Basin	Maryborough Basin	Myrtle Creek Sandstone $RJdm_c$	Basal conglomerate contains clasts of vein quartz and phyllite in a dark grey muddy matrix.
South East Queensland Volcanic and Plutonic	Late Triassic postorogenic Volcanics	Undivided Triassic Volcanics Rv	Andesite to dacite flows, dacitic to rhyolitic tuff, volcanic breccia, felspathic arenite, mudstone and ignimbrite. Basal andesite to dacite flows comprise relatively fresh aligned plagioclase laths in a fine grained aphanitic groundmass. The flows are overlain by very coarse volcanic breccia and agglomerate. South of Mount Wolvi the breccia contains clasts of rhyolitic to dacitic lava, pumice, and phyllite in a very fine ashy groundmass. North of Mount Wolvi, breccia to agglomerate contains boulder-size blocks of andesite, diorite and gabbro (? derived from Goomboorian Igneous Complex) dacite lava and phyllite in a fine ashy groundmass. Southwest of Mount Wolvi, the sequence consists of flow-aligned andesite successively overlain by a clast-rich pyroclastic flow, volcaniclastic sediments (felspathic arenite and mudstone) and feldspar crystal-poor ignimbrite.


CITY OF GYMPIE
0 500 1000
metres
Rainbow Beach 60km
Tin Can Bay 48km
Maryborough 83km
Kilkivan 46km
KEY TO MAP SYMBOLS
Gympie Tourist Drive
Tourist Drive Marker
National Highway
Main road
Streets & roads
Railway & station
Main built-up area
Parks & reserves
Schools & colleges
Ambulance
Barbeque / fireplace
Bowls club
Caravan park
Church
VETERAN
BANKS POCKET
ARALUEN
Industrial Estate
GYMPIE NORTH RAILWAY STATION
VICTORY HEIGHTS
Pinewoods Industrial Estate
GYMPIE
COOLOOLA SHIRE
ONE MILE
EAST DEEP CREEK
SOUTHSIDE
Southside Industrial Park
MONKLAND
NORTH COAST RAILWAY
(THE SUNSHINE ROUTE)
Rocky Ridge
R491
Moody Creek
Deep Creek
Nash Gully



NOTE: Lot Description takes effect upon amendment to the current Lease Document

Surveyed under *Written* Instructions from *the Warden* No.______

dated __________ 1875, and Transmitted to *him*

with my Letter No. ______ dated *28th Jan'y* 1876

SURVEY OF *G F Homesteads*

Nos 209 215 & 232

Gympie **GOLD FIELD.**

PARISH OF *Gympie* **COUNTY OF** *March*

DISTRICT OF ~~*Gympie*~~ *Wide Bay.* 14105

Cat. No. ~~92~~ A

②

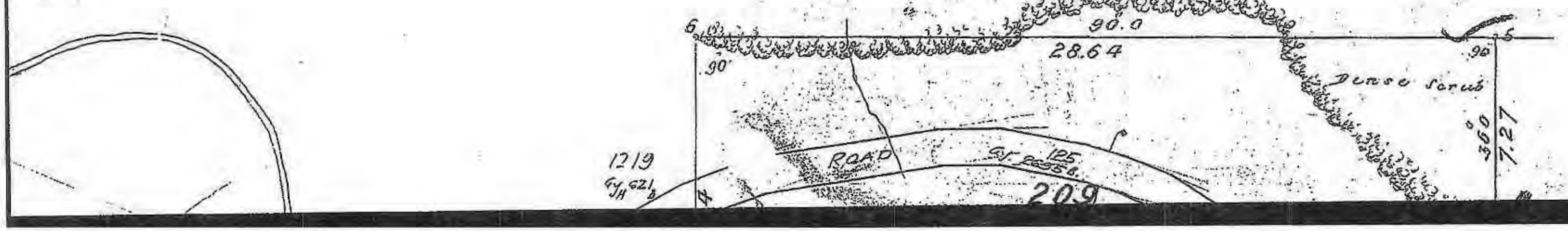
G, F, Homesteads Nos 209. 215 & 232

14105

Cat N° 92

209
234
231 War

For Additional Plan &
Document Notings
Refer to CISP



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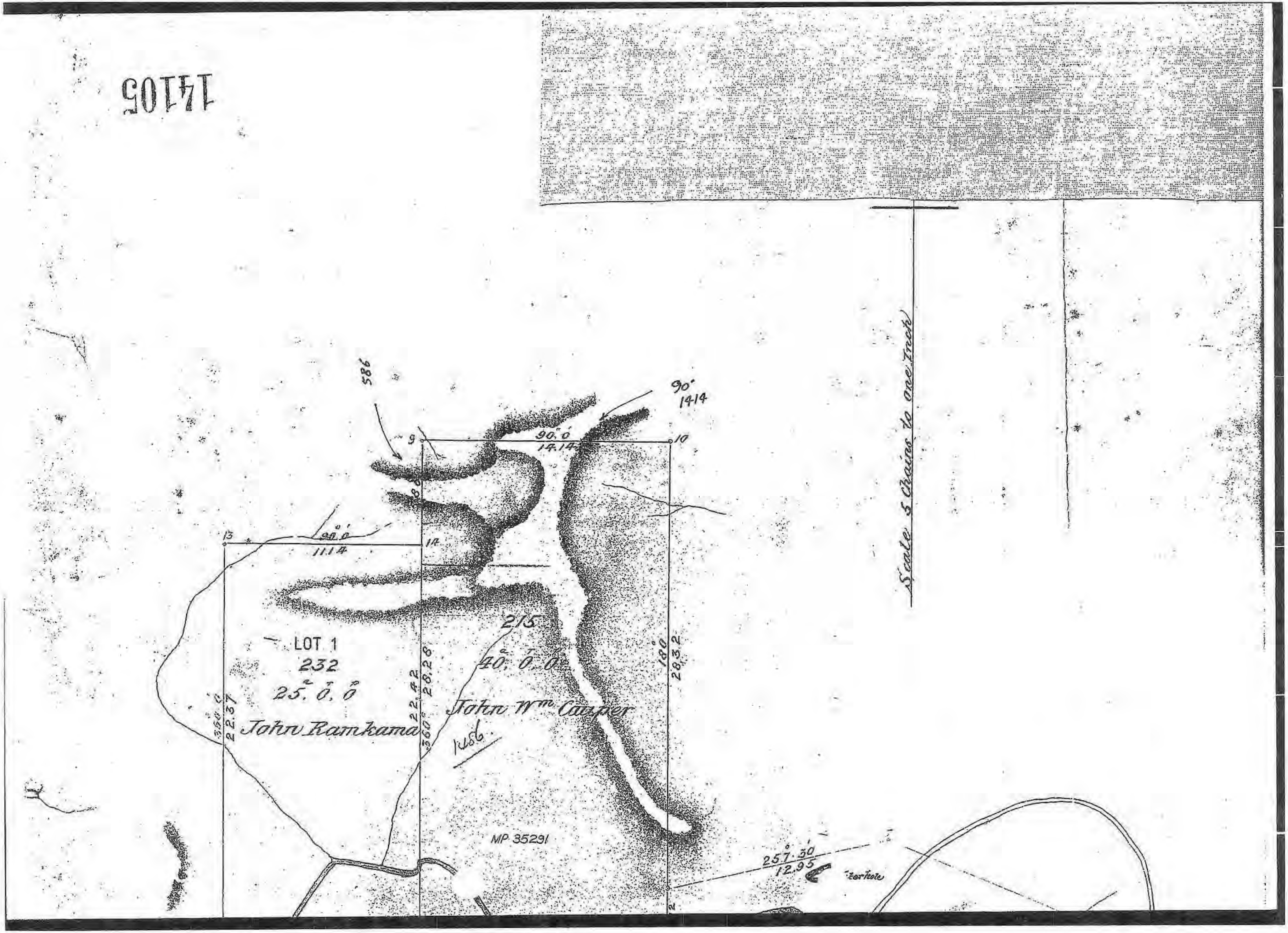
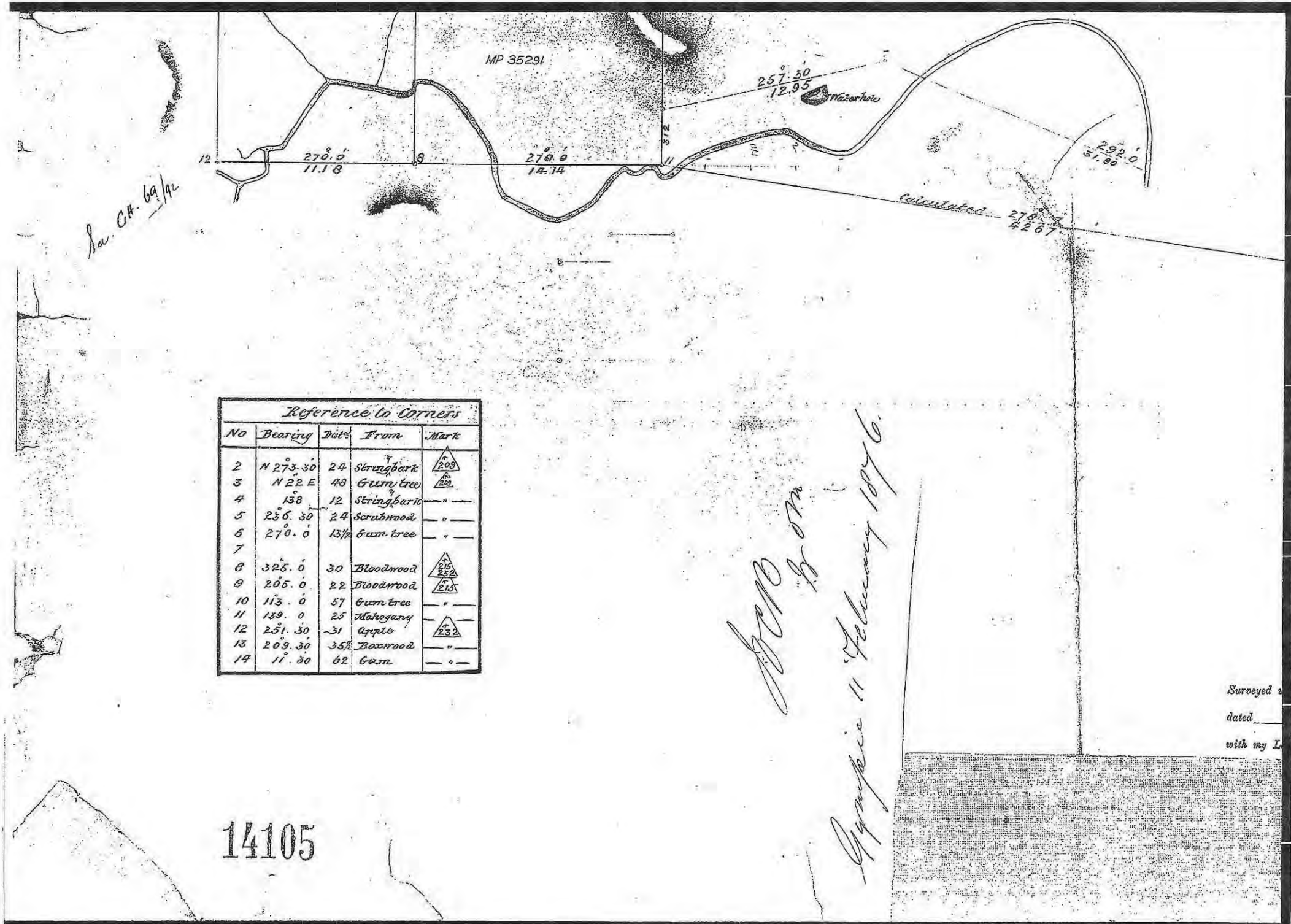

Scale 5 Chains to one Inch
586
90°
1414
9
90° 0'
14.14
10
8
13
90° 0'
11.14
14
215
40ᵃ 0ʳ 0ᵖ
180°
28.32
LOT 1
232
25ᵃ 0ʳ 0ᵖ
360° 0'
22.37
360°
22.42
28.28
John Ramkama
John Wᵐ Cauper
1486
MP 35291
257° 30'
12.95
2



Reference to Corners				
No	Bearing	Dists	From	Mark
2	N 273° 30'	24	Stringybark	T 209
3	N 22° E	48	Gum tree	T 209
4	138°	12	Stringybark	—" —
5	236° 30'	24	Scrubwood	—" —
6	270° 0'	13½	Gum tree	—" —
7				
8	325° 0'	30	Bloodwood	T 215 T 252
9	205° 0'	22	Bloodwood	T 215
10	113° 0'	57	Gum tree	—" —
11	139° 0'	25	Mahogany	—" —
12	251° 30'	31	Apple	T 232
13	209° 30'	35½	Boxwood	—" —
14	11° 30'	62	Gum	—" —

Surveyed

dated

with my L

14105

Appendix B

Fauna Movement and Road Impact Mitigation (Biodiversity Assessment and Management)

FAUNA MOVEMENT AND ROAD IMPACT MITIGATION

1.0 INTRODUCTION

In response to the internationally recognised problem of the detrimental effects associated with roads and traffic on populations of fauna, particularly rare or threatened species, dedicated fauna crossing structures are increasingly being employed to ensure the safe passage of individual animals.

Research in the northern Hemisphere has documented that fauna crossing structures are best positioned in locations where traditional fauna movement patterns occur (Foster and Humphrey 1995). While Australian large portions of fauna does not have clearly defined movement routes, the principle still applies as it is evident that some areas are more highly favoured for movement as evident from road kill data (Ramp and Croft 2002).

In most circumstances, fauna movement will be highest through areas where existing remnant vegetation occurs, particularly those areas that connect larger patches of vegetation.

2.0 FAUNA CROSSING LOCATION

Crossing infrastructure must be accompanied by guide fencing, which should be fauna proof on the habitat side of the fence, guiding animals to crossing points. However individuals will move only a limited distance along fences before the fence itself becomes a hindrance to movement and dispersal. Furthermore, consideration must be given to stochastic situations such as fire where the fence may hinder the movement of fleeing individuals.

The distance at which a fence becomes itself a detrimental impact is highly dependant on the mobility of a species. For example, large wallabies and kangaroos will move much greater distances along a fence structure than small species such as bandicoots. In most cases, the distance from a crossing structure at which the fence becomes ineffectual is considered to be around 200-300m (BAAM 2004). Consequently, **crossing structures should aim to be no more than around 500m apart.**

The length of the subject roadway is such that fencing the entire length of the roadway without crossing points every 500m would be detrimental to local and regional fauna movement. Providing crossings at key locations where fauna movement is most common across the roadway, accompanied by one-way guide fencing that allows fauna to re-enter habitat from the road surface represents the most suitable method of reducing road kills.

In the context of the Curra to Cooroy highway upgrade, four areas in particular are likely to be used by local fauna movements:

- Curra State Forest;
- Woondum State Forest;
- Traveston State Forest; and
- Yurol State Forest.

These areas have been identified only by a preliminary habitat assessment. Further study may identify other potential areas of high fauna movement.

3.0 FAUNA CROSSING TYPES

Fauna crossing structures may be grouped into two types:

- Underpasses: either as culverts or road bridges; and
- Overpasses: such as land bridges or rope bridges.

Each of these can incorporate a broad range of variation in design, dependent on the purpose for which they are intended and the surrounding topography and vegetation. All crossing structures and associated fencing require continual maintenance to ensure their proper function, and monitoring of their use, and road kills on the subject road is required for several years following installation to assess the effectiveness and/or appropriateness of the installations.

A brief discussion of underpass and overpass structures is provided below.

3.1 UNDERPASSES

Underpasses allow fauna passage beneath the road either through a below-ground tunnel structure or a bridging structure. External to the design of the underpass structure itself, research has indicated that appropriate vegetation on the approach of the underpass is highly beneficial (Goosem 2003).

Vegetation connecting nearby forest to the underpass allows fauna some sheltering opportunity while approaching the underpass. In addition, some studies have indicated that predators are more likely to utilise underpasses where there is little vegetation on the approach (AMBS 2002). **The provision of suitable vegetation at the approach to each end of the underpass is therefore an important design consideration.**

3.1.1 Culverts

The topography in locations where roadways cross watercourses provides opportunities to install fauna crossing infrastructures beneath roads. In addition, riparian vegetation is often preserved in otherwise mostly cleared landscapes, and often functions as fauna movement corridors.

When specifically designed for fauna passage, portions of these structures should not convey water, or should be constructed separately as dry passage is required.

Many culverts employed in modern roadways have one or two raised edges (Plate 1).

An extension of this idea is an over-sized culvert such as a pre-cast arch that includes the creation of artificial riverbanks (Figure 1).

Plate 1. Culvert with dry ledges

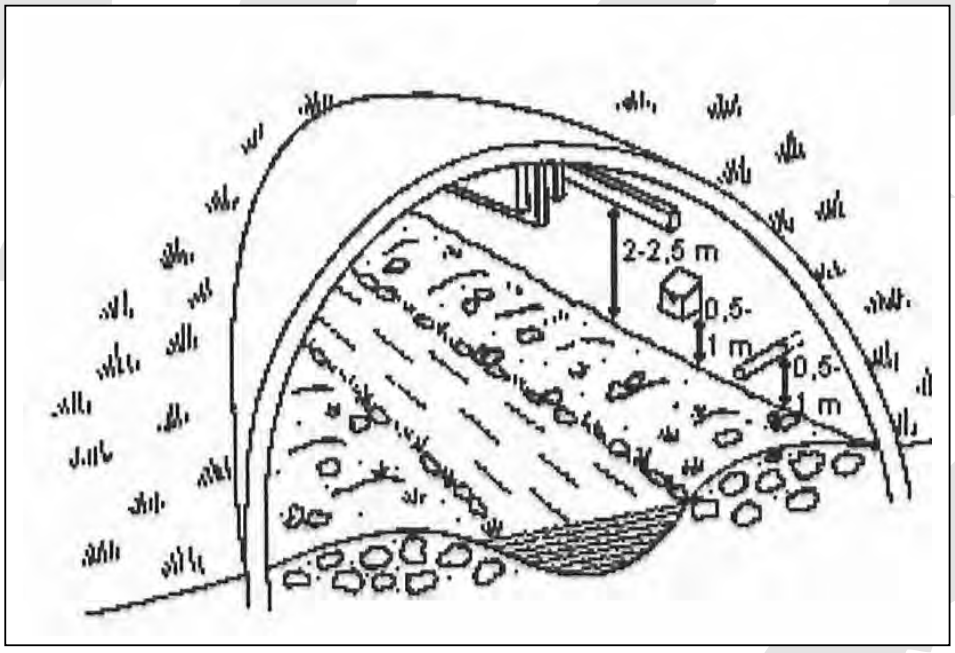


Figure 1. An oversized arch underpasses (Chenoweth 2003)

Where possible, underpasses should include 'furniture' such as ropes, hollow logs, rocks and poles (Plate 2). These provide shelter opportunities for passing fauna and may alleviate the threat of predation. The inclusion of these features and mass plantings leading into the culvert from nearby forest was found to be highly effective in northern Queensland (Goosem 2003).

Plate 2. 'Furniture' such as ropes and debris may encourage underpass usage (Goosem 2006).

In addition to duel function underpasses, dedicated fauna underpasses may be constructed. Most fauna species prefer to move over dry land (except amphibians and fish) and hence dedicated fauna underpasses can be designed such that limited water pools or runs through the structure. Furthermore, fauna passage can be encouraged by covering the substrate with sand or soil. This alters the ground surface texture for crossing animals as well as allowing vegetation growth where sufficient light occurs. These types of underpasses have been used in road projects within Australia, particularly New South Wales. For example, 17 dedicated 3 x 3m box culverts were installed between Bulahdelah to Coolongolook on the Pacific Highway in New South Wales (AMBS 2001) and several structures including a 10m diameter tunnel were included in the design of the F3 Freeway between Sydney and Newcastle (AMBS 1997).

In addition to the above considerations, the size of the culvert is crucial and will significantly influence the type of fauna utilising the structure. For example, large species such as kangaroos rarely use culverts less than 3 x 3m and hence smaller culverts may restrict their use to smaller animals. Long culverts are less likely to be used than similar sized culverts of a shorter length (AMBS 2002). This is most likely related to the visibility of habitat on the other side of the crossing which is widely agreed to be an important consideration.

Several important principles in fauna friendly culvert design must therefore be considered:

- **Low-lying areas and particularly watercourses (both ephemeral and permanent) are likely to be regularly used as movement routes. Underpasses at these locations are therefore a priority;**
- **Box culverts or steel arch culverts are preferred over cylindrical culverts;**
- **Culverts should be as large as possible;**
- **Culverts should include at least one raised edge for dry passage and preferably some furniture features; and**
- **Culverts should be over as shorter distance as possible, and should increase in size with increasing distance.**

3.1.2 Road Bridges

Principles applied to underpasses are also applicable to road bridges, either those crossing waterways, or those deliberately constructed over dry land to facilitate fauna crossing. **Bridges are the most effective underpass option** as they have greater potential to facilitate movement through their more open nature and greater opportunities to retain natural substrate. When associated with waterways, fauna sensitive bridge design sets the bridge footings well back from the water where vegetation growth may occur, debris may be distributed and fauna species may move by dry passage. Bridge crossings have wider entrances than culvert underpasses, with more light, and often have more height which allows greater opportunity for the installation of 'furniture' (Plate 2).

3.2 OVERPASSES

Overpasses are structures that allow fauna species to move above the traffic flow. Two common overpasses have been utilised in eastern Australia, land bridges and rope bridges.

3.2.1 Land Bridges

Land bridges provide an opportunity to link two areas of habitat over a road cutting on which a 'natural' habitat can be established. Land bridges therefore provide a very attractive solution they caters for a broad range of species, both those that are ground dwelling in habitat and those that are arboreal. Overpasses provide the opportunity to install glider poles, which allow arboreal species to cross the overpass either without coming to the ground (e.g. gliders) or provide refuge for non-gliding species (e.g. Koalas and possums). Establishment of vegetation and cover within the land bridge structure provides greater shelter for individuals and therefore a safer crossing option.

Similar to underpasses, land bridges are most effective if vegetation connects the bridge to nearby habitat. They are increasingly recognised as the preferred and most versatile fauna passage option and many recent road projects have included these structures in their design. Such examples include Crompton Road in Brisbane (Plate 3) and the Yelgun to Chinderah section of the Pacific Highway in NSW.

Plate 3. Compton Road Land Bridge, Brisbane.

The installation of land bridges is most suitable in areas where the topography allows construction with minimal disturbance to adjoining habitat. Areas where deep cuttings are planned should be investigated for suitability as land bridge areas.

Dedicated land bridges are highly effective in facilitating fauna movement across roadways. They should include planting of species to connect areas of existing habitat/vegetation.

3.2.2 Rope Bridges

Rope bridges provide passage for agile arboreal species such as gliders and possums (but not Koalas). They do not provide passage for ground-dwelling species. These structures have only recently been incorporated into Australian road designs. However early monitoring results suggest that they are highly successful (Goosem *et. al*. 2005, Bax 2006) and arboreal species are willing to cross long spans of road (40-70m) using rope bridges (Bax 2006). Early designs were constructed from braided rope and were tubular in shape. It was thought that individuals might move through the centre of the structure reducing the risk of falls and predation. However, most monitoring studies of these structures have indicated that the majority of movements occur along the top of the rope bridge and therefore the design may be simplified (Box 2006).

The effectiveness of rope bridges has been increased by positioning them such that the support base (usually a large pole) is set within vegetation, or connected by thick braided rope. This allows easy access to and from the rope bridge.

Rope bridges provide a successful connection for arboreal mammal species such as possums and gliders.

Plate 4. Squirrel Glider using a rope bridge over the Karuah Bypass (Bax 2006)

4.0 EXCLUSION AND GUIDE FENCE DESIGN

The fencing design that would be most effective in a situation where only sections of road are fenced to guide fauna to crossing points, rather than fencing to exclude fauna from the entire road surface, is a one-way fence that prevents fauna from entering the road surface within 250 metres of the crossing point, but which allows fauna that have entered the road corridor to re-enter roadside habitat.

This design is a standard 1.4 m chain-wire fence with a 60cm strip of sheet metal (or plastic) attached beneath the top rail, on the side away from the road. This strip inhibits arboreal fauna from climbing the exclusion side of the fence. Earth bunds are constructed on the road side of the fencing every 50m to allow fauna re-entry. This size of fence is less effective for large macropods, although a 2m fence can be easily breached by a Grey Kangaroo, and the benefits from allowing fauna re-entry over a lower fence would outweigh the potential for macropods to breach the fencing.

Small areas of fencing can be installed without associated crossing infrastructure in locations where driver visibility is low, such as at bends or crests in the road.

Vegetation must be removed and maintained at 3m distance from the fencing, including overhanging branches.

All fences require maintenance to ensure vegetation growth (e.g. vines) or fallen debris does not affect the efficiency of the structure.

It is important to note that, before any exclusion or guide fencing is installed, the treatment for safe crossing must be installed first.

Main principles in the inclusion and design of exclusion or guidance fencing are:

- **Stretches of fencing should be no more than 250m long before allowing access to a crossing structure or the road surface.**
- **The fence should allow one-way fauna movement from the roadway (via the construction of earth bunds at 50m intervals) into vegetation but prevent movement onto the roadway;**
- **Maintenance of fencing is required to ensure their long-term efficiency.**

5.0 OTHER DESIGN CONSIDERATIONS

In some locations, costs and topography may not allow the construction of sufficient crossing opportunities. Other alternatives in these locations need to be assessed if long stretches of road cannot be fenced. Treatments that increase the ability of drivers to see fauna crossing or about to cross the road will have the greatest effect.

Roadside treatment in these areas should include regular mowing/slashing of verges (to a distance of 3m from the road edge) and median strips to ensure that an animal cannot be hidden from a motorist by long grass or weeds. It is preferred that there is no vegetation planted within median strips and that median strips are as narrow as possible to reduce the time that crossing animals are within the road corridor.

Maintenance of the nominated verges and median strips should be incorporated into existing roadside maintenance programs, although frequency of attention to these areas may need to be increased, particularly during summer months when rainfall is higher and vegetation growth rates increase.

In addition, signage warning of the potential for fauna presence on roads should be installed, particularly where guide fencing for crossings terminate.

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