Council Chambers
62 Valentine Plains Road
Valentine Plains
Biloela Qld 4715

All Correspondence to
Chief Executive Officer
PO Box 412
Biloela Qld 4715

Phone 07 4992 9500
Fax 07 4992 3493
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ABN 85 946 116 646

Banana SHIRE
SHIRE OF OPPORTUNITY

**Your Reference:**
**Our Reference:** CW: mw: 23-10 (FID92235, MCU011-22/23, 15247-00000-000, ID1767441, ID1812710, ID1825305, OM005812)
**Contact:** enquiries@banana.qld.gov.au

27 October 2023

Edify Energy
C/- RPS AAP Consulting Pty Ltd
PO Box 1559
FORTITUDE VALLEY QLD 4006

Dear Sir/Madam

**NEGOTIATED Decision Notice – Approval**
*(Given under section 63 of the Planning Act 2016)*

| | |
|---|---|
| **Application Number:** | MCU011-22/23 |
| **Description:** | Public Facility Other (Solar Farm) & Animal Husbandry |
| **Level of Assessment:** | Impact Assessable |
| **Site Address:** | 641 BILOELA CALLIDE ROAD, MOUNT MURCHISON<br>551 BILOELA CALLIDE ROAD, MOUNT MURCHISON |
| **Lot & Plan Details:** | Lot 3 on RP608599, Lot 28 on RN519, Lot 2 on RP619032, Lot 154 on SP126053 |

On 25 October 2023, at Council's Ordinary Meeting (OM005812), your request for a Negotiated Decision Notice, received by Council on 08 September 2023, was approved to the extent detailed in this Notice. This Negotiated Decision Notice replaces the Decision Notice previously issued and dated 25 July 2023, approved 19 July 2023 at Council's ordinary meeting (OM005715).

The nature of the changes are listed below and clearly shown in the Negotiated Decision Notice and Attachment 1 (as strikethrough bold text):-

- Condition 1 - Amended
- Condition 7 - Retained
- Condition 8 - Amended
- Condition 9 - Amended
- Condition 15 - Amended
- Condition 19 - Amended
- Condition 20 - Amended
- Condition 23 - Amended
- Condition 64 - Amended
- Condition 75 - Retained

## 1. Details of Approval

The following approval is given:

| | Planning Regulation 2017 reference | Development Permit | Preliminary Approval |
|---|---|---|---|
| Making a Material Change of Use assessable under the planning scheme | s20 | ☑ | ☐ |

## 2. Approved Plans

The approved plans and documents for this development approval are listed in the following table:

| Document number | Plan/Document name | Date |
|---|---|---|
| PR151484-1 | Preliminary Site Layout prepared by RPS | Received by Council on ~~20 December 2022~~ **08 September 2023** |
| MJ2370-TIA (Revision C) | Traffic Impact Statement prepared by Northern Consulting Engineers | 30/11/2022 |
| EDF-002 (Revision A) | Surface Water and Flood Impact Assessment Report prepared by Civil IQ | 9 November 2022 |
| Version 2 | Landscape Character and Visual Impact Assessment prepared by Accent Environmental | Received by Council on 17 March 2023 |

## 3. Further Development Permits

Please be advised that the following development permits are required to be obtained before the development can be carried out:

- Operational Works
- Building Works
- Plumbing & Drainage

## 4. Conflict with relevant instrument and reasons for the decision despite the conflict.

The assessment manager does not consider that the assessment manager's decision conflicts with a relevant instrument.

## 5. Submissions

There were properly made submissions about the application.

The name and address of the principal submitter for each properly made submission are as follows:

| Name of Principal Submitter/s | Address |
|---|---|
| Raymond Wilkie | PO Box 269<br>BILOELA QLD 4715 |
| Phillip & Narelle Wilkie | PO Box 269<br>BILOELA QLD 4715 |
| Climate & Energy Realists Queensland | PO Box 259<br>SOUTHPORT BC<br>GOLD COAST QLD 4215 |
| Cedric Creed | beefy@activ8.net.au |
| Young Country Enterprises Pty Ltd | 214 Jambin Goovigen Road<br>GOOVIGEN QLD 4702 |
| Terry Wilkie | PO Box 652<br>BILOELA QLD 4715 |
| Christine Roebug | 48 Pratton Street<br>DALBY QLD 4405 |
| Peter DeGit | ptdegit7@gmail.com |
| Emily Brosnan | emily_brosnan@hotmail.com |
| Gwen Jensen | gwenandbevan@bigpond.com |
| Tony & Bridgette Bongers | PO Box 6<br>JAMBIN QLD 4702 |
| Hazel Reid | 383 Shorts Road<br>MOUNT MURCHISON QLD 4715 |
| Mia Jensen | the4jensens@bigpond.com |
| Grazing BestPrac<br>Mick Alexander | PO Box 8103<br>ALLENSTOWN QLD 4700 |
| Batchfire | PO Box 144<br>BILOELA QLD 4715 |
| Darren Jensen | 11179 Dawson Highway<br>MOUNT MURCHISON QLD 4715<br>sossj@me.com |
| Kamryn Johnston | The4jensens@bigpond.com |
| Ben Jensen | sossj@me.com |
| Tanya Jensen | 11179 Dawson Highway<br>BILOELA QLD 4715 |
| Symonn Leighton | 5 Callide Street<br>BILOELA QLD 4715 |
| Lynette LaBlack | lynettelablack@live.com |
| Carolyn Emms | carolynemms2@gmail.com |

## 6. Referral Agencies

The referral agencies for this application were:

| Name of referral agency | Advice agency or concurrence agency | Referral Basis | Address |
|---|---|---|---|
| Chief Executive - Queensland Treasury - State Assessment Referral Agency (SARA) | Concurrence | Schedule 10, Part 9, Division 4, Subdivision 2, Tbale 4. | RockhamptonSARA@dsdmip.qld.gov.au<br><br>Fitzroy & Central Region<br>PO Box 113<br>ROCKHAMPTON QLD 4701 |
| The Chief Executive Officer of the entity | Advice | Schedule 10, Part 9, Division 2, Table 2. | Powerlink<br>PO Box 1193<br>VIRGINIA QLD 4014 |

## 7. Currency Period for the Approval

This development approval will lapse at the end of the period set out in section 85 of the *Planning Act 2016.*

## 8. Statement of Reasons

| | |
|---|---|
| **Description of the development** | The development is for a Material Change of Use for an Integrated Animal Husbandry and Public Facility – Other (Solar PV & Battery Energy Storage System) |
| **Assessment Benchmarks** | The proposed development was assessed against the following assessment benchmarks:<br>- Rural Zone Code<br>- Animals Code<br>- Development Standards Code<br>- Natural Features & Conservation Area Overlay Code (Catchment Overlay)<br>- Economic Resources Overlay Code (Agricultural Land - Class Overlay)<br>- Major Utilities Overlay Code (Electricity Transmission Line Overlay)<br>- Natural Disaster Overlay Code |

| | |
|---|---|
| **Reasons for Decision** | **Desired Environmental Outcomes (DEO)**<br>The DEO relevant to the site and proposed development relate to the protection and sustainable use of productive agricultural land. The subject land is identified as suitable for grazing and cropping purposes and the proposed use allows grazing to continue during and cropping to be recommenced at the end of life of this project. The proposed development and the conditions attached to the approval ensure that the achievement of the DEO is not compromised.<br><br>**Assessment Benchmarks**<br><u>Rural Zone Code</u><br>The proposed development complies with the relevant Performance Outcomes or conditions have been imposed to ensure compliance, specifically for PO1, PO3, PO5 and PO7.<br><br><u>Natural Features and Conservation Area Overlays Code</u><br>The proposed development complies with the relevant Performance Outcomes or conditions have been imposed to ensure compliance, specifically for PO1, PO2, PO3 and PO4.<br><br><u>Economic Resources Overlays Code</u><br>The proposed development complies with the relevant Performance Outcomes or conditions have been imposed to ensure compliance, specifically for PO1.<br><br><u>Major Utilities Overlays Code</u><br>The proposed development complies with the relevant Performance Outcomes or conditions have been imposed to ensure compliance, specifically for PO3.<br><br><u>Natural Disaster Overlays Code</u><br>The proposed development complies with the relevant Performance Outcomes.<br><br><u>Animals Code</u><br>The proposed development complies with the relevant Performance Outcomes or conditions have been imposed to ensure compliance, specifically for PO1.<br><br><u>Development Standards Code</u><br>The proposed development complies with the relevant Performance Outcomes or conditions have been imposed to ensure compliance, specifically for PO1, PO2, PO3, PO5, PO6, PO8, PO11, Po12, PO13 and PO17 |

## 9. Appeal rights

The rights of an applicant to appeal to a tribunal or the Planning and Environment Court against a decision about a development application are set out in chapter 6, part 1 of the Planning Act 2016. For particular applications, there may also be a right to make an application for a declaration by a tribunal (see chapter 6, part 2 of the Planning Act 2016).

*Appeal by an applicant*

An applicant for a development application may appeal to the Planning and Environment Court against the following:

- the refusal of all or part of the development application
- a provision of the development approval
- the decision to give a preliminary approval when a development permit was applied for
- a deemed refusal of the development application.

An applicant may also have a right to appeal to the Development tribunal. For more information, see schedule 1 of the Planning Act 2016.

*Appeal by a submitter*

A submitter for a development application may appeal to the Planning and Environment Court against:

- any part of the development application for the development approval that required impact assessment
- a variation request.

The timeframes for starting an appeal in the Planning and Environment Court are set out in section 229 of the Planning Act 2016.

Attachment 2 is an extract from the Planning Act 2016 that sets down the applicant's appeal rights and the appeal rights of a submitter.

The Planning and Environment Court appeals database lists all the appeals lodged in the Planning and Environment Court since 15 March 2008, which the department has been notified of. It contains information about the appeal, including the appeal number, site address, local government area, and a copy of the appeal notice, including grounds for the appeal. The appeal database is an easy way for anyone to obtain information about an appeal or check if an appeal has been lodged for a specific development application or approval.

The appeal database is available at https://planning.dsdmip.qld.gov.au/planning/our-planning-system/dispute-resolution.

Should you require further assistance in relation to this matter, please do not hesitate to contact Council's Development Services section on (07) 4992 9500, quoting you application number of MCU011-22/23.

Yours Sincerely

Chris Welch
**DIRECTOR COUNCIL SERVICES**

CC All Referral Agencies (both advice and concurrence)
State Assessment and Referral Agency (SARA)
rockhamptonSARA@dilgp.qld.gov.au

Powerlink
PO Box 1193
VIRGINIA QLD 4014

Enc Attachment 1 – Part A Conditions imposed by the Assessment Manager
Attachment 1 – Part B Assessment Manager Notes
Attachment 1 – Part C Conditions imposed by SARA
Attachment 1 – Part D PowerLink Advice
Attachment 2 – Appeal Rights
Attachment 3 – Approved Drawings
Attachment 4 – Infrastructure Charges

# MCU011-22/23 Attachment 1

*Part A - Conditions imposed by the Assessment Manager*

## General

1 **(Amended 25 October 2023)** The development is to be completed and carried out generally in accordance with the following approved plans and reports, except where modified by the conditions of this Development Approval:

| Plan/Document number | Plan/Document name | Date |
|---|---|---|
| PR151484-1 | Preliminary Site Layout prepared by RPS | Received by Council on ~~20 December 2022~~ **08 September 2023** |
| MJ2370-TIA (Revision C) | Traffic Impact Statement prepared by Northern Consulting Engineers | 30/11/2022 |
| EDF-002 (Revision A) | Surface Water and Flood Impact Assessment Report prepared by Civil IQ | 9 November 2022 |
| Version 2 | Landscape Character and Visual Impact Assessment prepared by Accent Environmental | Received by Council on 17 March 2023 |

2 Comply with all of the conditions of this Development Approval prior to the commencement of the use, unless otherwise stated within this Decision Notice, and maintain compliance for the duration of the approved use.

3 Exercise the approval and complete all associated works, including any relocation or installation of services, at no cost to Council.

4 Alterations to public utilities, mains and services made necessary in connection with any of the works arising from this approval including works to restore and reinstate all roads are to be completed at no cost to Council.

## Amended Plans

5 Final detailed layout plans of the solar farm facility are to be submitted to Council for approval prior to the commencement of the use. The plans at a minimum must show:

a. all building and structure locations;

b. substation locations;
c. inverter locations;
d. above and below ground cabling;
e. internal access roads;
f. boundary setbacks;
g. solar panel system type;
h. solar plant configuration; and
i. fencing associated with the use;

**Approved Use**

**6** The approved use of the premises is for Integrated Animal Husbandry and Public Facility – Other (Solar PV & Battery Energy Storage System.

**7** **(Retained 25 October 2023)** The approved use may operate for a maximum of 35 years from the date the facility, or part thereof, becomes operational after which the site must be returned to agricultural use.

**8** **(Amended 25 October 2023)** The approved Public Facility – Other must operate in conjunction with Animal Husbandry ~~**activities**~~ **use** at all times**, where practicable,** following the reestablishment of grasses and groundcover after construction of the solar panel arrays **so that groundcover would adequately support Animal Husbandry activities. Where the Animal Husbandry use is inhinited by unforeseen circumstances relating to animal welfare, the applicant will notify Council providing detailed information to support suspension of the Animal Husbandry use and anticipated schedule for the resumption of activities**.

**9** **(Amended 25 October 2023)** Operating mechanisms for the movement of solar arrays must ~~**be a minimum height to avoid**~~ **minimise** any conflict with grazing animals under the arrays**, as identified in a risk assessment to be prepared and submitted to Council, prior to the operation of the Animal Husbandry use**.

**Building and other works**

**10** The applicant shall obtain a development permit prior to commencement of any works defined as building work under the Building Act 1975.

**11** All habitable buildings must be located a minimum of 30 metres from any electricity transmission line.

**12** The maximum height of any building must not exceed 15 meters above natural ground level. This does not include any aerials, chimneys, flagpoles, load-bearing antenna or transmission line.

**13** Buildings, structures or other housings enclosing higher risk facilities such as battery storage are fitted with systems that manage fire and heat risks to avoid placing undue pressure on existing emergency services.

**14** Plumbing and Drainage work permit is to be obtained for any sanitary facilities or plumbing fixtures regulated under the *Plumbing and Drainage Act 2018.*

**15** **(Amended 25 October 2023)** Proposed earthworks are limited to the establishment of building pads, hardstand areas, internal roads, vehicle parking areas and minor re-profiling of land beneath the solar arrays. ~~**Buildings, roads, driveways and other works are sited and constructed without the need for cut and fill earthworks exceeding 2,000m3 of material. A development permit is required for all Operational Works**~~ **Earthworks will be be sited and constructed in accordance with an approved Operational Works permit to ensure that development is integrated with the landform and landscape of the site and surrounding area.**

**Setbacks and screening**

**16** Prior to commencement of construction of the development, the applicant must negotiate with the landowner (at the date of the approval) of land located as Lot 1 RP612153 (described as R4 in the approved Landscape Character and Visual Impact Assessment) on an agreed and reasonable solution to the visual impact of the development on this land. Evidence of such agreement is to be provided to Council prior to the commencement of construction.

In the instance that an agreement cannot be reached with the landowner prior to the commencement of construction, the Applicant must negotiate a reasonable alternative solution with Council prior to operations commencing.

**17** Except where in conflict with other conditions of this approval, the location of landscape buffers is in accordance with the approved plan and Landscape Character and Visual Impact Assessment.

**18** Project infrastructure is setback a minimum of 10 metres from all site boundaries except where greater distances are required for landscaping by Condition 20 of this approval.

**19** **(Amended 25 October 2023)** Project infrastructure is setback ~~**100**~~ **50** metres from the centreline of watercourses and 4 metres from the centreline of any drainage features (unless a greater distance is specified in the Approved Surface Water and Flood Impact Assessment Report or an Erosion and Sediment Control Plan).

20 **(Amended 25 October 2023)** Prior to installation of development infrastructure, excluding site fencing, screen landscaping in accordance with Condition 64 below is planted ~~**for a distance of 20 metres from the southern edge of the development footprint as identified on the approved plan and 10 metres from the site boundaries with Shorts Road**~~ **in the location illustrated on approved site plan (ref: 151484-1) and in accordance with the approved Landscape Character and Visual Impact Assessment (dated 28 February 2023). The landscaping along Shorts Road is to be 5 metres in width, with the landscape vegetation height in line with Condition 64 of this approval. The applicant is to submit an amended Preliminary Site Layour Plan for Council Approval, identifying the extent of the landscape buffer in accordance with the figure below, excluding site access areas.**


21 No development occurs within the easement associated with the electricity transmission lines traversing the site, unless permitted in the advice provided by Powerlink (as attached).

22 No animal enclosures (e.g., stables, barns, holding yards) are permitted within 100 metres of a residence not associated with the use.

**Road work and access**

23 **(Amended 25 October 2023)** Prior to commencement of development works, Shorts Road must be upgraded to address the safety deficiencies identified in the approved Traffic Impact Statement. The works must be

undertaken in accordance with an Operational Works approval and as per the following:

a. Shorts Road is to be upgraded to a minimum 2-coat seal in accordance with the Capricorn Municipal Design Guidelines**, subject to a minimum width of 6.5 metres**. Erosion and sediment controls are to be implemented during this construction process.
b. Signage warning of the isolated humps within the roadway section are to be installed to improve awareness for unfamiliar drivers.

**24** Prior to undertaking any road upgrade works identified in the conditions of this development permit, provide a bank guarantee for an amount equivalent to 10% of the value of the road upgrade works.

**25** Shorts Road is to be maintained by the applicant during the construction process. This road reserve is to remain of a standard consistent of the pre-development or better, in addition to the works detailed in Condition 23. The maintenance is to be undertaken in accordance with an Operational Works approval until the development is deemed practically complete.

**26** Any damage to the existing road surface, services or furniture as a result of the development is to be repaired to the pre-existing or better condition within a reasonable period at no cost to Council.

**27** Vehicle access is to be provided in accordance with the approved plan and be the subject of an Operational Works approval. Each access shall be constructed as per the proposed plan and in accordance with the requirements of the Capricorn Municipal Development Guidelines (Standard Drawing CMDG-R-040) for a rural access. Please note that the dimensions listed on this standard drawing are considered the minimum required for compliance.

**Vehicle Parking and Manoeuvring Areas**

**28** The proposed internal access roads are to be constructed so as to be a minimum of 4 metres wide and be constructed of a suitably designed surface in accordance with an Operational Works approval.

**29** Provide sufficient parking and manoeuvring, loading/unloading space on-site for all vehicles at the operational phase. All car parking spaces for employees of the proposed development must be:

I. clearly line marked and/or delineated to the satisfaction of the Assessment Manager; and;
II. located on the site and be fully contained within the title boundaries.

**30** No vehicle storage or parking is permitted on the adjoining road reserve.

**31** All vehicles accessing the site must be able to enter and exit in a forward gear.

## Water and Sewerage Infrastructure

**32** At the time of lodging a building application, documentation is required to be submitted to Council that demonstrates that a reasonable water supply for potable (including adequate storage for a minimum 45,000 litres capacity volume) is available for the development.

**33** A separate storage system that permanently holds a minimum 5,000 litres is located within 50m of new buildings, exclusively for firefighting purposes. The storage system must allow for immediate access by emergency services plant.

**34** The minimum standard of wastewater treatment to be considered is secondary treatment incorporating disinfection. Appropriate reserve disposal areas are to be provided and maintained on the site.

**35** Prior to the commencement of use, an effluent disposal/storage system, appropriate for the proposed development, is to be installed in accordance with a detailed report prepared by a suitably qualified person. All relevant approvals for this system, in accordance with the requirements of the *Plumbing and Drainage Act*, are to be obtained before installation.

**36** The proposed effluent disposal/storage system is to be maintained so that all effluent is wholly contained within the confines of the development site and does not pond or enter any gully, watercourse, stormwater system or adjoining properties.

## Stormwater

**37** The development does not adversely interfere with the existing hydrological regime of adjoining properties or catchments

**38** Stormwater Management is to be undertaken in accordance with the approved Surface Water and Flood Impact Assessment Report.

**39** All stormwater infrastructure must be designed and constructed, prior to the commencement of use, as per the requirements of the Approved Surface Water and Flood Impact Assessment Report.

**40** The stormwater drainage system must be designed so that the development will not make material changes to the pre-development location, duration, frequency or concentration of overland stormwater flow at the point of discharge to all downstream properties, including road reserves. In the event that a material change to the pre-development stormwater flows cannot be avoided, provide written evidence to Council's satisfaction of a legal right to discharge stormwater over the downstream land in the proposed method.

41 Ponding of stormwater resulting from the development must not occur on adjacent properties.

42 Stormwater formerly flowing onto the site must not be diverted onto other properties.

43 All stormwater being discharged from the site is to meet the requirements of the Capricorn Municipal Development Guidelines and the Queensland Water Quality Guidelines 2009.

44 Contaminated water must not be directly or indirectly released from the premises onto the ground or into the groundwater at the premises.

45 Releases to stormwater must not cause any visible oil slick or other visible evidence of oil or grease, nor contain visible grease, scum, litter or floating oil.

**Erosion and Sediment Control**

46 A detailed Erosion and Sediment Control Plan, and associated engineered drawings, prepared by a Registered Professional Engineer of Queensland in accordance with the *Capricorn Municipal Design Guidelines*, is to be provided to Council as part of the Operation Works application.

47 During construction, the Developer is to undertake sedimentation and erosion control management in accordance with the approved Erosion and Sediment Management Plan.

48 Erosion and sediment control measures are to be maintained post-construction until disturbed areas are permanently stabilised through vegetation and/or landscaping.

**Construction Environmental Management Plan**

49 A Construction Environmental Management Plan (CEMP), prepared and certified by a suitably qualified person, is to be provided to Council as part of the Operation Works application. The CEMP is to ensure all potential impacts of the development are adequately controlled and provide detailed practical and achievable prevention, minimisation and mitigation strategies (including design standards) for controlling environmental impacts of the development.

50 The applicant must implement the recommendations of the approved CEMP including any recommended works, installation of monitoring equipment and management measures at all times during construction of the development.

## Operational Environmental Management Plan

**51** The Applicant must prepare and submit a detailed Operational Environmental Management Plan (OEMP), prepared and certified by a suitably qualified person, identifying environmental management measures to be implemented during operation of the development to Council for approval at least 40 working days prior to operations commencing. The plan must be approved by Council before operations commence.

**52** The applicant must implement the recommendations of the approved OEMP including any recommended works, installation of monitoring equipment and management measures at all times during operation of the development.

## Vegetation management

**53** Vegetation clearing undertaken as a consequence of development occurs in compliance with the *Vegetation Management Act 1999* and *Nature Conservation Act 1992.*

**54** Maintain development buffers to watercourses and/or drainage features in accordance with the approved plan and Condition 19 to minimise the removal of vegetation.

## Biosecurity

**55** Imported soil/fill used as part of works must be certified as weed free. A Weed Hygiene Declaration for the soil is to be provided to Council on request.

**56** Invasive biosecurity matters must be managed to prevent or minimise the harmful effects a biosecurity risk could have on adjacent agricultural land uses and environmental qualities. A biosecurity plan is to be prepared, approved by Council and implemented which identifies pertinent biosecurity risks and details reasonable and practical measures to prevent or minimise the biosecurity risks.

## Amenity

**57** The photovoltaic panels, any visible support structures, framing, cabling, or other equipment and infrastructure shall have a non-reflective or matte finish.

**58** In the event that panels become 'out-of-sync' (i.e., not tracking the sun such that the panels are perpendicular to the sun), the affected panels are to be repaired as soon as reasonably practicable; or removed; or adjusted to remain in a fixed stowed position (so that potential for reflection is minimised for any sensitive receptors) until the repair is completed.

59 The applicant must ensure that when undertaking any on-site or external works, including any filling and excavation, appropriate dust control measures are implemented in accordance with the *Environmental Protection Act 1994* and complies with the relevant air quality objectives defined in the Environmental Protection (Air) Policy 2019.

60 Operations on the site must have no significant impact on the amenity of adjoining premises or the surrounding area due to the emission of light, noise, dust or odour.

61 When requested by Council, nuisance monitoring must be undertaken and recorded within 3 months, to investigate any genuine complaint of nuisance caused by noise, light, odour or dust. An analysis of the monitoring data and a report, including nuisance mitigation measures, must be provided to Council within 14 days of the completion of the investigation.

62 Any lighting devices associated with the development, such as sensory lighting, must be positioned on the development site and shielded so as not to cause glare or other nuisance to nearby residents and motorists. Night lighting must be designed, constructed and operated in accordance with Australian Standard *AS4282 Control of the obtrusive effects of outdoor lighting*.

**Landscaping**

63 Prior to the commencement of the installation of any infrastructure associated with the use, the applicant is to submit for approval to Council, a landscaping plan in accordance with Section 6 of the approved Landscape Character and Visual Impact Assessment showing the vegetated buffers identified in Condition 20. The landscaping plan must include:

a. Identification of any existing vegetation to be retained as part of site landscaping;
b. A list of plantings, the species to be used, containing predominantly species that are endemic to Central Queensland;
c. The location of plantings, spaced to achieve a dense screen;
d. Sections through each area of landscaping showing the mature heights of the planted native vegetation
e. A watering and maintenance plan during the establishment phase;
f. An ongoing maintenance and replanting program.

64 **(Amended 25 October 2023)** Landscaping provided to the perimeter of the site, including road frontages traversing the site, has predominantly low to mid storey planting to screen view of the solar infrastructure more effectively from adjacent areas. Landscaping of internal areas (e.g., watercourses, drainage lines, etc.) **~~focuses on taller species to screen views from areas further away~~ will be provided where the opportunity arise, that would not be in conflict with the stormwater drainage system's compatibility across the site and the approved activities**.

**65** The landscaping is to be maintained in a tidy manner by the developer (i.e., watering, fertilising, mulching, weeding, and the like) at all times to the satisfaction of the Assessment Manager.

**66** Any significant trees to be retained as part of proposed landscaping are to be protected during construction.

**Fencing and signage**

**67** The applicant must install safety / security fencing a minimum of 1.8 metres in height along all property boundaries to prevent unauthorised or accidental public entry. The fencing must not obscure sight lines at corners or intersections. Where fronting the Biloela-Callide Road stock route, fencing must be stock resistant to prevent travelling stock entering the site.

**68** The applicant must install industry standard warning signage on all boundaries of the site, at regular intervals, warning of the safety hazards associated with the approved use.

**69** Erect and maintain a single sign with a minimum area of six square metres adjacent to each access for the approved use. The sign must display as a minimum:
the name of the business operating on the premises;
the maximum onsite speed limit of 20km/h;
contact details for complaints and the site office.

**70** All fencing must be completed prior to the commencement of use.

**Waste**

**71** The applicant is required to prepare a Waste Management Plan for the proposed development. The plan should include, but is not limited to, the following:

a. A description of the development activities that may generate waste
b. The types and amount of waste that might be generated by the activities
c. how the waste will be dealt with, including a description of the types and amounts of waste that will be dealt with under each waste management practices under the waste hierarchy
d. procedures for identifying and implementing opportunities to minimise the amount of waste generated, promote efficiency in the use of resources, and otherwise improve the waste management practices employed
e. procedures for dealing with accidents, spills and other incidents that may impact waste management
f. how often the waste management practices will be assessed

**72** Recycling and waste must use appropriately licensed facilities.

**73** Waste must not be burned at the premises.

**74** No disposal of any solar panels or associated material is permitted to municipal landfill facilities.

**Site rehabilitation**

**75** **(Retained 25 October 2023)** Bank guarantees are to be provided to Council at the commencement of construction of the development to be held against the cost of rehabilitating the site post-operation. The amount of the bank guarantee is to be agreed between the developer and Council and is to represent a reasonable estimation of rehabilitation costs less the estimated value of the renewable energy equipment situated on the site. The value of the bond is to be reviewed annually at the request of Council or the developer.

**76** A minimum of 12 months prior to operations associated with the approved use ceasing on the premises the applicant must provide a Site Rehabilitation Plan (SRP) to Council detailing proposed site rehabilitation works.

**77** Within 12 months of operations associated with the approved use ceasing on the premises and decommissioning of the facility, land that has been disturbed must be rehabilitated in a manner such that:

permits the rural use of the site to be re-established (unless otherwise agreed with the landholder or relevant authorities); and

the final landform is stable, potential erosion is minimised and protects public safety.

**78** Decommissioning activities to be undertaken as part of site rehabilitation (cessation of approved use) must include:

a. disconnection of the connection point at the substation
b. disconnection and removal of the solar panels for recycling
c. removal of all buildings and equipment, with materials recycled wherever possible
d. removal of steel framework/supports and cabling for recycling
e. removal of underground infrastructure
f. removal of fencing (unless otherwise agreed by the landholder or relevant authorities)

**79** Within 6 months of the site rehabilitation works being completed the applicant must submit a Site Conditions Report detailing the condition of the site following the recommended works stipulated in the SRP.

# MCU011-22/23 Attachment 1

## *Part B – Assessment Manager Notes*

**A** The approved development must also comply with Council's current Local Laws under the *Local Government Act 2009*.

**B** The applicant and or owner/s of the land and the person/s responsible for the management of the premise is/are to ensure ongoing compliance with conditions of this Development Permit including Conditions relating to the ongoing use of the premise, and the design and layout of the development.

**C** Pursuant to section 75 of the *Local Government Act 2009*, Council's written approval is required to carry out works on a road, or interfere with a road or its operation. This requirement applies to all Council-controlled roads within its local government area. The process for obtaining approval is set out in Council's *Local Law No. 1 (Administration) 2011.* Approval must be obtained prior to the commencement of the works.

**D** Please note the statements dated 21 February 2023 from Powerlink as an advice agency and attached to this Decision Notice.

**E** Where further development is proposed it is the applicant's / developer's responsibility to ensure further approvals are sought as required by the Banana Shire Planning Scheme.

**Engineering**

**F.** Prior to commencing any of the following construction activities the applicant/developer will be required to obtain a development permit for operational work:

i. Internal and external roadworks;
ii. earthworks;
iii. stormwater drainage ;
iv. erosion and sediment control;
v. internal and external lighting; and
vi. landscaping.

**G.** All works required by this approval shall be undertaken and completed in accordance with Council's Standards - Capricorn Municipal Development Guidelines (www.cmdg.com.au) at the Applicant's expense.

**H.** Any works on roads shall be conducted in accordance with the Queensland Department of Transport and Main Roads, "Manual of Uniform Traffic Control Devices – Part 3".

## Cultural Heritage

I It is advised that under section 23 of the *Aboriginal Cultural Heritage Act 2003*, a person who carries out an activity must take all reasonable and practicable measures to ensure the activity does not harm Aboriginal cultural heritage (the "cultural heritage duty of care"). Maximum penalties for breaching the duty of care are listed in the Aboriginal cultural heritage legislation. The information on Aboriginal cultural heritage is available on the Department of Aboriginal and Torres Strait Islander and Partnerships website: www.datsip.qld.gov.au

## Biosecurity

J Section 23 of the *Biosecurity Act 2014* outlines the General Biosecurity Obligation. All landowners have a General Biosecurity Obligation (GBO) for managing biosecurity risks that are under their control and that they know about or should reasonably be expected to know about. All individuals and organisations whose activities pose or is likely to pose a biosecurity risk must:

- take all reasonable and practical measures to prevent or minimise the biosecurity risk
- minimise the likelihood of causing a biosecurity event and limit the consequences if such an event occurs
- prevent or minimise the harmful effects a biosecurity risk could have
- not do anything that might make any harmful effects of a biosecurity risk worse

A biosecurity risk exists when you deal with any pest, disease, weed or contaminant. This includes moving an animal, plant, turf, soil, machinery and/or equipment that could carry a pest, disease, weed or contaminant.

## Environmental Nuisance

K It is an offence under section 440 of the *Environmental Protection Act 1994* to cause environmental nuisance to adjacent premises or other property during construction work. Environmental nuisance includes unreasonable interference caused by noise, dust, fumes, odour, smoke, aerosols, particles or light.

L It is the developer's responsibility to ensure compliance with the *Environmental Protection Act 1994*, which prohibits any construction, building and earthworks activities likely to cause nuisance noise (including the entry and departure of heavy vehicles) between the hours of 6.30 pm and 6.30 am from Monday to Saturday and at all times on Sundays or Public Holidays.

**General Environmental Duty**

**M** The *Environmental Protection Act 1994* lists obligations and duties to prevent environmental harm, nuisances and contamination. The two primary duties that apply to everyone in Queensland are:

**general environmental duty** – which means a person must not carry out any activity that causes or is likely to cause environmental harm, unless measures to prevent or minimise the harm have been taken; and
**duty to notify of environmental harm** – to inform the administering authority and landowner or occupier when an incident has occurred that may have caused or threatens serious or material environmental harm.

**N** In carrying out the activity or works associated with the development, all reasonable and practical measures are to be taken to minimise releases and the likelihood of releases of contaminants to the environment, except as otherwise provided by the conditions of this development approval.

**Mosquito breeding**

**O** The site is required to be appropriately drained so that water is not allowed to accumulate or pond in a manner that may allow mosquito breeding, as required under the *Public Health Regulation 2005*.

**Nature Conservation (Plants and Animals)**

**P** It is an offence under section 335 of the Nature Conservation (Animals) Regulation 2020 to remove, or tamper with, an animal breeding place that is being used by a protected animal to incubate or rear the animal's offspring.

Animal breeding places include obvious structures such as bird nests and tree hollows, as well as more cryptic places such as amphibian or reptile habitat where breeding takes place. Where activities are likely to impact on an animal breeding place, the applicant should contact the Queensland Department of Environment and Science to discuss if additional actions are required to be undertaken to meet obligations under the *Nature Conservation Act 1992.*

**Vegetation Management**

**Q** The *Vegetation Management Act 1999* regulates the clearing of vegetation in Queensland. No interference or clearing of vegetation is to be undertaken (unless the clearing is exempt, a development approval authorising the clearing has been obtained or the clearing is authorised in accordance with a code). Contact the Queensland Department of Resources should you require any further information on these matters.

**Water & Sewerage**

**R** Subsequent applications will be required for Operational Works, Building and Plumbing/Drainage Works. Building works are to comply with the *Building Act 1975*, the Building Code of Australia and other relevant authorities.

**S** All new taps and plumbing fixtures on the site are to be installed and maintained with approved water saving devices in accordance with current legislative and Council requirements (AAA rating or better). The installation shall include but not be limited to approved water efficient shower heads, flow restrictors/aerators on internal taps, dual flush toilets, etc. In addition approved water efficient washing machines, dishwashers and other appliances shall be the only appliances installed on the site. Pre and post installation inspections shall be arranged with Council's Plumbing Inspector.

**T** Hydraulic Services plans will be required to be submitted to Council for Plumbing and Drainage approval. These plans must show all drinking, non-drinking, heated, rainwater, sanitary plumbing, sanitary drainage and trade waste services.

**Amenity**

**U** Air and light emissions must be appropriately managed to prevent environmental nuisance beyond the boundaries of the property during all stages of the development including earthworks and construction.

**V** Suitable dust suppression should be used, where required during excavation and building works, to reduce the emission of dust or other such emissions from the site.

**W** Artificial illumination should not cause a nuisance to occupants of nearby premises and any passing traffic. Security and flood lighting is to be directed away from adjacent premises to minimise the protrusion of light outside the site.

**Water & Stormwater**

**X** It is an offence under the *Environmental Protection Act 1994* to discharge sand, silt, mud and other such contaminants to a stormwater drain, roadside gutter or a watercourse.

**Y** It is an offence under the *Environmental Protection Act 1994* to discharge or permit a prescribed water contaminant to enter a stormwater drain, roadside gutter or a watercourse. Prescribed contaminants include a wide variety of contaminants listed in Schedule 9 of the *Environmental Protection Act 1994.*

**Waste Management**

**Z** It is an offence under the *Waste Reduction and Recycling Act 2011* to leave litter behind or allow litter to blow from site. All waste must be appropriately contained on site prior to removal.

**AA** Trap Gully Landfill is the only approved waste facility within the Banana Shire for the disposal of commercial waste. No commercial waste is to be deposited at other Banana Shire landfills or transfer stations without prior written approval from Council.

# MCU011-22/23 Attachment 1

*Part C - Conditions imposed by the SARA*

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Queensland Government

SARA reference: 2301-32909 SRA
Council reference: MCU011-22/23

28 February 2023

Chief Executive Officer
Banana Shire Council
PO Box 412
Biloela QLD 4715
enquiries@banana.qld.gov.au

Attention: Rentia Robertson

Dear Sir/Madam

# SARA referral agency response— 551 and 641 Biloela Callide Road and Shorts Road, Mount Murchison

(Referral agency response given under section 56 of the *Planning Act 2016*)

The development application described below was confirmed as properly referred by the State Assessment and Referral Agency (SARA) on 17 January 2023.

## Response

| | |
|---|---|
| Outcome: | Referral agency response – with conditions |
| Date of response: | 28 February 2023 |
| Conditions: | The conditions in **Attachment 1** must be attached to any development approval |
| Advice: | Advice to the applicant is in **Attachment 2** |
| Reasons: | The reasons for the referral agency response are in **Attachment 3** |

## Development details

| | | |
|---|---|---|
| Description: | Development Permit | Material Change of Use - Solar Farm and Animal Husbandry |
| SARA role: | Referral agency | |
| SARA trigger: | Schedule 10, Part 9, Division 4, Subdivision 2, Table 4, Item 1 (Planning Regulation 2017) | |



Fitzroy/Central regional office
Level 2, 209 Bolsover Street, Rockhampton
PO Box 113, Rockhampton QLD 4700

| | |
|---|---|
| | Material change of use of premises within 25m of a state-controlled road and railway corridor |
| SARA reference: | 2301-32909 SRA |
| Assessment manager: | Banana Shire Council |
| Street address: | 551 and 641 Biloela Callide Road and Shorts Road, Mount Murchison |
| Real property description: | Lot 154 on SP126053; Lot 28 on RN519; Lot 2 on RP619032; Lot 3 on RP608599 |
| Applicant name: | Edify Energy C/- RPS AAP Consulting Pty Ltd |
| Applicant contact details: | PO BOX 1559<br>Fortitude Valley QLD 4006<br>harry.connolly@rpsgroup.com.au |
| State-controlled road access permit: | This referral included an application for a changed road access under section 62A(2) of *Transport Infrastructure Act 1994*. Below are the details of the decision:<br>• Approved<br>• Reference: TMR23-038441<br>• Date: 17 February 2023<br><br>If you are seeking further information on the road access permit, please contact the Department of Transport and Main Roads at Central.Queensland.IDAS@tmr.qld.gov.au |
| *Human Rights Act 2019* considerations: | A consideration of the 23 fundamental human rights protected under the *Human Rights Act 2019* has been undertaken as part of this decision. It has been determined that this decision does not limit human rights. |

## Representations

An applicant may make representations to a concurrence agency, at any time before the application is decided, about changing a matter in the referral agency response (s.30 Development Assessment Rules). Copies of the relevant provisions are in **Attachment 4**.

A copy of this response has been sent to the applicant for their information.

For further information please contact Leanne Simpson, Principal Planning Officer, on 5352 9707 or via email RockhamptonSARA@dsdilgp.qld.gov.au who will be pleased to assist.

Yours sincerely

Steve Conner
Executive Director

cc Edify Energy, harry.connolly@rpsgroup.com.au

enc Attachment 1 - Referral agency conditions
Attachment 2 - Advice to the applicant
Attachment 3 - Reasons for referral agency response
Attachment 4 - Representations about a referral agency response provisions

## Attachment 1—Referral agency conditions

(Under section 56(1)(b)(i) of the *Planning Act 2016* the following conditions must be attached to any development approval relating to this application)

| No. | Conditions | Condition timing |
|---|---|---|
| **Material Change of Use – Solar Farm and Animal Husbandry** | | |
| 10.9.4.2.4.1 – Material change of use near a state transport corridor—The chief executive administering the *Planning Act 2016* nominates the Director-General of Department of Transport and Main Roads to be the enforcement authority for the development to which this development approval relates for the administration and enforcement of any matter relating to the following condition(s): | | |
| 1. | (a) Provide road works comprising basic left turn (BAL) at Biloela Callide Road / Shorts Road intersection.<br>(b) Design and construct the road works in accordance with the TMR Road Planning and Design Manual 2nd Edition to cater for a 19m semi-trailer. | Prior to commencement of use |
| 2. | (a) Permanently close and remove the existing vehicular property access located at Lot 2 on RP619032 and Biloela Callide Road.<br>(b) Reinstate the table drain between the pavement edge and the property boundary in accordance with the TMR Road Planning and Design Manual at no cost to the Department of Transport and Main Roads. | Prior to commencement of use |
| 3. | (a) Stormwater management resulting from the development must ensure no worsening or actionable nuisance to the state-controlled road.<br>(b) Any works on the land must not:<br>(i) create any new discharge points for stormwater runoff onto the state-controlled road<br>(ii) interfere with and/or cause damage to the existing stormwater drainage on the state-controlled road<br>(iii) surcharge any existing culvert or drain on the state-controlled road<br>(iv) reduce the quality of stormwater discharge onto the state-controlled road. | At all times |

# Attachment 2—Advice to the applicant

| General advice | |
|---|---|
| 1. | Terms and phrases used in this document are defined in the *Planning Act 2016*, its regulation or the State Development Assessment Provisions (SDAP) (version 3.0). If a word remains undefined it has its ordinary meaning. |
| 2. | Under section 33 of the *Transport Infrastructure Act 1994,* written approval is required from the Department of Transport and Main Roads to carry out road works on a state-controlled road. Please contact the Department of Transport and Main Roads on 4931 1500 to make an application for road works approval. This approval must be obtained prior to commencing any works in the state-controlled road reserve. The approval process will require the approval of engineering designs of the proposed works, certified by a Registered Professional Engineer of Queensland (RPEQ). |

# Attachment 3—Reasons for referral agency response

(Given under section 56(7) of the *Planning Act 2016*)

**The reasons for the SARA's decision are:**

- The development application is for a Material Change of Use – Solar Farm and Animal Husbandry at 551 and 641 Biloela Callide Road and Shorts Road, Mount Murchison
- The site is within 25m of a state-controlled road, being Biloela Callide Road, and within 25m of a railway corridor
- The development proposes a changed access to the state-controlled road, being closure of a redundant vehicular access, requiring an access decision under s62A of the *Transport Infrastructure Act 1994*
- The application requires assessment by SARA against the State Development Assessment Provisions (SDAP), version 3.0, State code 1: Development in a state-controlled road environment and State code 2: Development in a railway environment
- SARA has assessed the development against State codes 1 and 2 and found the development complies with the relevant performance outcomes, subject to conditions to:
  - upgrade the Biloela Callide Road / Shorts Road intersection to provide a basic left turn (BAL) suitable to accommodate a 19m semi-trailer
  - close the existing vehicular property access at Lot 2 on RP619032 and reinstatement of the table drain
  - ensure that the impacts of stormwater events associated with development are minimised and managed to avoid creating any adverse impacts on the state-controlled road corridor.

**Material used in the assessment of the application:**

- the development application material and submitted plans
- *Planning Act 2016*
- Planning Regulation 2017
- the SDAP (version 3.0), as published by SARA
- the Development Assessment Rules
- SARA DA Mapping system
- section 58 of the *Human Rights Act 2019*

# Attachment 4—Representations about a referral agency response provisions

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# Development Assessment Rules—Representations about a referral agency response

The following provisions are those set out in sections 28 and 30 of the Development Assessment Rules[1] regarding **representations about a referral agency response**

# Part 6: Changes to the application and referral agency responses

## 28 Concurrence agency changes its response or gives a late response

28.1. Despite part 2, a concurrence agency may, after its referral agency assessment period and any further period agreed ends, change its referral agency response or give a late referral agency response before the application is decided, subject to section 28.2 and 28.3.

28.2. A concurrence agency may change its referral agency response at any time before the application is decided if—

(a) the change is in response to a change which the assessment manager is satisfied is a change under section 26.1; or

(b) the Minister has given the concurrence agency a direction under section 99 of the Act; or

(c) the applicant has given written agreement to the change to the referral agency response.[2]

28.3. A concurrence agency may give a late referral agency response before the application is decided, if the applicant has given written agreement to the late referral agency response.

28.4. If a concurrence agency proposes to change its referral agency response under section 28.2(a), the concurrence agency must—

(a) give notice of its intention to change its referral agency response to the assessment manager and a copy to the applicant within 5 days of receiving notice of the change under section 25.1; and

(b) the concurrence agency has 10 days from the day of giving notice under paragraph (a), or a further period agreed between the applicant and the concurrence agency, to give an amended referral agency response to the assessment manager and a copy to the applicant.

1 Pursuant to Section 68 of the *Planning Act 2016*

2 In the instance an applicant has made representations to the concurrence agency under section 30, and the concurrence agency agrees to make the change included in the representations, section 28.2(c) is taken to have been satisfied.

# Part 7: Miscellaneous

## 30 Representations about a referral agency response

30.1. An applicant may make representations to a concurrence agency at any time before the application is decided, about changing a matter in the referral agency response.[3]

[3] An applicant may elect, under section 32, to stop the assessment manager's decision period in which to take this action. If a concurrence agency wishes to amend their response in relation to representations made under this section, they must do so in accordance with section 28.

Our ref TMR23-038441
Your ref
Enquiries Jason Giddy

Queensland Government

Department of
**Transport and Main Roads**

17 February 2023

# Decision Notice – Permitted Road Access Location

## (s62(1) *Transport Infrastructure Act 1994*)

This is not an authorisation to commence work on a state-controlled road[1]

Development application reference number MCU011-22/12, lodged with Banana Shire Council involves constructing or changing a vehicular access between Lot 154SP126053 and Lot 2RP619032, the land the subject of the application, and 472 Biloela – Callide Road (a state-controlled road).

In accordance with section 62A(2) of the *Transport Infrastructure Act 1994* (TIA), this development application is also taken to be an application for a decision under section 62(1) of TIA.

**Applicant Details**

| | |
|---|---|
| Name and address | Edify Energy<br>c/- RPS AAP Consulting Pty Ltd PO Box 1559<br>Fortitude Valley QLD 4006 |

**Application Details**

| | |
|---|---|
| Address of Property | 551 Biloela Callide Road, Mount Murchison QLD 4715 |
| Real Property Description | Lot 154SP126053 and Lot 2RP619032 |

**Decision (given under section 67 of TIA)**

It has been decided to approve the application, subject to the following conditions:

| No. | Conditions of Approval | Condition Timing |
|---|---|---|
| 1 | The permitted road access location to Lot 154 on SP126053, is to be located at approximate chainage 5.557km (lat: -24.366656; long: 150.587398) on 472 Biloela – Callide Road. | At all times. |
| 2 | Direct access to the state-controlled road from Lot 2 on RP619032 is prohibited. | At all times. |
| 3 | The existing property access to Lot 2 on RP619032, located at approximate chainage 6.483km (lat: -24.363967; long: 150.596032) must be removed and the table drain reinstated. | Prior to commencement of use. |

[1] Please refer to the further approvals required under the heading 'Further approvals'

Program Delivery and Operations
Fitzroy District
31 Knight Street North Rockhampton QLD 4701
PO Box 5096 Red Hill Rockhampton QLD 4701

**Telephone** +61 7 (07) 4931 1686
**Website** www.tmr.qld.gov.au
**Email** Central.Queensland.IDAS@tmr.qld.gov.au
ABN: 39 407 690 291

| No. | Conditions of Approval | Condition Timing |
|---|---|---|
| 4 | The road access is to be constructed and maintained at no cost to the department in accordance with section 64(a) & (b) of the *Transport Infrastructure Act 1994*. | At all times. |
| 5 | The applicant shall be responsible for all maintenance works for the access in accordance with Module 9 of the Local Government Association of Queensland document 'TMR/Local Government Cost Sharing Arrangement', dated October 2017. | At all times. |
| 6 | All vehicles entering or exiting the property via the permitted access must travel in a forward direction only. | At all times. |
| 7 | Reasonable steps are taken to ensure that the permitted road access is used by others in accordance with these conditions. | At all times. |

**Reasons for the decision**

The reasons for this decision are as follows:

a) To remove a redundant property access no longer required due to the material change of use removing the existing dwelling and therefore the need for access.
b) The use is intended to obtain access via Shorts Road.
c) To approve an existing property access that remains required to provide access to Lot 154SP126053.

Please refer to **Attachment A** for the findings on material questions of fact and the evidence or other material on which those findings were based.

**Information about the Decision required to be given under section 67(2) of TIA**

1. There is no guarantee of the continuation of road access arrangements, as this depends on future traffic safety and efficiency circumstances.

2. In accordance with section 70 of the TIA, the applicant for the planning application is bound by this decision. A copy of section 70 is attached as **Attachment B**, as required, for information.

**Further information about the decision**

1. In accordance with section 67(7) of TIA, this decision notice:
   a) starts to have effect when the development approval has effect; and
   b) stops having effect if the development approval lapses or is cancelled; and
   c) replaces any earlier decision made under section 62(1) in relation to the land.

2. In accordance with section 485 of the TIA and section 31 of the *Transport Planning and Coordination Act 1994* (TPCA), a person whose interests are affected by this decision may apply for a review of this decision only within 28 days after notice of the decision was given under the TIA. A copy of the review provisions under TIA and TPCA are attached in **Attachment C** for information.

3. In accordance with section 485B of the TIA and section 35 of TPCA a person may appeal against a reviewed decision. The person must have applied to have the decision reviewed before an appeal about the decision can be lodged in the Planning and Environment Court. A copy of the Appeal Provisions under TIA and TPCA is attached in **Attachment C** for information.

**Further approvals**

The Department of Transport and Main Roads also provides the following information in relation to this approval:

1. Road Access Works Approval Required – Written approval is required from the department to carry out road works that are road access works (including driveways) on a state-controlled road in accordance with section 33 of the TIA. This approval must be obtained prior to commencing any works on the state-controlled road. The approval process may require the approval of engineering designs of the proposed works, certified by a Registered Professional Engineer of Queensland (RPEQ). Please contact the department to make an application.

If further information about this approval or any other related query is required, Mr Jason Giddy, Senior Town Planner should be contacted by email at CorridorManagement@tmr.qld.gov.au or on (07) 4931 1686.

Yours sincerely

Jason Giddy
Senior Town Planner

Attachments: Attachment A – Decision evidence and findings
Attachment B - Section 70 of TIA
Attachment C - Appeal Provisions

## Attachment A

## Decision Evidence and Findings

Findings on material questions of fact:

- Planning application (council ref. DA066-2022; SARA ref. 2301-32811 SRA) was referred to the Department of Transport and Main Roads (TMR) in accordance with Schedule 10 of the *Planning Regulation 2017*.
- The application is a Material Change of Use for a Solar Farm, Battery Storage and Animal Husbandry. The planning application is taken to be an application for a permitted access location in accordance with section 62(A) of the *Transport Infrastructure Act 1994* (TIA).
- The department assessed the application in accordance with the State Development Assessment Provisions v3.0, the provisions of the *Transport Infrastructure Act 1994* and the TMR Vehicular Access Policy (VAP).
- The use will obtain access via Shorts Road for all construction and operation activities. This results in the property access into Lot 2 RP619032 becoming redundant. The existing property access to Lot 154 SP126053 will remain as the use does not extend to the dwelling on this parcel. The access locations have been refused and approved respectively.
- As the property access into Lot 2 RP619032 is redundant, it must be removed to ensure access is obtained via the local road network in accordance with Principle 2, Strategy 2 of the TMR Vehicular Access Policy.

Evidence or other material on which findings were based:

- *Transport Infrastructure Act 1994*
- *Planning Act 2016*
- *Planning Regulation 2017*
- TMR Vehicular Access Policy

**Attachment B**

**Section 70 of TIA**



## 70 Offences about road access locations and road access works, relating to decisions under s 62(1)

(1) This section applies to a person who has been given notice under section 67 or 68 of a decision under section 62(1) about access between a State-controlled road and adjacent land.

(2) A person to whom this section applies must not—

(a) obtain access between the land and the State-controlled road other than at a location at which access is permitted under the decision; or

(b) obtain access using road access works to which the decision applies, if the works do not comply with the decision and the noncompliance was within the person's control; or

(c) obtain any other access between the land and the road contrary to the decision; or

(d) use a road access location or road access works contrary to the decision; or

(e) contravene a condition stated in the decision; or

(f) permit another person to do a thing mentioned in paragraphs (a) to (e); or

(g) fail to remove road access works in accordance with the decision.

Maximum penalty—200 penalty units.

(3) However, subsection (2)(g) does not apply to a person who is bound by the decision because of section 68.

**Attachment C**

**Appeal Provisions**



## 485 Internal review of decisions

(1) A person whose interests are affected by a decision described in schedule 3 (the ***original decision***) may ask the chief executive to review the decision.

(2) The person is entitled to receive a statement of reasons for the original decision whether or not the provision under which the decision is made requires that the person be given a statement of reasons for the decision.

(3) The *Transport Planning and Coordination Act 1994*, part 5, division 2—

(a) applies to the review; and

(b) provides—

(i) for the procedure for applying for the review and the way it is to be carried out; and

(ii) that the person may apply to QCAT to have the original decision stayed.

## 485B Appeals against decisions

(1) This section applies in relation to an original decision if a court (the appeal court) is stated in schedule 3 for the decision.

(2) If the reviewed decision is not the decision sought by the applicant for the review, the applicant may appeal against the reviewed decision to the appeal court.

(3) The Transport Planning and Coordination Act 1994, part 5, division 3—

(a) applies to the appeal; and

(b) provides—

(i) for the procedure for the appeal and the way it is to be disposed of; and

(ii) that the person may apply to the appeal court to have the original decision stayed.

(4) Subsection (5) applies if—

(a) a person appeals to the Planning and Environment Court against a decision under section 62(1) on a planning application that is taken, under section 62A(2), to also be an application for a decision under section 62(1); and

(b) a person appeals to the Planning and Environment Court against a decision under the Planning Act on the planning application.

(5) The court may order—

(a) the appeals to be heard together or 1 immediately after the other; or

(b) 1 appeal to be stayed until the other is decided.

(6) Subsection (5) applies even if all or any of the parties to the appeals are not the same.

(7) In this section—

***original decision*** means a decision described in schedule 3.

***reviewed decision*** means the chief executive's decision on a review under section 485.

## 31 Applying for review

(1) A person may apply for a review of an original decision only within 28 days after notice of the original decision was given to the person under the transport Act.

(2) However, if—

(a) the notice did not state the reasons for the original decision; and

(b) the person asked for a statement of the reasons within the 28 days mentioned in subsection (1)

the person may apply within 28 days after the person is given the statement of the reasons.

(3) In addition, the chief executive may extend the period for applying.

(4) An application must be written and state in detail the grounds on which the person wants the original decision to be reviewed.

## 32 Stay of operation of original decision

(1) If a person applies for review of an original decision, the person may immediately apply for a stay of the decision to the relevant entity.

(2) The relevant entity may stay the original decision to secure the effectiveness of the review and any later appeal to or review by the relevant entity.

(3) In setting the time for hearing the application, the relevant entity must allow at least 3 business days between the day the application is filed with it and the hearing day.

(4) The chief executive is a party to the application.

(5) The person must serve a copy of the application showing the time and place of the hearing and any document filed in the relevant entity with it on the chief executive at least 2 business days before the hearing.

(6) The stay—

(a) may be given on conditions the relevant entity considers appropriate; and

(b) operates for the period specified by the relevant entity; and

(c) may be revoked or amended by the relevant entity.

(7) The period of a stay under this section must not extend past the time when the chief executive reviews the original decision and any later period the relevant entity allows the applicant to enable the applicant to appeal against the decision or apply for a review of the decision as provided under the QCAT Act.

(8) The making of an application does not affect the original decision, or the carrying out of the original decision, unless it is stayed.

(9) In this section—

***relevant entity*** means—

(a) if the reviewed decision may be reviewed by QCAT—QCAT; or

(b) if the reviewed decision may be appealed to the appeal court—the appeal court.

## 35 Time for making appeals

(1) A person may appeal against a reviewed decision only within—

(a) if a decision notice is given to the person—28 days after the notice was given to the person; or

(b) if the chief executive is taken to have confirmed the decision under section 34(5)—56 days after the application was made.

(2) However, if—

(a) the decision notice did not state the reasons for the decision; and

(b) the person asked for a statement of the reasons within the 28 days mentioned in subsection (1)(a);

the person may apply within 28 days after the person is given a statement of the reasons.

(3) Also, the appeal court may extend the period for appealing.

# MCU011-22/23 Attachment 1

*Part D - PowerLink Advice*

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20 February 2023

**Our Ref**: DA5119 (MSLink14269, 14264, 14266)

Banana Shire Council
PO Box 412
BILOELA QLD 4715

Attention: Rentia Robertson
Email: enquiries@banana.qld.gov.au
Application: MCU011-22/23

Edify Energy
C/- RPS AAP consulting Pty Ltd
PO BOX 1559
FORTITUDE VALLEY QLD 4006

Attention: Harry Connolly
Email: Harry.Connolly@rpsgroup.com.au

Dear Harry,

**Referral Agency Response (Advice)**

(Given under section 9.2 of the Development Assessment Rules)

| **Transmission Infrastructure Impacted** | |
|---|---|
| **Transmission Corridor** | Callide A Moura (132kV) Transmission Line Corridor |
| **Easement ID** | Easement A on RN1176 (Dealing No. 601399533)<br>Easement A on RP615786 (Dealing No. 601288121)<br>Easement A on RN1178 (Dealing No. 601399528) |
| **Location Details** | |
| **Street address** | 551 & 641 Biloela Callide Road, Mount Murchison |
| **Real property description** | Lot 154 on SP126053<br>Lot 2 on RP619032<br>Lot 28 on RN519<br>Lot 3 on RP608599 |
| **Local government area** | Banana Shire Council |
| **Application Details** | |
| **Proposed development:** | Material change of use |
| **Approval sought** | Development Permit |

We refer to the above referenced development application which has been referred to Powerlink Queensland in accordance with Section 54 of the *Planning Act 2016*.

In accordance with its jurisdiction under Schedule 10 Part 9 Division 2 of the *Planning Regulation 2017*, Powerlink Queensland is a Referral Agency (Advice) for the above development application.

Specifically, the application has been triggered for assessment by Powerlink Queensland because:

1. For **material change of use** – all or part of the premises are subject to a transmission entity easement which is part of the transmission supply network (Table 2 1b)

## PLANS AND REPORTS ASSESSED

The following plans and reports have been reviewed by Powerlink Queensland and form the basis of our assessment. Any variation to these plans and reports may require amendment of our advice.

**Table 1: Plans and Reports upon which the assessment is based**

| Drawing / Report Title | Prepared by | Dated | Reference No. | Version / Issue |
|---|---|---|---|---|
| Preliminary Site Layout | RPS | 20/12/2022 | PR151484-1 | |

Powerlink Queensland, acting as a Referral Agency (Advice) under the Planning Regulation 2017 provides its response to the application as attached **(Attachment 1)**.

Please treat this response as a properly made submission for the purposes of Powerlink being an eligible advice agency in accordance with the *Planning Act 2016*.

For further information please contact our Property Services Team via email property@powerlink.com.au who will be pleased to assist.

Yours sincerely

for: Narelle Titman
**MANAGER PROPERTY**

## ATTACHMENT 1 – REFERRAL AGENCY (ADVICE) RESPONSE

Powerlink Queensland **supports** this application subject to the inclusion of the following conditions in the Assessment Manager's Decision Notice.

| No. | Condition | Timing | Reason |
|---|---|---|---|
| 1 | The development must be carried out generally in accordance with the reviewed plans detailed in Table 1. | At all times. | To ensure that the development is carried out generally in accordance with the plans of development submitted with the application. |
| 2 | The statutory clearances set out in the *Electrical Safety Regulation 2013* must be maintained during construction and operation. No encroachment within the statutory clearances is permitted. | At all times. | To ensure that the purpose of the *Electrical Safety Act 2002* is achieved and electrical safety requirements are met. |
| 3 | Compliance with the terms and conditions of the easement dealing no. shown in the heading of this letter. | At all times. | To ensure that the existing rights contained in the registered easement dealings are maintained. |
| 4 | Compliance with the generic requirements in respect to proposed works in the vicinity of Powerlink Queensland infrastructure as detailed in the enclosed Annexure "A". | At all times. | To ensure that the purpose of *the Electrical Safety Act 2002* is achieved and electrical safety requirements are met.<br>To ensure the integrity of the easement is maintained. |

**Advice to Council and the Applicant**

1. Powerlink and Edify are currently negotiating network connection of the solar farm to the transmission grid. This correspondence does not constitute approval for connection which remains the subject of ongoing technical assessment and commercial negotiations. The exact location of connecting infrastructure is also part of ongoing negotiations. As a result we wish to advise council that the location of any infrastructure is likely to change, and as such its location should not form part of the approval.

2. Powerlink has previously met with members of the Callide Solar Power Station (CSPS) team (meeting October 2022), and discussed how Powerlink's corridor selection investigations for the Banana Range Wind Farm connection project apply to lot 2/RP619032 and lot 28/RN519. At that meeting, Edify representatives noted that all three corridor options potentially traverse north to south of the eastern edge of CSPS project land (where the project land shares a boundary with the Callide Power Station, CS Energy site), and this may result in a loss of approximately 3-5MW PV capacity if the easement sits within the CSPS project land. Further, it was noted that out of the 3 corridors proposed, the northern 1 corridor would have no further impact on CSPS project lands as it would not traverse over any further CSPS land (east to west). By way of an update, Powerlink can advise that the northern 1 corridor was recommended by our draft corridor selection report released in November. The latest information regarding the status of this project is available via our project page www.powerlink.com.au/projects/Banana-range-wind-farm-connection-project

3. Should any doubt exist in maintaining the prescribed clearance to electrical infrastructure the applicant is obliged under the *Electrical Safety Act 2002* to seek advice from Powerlink.

4. This response **does not constitute an approval to commence operational works within the easement.** Prior written approval is required from Powerlink Queensland before any work is undertaken within the easement area. All works on easement (including but not limited to earthworks, drainage and detention basins; road construction; underground and overhead service installation) require detailed submissions, assessments and consent (or otherwise) by Powerlink. Further, Powerlink may require that such drawings be provided in electronic format (3D DXF or equivalent of final design RL's AHD and MGA GDA94 in applicable zone)

5. In order for Powerlink to maintain and operate a safe and reliable supply of electricity, we require unrestricted 24-hour access to our corridors and infrastructure.

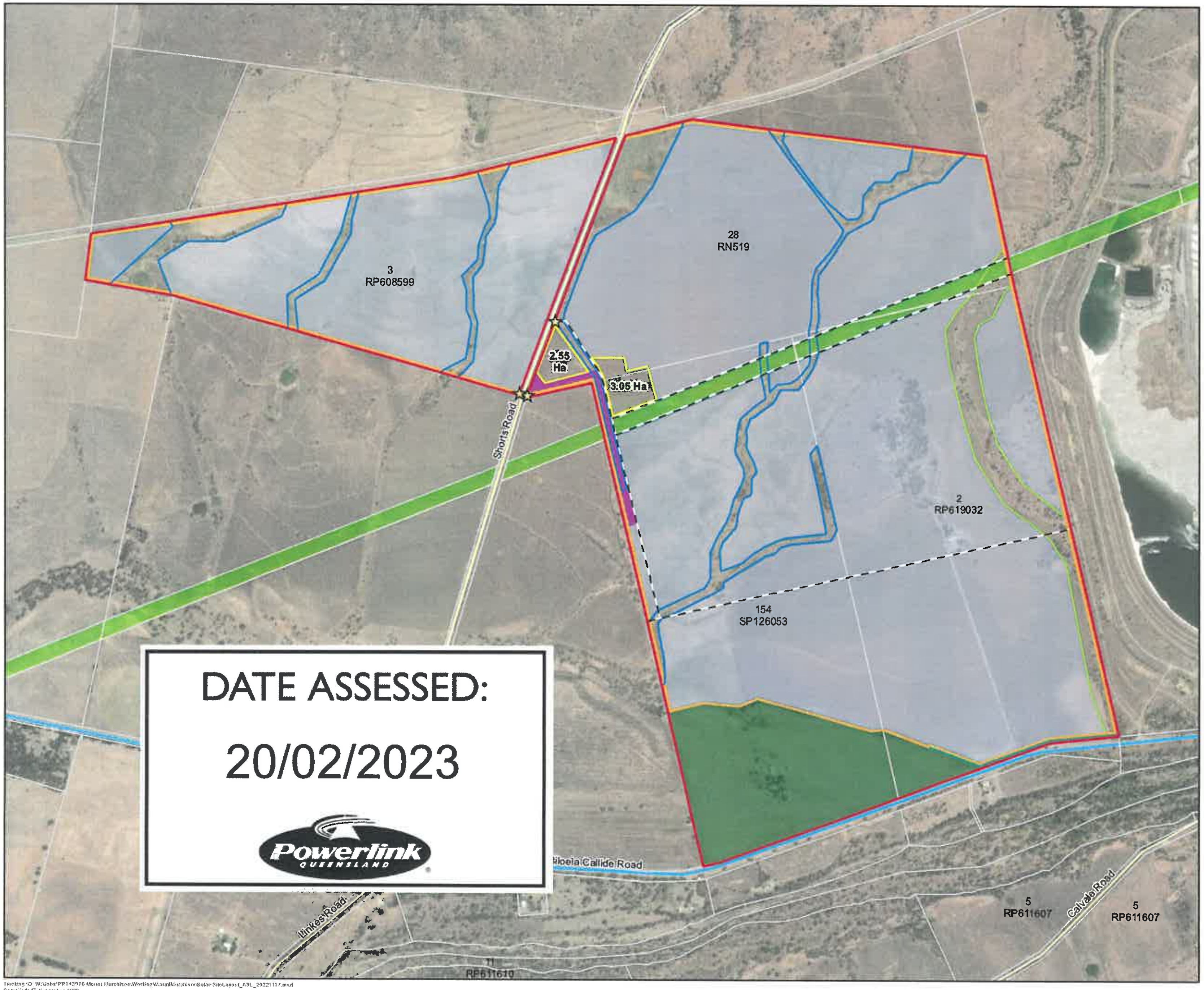
   We will require practical access (typically by 4WD vehicle – but to standard no less than existing) to the Powerlink structures.

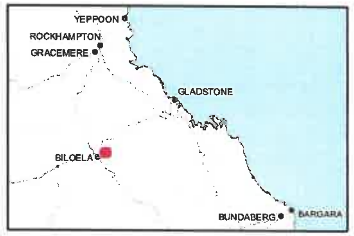
   If it is envisaged that there will be any interference or alteration to our current access arrangements prior, during or after the completion of your works, we require that the applicant contacts our Works Control Manager Easements (Mr Ehren Wittmer – ph 0418 233 916)

6. Compliance with the Electrical Safety Act 2002 including any Code of Practice under the Act and the Electrical Safety Regulation 2013 including any safety exclusion zones defined in the Regulation.

   In respect of this application, the exclusion zone for untrained persons and for operating plant operated by untrained persons is three (3) metres from the 132,000-volt wires and exposed electrical parts.

   If works have the potential to come within the prescribed clearance to the conductors and electrical infrastructure, then the applicant must seek advice from Powerlink by completing the attached Application for Safety Advice – Form and submitting to property@powerlink.com.au




**LEGEND**

- Proposed / Existing Access
- New Farm Fences
- State Controlled Road
- Local Road
- Cadastre
- Site Boundary
- Solar Array Disturbance Footprint
- Vegetation Buffer (Up to 10m wide)
- Bushfire/Access Buffer (10m wide) and Security Fence
- Livestock Laneway / Yard
- Optional BESS Location / Site Office / Laydown Area / Substation
- Drainage Line
- Watercourse Buffer (approx. 100m wide)
- Transmission Line Easement
- Flood Area

N

0 250 500 750 1,000

Metres
APPROX SCALE 14,000 @ A3
GDA 2020 MGA Zone 56

**Disclaimer:** While all reasonable care has been taken to ensure the information contained on this map is up to date and accurate, no guarantee is given that the information portrayed is free from error or omission. Please verify the accuracy of all information prior to use.

DATA SOURCES
Imagery from Esri basemap layer.
Cadastral data © Department of Resources 2022

rps

PR151484-1
**Preliminary Site Layout**
Callide Solar Power Station

Tracking ID: W:\Jobs\PR143974 Mount Murchison\Working\MountMurchisonSolar-SiteLayout_A3L_20221117.mxd
Compiled: 17 November 2022

## ANNEXURE A – GENERIC REQUIREMENTS

**The conditions contained in this Annexure have been compiled to assist persons (the applicant) intending to undertake work within the vicinity of high-voltage electrical installations and infrastructure owned or operated by Powerlink. The conditions are supplementary to the provisions of the Electrical Safety Act 2002, Electrical Safety Regulation 2013 and the Terms and Conditions of Registered Easements and other forms of Occupational Agreements hereinafter collectively referred to as the "Easement". Where any inconsistency exists between this Annexure and the Easement, the Easement shall take precedence.**

### 1. POWERLINK INFRASTRUCTURE

You may not do any act or thing which jeopardises the foundations, ground anchorages, supports, towers or poles, including (without limitation) inundate or place, excavate or remove any soil, sand or gravel within a distance of twenty (20) metres surrounding the base of any tower, pole, foundation, ground anchorage or support.

### 2. STRUCTURES

No structures should be placed within twenty (20) metres of any part of a tower or structure foundation or within 5m of the conductor shadow area. Any structures on the easement require prior written consent from Powerlink.

### 3. EXCLUSION ZONES

Exclusion zones for operating plant are defined in Schedule 2 of the Electrical Safety Regulation 2013 for Untrained Persons. All Powerlink infrastructure should be regarded as "electrically live" and therefore potentially dangerous at all times.

In particular your attention is drawn to Schedule 2 of the Electrical Safety Regulation 2013 which defines exclusion zones for untrained persons in charge of operating plant or equipment in the vicinity of electrical facilities. If any doubt exists in meeting the prescribed clearance distances from the conductors, the applicant is obliged under this Act to seek advice from Powerlink.

### 4. ACCESS AND EGRESS

Powerlink shall at all times retain the right to unobstructed access to and egress from its infrastructure. Typically, access shall be by 4WD vehicle.

### 5. APPROVALS (ADDITIONAL)

Powerlink's consent to the proposal does not relieve the applicant from obtaining statutory, landowner or shire/local authority approvals.

### 6. MACHINERY

All mechanical equipment proposed for use within the easement must not infringe the exclusion zones prescribed in Schedule 2 of the Electrical Safety Regulation 2013. All operators of machinery, plant or equipment within the easement must be made aware of the presence of live high-voltage overhead wires. It is recommended that all persons entering the Easement be advised of the presence of the conductors as part of on site workplace safety inductions. The use of warning signs is also recommended.

## ANNEXURE A – GENERIC REQUIREMENTS

**7. EASEMENTS**

All terms and conditions of the easement are to be observed. Note that the easement takes precedence over all subsequent registered easement documents. Copies of the easement together with the plan of the Easement can be purchased from the Department of Environment & Resource Management.

**8. EXPENDITURE AND COST RECOVERY**

Should Powerlink incur costs as a result of the applicant's proposal, all costs shall be recovered from the applicant.

Where Powerlink expects such costs to be in excess of $10 000.00, advanced payments may be requested.

**9. EXPLOSIVES**

Blasting within the vicinity (500 metres) of Powerlink infrastructure must comply with AS 2187. Proposed blasting within 100 metres of Powerlink infrastructure must be referred to Powerlink for a detailed assessment.

**10. BURNING OFF OR THE LIGHTING OF FIRES**

We strongly recommend that fires not be lit or permitted to burn within the transmission line corridor and in the vicinity of any electrical infrastructure placed on the land. Due to safety risks Powerlink's written approval should be sort.

**11. GROUND LEVEL VARIATIONS**

**Overhead Conductors**

Changes in ground level must not reduce statutory ground to conductor clearance distances as prescribed by the Electrical Safety Act 2002 and the Electrical Safety Regulation 2013.

**Underground Cables**

Any change to the ground level above installed underground cable is not permitted without express written agreement of Powerlink.

**12. VEGETATION**

Vegetation planted within an easement must not exceed 3.5 metres in height when fully matured. Powerlink reserves the right to remove vegetation to ensure the safe operation of the transmission line and, where necessary, to maintain access to infrastructure.

**13. INDEMNITY**

Any use of the Easement by the applicant in a way which is not permitted under the easement and which is not strictly in accordance with Powerlink's prior written approval is an unauthorised use. Powerlink is not liable for personal injury or death or for property loss or damage resulting from unauthorized use. If other parties make damage claims against Powerlink as a result of unauthorized use then Powerlink reserves the right to recover those damages from the applicant.

**ANNEXURE A – GENERIC REQUIREMENTS**

**14. INTERFERENCE**

The applicant's attention is drawn to s.230 of the Electricity Act 1994 (the "Act"), which provides that a person must not wilfully, and unlawfully interfere with an electricity entity's works. "Works" are defined in s.12 (1) of the Act. The maximum penalty for breach of s.230 of the Act is a fine equal to 40 penalty units or up to 6 months imprisonment.

**15. REMEDIAL ACTION**

Should remedial action be necessary by Powerlink as a result of the proposal, the applicant will be liable for all costs incurred.

**16. OWNERS USE OF LAND**

The owner may use the easement land for any lawful purpose consistent with the terms of the registered easement; the conditions contained herein, the Electrical Safety Act 2002 and the Electrical Safety Regulation 2013.

**17. ELECTRIC AND MAGNETIC FIELDS**

Electric and Magnetic Fields (EMF) occur everywhere electricity is used (e.g. in homes and offices) as well as where electricity is transported (electricity networks).

Powerlink recognises that there is community interest about Electric and Magnetic Fields. We rely on expert advice on this matter from recognised health authorities in Australia and around the world. In Australia, the Federal Government agency charged with responsibility for regulation of EMFs is the Australian Radiation Protection and Nuclear Safety Agency (ARPANSA). ARPANSA's *Fact Sheet – Magnetic and Electric Fields from Power Lines*, concludes:

*"On balance, the scientific evidence does not indicate that exposure to 50Hz EMF's found around the home, the office or near powerlines is a hazard to human health."*

Whilst there is no scientifically proven causal link between EMF and human health, Powerlink nevertheless follows an approach of "*prudent avoidance*" in the design and siting of new powerlines. This includes seeking to locate new powerline easements away from houses, schools and other buildings, where it is practical to do so and the added cost is modest.

The level of EMF decreases rapidly with distance from the source. EMF readings at the edge of a typical Powerlink easement are generally similar to those encountered by people in their daily activities at home or at work. And in the case of most Powerlink lines, at about 100 metres from the line, the EMF level is so small that it cannot be measured.

Powerlink is a member of the ENA's EMF Committee that monitors and compiles up-to-date information about EMF on behalf of all electricity network businesses in Australia. This includes subscribing to an international monitoring service that keeps the industry informed about any new developments regarding EMF such as new research studies, literature and research reviews, publications, and conferences.

We encourage community members with an interest in EMF to visit ARPANSA's website: www.arpansa.gov.au Information on EMF is also available on the ENA's website: www.ena.asn.au

# Attachment 2
# Planning Act 2016 Extract on Appeal Rights

**Part 1 Appeal rights**

229 Appeals to tribunal or P&E Court

(1) Schedule 1 states–
(a) matters that may be appealed to–
(i) either a tribunal or the P&E Court; or
(ii) only a tribunal; or
(iii) only the P&E Court; and
(b) the person–
(i) who may appeal a matter (the appellant); and
(ii) who is a respondent in an appeal of the matter; and
(iii) who is a co-respondent in an appeal of the matter; and
(iv) who may elect to be a co-respondent in an appeal of the matter.

(2) An appellant may start an appeal within the appeal period.

(3) The appeal period is–
(a) For an appeal by a building advisory agency–10 business days after a decision notice for the decision is given to the agency; or
(b) For an appeal against a deemed refusal–at any time after the deemed refusal happens; or
(c) for an appeal against a decision of the Minister, under chapter 7, part 4, to register premises or to renew the registration of premises–20 business days after a notice is published under section 269(3)(a) or (4); or
(d) for an appeal against an infrastructure charges notice–20 business days after the infrastructure charges notice is given to the person; or
(e) for an appeal about a deemed approval of a development application for which a decision notice has not been given–30 business days after the applicant gives the deemed approval notice to the assessment manager; or
(f) for any other appeal–20 business days after a notice of the decision for the matter, including an enforcement notice, is given to the person. Note– See the P&E Court Act for the court's power to extend the appeal period.

(4) Each respondent and co-respondent for an appeal may be heard in the appeal.

(5) If an appeal is only about a referral agency's response, the assessment manager may apply to the tribunal or P&E Court to withdraw from the appeal.

(6) To remove any doubt, it is declared that an appeal against an infrastructure charges notice must not be about–
(a) the adopted charge itself; or
(b) for a decision about an offset or refund–
(i) the establishment cost of trunk infrastructure identified in a LGIP; or
(ii) The cost of infrastructure decided using the method included in the local government's charges resolution.

# Attachment 3
## Approved Drawings

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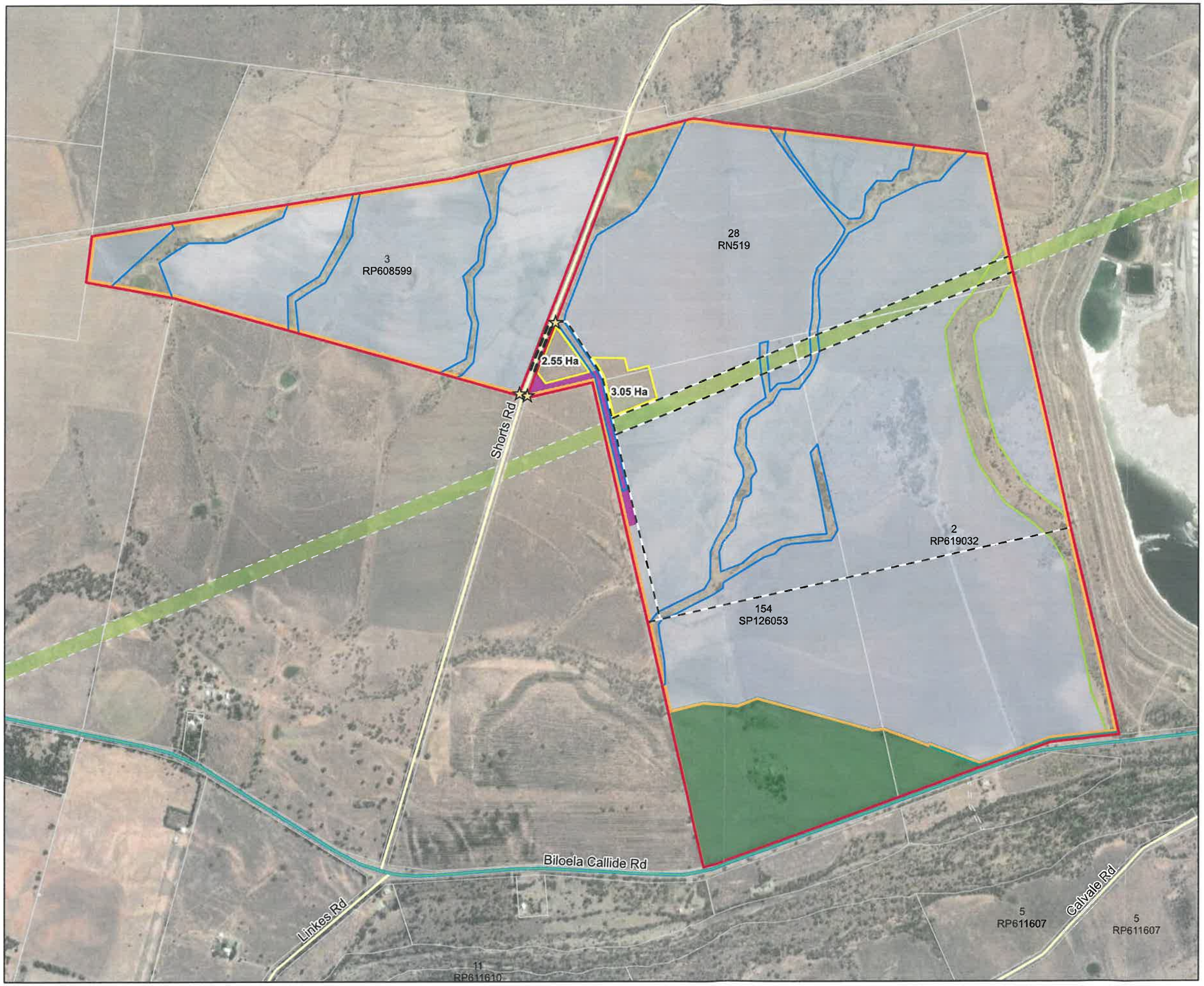



**LEGEND**

- Proposed / Existing Access
- Site Boundary
- Solar Array Disturbance Footprint
- Vegetation Buffer (7m wide)
- Bushfire/Access Buffer (10m wide) and Security Fence
- Livestock Laneway / Yard
- Optional BESS Location / Site Office / Laydown Area / Substation
- Drainage Line
- Watercourse Buffer (approx. 100m wide)
- Transmission Line Easement
- Flood Area
- Easement
- Strata
- Cadastre
- New Farm Fences
- State Controlled Road
- Local Road
- Shorts Road Vegetation Buffer (5m Wide)

Banana Shire Council
PLANNING APPROVAL

25 OCT 2023

MCU011/22/23

N

0 250 500 750 1,000
Metres
APPROX SCALE @ A3
GDA 2020 MGA Zone 56

**Disclaimer:** While all reasonable care has been taken to ensure the information contained on this map is up to date and accurate, no guarantee is given that the information portrayed is free from error or omission. Please verify the accuracy of all information prior to use.

DATA SOURCES
Imagery from Esri basemap layer.
Cadastral data © Department of Resources 2022

PR151484-1
**Preliminary Site Layout**
Mount Murchison Solar Project

Tracking ID: C:\OnedrivePortal\RPS Group\AAP Geospatial Intelligence Services - Projects\ProjectFiles\Edify\Callide Solar Power Station\03_Projects\MountMurchisonSolar.aprx
Compiled: 06 September 2023

NORTHERN CONSULTING engineers

# TRAFFIC IMPACT ASSESSMENT (STATE AGENCY)

CALLIDE SOLAR POWER STATION
551 & 641 BILOELA CALLID ROAD & SHORTS ROAD, MOUNT MURCHISON

Banana Shire Council
PLANNING APPROVAL

19 JUL 2023

MCU011-22/23

FOR
EDIFY ENERGY

JOB No: MJ2370

Doc Ref: MJ2370-TIA

Phone: 07 4725 5550
Fax: 07 4725 5850
Email: mail@nceng.com.au
50 Punari Street Currajong Qld 4812
Milton Messer & Associates Pty Ltd
ACN 100 817 356 ABN 34 100 817 356

## DOCUMENT CONTROL

| Rev | Author | Reviewed | Approved | | Date | Issued To: | Purpose |
|---|---|---|---|---|---|---|---|
| A | Brendan Blair | Derek Saw | Derek Saw (RPEQ7363) | | 18/11/2022 | Edify Energy | Draft - For review |
| B | Brendan Blair | Derek Saw | Derek Saw (RPEQ7363) | | 28/11/2022 | Edify Energy | In support of DA |
| C | Brendan Blair | Derek Saw | Derek Saw (RPEQ7363) | | 30/11/2022 | Edify Energy | Figure 1-1 and Appendix A updated |
| | | | | | - | - | - |
| - | - | - | - | - | - | - | - |
| - | - | - | - | - | | | |
| | | | | | | | |

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NORTHERN
CONSULTING
engineers

**EXECUTIVE SUMMARY**

Northern Consulting Engineers (NCE) have been commissioned by Edify Energy to undertake a Traffic Impact Assessment (TIA) relating to the proposed solar power station at 551 & 641 Biloela Callide Road & Shorts Road, Mount Murchison. The development site is situated on lands described as Lot 154 SP126053, Lot 2 RP619032, Lot 28 RN519 and Lot 3 RP608599.

The proposed development involves the establishment of a solar power station with a solar generating capacity of 200MW and a battery energy storage system (BESS) capable of storing 200MW/800MWh.

This report summarises the analysis and results of the traffic study associated with the proposed development, including the likely impacts and mitigation measures required to ensure the development can proceed whilst maintaining an acceptable level of service within the state-controlled road network.

As survey data was not available for the assessed intersection NCE completed calculations utilising from the available TMR Traffic Analysis and Reporting System (TARS) data. The 10-year background traffic growth rates from the TMR data were adopted and applied to the TMC data to forecast future background traffic.

Development generated traffic rates were determined separately for both the construction and operation phases of the development. A first principles assessment of the development generated traffic has been used due to a lack of available data relating to the generation of traffic from this type of development. Edify Energy has provided NCE with information pertaining to the generation of traffic for the construction and operation of previous solar farms. NCE have utilised calculations from past solar farms and the information provided by Edify Energy to calculate the number of containers of construction material and operational traffic to be generated per MW of solar farm.

A SIDRA analysis concluded that the existing state-controlled Biloela Callide Road / Shorts Road / Linkes Road intersection performed satisfactorily without and with the development with the average delay in the worst-case scenario not exceeding 26.0 seconds (LOS D).

An intersection turn warrant assessment was completed for the Shorts Road turn movements which were found to only require a proper basic left turn configuration. No right turn treatment is required as the existing conditions and development do not utilise that movement. NCE have provided a sketch of the widening required for a proper basic left turn treatment.

A swept path assessment found that the existing intersection configuration was not adequate for a 19m prime mover and semi-trailer design vehicle. NCE have provided a sketch of the extra pavement and upgrades required to the intersection to accommodate this type of vehicle.

Sight distance checks were completed for the stopping sight distance and safe intersection sight distance for each approach at the Biloela Callide Road / Shorts Road / Linkes Road intersection. Generally, the stopping sight distances were adequate, aside from the Linkes Road approach which provides appropriate signage to warn traffic of the upcoming intersection and stop sign. Not enough sight distance is provided along the Biloela Callide Road for the safe intersection sight distance requirements. This is already addressed by signage warning of the upcoming intersection. As the stopping sight distance is provided NCE believe the current intersection creates no major safety risks.

NCE provide the AADT data over the impacted railway level crossing for assessment of the impacted railway level crossing on the Dawson Highway.

# 1.0 INTRODUCTION

## 1.1 Background

Northern Consulting Engineers (NCE) have been commissioned by Edify Energy to undertake a Traffic Impact Assessment (TIA) relating to the proposed solar power station at 551 & 641 Biloela Callide Road & Shorts Road, Mount Murchison. The development site is situated on lands described as Lot 154 SP126053, Lot 2 RP619032, Lot 28 RN519 and Lot 3 RP608599.

## 1.2 Previous work

NCE are not aware of any previous traffic studies relating to the site.

## 1.3 Study area and report purpose

The proposed development is located within the Banana Shire Council (BSC) rural locality of Mount Murchison (QLD, 4715). The site is to be located over multiple land parcels listed below.

- Lot 154 on SP126053
- Lot 2 on RP619032
- Lot 28 on RN519
- Lot 3 on RP608599

The land is zoned rural in BSC Zoning Map as indicated in **Figure 1-1** below. The development is located 8km north east of the rural town of Biloela. The Biloela Callide Road runs parallel to the southern boundary of the development site with the Moura System rail line bordering the northern boundaries.

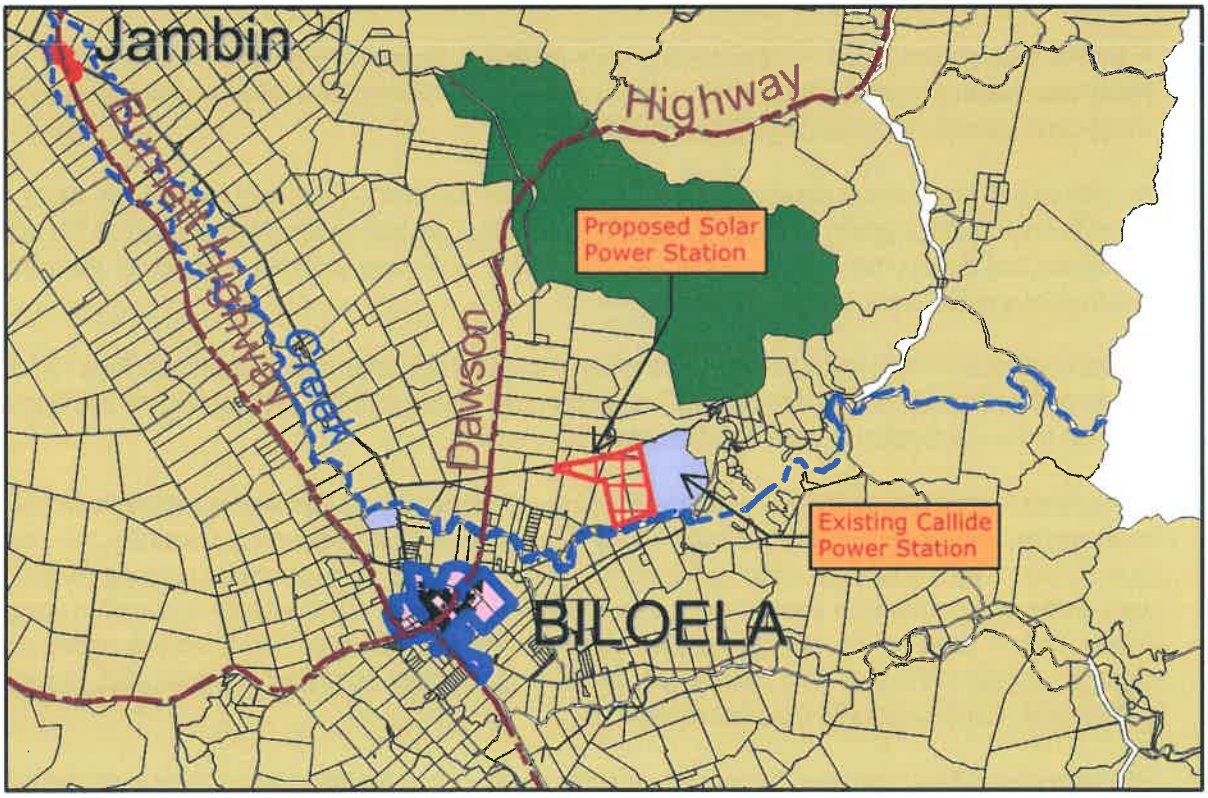



**Figure 1-1** Site locality and zoning

**Appendix A** shows the full zoning map.

The purpose of the report is to document the traffic analysis undertaken, which has focused on the potential impacts upon the Biloela Callide Road and Shorts Roads inclusive of the intersection between Biloela Callide Road and Shorts Road, as a direct result of the traffic generated from the proposed development.

## 1.4 Proposed development

The proposed development involves the establishment of a solar power station with a solar generating capacity of 200MW and a battery energy storage system (BESS) capable of storing 200MW/800MWh. **Figure 1-2** depicts the preliminary site layout plan.

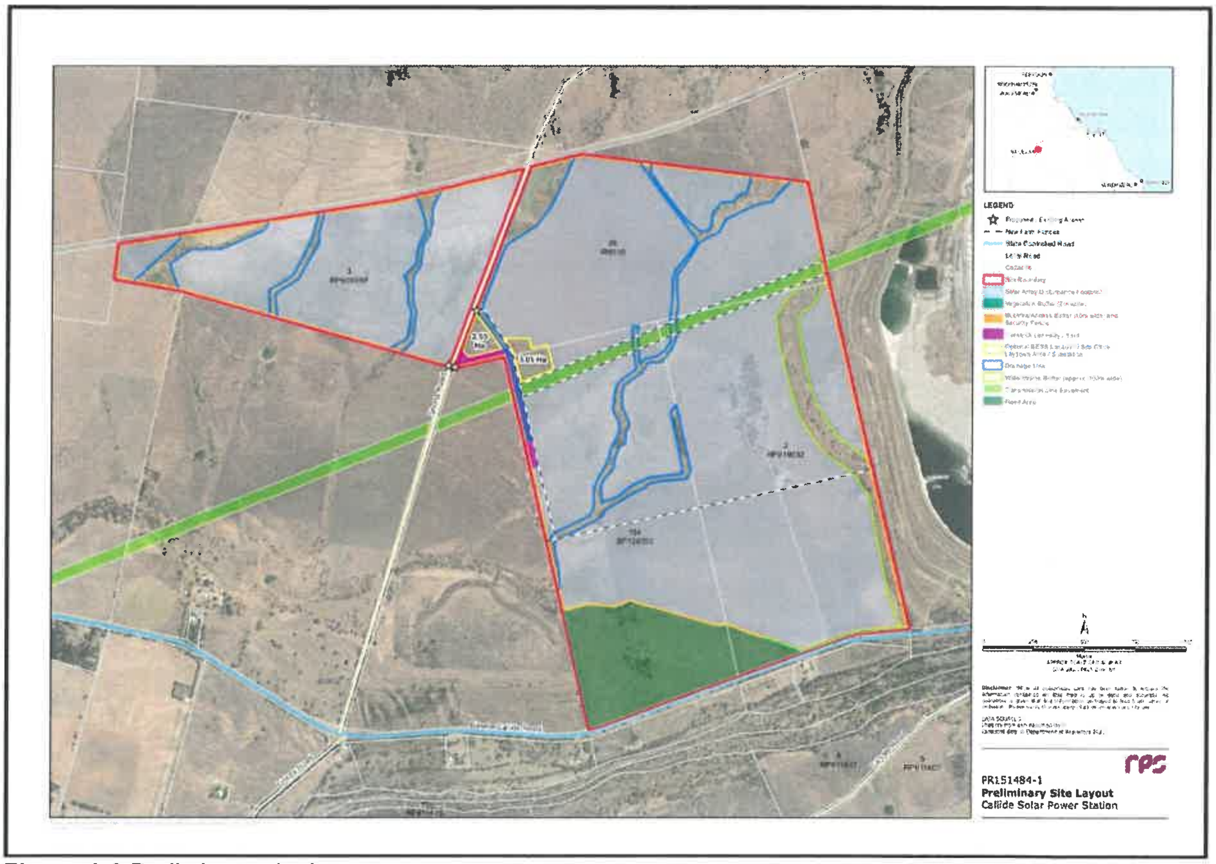



**Figure 1-2** Preliminary site layout

### 1.4.1 Proposed access and parking

All generated traffic to/from the development is expected to use Shorts Road and by extension the Biloela Callide Road in order to gain access to the site. The proposed and existing access locations are indicated in in **Figure 1-2.** Therefore, all generated traffic during both the operation and construction will be required to use the Biloela Callide Road / Shorts Road intersection.

The specific footprint for on-site parking has not been indicated, however, it is expected that all traffic will be contained on-site during the construction and operation of the facilities. It is expected that traffic generated during the operation of the development site will park in/around the anticipated substation footprint. A total of 12 parking bays are currently planned to be provided as part of the site works and operation, no specific dimensions have been provided.

Internal roads will be required to be constructed to provide access to various work fronts for construction and maintenance. The internal roads are expected to be unsealed, single to dual vehicle width and include areas for manoeuvring. The internal roads will be located entirely within the development footprint. Indicative internal roads are yet to be mapped and thus a driveway and frontage assessment has not been completed. For a review of Shorts Road refer to the Capability and Suitability Report provided in **Appendix B**.

## 2.0 EXISTING CONDITIONS

### 2.1 Land use and zoning

The proposed development is over land with an existing use of small crops and fodder that is not irrigated. There are a number of existing drainage lines to be maintained as well as vegetation management watercourse through the north-east to south-east boundaries of the lot. A portion of the south western corner of the lot has also been indicated as a flood area and will not be developed. The development will ensure that all existing drainage lines and watercourses will not be impacted/developed and the development will avoid these areas. Refer to **Figure 1-2** which indicates the drainage and flooding areas.

### 2.2 Surrounding road network details

The surrounding road network is made up of both local government roadways and State Controlled Roadways.

The proposed development is situated within the Central Region (D6) District of the Queensland Department of Transport and Main Roads (TMR), the district mapping from TMR is provided in **Appendix C.** The adjacent State Controlled Road Network (SCRN) comprises:

- Biloela Callide Road – Road Section 472 – Site IDs 60126 & 61286 – access corridor connecting the Callide Power Station and Mine with the Dawson Highway. Designated as a PBS 2A route for up to 25m b-doubles (B25 route).
- Dawson Highway – Road Section 46A – Site IDs 60067, 61084 & 160067 – highway connecting Gladstone to Biloela. Designated as a PBS 2A route for up to 25m b-doubles (B25 route).

**Figure 2-1** is an excerpt from Queensland Globe showing the heavy vehicles routes and restrictions for the areas expected to be used by the development generated traffic, labels are based on the most up to date routes and restrictions given by the NHVR.

The existing local road network consists of the following:

- Shorts Road – unsealed minor road. Utilised by local traffic only from the surrounding rural use lots. Only accessible by general access vehicles.
- Linkes Road – sealed minor road. Connects traffic from Biloela through to Biloela Callide Road via Calvale Road. Only accessible by general access vehicles.

**Figure 2-2** shows the surrounding road network to be utilised by the development.


**Figure 2-1** Heavy vehicle routes and restrictions

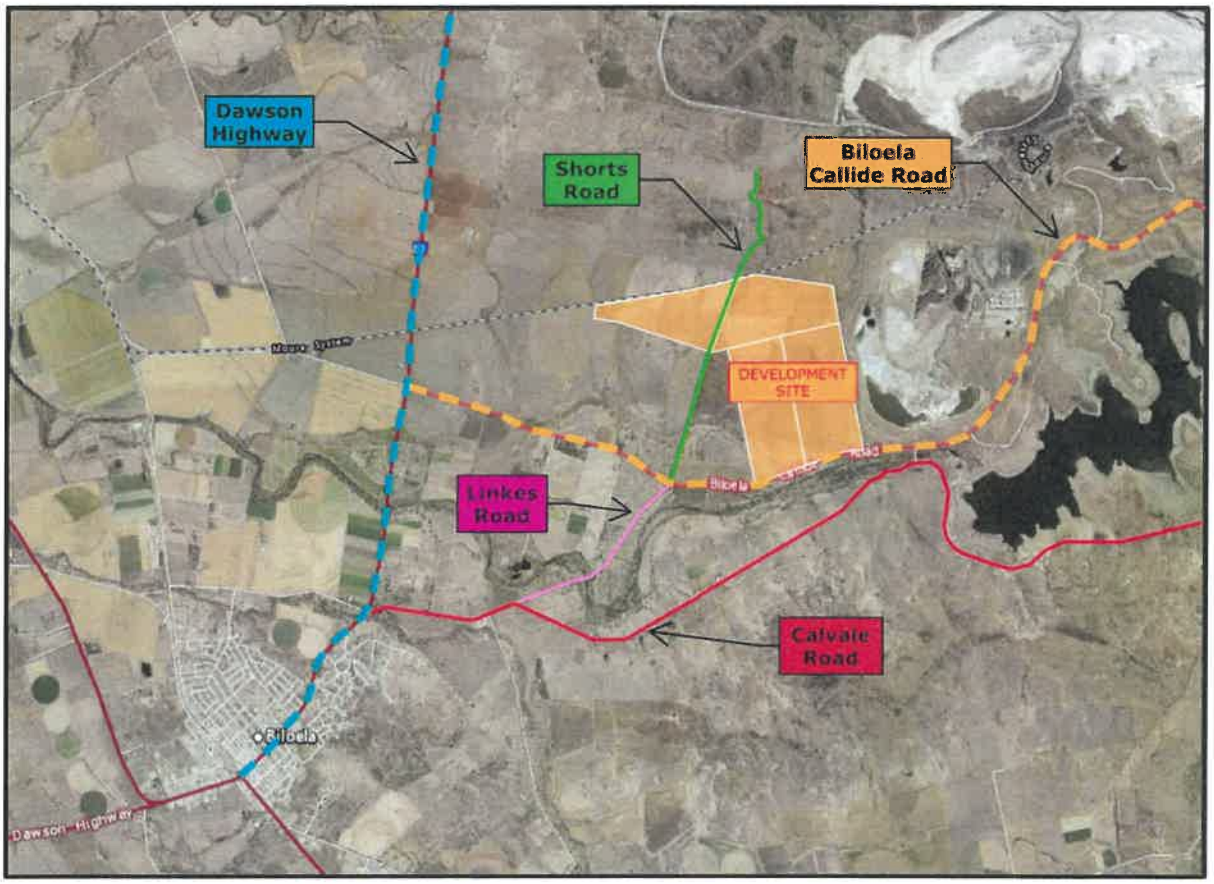



**Figure 2-2** Road network surrounding the development

## 2.3 Background traffic volumes

Background traffic volumes utilised within the analysis were derived from the available TMR Traffic Analysis and Reporting System (TARS) data.

- TMR's traffic analysis and reporting data was used for traffic volumes on SCRNs.
  - Dawson Highway – Road Section 46A – Data collected in 2022 at Site ID 61084, data collected in 2019 for Site ID 60067 and data collected in 2022 for Site ID 160067
  - Biloela Callide Road – Road Section 472 – Data collected in 2022 for Site ID 60126 and data collected in 2022 for Site ID 61286.

The TARS data locations are depicted in **Figure 2-3** below.

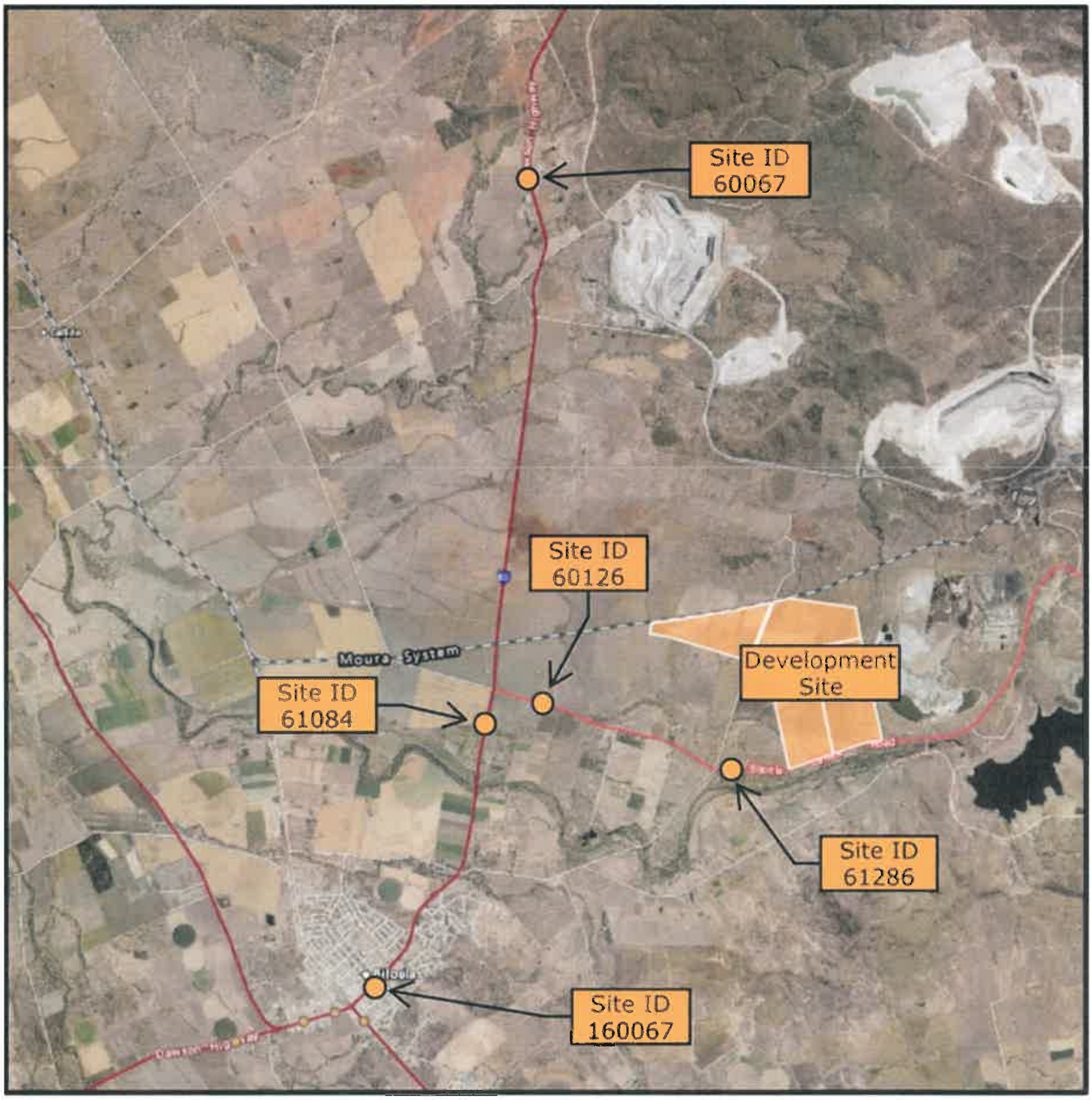



**Figure 2-3** TMR TARS data survey locations

### 2.3.1 Background traffic calculations and assessment

The traffic data provided for Site ID 60126 and 61286 were used to calculate the intersection movements through the Biloela Callide Road / Shorts Road / Linkes Road intersection. Differences between the traffic counts on either side of the intersection were calculated and utilised as the turn movement counts.

**Figure 2-4** depicts the calculation for the background traffic directional calculations from the given TARS data.

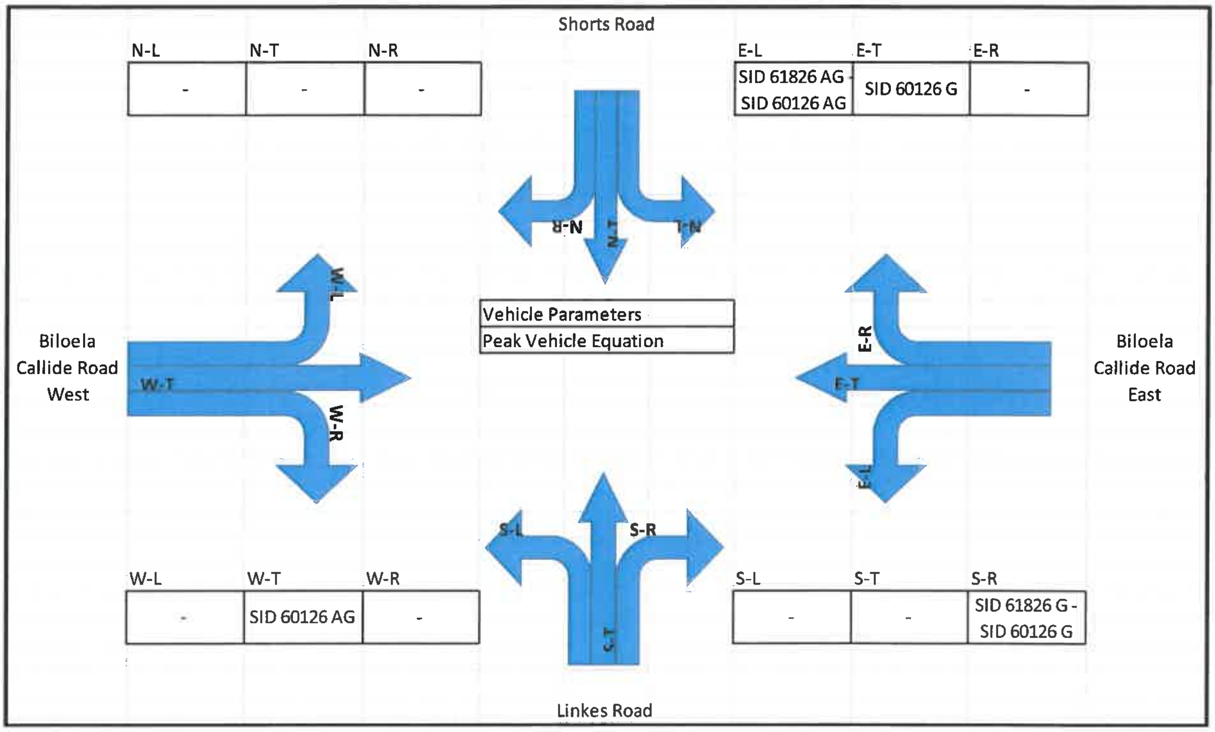



**Figure 2-4** Background traffic calculations

Copies of the TARS data relied upon as part of the assessment are contained within **Appendix D.**

There are no other available sources of data for the intersection and approach roads and no survey has been completed. Therefore, NCE believe the available data and the above calculations to be an acceptable interpretation of the traffic movements at the intersection.

The background traffic volumes for each site ID were forecast utilising the 10-year growth percent for each direction (gazettal and against-gazettal) respectively.

The TMR traffic composition data has been utilised to split the peak total traffic values calculated between the TMR traffic classifications, 1A, 1B, 1C and 1D. The heavy vehicle percentages and splits between the different TMR traffic classifications have been averaged for the two (2) sites and each direction and applied to the calculated traffic movements at the intersection. The traffic classification separation is given below.

- Class 1A – Light Vehicles – Average percentage split: 82.5%
- Class 1B – Truck or Bus – Average percentage split: 12.4%
- Class 1C – Articulated Vehicles – Average percentage split: 1.5%
- Class 1D – Road Trains / B-doubles – Average percentage split: 3.6%

## 2.4 Road safety issues

Crash data was obtained for the area via the Department of Transport and Main Roads. The crash data was requested from TMR in the following locations:

- 1km either side of Biloela Callide Road / Shorts Road intersection along the Biloela Callide Road
- Full length of Shorts Road
- Biloela Callide Road from chainage 5km to 8km
- 2km either side of Dawson Highway / Biloela Callide Road intersection along Dawson Highway and Biloela Road

The data returned contained a total of four (4) accidents from 2020 to 2021, this included three (3) hospitalisations and one (1) fatal crash.

Queensland Globe data has also been obtained for the areas to be impacted by the development including but not limited to the locations listed below:

- Dawson Highway / Biloela Callide Road intersection
- Biloela Callide Road / Shorts Road / Linkes Road intersection
- Biloela Callide Road from chainages 0 km to 7.5km
- Full length of Shorts Road
- Linkes Road from the Biloela Callide Road intersection up to, but not including, the Calvale Road intersection

This data returned a much larger number of crashes with fifteen (15) separate crashes reported from 2004 to 2020, this includes property damage crashes which are not contained in the TMR data set. The Queensland Globe data includes one (1) fatal crash, six (6) crashes resulting in hospitalisations, four (4) crashes requiring medical treatment, two (2) crashes resulting in minor injuries and two (2) crashes resulting in property damage only. The Queensland Globe crash data generally includes all the data provided by TMR aside from some items outside of the assessment area.

The TMR and Queensland Globe data are compiled in **Table 2-1** below which includes the details of the events.

NCE have assessed the crash data and find that the majority of crashes are not a result of improper road safety design and are a result of driver error. The TMR data includes two (2) crashes which are a result of vehicles driving off the carriageway and another which was out of control on the carriageway. The Queensland Globe data is also a majority of crashes resultant from driving off the carriageway or out of control on the carriageway, with a total of seven (7) crashes resulting from this type. NCE have assessed the horizontal curve at the Biloela Callide Road / Shorts Road intersection and found it to be compliant for the 85$^{th}$ percentile road speed. Whilst a deficiency in the geometry of the road does not seem to be the cause of the crashes, the lack of trafficable verge width due to the relatively deep table drains may not provide errant vehicles adequate room to regain control. The depth of the table drains may also account for the severity of the crash types when combined with the high-speed environment. Traffic safety on Shorts Road has been addressed as part of the Capability and Suitability Report provided in **Appendix B**.

**Table 2-1** Crash Data from QLD Globe

| Location | Date and Time | Occupancy | Nature of Crash |
|---|---|---|---|
| TMR Crash Report Data | | | |
| Biloela - Callide Rd / | August 2020, Thursday at 6:00 AM | (1) Hospitalisation | Multi-vehicle, Rear-end, Veh'S Same Direction: Rear End |
| Biloela - Callide Rd / | April 2020, Sunday at 2:00 PM | (1) Hospitalisation | Single vehicle, Hit object, Off Path-Curve: Off Cway Rt Bend Hit Obj |
| Calvale Rd / | April 2021, Tuesday at 2:00 PM | (1) Fatal | Single vehicle, Hit object, Off Path-Straight:Right Off Cway Hit Obj |
| Biloela - Callide Rd / | December 2020, Friday at 11:00 PM | (2) Hospitalisation | Single vehicle, Fall from vehicle, Off Path-Straight:Out Of Control On Cway |
| QLD Globe Crash Data | | | |
| Dawson Highway / Biloela Callide Road | March 2007, Saturday at 2:00 PM | (2) Fatal | Multi-Vehicle, Angle, Veh'S Adjacent Approach: Thru-Thru |
| Biloela Callide Road | April 2020, Sunday at 2:00 PM | (1) Hospitalisation | Single Vehicle, Hit object, Off Path-Curve: Off Cway Rt Bend Hit Obj |
| Biloela Callide Road | August 2004, Wednesday at 1:00 PM | (3) Hospitalisation | Single Vehicle, Hit object, Off Path-Straight: Left Off Cway Hit Obj |
| Biloela Callide Road | August 2020, Thursday at 6:00 AM | (1) Hospitalisation | Multi-Vehicle, Rear-end, Veh'S Same Direction: Rear End |
| Biloela Callide Road | December 2020, Friday at 11:00 PM | (2) Hospitalisation | Single Vehicle, Fall from vehicle, Off Path-Straight:Out Of Control On Cway |
| Dawson Highway / Biloela Callide Road | February 2005, Sunday at 6:00 AM | (1) Hospitalisation | Multi-Vehicle, Angle, Veh'S Adjacent Approach: Thru-Thru |
| Biloela Callide Road / Linkes Road | August 2007, Wednesday at 7:00 AM | (2) Hospitalisation | Multi-Vehicle, Angle, Veh'S Adjacent Approach: Right-Thru |
| Linkes Road | December 2019, Tuesday at 12:00 PM | (2) Medical treatment | Single Vehicle, Hit object, Veh'S On Path: Temporary Object On C'Way |
| Biloela Callide Road | September 2005, Friday at 2:00 PM | (1) Medical treatment | Single Vehicle, Hit object, Off Path-Curve: Off Cway Rt Bend Hit Obj |
| Biloela Callide Road | May 2006, Thursday at 6:00 PM | (1) Medical treatment | Multi-Vehicle, Sideswipe, Veh'S Same Direction: Lane Side Swipe |
| Shorts Road | November 2006, Monday at 9:00 AM | (1) Medical treatment | Single Vehicle, Hit object, Off Path-Curve: Off Cway Rt Bend Hit Obj |
| Biloela Callide Road | March 2006, Sunday at 12:00 PM | (3) Minor injury | Multi-Vehicle, Angle, Veh'S Manoeuvring: Leaving Driveway |
| Dawson Highway / Biloela Callide Road | March 2007, Sunday at 6:00 AM | (2) Minor injury | Multi-Vehicle, Angle, Veh'S Adjacent Approach: Thru-Thru |
| Linkes Road / Calvale Road | April 2010, Friday at 11:00 AM | (0) Property damage only | Multi-Vehicle, Angle, Veh'S Overtaking: Overtake-Right Turn |
| Biloela Callide Road / Linkes Road | June 2005, Thursday at 11:00 AM | (0) Property damage only | Multi-Vehicle, Angle, Veh'S Adjacent Approach: Thru-Thru |

## 2.5 Current intersection configuration

**Figure 2-5** depicts the current intersection from the Queensland Globe Imagery.

There are currently no turning lanes in place for any turn movements around the intersection. The westbound lane for the Biloela Callide Road includes an approximately 100m widening at the intersection with the hold line of the Linkes Road leg being approximately 4m away. This widening allows vehicles entering Linkes Road from the east to deviate off Biloela Callide Road and therefore reduce the impacts upon the state-controlled roadway. The additional pavement footprint also enables vehicles travelling west along Biloela Callide Road opportunity to avoid vehicles turning into Shorts Road.

Aside from the widening at the intersection there are no other turn treatments provided at the intersection aside from the hold line being located approximately 2m from the Biloela Callide Road eastbound lane. The required shoulder widening conditions to classify the turns as basic left (BAL) or base right turn (BAR) treatments are not evident on-site.


**Figure 2-5** Existing intersection configuration

## 2.6 Railway level crossings

The Moura System railway line runs adjacent to the Biloela Callide Road to the north. This line crosses two (2) roads within the assessment area. This includes a stop-sign controlled railway level crossing over Shorts Road and an active trackside road sign with lights over the Dawson highway. The location of the two railway level crossings is shown in **Figure 2-6** below. The imagery inset into the figure showing the Dawson Highway and Shorts Road railway crossings were obtained from Google Street View and the Shorts Road visual inspection recording respectively.


**Figure 2-6** Railway level crossing within the assessed area

The railway level crossing on Shorts Road is located approximately 3km from the Biloela Callide Road intersection. Adequate vertical and horizontal site distance is provided and prior warning in the form of signage is also in place. As Shorts Road is unsealed no line marking is provided. Access across the Shorts Road level crossing is not anticipated as part of either the construction phase and or operational phase of the development. Therefore, no further assessment of this crossing is warranted or provided.

The railway level crossing on Dawson highway is located approximately 750m north of the Biloela Callide Road intersection. Adequate vertical and horizontal site distance is provided and prior warning in the form of signage is also in place. Hold lines are in place and set behind the crossing signage and lights.

### 2.7 Sight distances

An assessment of available sight distances for traffic using the Biloela Callide Road / Shorts Road intersection is undertaken to ensure the existing intersection configuration is adequate for the types of vehicles using it.

Calculations have been completed using the coefficient of deceleration for a truck as a worst-case situation. As-constructed plans supplied by TMR have been provided for the Biloela Callide Road, these plans were used to calculate the approach grades for the intersection. A reaction time of two (2) seconds has been assumed as the average case for the environment.

It must be noted that due to the relatively flat landscape of the area it is assumed that longitudinal sight triangles will not be obstructed by undulations or dips in the road and thus have not been specifically assessed.

### 2.7.1 Intersection sight distances

The approach sight distance for vehicles required to stop at the intersection hold lines on both Shorts Road and Linkes Road were assessed. No data was available to calculate the approach grades, thus a grade of 0% has been assumed. An approach speed of 80km/hr has been adopted as the 85th percentile speed for the Shorts Road approach as there is no sign posted speed and it is an unsealed road. An approach speed of 110km/hr has been adopted as the 85th percentile speed for the Linkes Road approach as the signposted speed is 100km/hr. Sight triangles for approach sight distances can be seen in **Figure 2-7**.

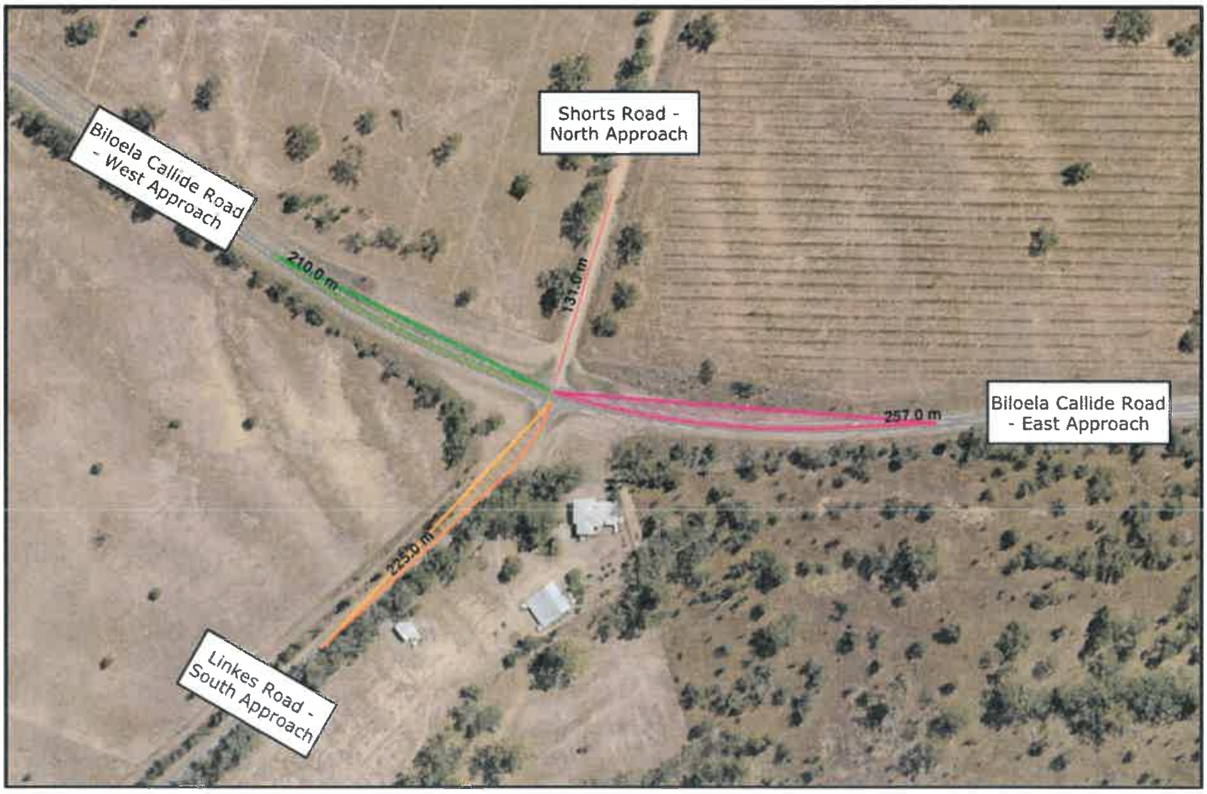



**Figure 2-7** Biloela Callide Road / Shorts Road / Linkes Road intersection – minimum stopping sight distances

Vehicles approaching the intersection from Shorts Road (north approach) have more than adequate approach sight distance to see the intersection and signage and come to a complete stop. Although the road is unsealed the approach is relatively straight for approximately the first 1.5km meaning the approach will not generate an unsafe interaction.

Vehicle approaching the intersection from Linkes Road (south approach) do not have adequate approach sight distances due to a bend in the road right before the intersection. Whilst the minimum approach sight distance is not available the road does provide adequate signage (approaching intersection and approaching stop sign) to warn the driver of the upcoming intersection and to begin to slow down. This intersection has been operating in the current configuration without significant safety issues being raised, therefore it is suggested the approach is safe given the existing signage.

Vehicles approaching the intersection along Biloela Callide Road from the west have more than adequate stopping sight distance to see any obstructions or vehicles at the intersection and come to a complete stop. However, the bend in the road means there is not much additional sight distance past the minimum.

Vehicles approaching the intersection along Biloela Callide Road from the east have adequate stopping sight distance to see any obstructions or vehicles at the intersection and come to a complete stop. Although the bend in the road means there is no additional sight distance past the minimum, the conservative approach adopted means the road is generally acceptable.

The safe intersection sight distances for the Biloela Callide / Shorts Road / Linkes Road intersection have been calculated based on the previously mentioned variables. Sight triangles for traffic from Linkes Road are shown in **Figure 2-8** and sight triangles for traffic from shorts road are shown in **Figure 2-9**.


**Figure 2-8** Biloela Callide Road / Shorts Road / Linkes Road intersection – Linkes Road approach safe intersection sight distances


**Figure 2-9** Biloela Callide Road / Shorts Road / Linkes Road intersection – Shorts Road approach safe intersection sight distances

The current available safe intersection sight distances to the Linkes Road approach are generally not acceptable. The west and east approaches have sufficient clearance to be able to see a vehicle stopped at hold line and through the intersection.

The current available safe intersection sight distances to the Shorts Road approach are generally not acceptable. The sight triangles seen in the figure both extend outside of the road verge and into the adjacent properties. Google Street View shows a number of trees and taller vegetation through the area which effectively blocks sight line to the intersection. An approaching intersection sign is provided for each approach around the corner which does give prior warning to the intersection.

All sight distance values have been calculated in accordance with the Austroads Guide to Road Design Part 3 & 4A – Geometric Road Design and Unsignalised and Signalised Intersections 2021.

#### 2.7.2 Access Sight Distances

For any assessments relating to the access off of Shorts Road refer to the Capability and Suitability Report provided in **Appendix B**

### 2.8 Intersection and network performance

An analysis of the existing intersection for the years 2024 and 2034 was undertaken using SIDRA intersection 9.1 (Version 9.1.1.200). The intersection was analysed in the AM and PM peaks and the results of the anaysis are given in **Table 2-2**.

The intersection performance is assessed via the level of service (LOS) which represents the average delay for a vehicle making a movement. The Department of Transport and Main Roads (DTMR) Guide to Traffic Impact Assessment (GTIA) indicates that that a limit of 42 seconds of average delay should not be exceeded by any movement at a priority-controlled intersection. As indicated by the SIDRA analysis the existing intersection configuration will be adequate in all cases in the end of construction 2024 and the end of the operational design horizon 2034.

NCE have utilised a user defined vehicle class to accurately depict the class 1D vehicles. The data input into the user defined class is equivalent to a triple road train, this creates a conservative situation for the average class 1D vehicle. Feedback on the input data has been provided by the SIDRA support team which is provided in **Appendix F** with the rest of the SIDRA results reports.

**Table 2-2** Biloela Callide Road / Shorts Road / Linkes Road intersection analysis results – background traffic

| Critical Movement comparisons | | | | | | |
|---|---|---|---|---|---|---|
| Time Status | Approach Leg | Movement Ref | Deg. Saturation | LOS | Delay (sec) | Back of Queue Dist (m) |
| Background 2024 AM | Biloeala Callide Road East | T1 | 0.086 | A | 0.0 | 0.1 |
| Background 2034 AM | Biloeala Callide Road East | T1 | 0.115 | A | 0.0 | 0.1 |
| Background 2024 AM | Biloeala Callide Road East | L2 | 0.086 | A | 8.3 | 0.1 |
| Background 2034 AM | Biloeala Callide Road East | L2 | 0.115 | A | 8.5 | 0.1 |
| Background 2024 AM | Biloeala Callide Road West | T1 | 0.021 | A | 0.0 | 0.1 |
| Background 2034 AM | Biloeala Callide Road West | T1 | 0.035 | A | 0.0 | 0.1 |
| Background 2024 AM | Biloeala Callide Road West | L2 | 0.021 | A | 7.8 | 0.1 |
| Background 2034 AM | Biloeala Callide Road West | L2 | 0.035 | A | 7.8 | 0.1 |
| Background 2024 AM | Shorts Road | T1 | 0.003 | A | 9.9 | 0.1 |
| Background 2034 AM | Shorts Road | T1 | 0.003 | B | 10.4 | 0.1 |
| Background 2024 AM | Shorts Road | R2 | 0.003 | A | 9.6 | 0.1 |
| Background 2034 AM | Shorts Road | R2 | 0.003 | B | 10.1 | 0.1 |
| Background 2024 AM | Linkes Road | T1 | 0.161 | A | 10.0 | 5.0 |
| Background 2034 AM | Linkes Road | T1 | 0.191 | B | 10.5 | 5.9 |
| Background 2024 AM | Linkes Road | R2 | 0.161 | B | 12.0 | 5.0 |
| Background 2034 AM | Linkes Road | R2 | 0.191 | B | 13.1 | 5.9 |
| Background 2024 PM | Biloeala Callide Road East | T1 | 0.094 | A | 0.0 | 0.1 |
| Background 2034 PM | Biloeala Callide Road East | T1 | 0.104 | A | 0.0 | 0.1 |
| Background 2024 PM | Biloeala Callide Road East | L2 | 0.094 | A | 8.4 | 0.1 |
| Background 2034 PM | Biloeala Callide Road East | L2 | 0.104 | A | 8.4 | 0.1 |
| Background 2024 PM | Biloeala Callide Road West | T1 | 0.039 | A | 0.0 | 0.1 |
| Background 2034 PM | Biloeala Callide Road West | T1 | 0.059 | A | 0.0 | 0.1 |
| Background 2024 PM | Biloeala Callide Road West | L2 | 0.039 | A | 7.8 | 0.1 |
| Background 2034 PM | Biloeala Callide Road West | L2 | 0.059 | A | 7.8 | 0.1 |
| Background 2024 PM | Shorts Road | T1 | 0.003 | B | 10.1 | 0.1 |
| Background 2034 PM | Shorts Road | T1 | 0.003 | B | 10.4 | 0.1 |
| Background 2024 PM | Shorts Road | R2 | 0.003 | A | 9.3 | 0.1 |
| Background 2034 PM | Shorts Road | R2 | 0.003 | A | 9.6 | 0.1 |
| Background 2024 PM | Linkes Road | T1 | 0.038 | A | 9.8 | 1.0 |
| Background 2034 PM | Linkes Road | T1 | 0.041 | B | 10.1 | 1.1 |
| Background 2024 PM | Linkes Road | R2 | 0.038 | B | 11.5 | 1.0 |
| Background 2034 PM | Linkes Road | R2 | 0.041 | B | 12.0 | 1.1 |

## 3.0 DEVELOPMENT TRAFFIC

### 3.1 Traffic generation

In accordance with the Department of Transport and Main Roads Guide to Traffic Impact Assessment December 2018, a first principles assessment of the development generated traffic has been used due to a lack of available data relating to the generation of traffic from this type of development.

Edify Energy has provided NCE with information pertaining to the generation of traffic for the construction and operation of previous solar farms. NCE have utilised calculations from past solar farms and the information provided by Edify Energy to calculate the number of containers of construction materials to be generated per MW of solar farm. NCE considered this container generation method and using the following theory developed a trip generation method.

(1) Solar Panel Modules – calculated to be 0.18 MW per container.

(2) Inverter Stations – calculated to be 2.00 MW per container.

(3) Fixing Systems – calculated to be 0.15 MW per container.

(4) Switchgear – one container per station.

(5) Power Transformer – one container per station.

(6) Piles – calculated to be 0.13 MW per container.

(7) Tube – calculated to be 0.13 MW per container.

(8) Tracker – calculated to be 0.13 MW per container

(9) Balance of System – calculated to be 0.75 MW per container.

(10) Earthworks / Road Materials – calculated to be 0.13 MW per container.

(11) 1 container per semi-trailer (Class 9 Heavy Vehicle) (Average payload of all containers used).

(12) LV movements for construction workers using buses, personal vehicles and additional daily cars based on numbers provided by Edify Energy.

   a. Daily On-Site Labour – calculated to be 0.08 vehicles per day per MW.

   b. Daily Mini Bus Activity – calculated to be 0.03 vehicles per day per MW.

   c. Additional Daily Cars – calculated to be 0.03 vehicles per day per MW.

(13) Numbers of workers and vehicles generated by the operation and maintenance of the solar power station were provided by Edify Energy.

   a. Management / Office – 3 total vehicles per day one way.

   b. Electrical maintenance crew – 1 total vehicle per day one way.

   c. Cleaning (Panel) crew – Annually 20 vehicles per event to be negligible over the duration of the operation.

(14)Deliveries required by the operational activities were also outlined by Edify Energy.

a. Water supply for drinking deliveries – 1 heavy vehicle monthly.

b. Water supply for cleaning deliveries – Annual event 2 heavy vehicles per event.

A 10-year design horizon starting in 2024 for the life of the development has been used for the purpose of the traffic impact assessment.

**Table 3-1** below outlines the construction and operation particulars.

**Table 3-1** Development information

| Development - Particulars | | |
|---|---|---|
| Construction Commencement | 2023 | year |
| Construction Duration | 52 | weeks |
| Construction Duration (Assumed 6 days/week) | 312 | days |
| Operations Commencement | 2024 | year |
| Operational Design Life | 30 | years |
| Operational Design Life | 1560 | weeks |
| Operational Design Life (Assumed 5 days/week) | 7800 | days |

### 3.1.1 Traffic generation during construction

Using the calculations from above the total heavy vehicle movements generated by the development site is 9,213 HV. It is expected that the site deliveries are to be spaced out over the entire duration of the construction, therefore, these have been averaged over the duration of the construction which comes out to 30 HV/day. The construction delivery traffic calculated is outlined in **Table 3-2**. The construction site labour has been calculated at 26 LV/day as per the calculations outlined above. The construction labour traffic calculated is outlined in **Table 3-3**.

**Table 3-2** Construction delivery traffic

| Solar Array System | | | | |
|---|---|---|---|---|
| Expected MWp | 200 | | | |
| | MWp per Container | Movements (One way only) | Weight per Container (kg) | Total Weight Moved |
| Modules | 0.18 | 1,111 | 15,500 | 8,610,250 |
| Inverter Stations | 2.00 | 100 | 15,500 | 775,000 |
| Fixing System | 0.15 | 1,333 | 20,500 | 13,663,250 |
| Switchgear | 200.00 | 1 | 50,000 | 25,000 |
| Power Transformer | 200.00 | 1 | 50,000 | 25,000 |
| Pile | 0.13 | 1,600 | 20,500 | 16,400,000 |
| Tube | 0.13 | 1,600 | 19,500 | 15,600,000 |
| Tracker | 0.13 | 1,600 | 13,000 | 10,400,000 |
| Balance of System | 0.75 | 267 | 15,500 | 2,069,250 |
| Earthworks / Road Materials | 0.13 | 1,600 | 15,500 | 12,400,000 |
| Total Heavy Vehicle Movements | | 9,213 | Average Payload (kg) | 8,875 |
| Average Daily Heavy Vehicle Movements | | 30 | HV/day | |

**Table 3-3** Construction labour traffic

| Construction Labour (Vehicle trips per day one way) | | |
|---|---|---|
| Daily on Site Labour | 0.08 | 15 |
| Daily Mini Bus Activity | 0.03 | 6 |
| Additional Daily Cars | 0.03 | 5 |
| Total Light Vehicle Movements (per day) | | 26 |

Construction deliveries are expected to be generated from Gladstone or that direction whereas construction labour is expected to be local and arrive from the direction of Biloela. The relative locations and expected routes are depicted in **Figure 3-1** which is shown in the following sections.

### 3.1.2 Traffic generation during operation

The oneartion of the solar power station is expected to generate significantly less traffic with the average daily light traffic generated being 7 LV/day. The operational traffic light vehicles calculations are depicted in **Table 3-4**. The heavy vehicle movements which are solely generated from the delivery of drinking water and cleaning water creates an average of 1 HV/day. The heavy vehicle generation calculations are outlined in **Table 3-5**.

**Table 3-4** Operational traffic generation – light vehicles

| Operational traffic Light Vehicles (per day one way) | | |
|---|---|---|
| Management / Office | | 6.000 |
| Electrical maintenance crew | | 1.000 |
| Cleaning (Panel) crew (Annually - 20 veh per event) | | 0.077 |
| Total Light Vehicle Movements (per day one way) | | 7.077 |

**Table 3-5** Operational traffic generation – heavy vehicles

| Operational traffic Heavy Vehicles (per day one way) | | |
|---|---|---|
| Water Supply drinking (1 x monthly) | | 0.046 |
| Water Supply Cleaning (Annually - 2 HV's per event) | | 0.008 |
| Total Heavy Vehicle Movements (per day one way) | | 0.054 |

Edify Energy have indentified that once in full operation, the normal operating hours of the solar power station will be during daylight hours between the hours of sunrise approximately 7am to 6pm. For the purpose of this TIA the generated traffic will be applied to the identified AM and PM peaks.


**Figure 3-1** Generated traffic routes and locations

### 3.2 Traffic composition

Generated traffic contribution is split between light vehicles including buses and cars and heavy vehicles which will generally be semi-trailers. The number of each vehicle type is depicted in the tables outlined in **Section 3.1**.

All light vehicles will be classed as under the 0A / 1A TMR traffic data classifications.

All development heavy vehicles are to be Class 9 – Six Axle Articulated (Semi Trailer) which is the equivalent of a Class 2I in the TMR traffic data classifications. The Class 2I is specified under a Class 1C. Whilst some heavy vehicles such as water deliveries could be classed as a lower vehicle class they are to be adopted as semi-trailers to take a conservative approach.

### 3.3 Trip distribution (In/Out) splits

Based on a worse-case assumption that all construction deliveries can arrive during the peak hour and that there will be a high turnover of delivery vehicles an in / out split of 100% / 100%. This is a very conservative assumption which will also account for the possibilities of deliveries not being distributed exactly over the span of the development.

The light vehicle in / out split is to be 100% / 0% for the AM peak hour and 0% / 100% for the PM peak hour. This will simulate the arrival of workers to the site in the morning and the departure of workers in the afternoon.

### 3.4 Development traffic volumes on the network

The full set of traffic calculations and intersection warrants are given in **Appendix E**. The following sheets show the split of the development traffic through the intersection:

- DEV 2024 AM – this shows the construction traffic in the AM peak added to the background traffic. This traffic is applied at the end of the construction period as a worst-case scenario of the construction traffic.
- DEV 2024 PM – this shows the construction traffic in the PM peak added to the background traffic. This traffic is applied at the end of the construction period as a worst-case scenario of the construction traffic.
- DEV 2034 AM – this shows the operation traffic in the AM peak added to the background traffic. This traffic is applied at the end of the operation design horizon as a worst-case scenario of the operational traffic.
- DEV 2034 PM – this shows the operation traffic in the PM peak added to the background traffic. This traffic is applied at the end of the operation design horizon as a worst-case scenario of the operational traffic.

Heavy vehicles during both the construction and operation phases will approach the Biloela Callide Road / Shorts Road / Linkes Road from the west and turn left onto Shorts Road to enter the development site. Heavy vehicles during both the construction and operation phases will turn right out of Shorts Road to drive towards Gladstone via the Biloela Callide Road and Dawson Highway as depicted in **Figure 3-1**.

Light vehicles are expected to arrive from and depart to Biloela via Calvale and Linkes Roads as depicted in **Figure 3-1**. This traffic will drive straight through the Biloela Callide Road / Shorts Road / Linkes Road from the Linkes Road approach and depart in the opposite direction.

### 3.5 Heavy vehicle payloads

The average payload for heavy vehicles is given in **Table 3-2**.

## 4.0 IMPACT ASSESSMENT AND MITIGATION

For comparison to existing conditions refer to **Section 2.0**.

### 4.1 With development scenario traffic volumes

The full traffic generation spreadsheet is contained in **Appendix E**.

#### 4.1.1 Construction and establishment of solar power station

**Figure 4-1** shows the 2024 AM traffic peak at the Biloela Callide Road / Shorts Road / Linkes Road intersection, inclusive of the construction traffic for the development. **Figure 4-2** shows the 2024 PM traffic peak at the Biloela Callide Road / Shorts Road / Linkes Road intersection, inclusive of the construction traffic for the development.

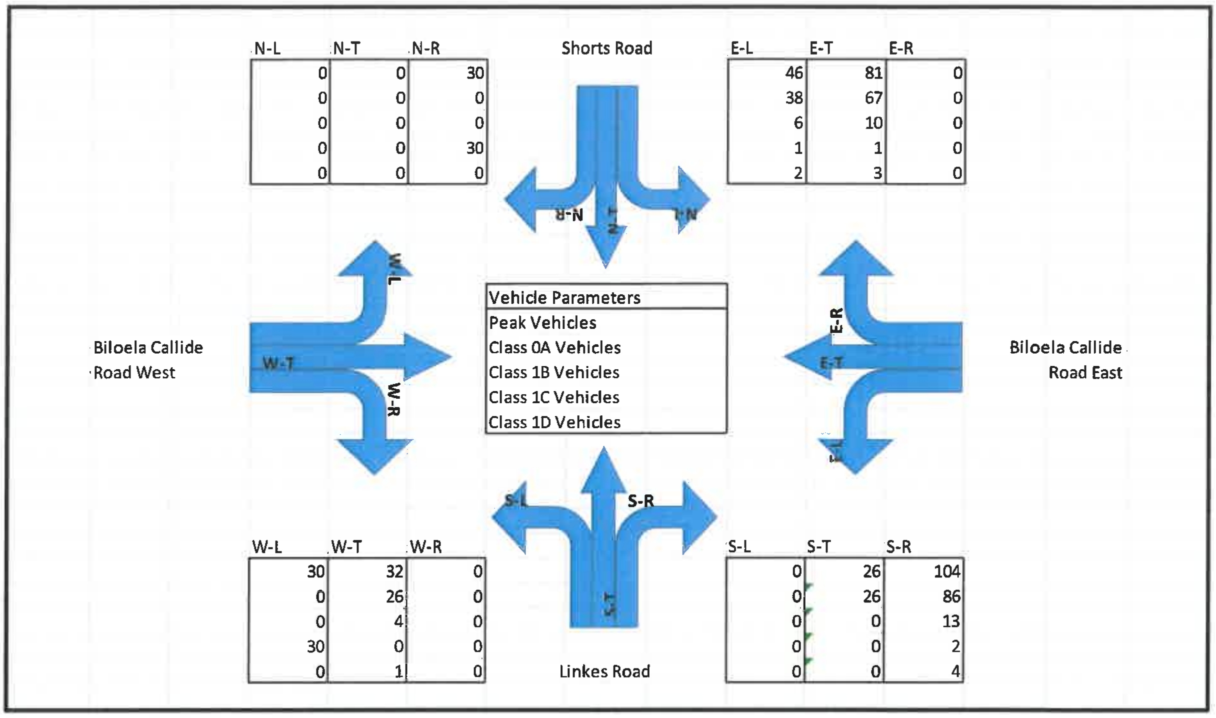



**Figure 4-1** 2024 AM traffic peak – construction traffic

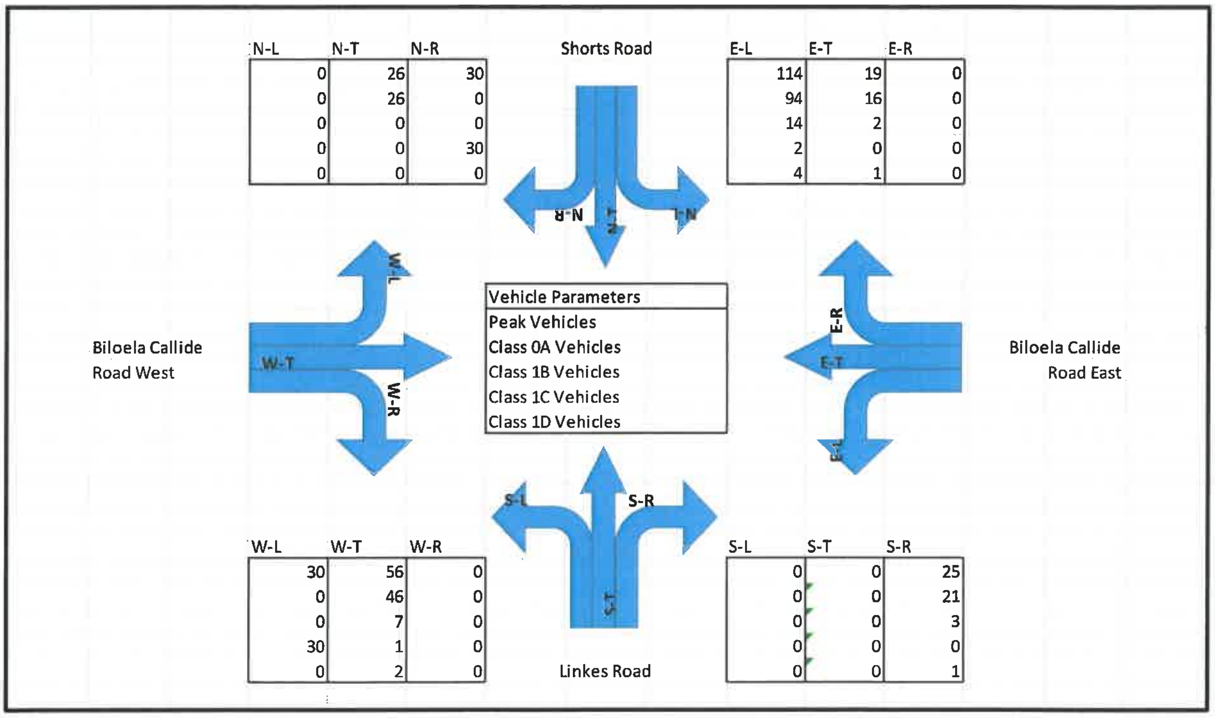



**Figure 4-2** 2024 PM traffic peak – construction traffic

### 4.1.2 Operation of the solar power station

**Figure 4-3** shows the 2034 AM traffic peak at the Biloela Callide Road / Shorts Road / Linkes Road intersection, inclusive of the operation traffic for the development. **Figure 4-4** shows the 2034 PM traffic peak at the Biloela Callide Road / Shorts Road / Linkes Road intersection, inclusive of the operation traffic for the development.

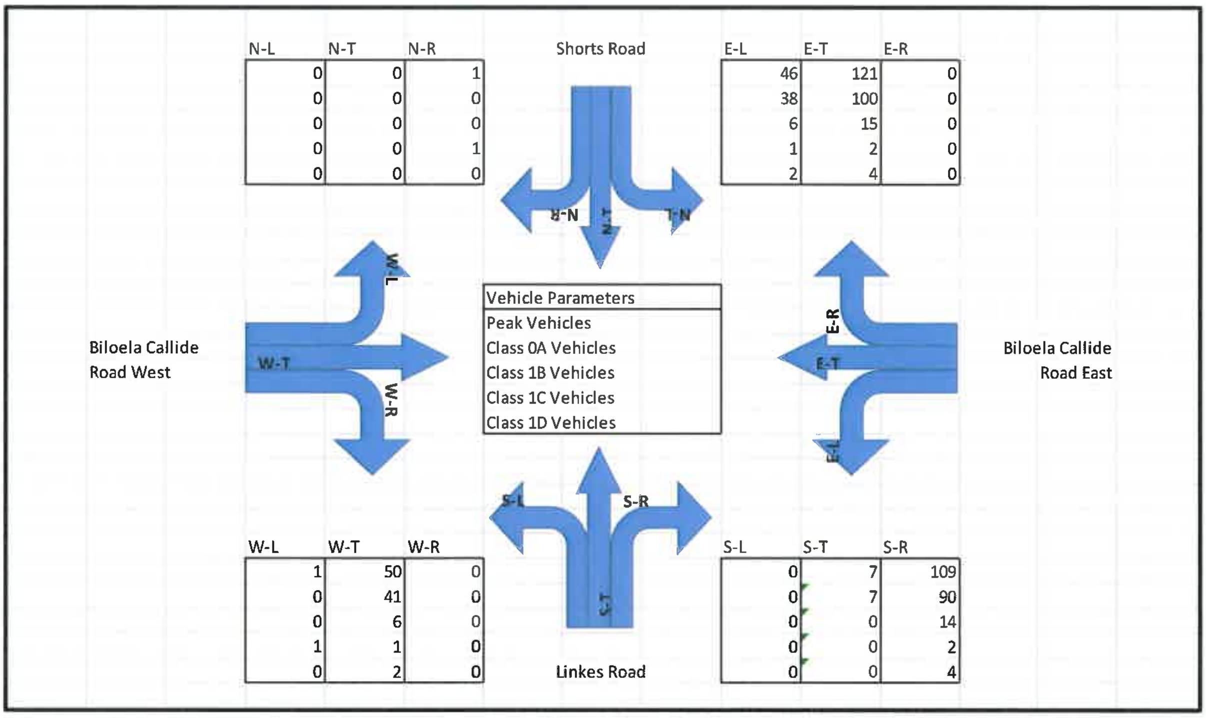


**Figure 4-3** 2034 AM traffic peak – operational traffic

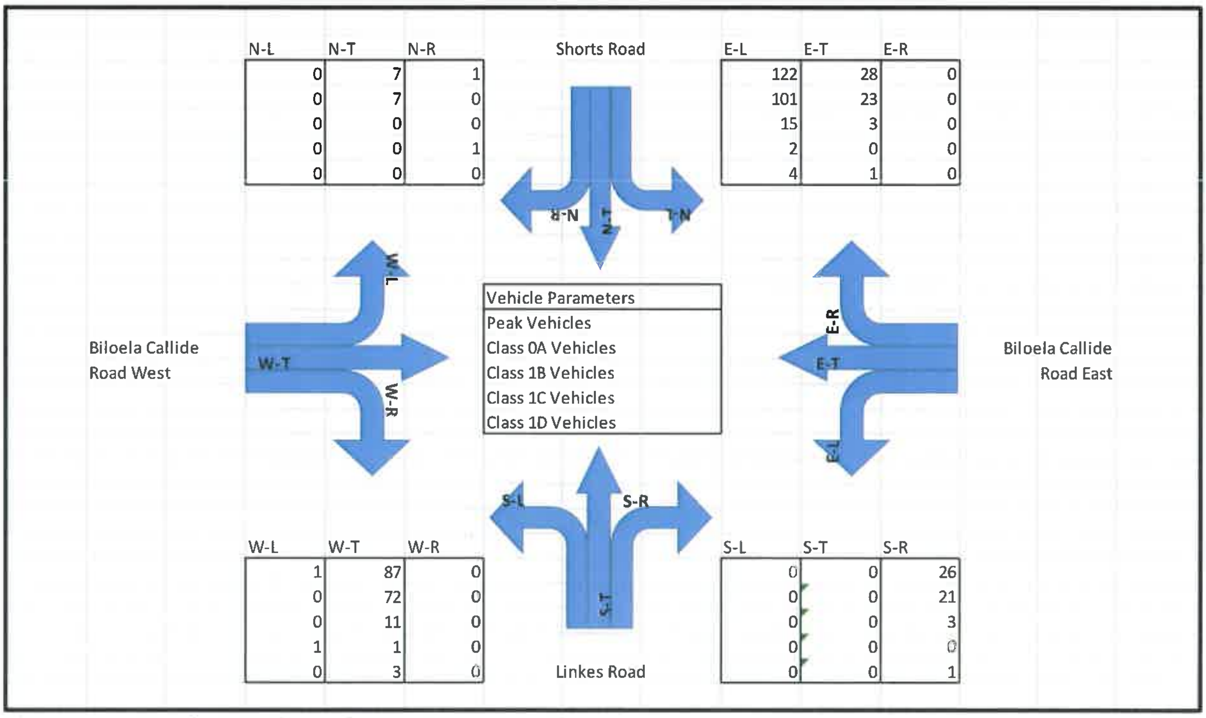


**Figure 4-4** 2034 PM traffic peak – operational traffic

## 4.2 Intersection warrant assessment

The Biloela Callide Road / Shorts Road intersection has been assessed using the intersection warrant method outlined by the Austroads Guide to Traffic Management Part 6. The Shorts Road leg has been assessed only as the development will not generate additional traffic in any other turn scenarios. The intersection has been assessed for the development generated traffic calculated for the end of construction and end of the operational design horizon. NCE have assessed Shorts Road and consider that the peak hour locally generated traffic will be offset to the development peak hours, therefore no background traffic along Shorts Road has been added.

The intersection turn warrants for the worst case PM peak during the construction of the development in 2024 is depicted in **Figure 4-5** below.

As can be seen the low volume of traffic utilising the Biloela Callide Road results in the left turn only requiring a basic left turn treatment. The current intersection does not provide a basic left turn treatment as there is no applicable widening and taper at the intersection left turn. As the development does not generate any right turns onto Shorts Road from Biloela Callide Road it is suggested that no turn treatment is required as the number of vehicles turning right into Shorts Road will be negligible and will not have an impact on the operation and safety of the intersection.

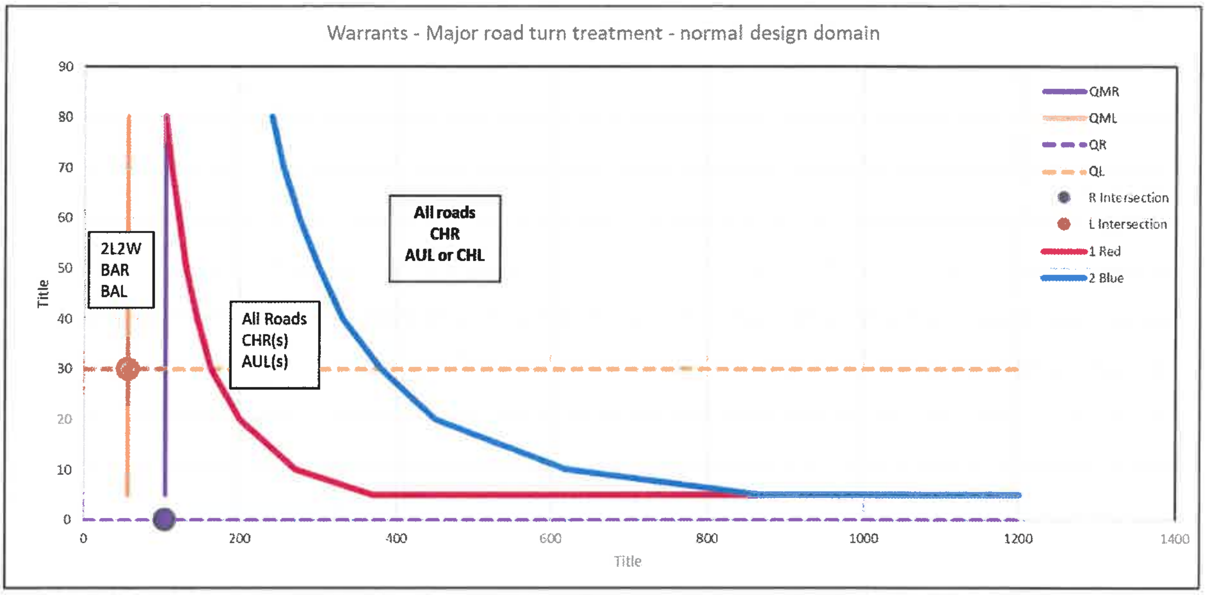



**Figure 4-5** Intersection warrants for construction traffic – 2024 PM Peak

The intersection turn warrants for the worst case PM peak at the end of the operational design horizon in 2034 is depicted in **Figure 4-6** below.

As can be seen despite the background traffic increasing the turn movements from Biloela Callide Road have decreased due to the commencement of operation. This results in a betterment to the intersection conditions from the construction phase. Therefore, it is suggested that no further mitigation is required as the basic left turn treatment will cater for the decreased number of turning vehicles. The full intersection warrant assessment spreadsheet is also contained within the spreadsheet in **Appendix E**.

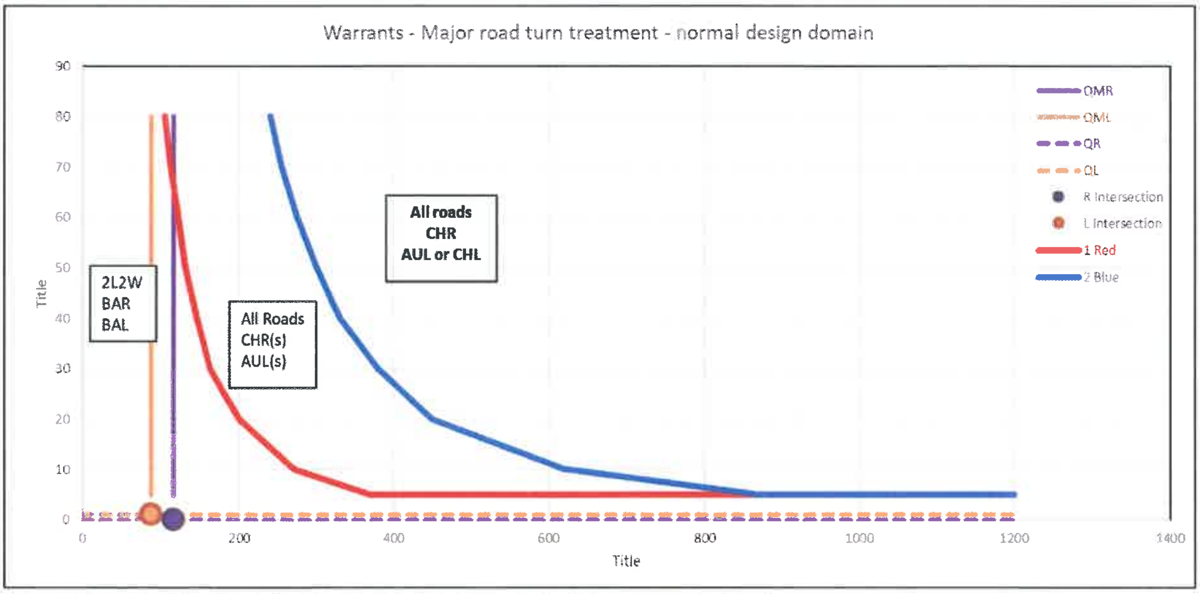



**Figure 4-6** Intersection warrants for operational traffic – 2034 PM Peak

## 4.3 SIDRA analysis

An analysis of the existing intersection with development traffic for the expected end of construction and expected end of operation design horizon was undertaken using SIDRA Intersection 9.1 (Version 9.1.1.200). The intersection was analysed in the AM and PM peaks for each traffic generation scenario. The results of the SIDRA modelling are shown in **Figure 4-1** and **Figure 4-2** for the AM and PM peak assessments respectively.

The intersection performance is assessed via the level of service (LOS) which represents the average delay for a vehicle making a movement. The GTIA indicates that a limit of 42 seconds of average delay should not be exceeded by any movement at a priority-controlled intersection. As indicated by the SIDRA analysis the existing intersection configuration will be adequate in all cases including the expected finish year of construction (2024) and end of operational design horizon (2034). The worst-case LOS is a D for right turn movements out of Shorts Road in the AM peak during the construction and operation, this worsens the movement from an LOS of A and B respectively when compared to the background traffic only. Therefore, NCE consider no additional mitigation or upgrades to the intersection are required by the SIDRA analysis.

**Table 4-1** Biloela Callide Road / Shorts Road / Linkes Road intersection analysis results – AM peak development generated traffic

| Critical Movement comparisons | | | | | | |
|---|---|---|---|---|---|---|
| Time Status | Approach Leg | Movement Ref | Deg. Saturation | LOS | Delay (sec) | Back of Queue Dist (m) |
| Background 2024 AM | Biloeala Callide Road East | T1 | 0.086 | A | 0.0 | 0.1 |
| Background 2034 AM | Biloeala Callide Road East | T1 | 0.115 | A | 0.0 | 0.1 |
| Construction 2024 AM | Biloeala Callide Road East | T1 | 0.086 | A | 0.0 | 0.1 |
| Operation 2034 AM | Biloeala Callide Road East | T1 | 0.115 | A | 0.0 | 0.1 |
| Background 2024 AM | Biloeala Callide Road East | L2 | 0.086 | A | 8.3 | 0.1 |
| Background 2034 AM | Biloeala Callide Road East | L2 | 0.115 | A | 8.5 | 0.1 |
| Construction 2024 AM | Biloeala Callide Road East | L2 | 0.086 | A | 8.3 | 0.1 |
| Operation 2034 AM | Biloeala Callide Road East | L2 | 0.115 | A | 8.5 | 0.1 |
| Background 2024 AM | Biloeala Callide Road West | T1 | 0.021 | A | 0.0 | 0.1 |
| Background 2034 AM | Biloeala Callide Road West | T1 | 0.035 | A | 0.0 | 0.1 |
| Construction 2024 AM | Biloeala Callide Road West | T1 | 0.064 | A | 0.0 | 0.1 |
| Operation 2034 AM | Biloeala Callide Road West | T1 | 0.036 | A | 0.0 | 0.1 |
| Background 2024 AM | Biloeala Callide Road West | L2 | 0.021 | A | 7.8 | 0.1 |
| Background 2034 AM | Biloeala Callide Road West | L2 | 0.035 | A | 7.8 | 0.1 |
| Construction 2024 AM | Biloeala Callide Road West | L2 | 0.064 | B | 11.1 | 0.1 |
| Operation 2034 AM | Biloeala Callide Road West | L2 | 0.036 | B | 11.1 | 0.1 |
| Background 2024 AM | Shorts Road | T1 | 0.003 | A | 9.9 | 0.1 |
| Background 2034 AM | Shorts Road | T1 | 0.003 | B | 10.4 | 0.1 |
| Construction 2024 AM | Shorts Road | T1 | 0.143 | B | 10.3 | 11.9 |
| Operation 2034 AM | Shorts Road | T1 | 0.007 | B | 10.4 | 0.3 |
| Background 2024 AM | Shorts Road | R2 | 0.003 | A | 9.6 | 0.1 |
| Background 2034 AM | Shorts Road | R2 | 0.003 | B | 10.1 | 0.1 |
| Construction 2024 AM | Shorts Road | R2 | 0.143 | D | 26.0 | 11.9 |
| Operation 2034 AM | Shorts Road | R2 | 0.007 | D | 25.9 | 0.3 |
| Background 2024 AM | Linkes Road | T1 | 0.161 | A | 10.0 | 5.0 |
| Background 2034 AM | Linkes Road | T1 | 0.191 | B | 10.5 | 5.9 |
| Construction 2024 AM | Linkes Road | T1 | 0.189 | B | 10.5 | 5.9 |
| Operation 2034 AM | Linkes Road | T1 | 0.198 | B | 10.5 | 6.1 |
| Background 2024 AM | Linkes Road | R2 | 0.161 | B | 12.0 | 5.0 |
| Background 2034 AM | Linkes Road | R2 | 0.191 | B | 13.1 | 5.9 |
| Construction 2024 AM | Linkes Road | R2 | 0.189 | B | 12.1 | 5.9 |
| Operation 2034 AM | Linkes Road | R2 | 0.198 | B | 13.1 | 6.1 |

**Table 4-2** Biloela Callide Road / Shorts Road / Linkes Road intersection analysis results – AM peak development generated traffic

| Critical Movement comparisons | | | | | | |
|---|---|---|---|---|---|---|
| Time Status | Approach Leg | Movement Ref | Deg. Saturation | LOS | Delay (sec) | Back of Queue Dist (m) |
| Background 2024 PM | Biloeala Callide Road East | T1 | 0.094 | A | 0.0 | 0.1 |
| Background 2034 PM | Biloeala Callide Road East | T1 | 0.104 | A | 0.0 | 0.1 |
| Construction 2024 PM | Biloeala Callide Road East | T1 | 0.094 | A | 0.0 | 0.1 |
| Operation 2034 PM | Biloeala Callide Road East | T1 | 0.104 | A | 0.0 | 0.1 |
| Background 2024 PM | Biloeala Callide Road East | L2 | 0.094 | A | 8.4 | 0.1 |
| Background 2034 PM | Biloeala Callide Road East | L2 | 0.104 | A | 8.4 | 0.1 |
| Construction 2024 PM | Biloeala Callide Road East | L2 | 0.094 | A | 8.4 | 0.1 |
| Operation 2034 PM | Biloeala Callide Road East | L2 | 0.104 | A | 8.4 | 0.1 |
| Background 2024 PM | Biloeala Callide Road West | T1 | 0.039 | A | 0.0 | 0.1 |
| Background 2034 PM | Biloeala Callide Road West | T1 | 0.059 | A | 0.0 | 0.1 |
| Construction 2024 PM | Biloeala Callide Road West | T1 | 0.082 | A | 0.0 | 0.1 |
| Operation 2034 PM | Biloeala Callide Road West | T1 | 0.060 | A | 0.0 | 0.1 |
| Background 2024 PM | Biloeala Callide Road West | L2 | 0.039 | A | 7.8 | 0.1 |
| Background 2034 PM | Biloeala Callide Road West | L2 | 0.059 | A | 7.8 | 0.1 |
| Construction 2024 PM | Biloeala Callide Road West | L2 | 0.082 | B | 11.1 | 0.1 |
| Operation 2034 PM | Biloeala Callide Road West | L2 | 0.060 | B | 11.1 | 0.1 |
| Background 2024 PM | Shorts Road | T1 | 0.003 | B | 10.1 | 0.1 |
| Background 2034 PM | Shorts Road | T1 | 0.003 | B | 10.4 | 0.1 |
| Construction 2024 PM | Shorts Road | T1 | 0.146 | B | 10.6 | 8.7 |
| Operation 2034 PM | Shorts Road | T1 | 0.013 | B | 10.5 | 0.4 |
| Background 2024 PM | Shorts Road | R2 | 0.003 | A | 9.3 | 0.1 |
| Background 2034 PM | Shorts Road | R2 | 0.003 | A | 9.6 | 0.1 |
| Construction 2024 PM | Shorts Road | R2 | 0.146 | C | 22.1 | 8.7 |
| Operation 2034 PM | Shorts Road | R2 | 0.013 | C | 21.6 | 0.4 |
| Background 2024 PM | Linkes Road | T1 | 0.038 | A | 9.8 | 1.0 |
| Background 2034 PM | Linkes Road | T1 | 0.041 | B | 10.1 | 1.1 |
| Construction 2024 PM | Linkes Road | T1 | 0.039 | B | 10.3 | 1.1 |
| Operation 2034 PM | Linkes Road | T1 | 0.041 | B | 10.1 | 1.1 |
| Background 2024 PM | Linkes Road | R2 | 0.038 | B | 11.5 | 1.0 |
| Background 2034 PM | Linkes Road | R2 | 0.041 | B | 12.0 | 1.1 |
| Construction 2024 PM | Linkes Road | R2 | 0.039 | B | 11.7 | 1.1 |
| Operation 2034 PM | Linkes Road | R2 | 0.041 | B | 12.0 | 1.1 |

The SIDRA results reports can be found in **Appendix F**.

## 4.4 Road safety impact assessment and mitigation

### 4.4.1 <u>Safe intersection sight distance</u>

As discussed in **Section 2.7** the safe intersection sight distance and sight distances have been deemed acceptable given the safety measures in place.

### 4.4.2 Swept path assessment

A swept path assessment of the Biloela Callide Road / Shorts Road intersection was completed and can be seen in **Appendix G**. This drawing was completed using the Queensland Globe aerial imagery and thus exact dimensions of the intersection cannot be assured. A design vehicle of a 19m prime mover and semi-trailer has been run through the intersection.

The current intersection configuration cannot accommodate the left turn movement from the Biloela Callide Road onto Shorts Road without running off the road on the internal corner or crossing into an opposing lane. The current intersection configuration can however accommodate the right turn movement out of Shorts Road due to the intersection widening provided at the Linkes Road leg.

Due to this issue, it is expected that road alterations in the form of pavement widening would be required to accommodate the design vehicle. The expected increase in pavement area is shown in the drawing in **Appendix G**. The widening of the pavement shoulder at this turn will also require the extension of the existing culvert in the table drain which is indicated in the provided drawing.

### 4.4.3 Impacts on railway level crossings

The location of the railway level crossings within the assessment area are indicated in **Figure 2-6**. It should be noted that the level crossing on Shorts Road is positioned after the proposed accesses to the development site and thus will not be impacted by the development traffic.

The railway level crossing on the Dawson highway will be utilised by the heavy vehicle traffic generated by the development. These vehicles will be 100% class 9 semi-trailers with a total of 30 HV/day for the duration of the construction and 1 HV/day for the operation.

The AADT over the railway crossing with and without the development traffic is given in **Table 4-3** for use in ALCAM assessments. The background traffic and growth has been calculated using the Site ID 60067 with the 10-year growth percent applied to forecast the background conditions in 2022, 2023 and 2024.

**Table 4-3** ALCAM - AADT Over Railway Crossing

| **AADT over railway level crossing**<br>Manton Quarry Road / Flinders Highway Intersection | | | |
|---|---|---|---|
| Year | Without development (background growth) | With development | No. and dimensions/type of heavy vehicles |
| 2020 (current scenario) | 302 HV/day<br>970 LV/day | 302 HV/day<br>970 LV/day | 153 Class 1B HV/day<br>62 Class 1C HV/day<br>87 Class 1D HV/day |
| Commencement of construction (2023) | 307 HV/day<br>988 LV/day | 337 HV/day<br>988 LV/day | 155 Class 1B HV/day<br>93 Class 1C HV/day<br>89 Class 1D HV/day |
| Commencement of operation (2024) | 313 HV/day<br>1008 LV/day | 314 HV/day<br>1008 LV/day | 158 Class 1B HV/day<br>65 Class 1C HV/day<br>91 Class 1D HV/day |
| Ten-year design horizon (2034) | 367 HV/day<br>1180 LV/day | 368 HV/day<br>1180 LV/day | 186 Class 1B HV/day<br>76 Class 1C HV/day<br>106 Class 1D HV/day |

*Note: Operational daily vehicle counts represent worst case daily only as some vehicles are only generated on a greater than daily basis*

## 5.0 PAVEMENT IMPACT ASSESSMENT

A pavement impact assessment has not been completed as part of this TIA.

## 6.0 CONCLUSIONS AND RECOMMENDATIONS

### 6.1 Summary of impacts and mitigation measures proposed

NCE have undertaken a traffic study for the proposed Callide Solar Power Station at 551 & 641 Biloela Callide Road & Shorts Road, Mount Murchison. The findings of this assessment are summarised below:

- Intersection impact assessment and mitigation
    - A SIDRA analysis found that the existing intersection configuration will be adequate in all cases including the expected year of the end of construction (2024) and the end of the operational design horizon (2034).
    - An intersection warrant assessment was completed for the turn movements into Shorts Road only. This assessment found that a basic left turn (BAL) treatment configuration is required onto Shorts Road. However, no upgrades to the existing right turn treatment are required. NCE have indicated the extent of pavement widening required to incorporate a BAL treatment in the swept path plan in **Appendix G**.

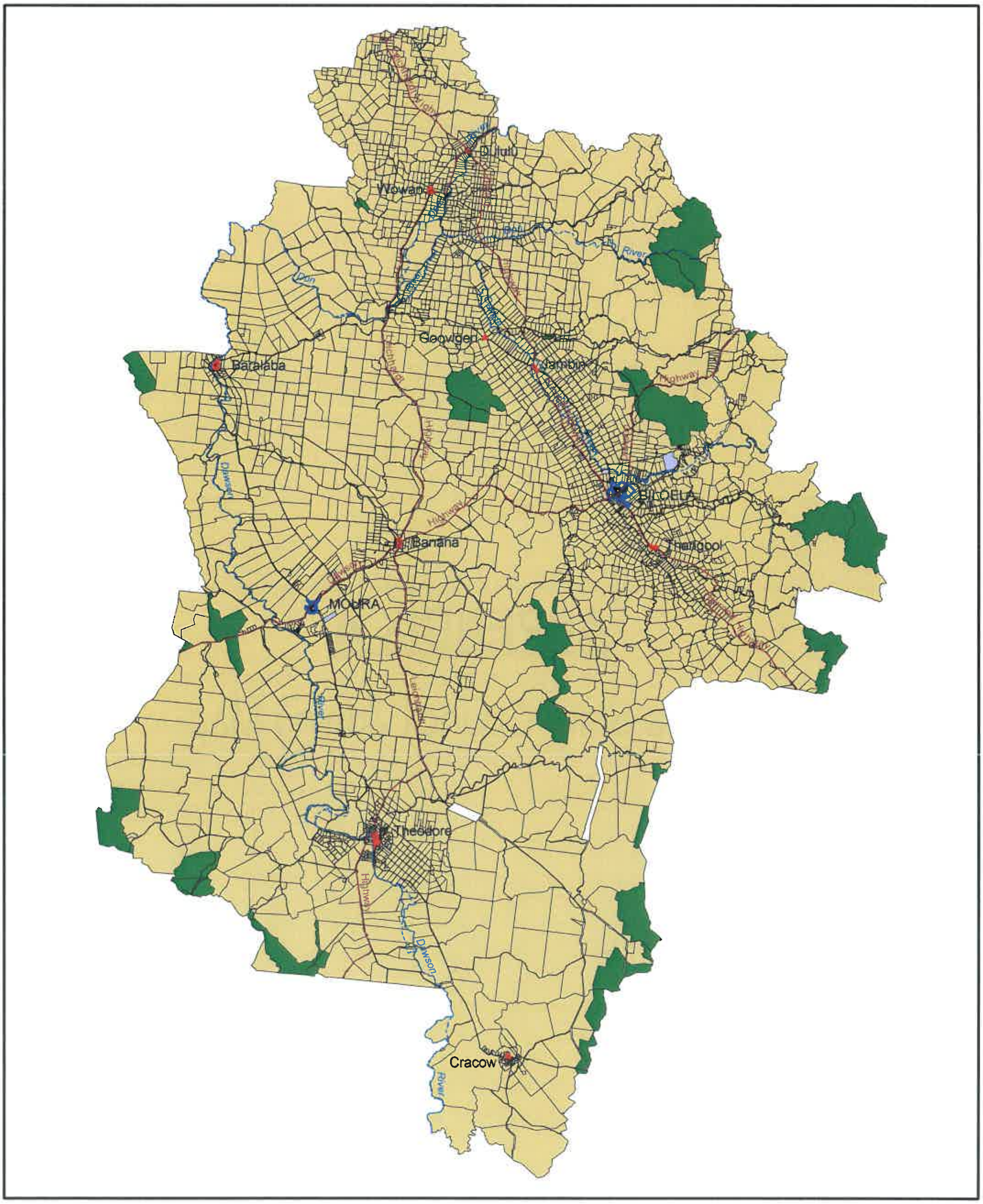
- Road safety impact assessment and mitigation
    - The current intersection provides adequate stopping sight distance for the Biloela Callide Road east and west approaches and the Shorts Road approach. Due to a bend at the end of Linkes Road the stopping sight distance is inadequate. The safety issues generated by the lack of stopping sight distance for Linkes Road are mitigated by providing adequate signage warning of the approaching intersection and stop sign.
    - The current major road approaches for the Biloela Callide Road do not provide adequate safe intersection sight distance. The safety issues generated by the lack of safe intersection sight distance are mitigated by providing adequate signage warning of the approaching intersection. As the stopping sight distance is also available in conjunction with this signage NCE suggest the intersection does not pose any major safety risks.
    - NCE have completed a swept path assessment for a design vehicle of a 19m prime mover and semi-trailer turning left into and right out of Shorts Road. The swept path assessment indicates a widening at the internal left corner is required. The extent of widening is indicated in the swept path plan in **Appendix G** along with the required extension of the culvert to incorporate the widening.
    - NCE provide the AADT data over the impacted railway level crossing for assessment of the impacted railway level crossing on the Dawson Highway.

### 6.2 Certification statement and authorisation

A signed Traffic Impact Assessment Certification can be found in **Appendix H**.

# APPENDIX A

## Banana Shire Council Zoning Map




# ZONING
## Banana Shire Planning Scheme
## Map No. ZONE-1

Scale 1:650 000

10 0 10 20 30 40

Kilometres

Key

Zones

- Open Space
- Rural
- Special Industrial
- Town
- Village

Digital Cadastral Database (DCDB) supplied by Natural Resources and Mines.

**June 2005**

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# APPENDIX B

Shorts Road Capability and Suitability Report

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# SHORTS ROAD – CAPABILITY AND SUITABILITY REPORT

CALLIDE SOLAR POWER STATION

FOR
EDIFY ENERGY

**JOB No:** MJ2370

**REVISION:** B

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| ISSUE | AUTHOR | APPROVED FOR ISSUE | | | ISSUED TO: | REASON |
|---|---|---|---|---|---|---|
| | | NAME | SIGNATURE | DATE | | |
| A | Derek Saw | Derek Saw (REPQ 7363) | | 17/11/2022 | Edify | DRAFT For Review / Comment |
| B | Derek Saw | Derek Saw (REPQ 7363) | | 28/11/2022 | Edify | In support of DA |

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## 1.0 Executive Summary

The objective of this report is to complete an assessment of Shorts Road in terms of the infrastructure capability to service the construction and operational phases of the Callide Solar Power Station development. This assessment is limited to Shorts Road between Biloela-Callide Road and the Moura system rail line, within the jurisdiction of the Banana Shire Council.

The review of Shorts Road has been completed in accordance with ARRB – Unsealed Roads Best Practise Guide 2 (October 2020). Based upon the existing characteristics of Shorts Road, combined with the predicted traffic volumes during the construction period. Shorts Road can be classified as:

- Laying slightly above the upper bounds of a Class 4B roadway and,
- Laying within the lower bounds of a Class 4A roadway.

The results of the compliance assessment against geometric design standards assigned to Class 4B roadways found Shorts Road was considered deficient with respect to the below design parameter:

- Minimum crossfall %:
    - Shorts Road falls short of the recommended 5% crossfall.

Recommendations

1. Shorts Road profile (crossfall) can be improved by importing a suitable gravel overlay material, incorporating into the existing granular profile and re-shaping to introduce the preferred cross fall grades
2. Signage relating the isolated humps within the roadway section can be installed to improve awareness for unfamiliar drivers.
3. Improvement in some aspects of the drainage and potential increased maintenance during the construction period would assisting in limiting or eliminating surface erosion through runoff scouring and reduce the potential for rutting and shoving in the few locations observed.

# 2.0 DEVELOPMENT CONTEXT

## 2.1 Site details

The site is located at Shorts Road, Biloela, within the jurisdiction of the Banana Shire Council.

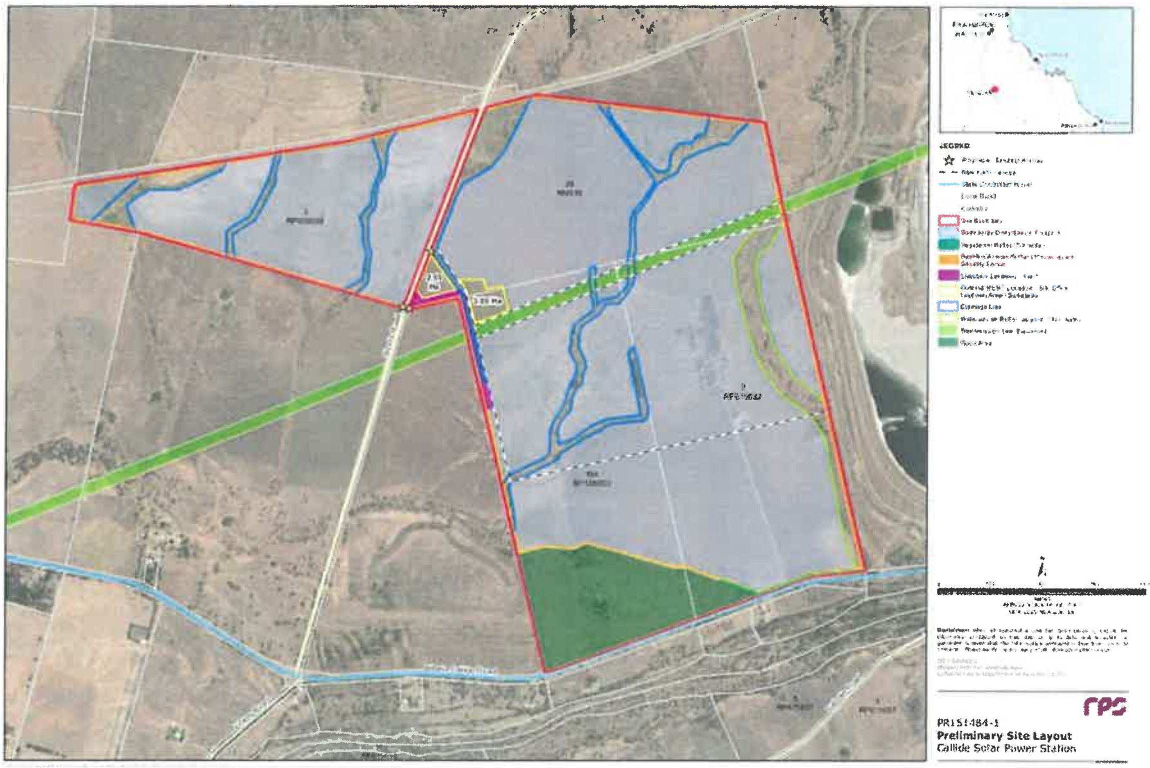


**Figure 2-1 - Site Location Map**

## 2.2 Site Access

Access to the site for the purposes of delivering materials for the construction of the solar farm will be obtained via the Dawson Highway, Biloela-Callide Road and Shorts Road.

During the operational phase vehicles are expected to access the site via Links Road and or the Biloela-Callide Road then Shorts Road.

Utilisation of Shorts Road will occur between Ch00 (Biloela-Callide Road) and Ch 2,940 (Moura System Rail Line).

The Main access route will occur over Ch00 to Ch1,870/Ch2,160 being the point at which construction traffic will exit Shorts Road to access the construction lay down area, construction hub, substation and Maintenance operations.

Shorts Road between Ch2,160 and Ch2,940 may be utilised to access Lot 3 on RP608599 via secondary access gates.

## 3.0 Roadway Classification assessment

An assessment of Shorts Road has been completed in accordance with ARRB – Unsealed Roads Best Practise Guide 2 (October 2020).

**Table 3-1** Unsealed Roads – Table 3.9 Classification system.

Table 3.9: Unsealed roads classification system

| Road class | Class type | Service function description | Road type description |
|---|---|---|---|
| 4A | Main road > 150 ADT | This type of road is used for major movements between population centres and connection to adjacent areas. High traffic volumes occur, and the road can carry large vehicles. | • All weather road, predominantly two-lane and unsealed. Can be sealed if economically justified.<br>• Operating speed standard of 50–80 km/h according to terrain.<br>• Minimum carriageway width is 7 m. |
| 4B | Minor road 50–150 ADT | This type of road is used for connection between local centres of population and links to the primary network. Roads may or may not be sealed depending on the importance and function of the road. | • All-weather two-lane road formed and gravelled or single-lane sealed road with gravel shoulders.<br>• Operating speed standard of 30–70 km/h according to terrain.<br>• Minimum carriageway width is 5.5 m. |
| 4C | Access road 10–50 ADT | Provides access to low use areas or individual rural property sites and forest areas. Caters for low travel speed and a range of vehicles and may be seasonally closed. | • Substantially a single lane two-way, generally dry weather, formed road.<br>• Operating speeds standard of < 20–40 km/h according to terrain.<br>• Minimum carriageway width is 4 m.<br>• May be restricted to four-wheel drive vehicles. |
| 4D | Tracks < 10 ADT | Mainly used for fire protection purposes, management access and limited recreational activities. | • Predominantly a single-lane two-way earth track (unformed) at or near the natural surface level.<br>• Predominantly not conforming to any geometric design standards.<br>• Minimum cleared width is 3 m.<br>• Primarily for four-wheel drive vehicles. |

### 3.1.1 Roadway data summary

### 3.1.2 Road Width:

7.0m to 7.5m typical carriageway width and in excess of the minimum 1.5m clear zone provided in almost all situations. The carriageway width is considered adequate for the purposes of two-way traffic volumes

### 3.1.3 Road Surface:

Gravel construction (pavement profile depths unknown), whilst the granular material varies in nature throughout the length of Shorts Road, it appears to be reasonably well graded for the purposes of a gravel wearing course with a mix of fine material and larger granular stone to balance skid resistance and dust emission. The formation/profile lacks sufficient cross fall to adequately shed stormwater and has resulted in isolated areas that display ponded run-off and locations in which surface deformation (sub-grade rutting) is evident. The lack of cross fall is also contributing to longitudinal scouring and loss of road base materials through longitudinal drainage paths eroding the granular surface.

### 3.1.4 Road Drainage:

Table drains and outlet drains evident in areas, maintenance required.

### 3.1.5 Road Horizontal alignment;

The horizontal alignment of Shorts Road is described as straight. A small deflection of between 4 and 5 degrees is located at Ch 1,870 which coincides with the main access to the Callide SPS substation and Site Office.

### 3.1.6 Road Vertical alignment:

Generally speaking, the vertical alignment of Shorts Road can be described as flat. There are however (3) isolated short humps in the roadway. These humps are assumed to serve as diversion structures associated with stormwater run-off.

### 3.1.7 Development Generated Traffic:

Construction phase traffic is expected to generate 112 total vehicle movement per day.

- 30 (Class 9) Heavy vehicles per day (Average payload 8.875 tonne) one way
- 26 (Class 2/3) Light vehicles per day one way

Operational phase traffic is expected to generate 8 total vehicle movement per day.

- 1 (Class 9) Heavy vehicles per day (Average payload 26) one way
- 7 (Class 2/3) Light vehicles per day one way

Whilst a specific Traffic Movement survey has not been completed with respect to Shorts Road it is expected the AADT for this section of roadway would be between 50 and 80 veh/day based upon 10 trips per residence plus rural farming traffic.

Therefore, an estimated AADT during the construction period is between 162 and 192 veh/day would be considered reasonable. The volume of Operational traffic is considered to be negligible and therefore no further analysis of those traffic loads is warranted.

### 3.1.8 Roadway Classification Determination

Based upon the existing characteristics of Shorts Road listed above combined with the predicted traffic volumes during the construction period. Shorts Road can be classified as:

Laying slightly above the upper bounds of a Class 4B roadway and,

Laying within the lower bounds of a Class 4A roadway.

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## 3.2 Compliance Assessment Results

Based upon a compliance assessment against Type 4B and 4A classified unsealed roads, it can be seen from Table 3.9, that shorts Road satisfies the majority of geometric design standards.

**Table 3-2** Unsealed Roads – Table 3.9 Classification system.

Table 3.10: Guidelines for the main geometric design standards for unsealed roads

| Road classification | 4A Main | | | 4B Minor | | | 4C Access | | | 4D Tracks | | | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Terrain type | Flat | Rolling | Mountainous | Flat | Rolling | Mountainous | Flat | Rolling | Mountainous | Flat | Rolling | Mountainous | |
| **Main geometric characteristic** *based on safety, costs and environmental considerations* | | | | | | | | | | | | | |
| Operating speed value (km/h) | 80 | 70 | 50 | 70 | 50 | 30 | 60 | 40 | 20 | N/A | N/A | N/A | Based on 85th percentile speed |
| **Cross-section elements** | | | | | | | | | | | | | |
| Number of traffic lanes | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | Unsealed lanes |
| Minimum cross fall (%) | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 4 | 4 | 4 | Min. of 4% to drain rainfall off tracks |
| Maximum superelevation (%)[1] | 6 | 7 | 8 | 6 | 8 | 10 | 6 | 8 | 10 | N/A | N/A | N/A | |
| Minimum traffic lane width (m)[2] | 3.5 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | |
| Minimum shoulder width (m) | 1 | 1 | 0.5 | 0.5 | 0.5 | 0.5 | 1.5 | 1 | 0.5 | 0 | 0 | 0 | |
| Minimum carriageway width (lanes + shoulder) (m) | 9 | 8 | 7 | 7 | 7 | 7 | 6 | 5 | 4 | 3 | 3 | 3 | |
| Minimum formation width (including verges) (m)[3] | 11 | 10 | 9 | 9 | 9 | 9 | 8 | 7 | 6 | 3 | 3 | 3 | |
| **Horizontal geometry** | | | | | | | | | | | | | |
| Minimum curve radius (m)[4] | 320 | 250 | 140 | 250 | 100 | 35 | 170 | 60 | 15 | N/A | N/A | N/A | |

**Table 3-3** Unsealed Roads – Table 3.9 Classification system.

| Road classification | 4A Main | | | 4B Minor | | | 4C Access | | | 4D Tracks | | | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Terrain type | Flat | Rolling | Mountainous | Flat | Rolling | Mountainous | Flat | Rolling | Mountainous | Flat | Rolling | Mountainous | |
| Minimum stopping sight distance (m)[5] | 150 | 120 | 70 | 120 | 70 | 30 | 90 | 50 | 30 | N/A | N/A | N/A | |
| Minimum meeting sight distance (m)[6] | 290 | 230 | 130 | 230 | 130 | 60 | 180 | 100 | 60 | N/A | N/A | N/A | |
| **Vertical geometry** | | | | | | | | | | | | | |
| Maximum vertical grade (%)[7] | 6 | 8 | 12 | 6 | 8 | 12 | 6 | 8 | 12 | N/A | N/A | N/A | Avoid steep grades to reduce soil erosion along tracks |
| Minimum crest vertical curve (K value)[8] | 50 | 30 | 10 | 30 | 10 | 5 | 19 | 8 | 2 | N/A | N/A | N/A | |
| Minimum sag vertical curve (K value)[9] | 11 | 8 | 4 | 8 | 4 | 3 | 6 | 3 | 2 | N/A | N/A | N/A | |

1 The maximum superelevation value will need to consider the number of loaded heavy vehicles, speed and curve radii.
2 In cases where there are a high percentage of heavy vehicles (> 20%) minimum lane widths can be increased by 0.5 m.
3 Allows for 1 m verge/table drain width. This must be reviewed based on actual locations where for drainage reasons greater widths may be required.
4 Values rounded up. For minimum radius curves, widening on the inside of a curve may be necessary to accommodate longer vehicles.
5 Based on a reaction time of 2 seconds and surface coefficients relating to unsealed surfaces. Values rounded up. Values based on flat grades and allowances will need to be made for up and down grades.
6 This is mainly a requirement for single lane two way roads. Values rounded up.
7 In some cases, higher grades of up to 20% can be allowed for short sections (about 150 m). Keep grades on unsealed roads lower due to ravelling and scouring of surface.
8 Calculation of these values is to be based on information contained in Austroads (2016c). The length of the vertical curve (L) is based on the product of K multiplied by the algebraic difference in grades percentage A (i.e. L = K × A).
9 Sag values are based on comfort control criteria.

### 3.2.1 Identified deficiencies

The results of the compliance assessment against geometric design standards assigned to Class 4A and 4B roadways found Shorts Road was considered deficient with respect to the below design parameter:

- Minimum crossfall %:
  - Shorts Road falls short of the recommended 5% crossfall.
- Minimum carriageway:
  - Compliance with the 4A parameter's is not achieved.
- Minimum formation:
  - Compliance with the 4A parameter's is not achieved.
  - .

Whilst compliance with carriageway and formation widths are not compliant with Road class 4A. Reference to the estimated traffic volumes being just outside the 4B range and the construction period having a defined duration. It is considered suitable to assess Shorts Road against Class 4B criteria in this instance with respect to carriageway width and formation width. Both of which are considered reasonable in terms of the composition of traffic and volume.

NORTHERN CONSULTING engineers

## 4.0 Visual Inspection and Video Record of Shorts Road

Shorts Road, were inspected/recorded on the 4th October 2022.

Inspecting personal:

- Damien Krauklis (Edify Energy)

Inspection technique:

- Go-Pro camera mounted on the front of inspection vehicle.

A digital copy of the video recording is available from Northern Consulting Engineers upon request.

The following criteria were utilised to classify existing failures within the road section.

- Deformation (Erosion/Scouring)
- Deformation (Shoving/Rutting)
- Deformation (Potholes)
- Fatigue Cracking (Sealed roads)

Nominated areas for comparison with subsequent dilapidation inspections and video records

| Criteria | Chainage |
|---|---|
| Deformation (Erosion/Scouring) | (1,200-1,500), (1,600-1,870), (1,870-2,750) |
| Deformation (Shoving/Rutting) | 2,800 (Subgrade failure) |
| Deformation (Potholes) | 05 |
| Fatigue Cracking (Sealed intersection) | -02 |

Snapshots of images recorded during the inspection have been included herewith for convenience, however it is anticipated that a full comparison of the pre and post construction videos will be undertaken following the completion of the construction period.

Figure 4-1 – Shorts Road Ch-02 – Biloela, QLD (Fatigue cracking above culvert – Sealed intersection)

Figure 4-2 – Shorts Road Ch00 – Biloela, QLD

**Figure 4-3 – Shorts Road Ch260 – Biloela, QLD**

**Figure 4-4 – Shorts Road Ch430 – Biloela, QLD**

Figure 4-5 – Shorts Road Ch770 – Biloela, QLD

Figure 4-6 – Shorts Road Ch930 – Biloela, QLD

Figure 4-7 – Shorts Road Ch1575 – Biloela, QLD

Figure 4-8 – Shorts Road Ch1855 – Biloela, QLD

Figure 4-9 – Shorts Road Ch2000 – Biloela, QLD

Figure 4-10 – Shorts Road Ch2100 – Biloela, QLD

Figure 4-11 – Shorts Road Ch4210 – Biloela, QLD

Figure 4-12 – Shorts Road Ch2510 – Biloela, QLD

**Figure 4-13 – Shorts Road Ch2800 – Biloela, QLD**

## 5.0 Conclusions and Recommendations

Northern Consulting Engineers have completed a compliance assessment of Shorts Road against ARRB – Unsealed Roads Best Practise Guide 2 (October 2020) in order to determine the suitability of the road to operate effectively as the Access / Haul route during the Construction phase and Operational phase of the Callide Solar Power Station development.

### 5.1.1 Conclusion

The results of the compliance assessment found:

Shorts Road was considered deficient with respect to the below design parameter:

- Minimum crossfall %:
  - Shorts Road falls short of the recommended 5% crossfall.

### 5.1.2 Recommendations

4. Shorts Road profile (crossfall) is recommended to be improved by importing a suitable gravel overlay material. The existing surface should be tyned and mixed with the new material, compacted and shaped to introduce the preferred 5% crossfall over the roadway section to be trafficked during the construction period.

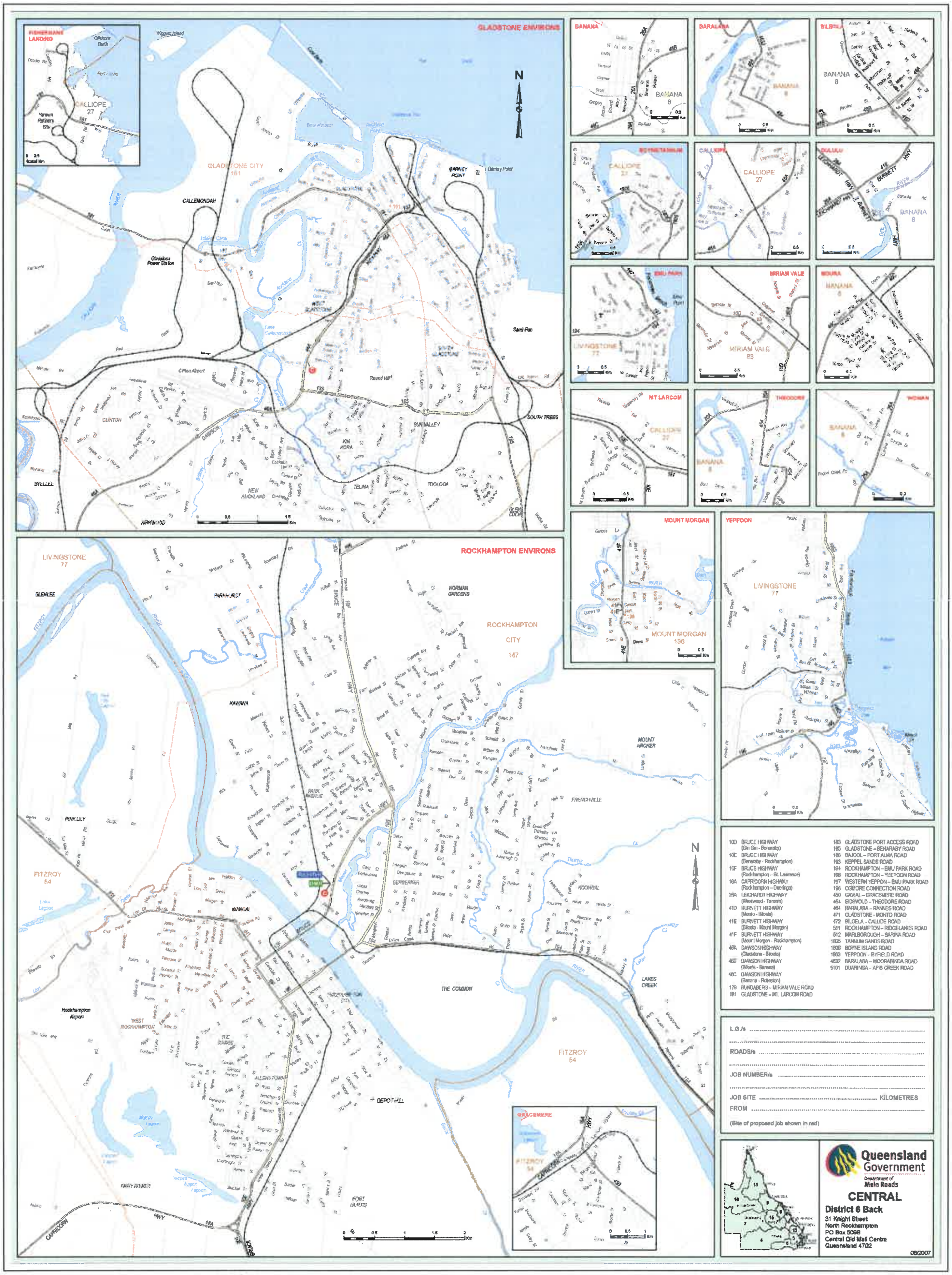
5. Signage of the isolated humps within the roadway section could be installed to improve awareness for unfamiliar drivers.

6. Improvement in some aspects of the drainage and potential increased maintenance during the construction period would assisting in limiting or eliminating surface erosion through runoff scouring and reduce soaking of subgrades leading to formal rutting and shoving in the few locations observed.

# APPENDIX C

Central Region (D6) District Mapping - Queensland Department of Transport and Main Roads (TMR)


LEGEND
STATE-CONTROLLED ROAD
FUTURE STATE-CONTROLLED / PROPOSED
OTHER ROAD
MR ROADSIDE AMENITY / HEAVY VEH. STOP
MR DISTRICT BOUNDARY
LOCAL GOVERNMENT BOUNDARY
A.B.S. STATISTICAL DIVISION 2001
RAILWAY
PIPELINE
NATURAL GAS OPERATIONAL / PROGRESSING
COAL SEAM GAS OPERATIONAL / PROGRESSING
CRUDE OIL OPERATIONAL
OPERATING MINE / AIRPORT
QT CUSTOMER SERVICE CENTRE
DRIVER LICENCING / VEHICLE REGISTRATION
MARINE & PORTS / ALL CUSTOMER SERVICES
DEPARTMENT OF MAIN ROADS OFFICES
DISTRICT
ROADTEK
PROJECTION: Map Grid of Australia, Zone 56
DATUM: Geocentric Datum of Australia, 1994
TOWNS
CAPITAL CITY BRISBANE
MAJOR CENTRE (10,001 - ) BUNDABERG
TOWN ( 2,501 - 10,000) Ayr
( 1,001 - 2,500) Beerwah
( 201 - 1,000) Aramac
PLACE ( 0 - 200) Bedourie
LOCALITY / HOMESTEAD Barmoya
Population of towns taken from 2001 census
LOCAL GOVERNMENT H.Q. (inset/main map) 150 TOWNSVILLE
DISTRICT H.Q. WARWICK
REFER TO INSET WHEN INDICATED THUS
10D BRUCE HIGHWAY (Gin Gin - Benaraby)
10E BRUCE HIGHWAY (Benaraby - Rockhampton)
10F BRUCE HIGHWAY (Rockhampton – St. Lawrence)
16A CAPRICORN HIGHWAY (Rockhampton – Duaringa)
26A LEICHARDT HIGHWAY (Westwood - Taroom)
41D BURNETT HIGHWAY (Monto - Biloela)
41E BURNETT HIGHWAY (Biloela - Mount Morgan)
41F BURNETT HIGHWAY (Mount Morgan - Rockhampton)
46A DAWSON HIGHWAY (Gladstone - Biloela)
46B DAWSON HIGHWAY (Biloela - Banana)
46C DAWSON HIGHWAY (Banana - Rolleston)
179 BUNDABERG – MIRIAM VALE ROAD
181 GLADSTONE – MT. LARCOM ROAD
183 GLADSTONE PORT ACCESS ROAD
185 GLADSTONE – BENARABY ROAD
186 BAJOOL – PORT ALMA ROAD
193 KEPPEL SANDS ROAD
194 ROCKHAMPTON – EMU PARK ROAD
196 ROCKHAMPTON – YEEPOON ROAD
197 WESTERN YEPPON – EMU PARK ROAD
198 OGMORE CONNECTION ROAD
450 GAVIAL – GRACEMERE ROAD
454 EIDSVOLD THEODORE ROAD
464 BARALABA – RANNES ROAD
471 GLADSTONE - MONTO ROAD
472 BILOELA – CALLIDE ROAD
511 ROCKHAMPTON – RIDGELANDS ROAD
512 MARLBOROUGH – SARINA ROAD
1805 TANNUM SANDS ROAD
1806 BOYNE ISLAND ROAD
1963 YEPPOON – BYFIELD ROAD
4632 BARALABA – WOORABINDA ROAD
5101 DUARINGA – APIS CREEK ROAD
QT CUSTOMER SERVICE CENTRES
Gladstone - 2 Paterson Street
Rockhampton - 31 Knight Street
N
BROADSOUND 20
LIVINGSTONE 77
FITZROY 54
DUARINGA 41
MOUNT MORGAN 136
CALLIOPE 27
MIRIAM VALE 89
BANANA 8
MONTO 64
PERRY 95
KOLAN 74
EIDSVOLD 48
TAROOM 116
ROCKHAMPTON
GLADSTONE
YEPPOON
Gracemere
Mount Morgan
Biloela
Moura
Theodore
Boyne Island
Tannum Sands
Emu Park
Byfield
Marlborough
Ogmore
Clairview
Duaringa
Baralaba
Woorabinda
Calliope
Miriam Vale
Monto
Cracow
L.G/s
ROAD/s
JOB NUMBER/s
JOB SITE KILOMETRES
FROM
(Site of proposed job shown in red)
Queensland Government
Department of Main Roads
CENTRAL
District 6 Front
31 Knight Street
North Rockhampton
PO Box 5096
Central Qld Mail Centre
Queensland 4702
06/2007


GLADSTONE ENVIRONS
FISHERMANS LANDING
ROCKHAMPTON ENVIRONS
BANANA
BARALABA
BILOELA
BOYNE/TANNUM
CALLIOPE
DUARINGA
EMU PARK
MIRIAM VALE
MOURA
MT LARCOM
THEODORE
WOWAN
MOUNT MORGAN
YEPPOON
GRACEMERE
10D BRUCE HIGHWAY (Gin Gin - Benaraby)
10E BRUCE HIGHWAY (Benaraby - Rockhampton)
10F BRUCE HIGHWAY (Rockhampton – St. Lawrence)
16A CAPRICORN HIGHWAY (Rockhampton – Duaringa)
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188 BAJOOL – PORT ALMA ROAD
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194 ROCKHAMPTON – EMU PARK ROAD
196 ROCKHAMPTON – YEEPOON ROAD
197 WESTERN YEPPON – EMU PARK ROAD
198 OGMORE CONNECTION ROAD
450 GAVIAL – GRACEMERE ROAD
454 EIDSVOLD – THEODORE ROAD
464 BARALABA – RANNES ROAD
471 GLADSTONE - MONTO ROAD
472 BILOELA – CALLIDE ROAD
511 ROCKHAMPTON – RIDGELANDS ROAD
512 MARLBOROUGH – SARINA ROAD
1805 TANNUM SANDS ROAD
1806 BOYNE ISLAND ROAD
1863 YEPPOON – BYFIELD ROAD
4632 BARALABA – WOORABINDA ROAD
5101 DUARINGA – APIS CREEK ROAD
L.G./s
ROADS/s
JOB NUMBER/s
JOB SITE KILOMETRES
FROM
(Site of proposed job shown in red)
Queensland Government
Department of Main Roads
CENTRAL
District 6 Back
31 Knight Street
North Rockhampton
PO Box 5096
Central Qld Mail Centre
Queensland 4702
08/2007

# APPENDIX D

TMR Traffic Analysis and Reporting System (TARS) Data

# DAILY VOLUME REPORT

Tips and Tricks for a Faster Dashboard

Daily Volume Report Overview

Click on this reset icon to reset all filters to default settings

| | | |
|---|---|---|
| Region | Central Queensland | All |
| District | 404 - Fitzroy | All |
| Local Government | Banana Shire | All |
| Road Section Name | 46A - DAWSON HIGHWAY (GLADSTONE - | All |
| Road Section Id | All | |
| Site Type | C - Coverage | All |
| Site | 61084 - 600m S biloela Callide Rd, Mt M.. | 61.. |
| Thru Distance | 114.33 | |
| Gazette Direction | TA - Thru traffic - against gazettal | TA |
| Traffic Class | 00 - All Vehicles | |
| Date Range (inclusive) | Start Date: Wednesday 1[illegible]-May-2.. | End Date: Monday 06-Jun-2022 |

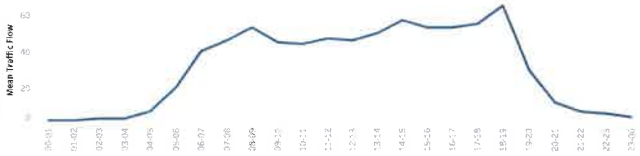
Select Time Window: 24 Hour

Days in Range: [illegible] Days Included: 20

| | Daily Average Volume | Proportion |
|---|---|---|
| 12-hour flow | 610.0 | 82.14% |
| 16-hour flow | 697.9 | 95.97% |
| 18-hour flow | [illegible] | 95.19% |
| 24-hour flow | 742.7 | 100.00% |


Site Type ■ C

| | 00 min - 15 min | | 15 min - 30 min | | 30 min - 45 min | | 45 min - 60 min | | Grand Total | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Avg Volume | Volume % | Avg Volume | Volume % | Avg Volume | Volume % | Avg Volume | Volume % | Avg Volume | Volume % |
| 00-01 | [illegible] | 0.5% | 1 | 0.5% | 1 | 0.5% | 1 | 0.5% | 4 | 0.5% |
| 01-02 | 1 | 0.5% | 1 | 0.5% | 1 | 0.5% | 1 | 0.5% | 4 | 0.5% |
| 02-03 | [illegible] | 0.0% | 2 | 1.0% | 1 | 0.5% | [illegible] | 0.5% | 4 | 0.5% |
| 03-04 | 1 | 0.5% | 1 | 0.5% | 1 | 0.5% | 1 | 0.5% | 4 | 0.5% |
| 04-05 | 1 | 0.5% | 2 | 1.0% | 1 | 0.5% | 3 | 1.6% | 7 | 0.9% |
| 05-06 | 3 | 1.5% | 5 | 2.5% | 6 | 3.3% | 7 | 3.6% | 21 | 2.7% |
| 06-07 | 8 | 4.1% | 9 | 4.5% | 11 | 6.0% | 13 | 6.7% | 41 | 5.3% |
| 07-08 | 16 | 8.2% | 11 | 5.5% | 9 | 4.9% | 11 | 5.7% | 47 | 6.1% |
| 08-09 | 14 | 7.2% | 16 | 8.0% | 11 | 6.0% | 12 | 6.2% | 53 | 6.9% |
| 09-10 | 10 | 5.1% | 12 | 6.0% | 12 | 6.5% | 12 | 6.2% | 46 | 6.0% |
| 10-11 | 11 | 5.6% | 12 | 6.0% | 12 | 6.5% | 10 | 5.2% | 45 | 5.8% |
| 11-12 | 12 | 6.2% | 12 | 6.0% | 12 | 6.5% | 12 | 6.2% | 48 | 6.2% |
| 12-13 | 12 | 6.2% | 11 | 5.5% | 12 | 6.5% | 13 | 6.7% | 48 | 6.2% |
| 13-14 | 11 | 5.6% | 13 | 6.5% | 12 | 6.5% | 14 | 7.3% | 50 | 6.5% |
| 14-15 | 12 | 6.2% | 15 | 7.5% | 18 | 9.8% | 13 | 6.7% | 58 | 7.5% |
| 15-16 | 13 | 6.7% | 12 | 6.0% | 13 | 7.1% | 15 | 7.8% | 53 | 6.9% |
| 16-17 | 14 | 7.2% | 13 | 6.5% | 14 | 7.6% | 13 | 6.7% | 54 | 7.0% |
| 17-18 | 15 | 7.7% | 16 | 8.0% | 12 | 6.5% | 13 | 6.7% | 56 | 7.3% |
| 18-19 | 16 | 8.2% | 21 | 10.5% | 13 | 7.1% | 17 | 8.8% | 67 | 8.7% |
| 19-20 | 16 | 8.2% | 7 | 3.5% | 4 | 2.2% | 3 | 1.6% | 30 | 3.9% |
| 20-21 | 3 | 1.5% | 4 | 2.0% | 3 | 1.6% | 3 | 1.6% | 13 | 1.7% |
| 21-22 | 2 | 1.0% | 2 | 1.0% | 2 | 1.1% | 2 | 1.0% | 8 | 1.0% |
| 22-23 | 2 | 1.0% | 1 | 0.5% | 2 | 1.1% | 2 | 1.0% | 7 | 0.9% |
| 23-00 | 1 | 0.5% | 1 | 0.5% | 1 | 0.5% | 1 | 0.5% | 4 | 0.5% |



# DAILY VOLUME REPORT

Tips and Tricks for a Faster Dashboard

Daily Volume Report Overview

Click on this reset icon to reset all filters to default settings

| | | |
|---|---|---|
| Region | Central Queensland | All |
| District | 404 - Fitzroy | All |
| Local Government | Banana Shire | All |
| Road Section Name | 472 - BILOELA - CALLIDE ROAD | All |
| Road Section Id | All | |
| Site Type | [illegible] | All |
| Site | 61296 - 275m E of Shorts Rd, Mount Mur... | 61... |
| Thru Distance | 4.26 | |
| Gazette Direction | TG - Thru traffic in gazettal dirn | TG |
| Traffic Class | 00 - All Vehicles | |
| Date Range (inclusive) | Start Date: Thursday 10-Feb-2022 | End Date: Tuesday 08-Mar-2022 |

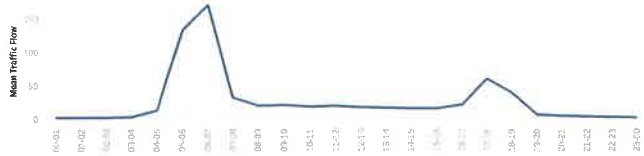

Site Type C

Select Time Window: 24 Hour

Days In Range: 27 Days Included: 27

| | Daily Average Volume | Proportion |
|---|---|---|
| 12-hour flow | 285.3 | 4[illegible].13% |
| 16-hour flow | 467.3 | [illegible] |
| 18-hour flow | 470.2 | 76.01% |
| 24-hour flow | [illegible]18.6 | 100.00% |

| | 00 min - 15 min | | 15 min - 30 min | | 30 min - 45 min | | 45 min - 60 min | | Grand Total | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Avg Volume | Volume % | Avg Volume | Volume % | Avg Volume | Volume % | Avg Volume | Volume % | Avg Volume | Volume % |
| 00-01 | 0 | 0.0% | 0 | 0.0% | 1 | 0.5% | 1 | 0.7% | 2 | 0.3% |
| 01-02 | 0 | 0.0% | 1 | 0.7% | 0 | 0.0% | 0 | 0.0% | 1 | 0.2% |
| 02-03 | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 1 | 0.7% | 1 | 0.2% |
| 03-04 | 1 | 0.7% | 0 | 0.0% | 1 | 0.5% | 1 | 0.7% | 3 | 0.5% |
| 04-05 | 1 | 0.7% | 2 | 1.3% | 3 | 1.5% | 6 | 4.0% | 12 | 1.9% |
| 05-06 | 14 | 9.5% | 26 | 17.1% | 55 | 28.1% | 39 | 26.2% | 134 | 20.8% |
| 06-07 | 44 | 29.7% | 44 | 28.9% | 53 | 27.0% | 30 | 20.1% | 171 | 26.5% |
| 07-08 | 10 | 6.8% | 8 | 5.3% | 7 | 3.6% | 6 | 4.0% | 31 | 4.8% |
| 08-09 | 5 | 3.4% | 5 | 3.3% | 5 | 2.6% | 5 | 3.4% | 20 | 3.1% |
| 09-10 | 5 | 3.4% | 5 | 3.3% | 5 | 2.6% | 5 | 3.4% | 20 | 3.1% |
| 10-11 | 4 | 2.7% | 5 | 3.3% | 5 | 2.6% | 4 | 2.7% | 18 | 2.8% |
| 11-12 | 4 | 2.7% | 5 | 3.3% | 6 | 3.1% | 5 | 3.4% | 20 | 3.1% |
| 12-13 | 5 | 3.4% | 4 | 2.6% | 5 | 2.6% | 5 | 3.4% | 19 | 2.9% |
| 13-14 | 4 | 2.7% | 4 | 2.6% | 5 | 2.6% | 4 | 2.7% | 17 | 2.6% |
| 14-15 | 4 | 2.7% | 4 | 2.6% | 4 | 2.0% | 4 | 2.7% | 16 | 2.5% |
| 15-16 | 4 | 2.7% | 5 | 3.3% | 3 | 1.5% | 4 | 2.7% | 16 | 2.5% |
| 16-17 | 5 | 3.4% | 5 | 3.3% | 6 | 3.1% | 6 | 4.0% | 22 | 3.4% |
| 17-18 | 9 | 6.1% | 14 | 9.2% | 22 | 11.2% | 16 | 10.7% | 61 | 9.5% |
| 18-19 | 23 | 15.5% | 10 | 6.6% | 5 | 2.6% | 2 | 1.3% | 40 | 6.2% |
| 19-20 | 2 | 1.4% | 2 | 1.3% | 2 | 1.0% | 1 | 0.7% | 7 | 1.1% |
| 20-21 | 1 | 0.7% | 1 | 0.7% | 1 | 0.5% | 1 | 0.7% | 4 | 0.6% |
| 21-22 | 1 | 0.7% | 1 | 0.7% | 1 | 0.5% | 1 | 0.7% | 4 | 0.6% |
| 22-23 | 1 | 0.7% | 0 | 0.0% | 1 | 0.5% | 1 | 0.7% | 3 | 0.5% |
| 23-00 | 1 | 0.7% | 1 | 0.7% | 0 | 0.0% | 1 | 0.7% | 3 | 0.5% |



# DAILY VOLUME REPORT

Tips and Tricks for a Faster Dashboard

Daily Volume Report Overview

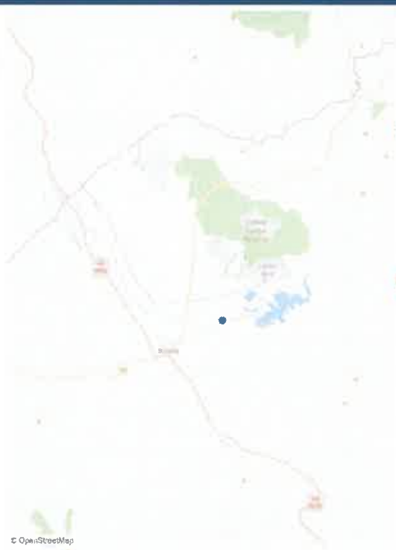
Click on this reset icon to reset all filters to default settings

| | | |
|---|---|---|
| Region | Central Queensland | All |
| District | 404 - Fitzroy | All |
| Local Government | Banana Shire | All |
| Road Section Name | 47Z - BILOELA - CALLIDE ROAD | All |
| Road Section Id | All | |
| Site Type | C - Coverage | All |
| Site | E12[illegible] - 275m E of St[illegible] Rd, Mount Mur... | 61... |
| Thru Distance | 4.26 | |
| Gazette Direction | TG - Thru traffic in gazettal direction | TG |
| Traffic Class | 00 - All Vehicles | |
| Date Range (inclusive) | Start Date: Thursday 10-Feb-2022 | End Date: Tuesday 08-Mar-2022 |

Select Time Window: 24 Hour

Days in Range: 27 Days Included: 27

| | Daily Average Volume | Proportion |
|---|---|---|
| 12-hour flow | 285.3 | 46.13% |
| 16-hour flow | 467.3 | 75.54% |
| 18-hour flow | 470.2 | 76.01% |
| 24-hour flow | 618.6 | 100.00% |




| | 00 min - 15 min | | 15 min - 30 min | | 30 min - 45 min | | 45 min - 60 min | | Grand Total | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Avg Volume | Volume % | Avg Volume | Volume % | Avg Volume | Volume % | Avg Volume | Volume % | Avg Volume | Volume % |
| 00-01 | 0 | 0.0% | 0 | 0.0% | 1 | 0.5% | 1 | 0.7% | 2 | 0.3% |
| 01-02 | 0 | 0.0% | 1 | 0.7% | 0 | 0.0% | 0 | 0.0% | 1 | 0.2% |
| 02-03 | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 1 | 0.7% | 1 | 0.2% |
| 03-04 | [illegible] | 0.7% | 0 | 0.0% | 1 | 0.5% | 1 | 0.7% | 3 | 0.5% |
| 04-05 | 1 | 0.7% | 2 | 1.3% | 3 | 1.5% | 6 | 4.0% | 12 | 1.9% |
| 05-06 | 14 | 9.5% | 26 | 17.1% | 55 | 28.1% | 39 | 26.2% | 134 | 20.8% |
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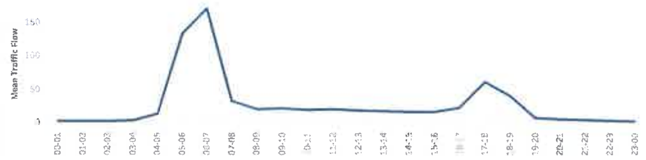
| 07-08 | 10 | 6.8% | 8 | 5.3% | 7 | 3.6% | 6 | 4.0% | 31 | 4.8% |
| 08-09 | 5 | 3.4% | 5 | 3.3% | 5 | 2.6% | 5 | 3.4% | 20 | 3.1% |
| 09-10 | 5 | 3.4% | 5 | 3.3% | 5 | 2.6% | 5 | 3.4% | 20 | 3.1% |
| 10-11 | 4 | 2.7% | 5 | 3.3% | 5 | 2.6% | 4 | 2.7% | 18 | 2.8% |
| 11-12 | 4 | 2.7% | 5 | 3.3% | 6 | 3.1% | 5 | 3.4% | 20 | 3.1% |
| 12-13 | 5 | 3.4% | 4 | 2.6% | 5 | 2.6% | 5 | 3.4% | 19 | 2.9% |
| 13-14 | 4 | 2.7% | 4 | 2.6% | 5 | 2.6% | 4 | 2.7% | 17 | 2.6% |
| 14-15 | 4 | 2.7% | 4 | 2.6% | 4 | 2.0% | 4 | 2.7% | 16 | 2.5% |
| 15-16 | 4 | 2.7% | 5 | 3.3% | 3 | 1.5% | 4 | 2.7% | 16 | 2.5% |
| 16-17 | 5 | 3.4% | 5 | 3.3% | 6 | 3.1% | 6 | 4.0% | 22 | 3.4% |
| 17-18 | 9 | 6.1% | 14 | 9.2% | 22 | 11.2% | 16 | 10.7% | 61 | 9.5% |
| 18-19 | [illegible] | 15.5% | 10 | 6.6% | 5 | 2.6% | 2 | 1.3% | 40 | 6.2% |
| 19-20 | [illegible] | 1.4% | 2 | 1.3% | 2 | 1.0% | 1 | 0.7% | 7 | 1.1% |
| 20-21 | 1 | 0.7% | 1 | 0.7% | 1 | 0.5% | 1 | 0.7% | 4 | 0.6% |
| 21-22 | 1 | 0.7% | 1 | 0.7% | 1 | 0.5% | 1 | 0.7% | 4 | 0.6% |
| 22-23 | 1 | 0.7% | 0 | 0.0% | 1 | 0.5% | 1 | 0.7% | 3 | 0.5% |
| 23-00 | [illegible] | 0.7% | 1 | 0.7% | 0 | 0.0% | 1 | 0.7% | 3 | 0.5% |



# DAILY VOLUME REPORT

Tips and Tricks for a Faster Dashboard

Daily Volume Report Overview

Click on this reset icon to reset all filters to default settings

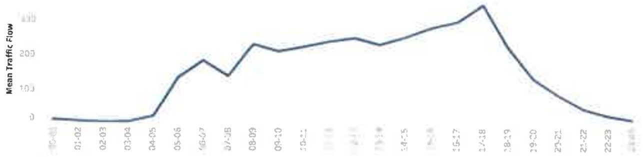
| | | |
|---|---|---|
| Region | Central Queensland | All |
| District | 404 - Fitzroy | All |
| Local Government | Banana Shire | All |
| Road Section Name | 46A DAWSON HIGHWAY (GLADSTONE -... | All |
| Road Section Id | All | |
| Site Type | C - Coverage | All |
| Site | [illegible] | 16.. |
| Thru Distance | 119.27 | |
| Gazette Direction | [illegible] | TA |
| Traffic Class | 00 - All Vehicles | |
| Date Range (inclusive) | Start Date Thursday 19-May-2022 | End Date Monday 06-Jun-2022 |

Select Time Window: 24 Hour

Days In Range: 19 Days Included: 19

| | Daily Average Volume | Proportion |
|---|---|---|
| 12-hour flow | 2,877 | 81.70% |
| 16-hour flow | 3,310 | 94.02% |
| 18-hour flow | 3,344 | 94.96% |
| 24-hour flow | 3,521 | 100.00% |


| | 00 min - 15 min | | 15 min - 30 min | | 30 min - 45 min | | 45 min - 60 min | | Grand Total | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Avg Volume | Volume % | Avg Volume | Volume % | Avg Volume | Volume % | Avg Volume | Volume % | Avg Volume | Volume % |
| 00-01 | 3 | 0.3% | 4 | 0.4% | 2 | 0.2% | 2 | 0.2% | 11 | 0.3% |
| 01-02 | 3 | 0.3% | 2 | 0.2% | 1 | 0.1% | 2 | 0.2% | 8 | 0.2% |
| 02-03 | 1 | 0.1% | 1 | 0.1% | 1 | 0.1% | 1 | 0.1% | 4 | 0.1% |
| 03-04 | 2 | 0.2% | 1 | 0.1% | 1 | 0.1% | 2 | 0.2% | 6 | 0.2% |
| 04-05 | 3 | 0.3% | 3 | 0.3% | 5 | 0.6% | 10 | 1.2% | 21 | 0.6% |
| 05-06 | 18 | 2.0% | 33 | 3.6% | 38 | 4.3% | 45 | 5.2% | 134 | 3.8% |
| 06-07 | 49 | 5.4% | 55 | 6.0% | 47 | 5.4% | 32 | 3.7% | 183 | 5.2% |
| 07-08 | 29 | 3.2% | 33 | 3.6% | 36 | 4.1% | 38 | 4.4% | 136 | 3.8% |
| 08-09 | 45 | 5.0% | 61 | 6.7% | 65 | 7.4% | 58 | 6.8% | 229 | 6.4% |
| 09-10 | 49 | 5.4% | 55 | 6.0% | 54 | 6.2% | 51 | 5.9% | 209 | 5.9% |
| 10-11 | 55 | 6.1% | 56 | 6.1% | 56 | 6.4% | 56 | 6.5% | 223 | 6.3% |
| 11-12 | 59 | 6.5% | 61 | 6.7% | 59 | 6.7% | 58 | 6.8% | 237 | 6.7% |
| 12-13 | 69 | 7.6% | 64 | 7.0% | 59 | 6.7% | 55 | 6.4% | 247 | 7.0% |
| 13-14 | 64 | 7.1% | 58 | 6.4% | 52 | 5.9% | 53 | 6.2% | 227 | 6.4% |
| 14-15 | 57 | 6.3% | 53 | 5.8% | 62 | 7.1% | 77 | 9.0% | 249 | 7.0% |
| 15-16 | 78 | 8.6% | 73 | 8.0% | 61 | 7.0% | 64 | 7.5% | 276 | 7.8% |
| 16-17 | 72 | 7.9% | 72 | 7.9% | 73 | 8.3% | 77 | 9.0% | 294 | 8.3% |
| 17-18 | 98 | 10.8% | 84 | 9.2% | 84 | 9.6% | 78 | 9.1% | 344 | 9.7% |
| 18-19 | 60 | 6.6% | 63 | 6.9% | 56 | 6.4% | 44 | 5.1% | 223 | 6.3% |
| 19-20 | 40 | 4.4% | 37 | 4.1% | 29 | 3.3% | 24 | 2.8% | 130 | 3.7% |
| 20-21 | 25 | 2.8% | 21 | 2.3% | 19 | 2.2% | 17 | 2.0% | 82 | 2.3% |
| 21-22 | 15 | 1.7% | 12 | 1.3% | 9 | 1.0% | 7 | 0.8% | 43 | 1.2% |
| 22-23 | 8 | 0.9% | 6 | 0.7% | 5 | 0.6% | 5 | 0.6% | 24 | 0.7% |
| 23-00 | 5 | 0.6% | 3 | 0.3% | 2 | 0.2% | 2 | 0.2% | 12 | 0.3% |



# DAILY VOLUME REPORT

Tips and Tricks for a Faster Dashboard

Daily Volume Report Overview

Click on this reset icon to reset all filters to default settings

| | | |
|---|---|---|
| Region | Central Queensland | All |
| District | 404 - Fitzroy | All |
| Local Government | Banana Shire | All |
| Road Section Name | 46A - DAWSON HIGHWAY (GLADSTONE - ... | All |
| Road Section Id | All | |
| Site Type | C - Coverage | All |
| Site | [illegible] | 16.. |
| Thru Distance | [illegible] | |
| Gazette Direction | TG - Thru traffic in gazettal dirn | TG |
| Traffic Class | 00 - All Vehicles | |
| Date Range (inclusive) | Start Date: Thursday 19-May-2022 | End Date: Monday 06-Jun-2022 |

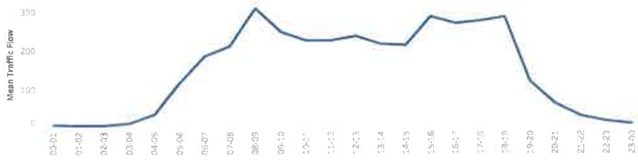

Site Type

Select Time Window: 24 Hour

Days In Range: [illegible] Days Included: 19

| | Daily Average Volume | Proportion |
|---|---|---|
| 12-hour flow | 2,957 | 83.39% |
| 16-hour flow | 3,356 | 94.31% |
| 18-hour flow | 3,381 | 95.01% |
| 24-hour flow | 3,559 | 100.00% |

| | 00 min - 15 min | | 15 min - 30 min | | 30 min - 45 min | | 45 min - 60 min | | Grand Total | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Avg Volume | Volume % | Avg Volume | Volume % | Avg Volume | Volume % | Avg Volume | Volume % | Avg Volume | Volume % |
| 00-01 | 2 | 0.2% | 2 | 0.2% | 2 | 0.2% | 2 | 0.2% | 8 | 0.2% |
| 01-02 | 1 | 0.1% | 1 | 0.1% | 2 | 0.2% | 2 | 0.2% | 6 | 0.2% |
| 02-03 | 1 | 0.1% | 2 | 0.2% | 1 | 0.1% | 2 | 0.2% | 6 | 0.2% |
| 03-04 | 3 | 0.3% | 3 | 0.3% | 3 | 0.4% | 4 | 0.4% | 13 | 0.4% |
| 04-05 | 5 | 0.5% | 4 | 0.4% | 9 | 1.1% | 17 | 1.9% | 35 | 1.0% |
| 05-06 | 17 | 1.8% | 27 | 3.0% | 31 | 3.7% | 41 | 4.5% | 116 | 3.2% |
| 06-07 | 44 | 4.7% | 42 | 4.7% | 39 | 4.6% | 59 | 6.4% | 184 | 5.1% |
| 07-08 | 51 | 5.5% | 46 | 5.1% | 49 | 5.8% | 65 | 7.1% | 211 | 5.9% |
| 08-09 | 62 | 6.7% | 87 | 9.7% | 78 | 9.2% | 78 | 8.5% | 305 | 8.5% |
| 09-10 | 64 | 6.9% | 57 | 6.3% | 63 | 7.4% | 62 | 6.8% | 246 | 6.9% |
| 10-11 | 54 | 5.8% | 58 | 6.4% | 55 | 6.5% | 57 | 6.2% | 224 | 6.2% |
| 11-12 | 53 | 5.7% | 57 | 6.3% | 55 | 6.5% | 59 | 6.4% | 224 | 6.2% |
| 12-13 | 61 | 6.6% | 57 | 6.3% | 55 | 6.5% | 61 | 6.7% | 234 | 6.5% |
| 13-14 | 55 | 5.9% | 52 | 5.8% | 50 | 5.9% | 58 | 6.3% | 215 | 6.0% |
| 14-15 | 53 | 5.7% | 52 | 5.8% | 54 | 6.4% | 53 | 5.8% | 212 | 5.9% |
| 15-16 | 95 | 10.2% | 65 | 7.2% | 61 | 7.2% | 64 | 7.0% | 285 | 7.9% |
| 16-17 | 67 | 7.2% | 67 | 7.4% | 67 | 7.9% | 67 | 7.3% | 268 | 7.5% |
| 17-18 | 70 | 7.6% | 70 | 7.8% | 68 | 8.0% | 66 | 7.2% | 274 | 7.6% |
| 18-19 | 87 | 9.4% | 88 | 9.8% | 54 | 6.4% | 55 | 6.0% | 284 | 7.9% |
| 19-20 | 46 | 5.0% | 32 | 3.6% | 24 | 2.8% | 18 | 2.0% | 120 | 3.3% |
| 20-21 | 18 | 1.9% | 17 | 1.9% | 14 | 1.7% | 13 | 1.4% | 62 | 1.7% |
| 21-22 | 10 | 1.1% | 7 | 0.8% | 6 | 0.7% | 7 | 0.8% | 30 | 0.8% |
| 22-23 | 5 | 0.5% | 4 | 0.4% | 4 | 0.5% | 4 | 0.4% | 17 | 0.5% |
| 23-00 | 3 | 0.3% | 3 | 0.3% | 2 | 0.2% | 2 | 0.2% | 10 | 0.3% |



# DAILY VOLUME REPORT

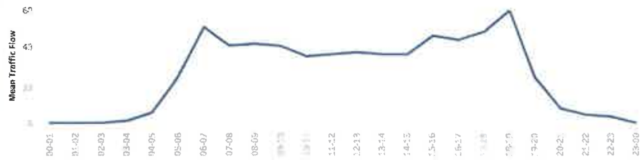
Tips and Tricks for a Faster Dashboard

Daily Volume Report Overview

Click on this reset icon to reset all filters to default settings

| | | |
|---|---|---|
| Region | Central Queensland | All |
| District | 404 - Fitzroy | All |
| Local Government | Banana Shire | All |
| Road Section Name | 46A - DAWSON HIGHWAY (GLADSTONE - ... | All |
| Road Section Id | All | |
| Site Type | C - Coverage | All |
| Site | [illegible] | 60.. |
| Thru Distance | 105.09 | |
| Gazette Direction | TA - Thru traffic - against gazettal | TA |
| Traffic Class | 00 - All Vehicles | |
| Date Range (Inclusive) | Start Date Saturday 09-Feb-2019 | End Date Thursday 28-Feb-2019 |


| | 00 min - 15 min | | 15 min - 30 min | | 30 min - 45 min | | 45 min - 60 min | | Grand Total | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Avg Volume | Volume % | Avg Volume | Volume % | Avg Volume | Volume % | Avg Volume | Volume % | Avg Volume | Volume % |
| 00-01 | 1 | 0.6% | 1 | 0.6% | 1 | 0.6% | 1 | 0.6% | 4 | 0.6% |
| 01-02 | 1 | 0.6% | 1 | 0.6% | 1 | 0.6% | 1 | 0.6% | 4 | 0.6% |
| 02-03 | 1 | 0.6% | 1 | 0.6% | 1 | 0.6% | 1 | 0.6% | 4 | 0.6% |
| 03-04 | 1 | 0.6% | 1 | 0.6% | 2 | 1.2% | 1 | 0.6% | 5 | 0.8% |
| 04-05 | 2 | 1.2% | 2 | 1.2% | 3 | 1.8% | 3 | 1.9% | 10 | 1.5% |
| 05-06 | 4 | 2.3% | 6 | 3.7% | 8 | 4.7% | 8 | 5.0% | 26 | 3.9% |
| 06-07 | 10 | 5.8% | 12 | 7.5% | 15 | 8.9% | 13 | 8.2% | 50 | 7.6% |
| 07-08 | 12 | 6.9% | 9 | 5.6% | 9 | 5.3% | 10 | 6.3% | 40 | 6.0% |
| 08-09 | 11 | 6.4% | 10 | 6.2% | 11 | 6.5% | 10 | 6.3% | 42 | 6.3% |
| 09-10 | 11 | 6.4% | 11 | 6.8% | 10 | 5.9% | 9 | 5.7% | 41 | 6.2% |
| 10-11 | 10 | 5.8% | 9 | 5.6% | 9 | 5.3% | 8 | 5.0% | 36 | 5.4% |
| 11-12 | 10 | 5.8% | 8 | 5.0% | 9 | 5.3% | 10 | 6.3% | 37 | 5.6% |
| 12-13 | 9 | 5.2% | 9 | 5.6% | 10 | 5.9% | 10 | 6.3% | 38 | 5.7% |
| 13-14 | 9 | 5.2% | 9 | 5.6% | 9 | 5.3% | 10 | 6.3% | 37 | 5.6% |
| 14-15 | 9 | 5.2% | 9 | 5.6% | 10 | 5.9% | 10 | 6.3% | 38 | 5.7% |
| 15-16 | 11 | 6.4% | 14 | 8.7% | 11 | 6.5% | 10 | 6.3% | 46 | 6.9% |
| 16-17 | 11 | 6.4% | 11 | 6.8% | 10 | 5.9% | 11 | 6.9% | 43 | 6.5% |
| 17-18 | 12 | 6.9% | 12 | 7.5% | 13 | 7.7% | 11 | 6.9% | 48 | 7.3% |
| 18-19 | 18 | 10.4% | 12 | 7.5% | 16 | 9.5% | 11 | 6.9% | 57 | 8.6% |
| 19-20 | 12 | 6.9% | 6 | 3.7% | 4 | 2.4% | 4 | 2.5% | 26 | 3.9% |
| 20-21 | 3 | 1.7% | 3 | 1.9% | 2 | 1.2% | 3 | 1.9% | 11 | 1.7% |
| 21-22 | 2 | 1.2% | 2 | 1.2% | 2 | 1.2% | 2 | 1.3% | 8 | 1.2% |
| 22-23 | 2 | 1.2% | 2 | 1.2% | 2 | 1.2% | 1 | 0.6% | 7 | 1.1% |
| 23-00 | 1 | 0.6% | 1 | 0.6% | 1 | 0.6% | 1 | 0.6% | 4 | 0.6% |




Select Time Window: 24 Hour

Days in Range: 20 | Days Included: 20

| | Daily Average Volume | Proportion |
|---|---|---|
| 12-hour flow | 490.7 | 77.37% |
| 16-hour flow | 581.4 | 91.67% |
| 18-hour flow | 589.7 | 92.98% |
| 24-hour flow | 634.2 | 100.00% |

# DAILY VOLUME REPORT

Tips and Tricks for a Faster Dashboard

Daily Volume Report Overview

Click on this reset icon to reset all filters to default settings

| | | |
|---|---|---|
| Region | Central Queensland | All |
| District | 404 - Fitzroy | All |
| Local Government | Banana Shire | All |
| Road Section Name | 46A - DAWSON HIGHWAY (GLADSTONE - … | All |
| Road Section Id | All | |
| Site Type | C - Coverage | All |
| Site | [illegible] | 60.. |
| Thru Distance | 107.09 | |
| Gazette Direction | TG - Thru traffic in gazettal dirn | TG |
| Traffic Class | 00 - All Vehicles | |
| Data Range (inclusive) | Start Date: Saturday 09-Feb-2019 | End Date: Thursday 28-Feb-2019 |

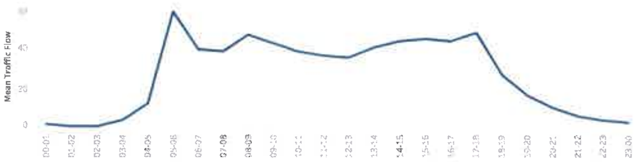
Select Time Window: 24 Hour

Days in Range: [illegible] Days Included: 20

| | Daily Average Volume | Proportion |
|---|---|---|
| 12-hour flow | 474.0 | 74.75% |
| 16-hour flow | 546.9 | 86.27% |
| 18-hour flow | 554.5 | 87.47% |
| 24-hour flow | 634.0 | 100.00% |


Site Type: C

| | 00 min - 15 min | | 15 min - 30 min | | 30 min - 45 min | | 45 min - 60 min | | Grand Total | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Avg Volume | Volume % | Avg Volume | Volume % | Avg Volume | Volume % | Avg Volume | Volume % | Avg Volume | Volume % |
| 00-01 | 1 | 0.6% | 1 | 0.6% | 1 | 0.6% | 1 | 0.6% | 4 | 0.6% |
| 01-02 | 1 | 0.6% | 1 | 0.6% | 1 | 0.6% | 0 | 0.0% | 3 | 0.4% |
| 02-03 | 1 | 0.6% | 1 | 0.6% | 1 | 0.6% | 1 | 0.6% | 4 | 0.6% |
| 03-04 | 1 | 0.6% | 1 | 0.6% | 2 | 1.2% | 2 | 1.2% | 6 | 0.9% |
| 04-05 | 2 | 1.2% | 2 | 1.1% | 4 | 2.4% | 7 | 4.3% | 15 | 2.2% |
| 05-06 | 9 | 5.5% | 19 | 10.9% | 18 | 10.8% | 12 | 7.4% | 58 | 8.7% |
| 06-07 | 14 | 8.5% | 7 | 4.0% | 10 | 6.0% | 9 | 5.6% | 40 | 6.0% |
| 07-08 | 10 | 6.1% | 11 | 6.3% | 9 | 5.4% | 9 | 5.6% | 39 | 5.8% |
| 08-09 | 9 | 5.5% | 13 | 7.5% | 12 | 7.2% | 13 | [illegible] | 47 | 7.0% |
| 09-10 | 10 | 6.1% | 11 | 6.3% | 11 | 6.6% | 11 | 6.8% | 43 | 6.4% |
| 10-11 | 10 | 6.1% | 9 | 5.2% | 9 | 5.4% | 10 | 6.2% | 38 | 5.7% |
| 11-12 | 9 | 5.5% | 10 | 5.7% | 8 | 4.8% | 10 | 6.2% | 37 | 5.5% |
| 12-13 | 9 | 5.5% | 9 | 5.2% | 9 | 5.4% | 9 | 5.6% | 36 | 5.4% |
| 13-14 | 9 | 5.5% | 11 | 6.3% | 10 | 6.0% | 10 | 6.2% | 40 | 6.0% |
| 14-15 | 11 | 6.7% | 10 | 5.7% | 11 | 6.6% | 11 | 6.8% | 43 | 6.4% |
| 15-16 | 11 | 6.7% | 12 | 6.9% | 12 | 7.2% | 10 | 6.2% | 45 | 6.7% |
| 16-17 | 9 | 5.5% | 12 | 6.9% | 11 | 6.6% | 12 | 7.4% | 44 | 6.6% |
| 17-18 | 14 | 8.5% | 15 | 8.6% | 10 | 6.0% | 9 | 5.6% | 48 | 7.2% |
| 18-19 | 10 | 6.1% | 6 | 3.4% | 6 | 3.6% | 6 | 3.7% | 28 | 4.2% |
| 19-20 | 6 | 3.6% | 5 | 2.9% | 4 | 2.4% | 3 | 1.9% | 18 | 2.7% |
| 20-21 | 3 | 1.8% | 3 | 1.7% | 3 | 1.8% | 3 | 1.9% | 12 | 1.8% |
| 21-22 | 2 | 1.2% | 2 | 1.1% | 2 | 1.2% | 2 | 1.2% | 8 | 1.2% |
| 22-23 | 2 | 1.2% | 1 | 0.6% | 1 | 0.6% | 1 | 0.6% | 5 | 0.7% |
| 23-00 | 2 | 1.2% | 2 | 1.1% | 1 | 0.6% | 1 | 0.6% | 6 | 0.9% |



# DAILY VOLUME REPORT

Tips and Tricks for a Faster Dashboard

Daily Volume Report Overview

Click on this reset icon to reset all filters to default settings

| | | |
|---|---|---|
| Region | Central Queensland | All |
| District | 404 - Fitzroy | All |
| Local Government | Banana Shire | All |
| Road Section Name | 472 - BILOELA - CALLIDE ROAD | All |
| Road Section Id | All | |
| Site Type | | All |
| Site | | 60.. |
| Thru Distance | | |
| Gazette Direction | TA - Thru traffic - against gazettal | TA |
| Traffic Class | 00 - All Vehicles | |
| Date Range (inclusive) | Start Date Thursday 10-Feb-2022 | End Date Tuesday 08-Mar-2022 |

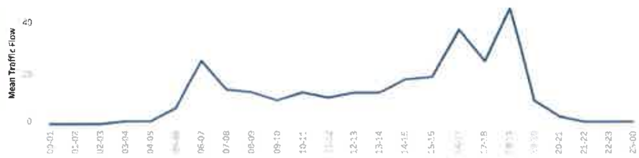
Select Time Window 24 Hour

Days In Range 27 Days Included

| | Daily Average Volume | Proportion |
|---|---|---|
| 12-hour flow | 226.3 | 80.00% |
| 16-hour flow | 267.4 | 94.64% |
| 18-hour flow | 270.1 | 95.60% |
| 24-hour flow | 282.6 | 100.00% |


Site Type C

| | 00 min - 15 min | | 15 min - 30 min | | 30 min - 45 min | | 45 min - 60 min | | Grand Total | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Avg Volume | Volume % | Avg Volume | Volume % | Avg Volume | Volume % | Avg Volume | Volume % | Avg Volume | Volume % |
| 00-01 | 1 | 1.0% | 1 | 1.5% | 0 | 0.0% | 0 | 0.0% | 2 | 0.6% |
| 01-02 | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% |
| 02-03 | 0 | 0.0% | 1 | 1.5% | 0 | 0.0% | 1 | 1.4% | 2 | 0.6% |
| 03-04 | 1 | 1.0% | 0 | 0.0% | [illegible] | 1.3% | 1 | 1.4% | 3 | 1.0% |
| 04-05 | 1 | 1.0% | 1 | 1.5% | 1 | 1.3% | 1 | 1.4% | 4 | 1.3% |
| 05-06 | 2 | 2.0% | 1 | 1.5% | 2 | 2.6% | 3 | 4.2% | 8 | 2.5% |
| 06-07 | 9 | 9.0% | 6 | 8.8% | 5 | 6.6% | 6 | 8.5% | 26 | 8.3% |
| 07-08 | 7 | 7.0% | 3 | 4.4% | 3 | 3.9% | 3 | 4.2% | 16 | 5.1% |
| 08-09 | 4 | 4.0% | 3 | 4.4% | 4 | 5.3% | 4 | 5.6% | 15 | 4.8% |
| 09-10 | 2 | 2.0% | 3 | 4.4% | 3 | 3.9% | 3 | 4.2% | 11 | 3.5% |
| 10-11 | 4 | 4.0% | 3 | 4.4% | 3 | 3.9% | 4 | 5.6% | 14 | 4.4% |
| 11-12 | 3 | 3.0% | 3 | 4.4% | 4 | 5.3% | 3 | 4.2% | 13 | 4.1% |
| 12-13 | 5 | 5.0% | 4 | 5.9% | 3 | 3.9% | 3 | 4.2% | 15 | 4.8% |
| 13-14 | 3 | 3.0% | 4 | 5.9% | 4 | 5.3% | 3 | 4.2% | 14 | 4.4% |
| 14-15 | 6 | 6.0% | 5 | 7.4% | 4 | 5.3% | 4 | 5.6% | 19 | 6.0% |
| 15-16 | 4 | 4.0% | 4 | 5.9% | 6 | 7.9% | 5 | 7.0% | 19 | 6.0% |
| 16-17 | 6 | 6.0% | 6 | 8.8% | 16 | 21.1% | 9 | 12.7% | 37 | 11.7% |
| 17-18 | 7 | 7.0% | 6 | 8.8% | 6 | 7.9% | 7 | 9.9% | 26 | 8.3% |
| 18-19 | 25 | 25.0% | 8 | 11.8% | 6 | 7.9% | 7 | 9.9% | 46 | 14.6% |
| 19-20 | 6 | 6.0% | 2 | 2.9% | 1 | 1.3% | 1 | 1.4% | 10 | 3.2% |
| 20-21 | 2 | 2.0% | 1 | 1.5% | 1 | 1.3% | 1 | 1.4% | 5 | 1.6% |
| 21-22 | 1 | 1.0% | 1 | 1.5% | 1 | 1.3% | 1 | 1.4% | 4 | 1.3% |
| 22-23 | 1 | 1.0% | 1 | 1.5% | 1 | 1.3% | 0 | 0.0% | 3 | 1.0% |
| 23-00 | 0 | 0.0% | 1 | 1.5% | 1 | 1.3% | 1 | 1.4% | 3 | 1.0% |



# DAILY VOLUME REPORT

Tips and Tricks for a Faster Dashboard

Daily Volume Report Overview

Click on the reset icon to reset all filters to default settings

| | | |
|---|---|---|
| Region | Central Queensland | All |
| District | 404 - Fitzroy | All |
| Local Government | Banana Shire | All |
| Road Section Name | 472 - BILOELA - CALLIDE ROAD | All |
| Road Section Id | All | |
| Site Type | C - Coverage | All |
| Site | 60126 - 075m E of Dawson Hwy, Dakenba | 60.. |
| Thru Distance | 0.6 | |
| Gazette Direction | TG - Thru traffic in gazettal dirn | TG |
| Traffic Class | 00 - All Vehicles | |
| Date Range (inclusive) | Start Date: Thursday 10-Feb-2022 | End Date: Tuesday 08-Mar-2022 |

Select Time Window: 24 Hour

Days in Range: [illegible] Days Included: 27

| | Daily Average Volume | Proportion |
|---|---|---|
| 12-hour flow | 157.0 | 54.55% |
| 16-hour flow | 234.6 | 81.51% |
| 18-hour flow | 237.2 | 82.40% |
| 24-hour flow | 287.9 | 100.00% |

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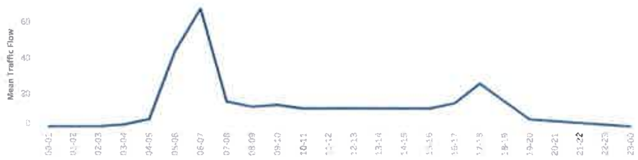
Site Type: C

| | 00 min - 15 min | | 15 min - 30 min | | 30 min - 45 min | | 45 min - 60 min | | Grand Total | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Avg Volume | Volume % | Avg Volume | Volume % | Avg Volume | Volume % | Avg Volume | Volume % | Avg Volume | Volume % |
| 00-01 | 0 | 0.0% | 0 | 0.0% | 1 | 1.1% | 1 | 1.3% | 2 | 0.6% |
| 01-02 | 0 | 0.0% | 1 | 1.3% | 0 | 0.0% | 0 | 0.0% | 1 | 0.3% |
| 02-03 | 0 | 0.0% | 0 | 0.0% | 1 | 1.1% | 1 | 1.3% | 2 | 0.6% |
| 03-04 | 1 | 1.4% | 0 | 0.0% | 1 | 1.1% | 1 | 1.3% | 3 | 0.9% |
| 04-05 | 1 | 1.4% | 1 | 1.3% | 1 | 1.1% | 2 | 2.6% | 5 | 1.6% |
| 05-06 | 4 | 5.7% | 9 | 11.4% | 17 | 18.3% | 13 | 17.1% | 43 | 13.5% |
| 06-07 | 14 | 20.0% | 18 | 22.8% | 23 | 24.7% | 14 | 18.4% | 69 | 21.7% |
| 07-08 | 4 | 5.7% | 5 | 6.3% | 4 | 4.3% | 3 | 3.9% | 16 | 5.0% |
| 08-09 | 3 | 4.3% | 3 | 3.8% | 3 | 3.2% | 3 | 3.9% | 12 | 3.8% |
| 09-10 | 4 | 5.7% | 4 | 5.1% | 4 | 4.3% | 3 | 3.9% | 15 | 4.7% |
| 10-11 | 3 | 4.3% | 3 | 3.8% | 3 | 3.2% | 3 | 3.9% | 12 | 3.8% |
| 11-12 | 3 | 4.3% | 3 | 3.8% | 3 | 3.2% | 3 | 3.9% | 12 | 3.8% |
| 12-13 | 3 | 4.3% | 3 | 3.8% | 3 | 3.2% | 3 | 3.9% | 12 | 3.8% |
| 13-14 | 3 | 4.3% | 3 | 3.8% | 3 | 3.2% | 3 | 3.9% | 12 | 3.8% |
| 14-15 | 3 | 4.3% | 3 | 3.8% | 3 | 3.2% | 3 | 3.9% | 12 | 3.8% |
| 15-16 | 3 | 4.3% | 3 | 3.8% | 3 | 3.2% | 3 | 3.9% | 12 | 3.8% |
| 16-17 | 3 | 4.3% | 3 | 3.8% | 4 | 4.3% | 5 | 6.6% | 15 | 4.7% |
| 17-18 | 5 | 7.1% | 7 | 8.9% | 9 | 9.7% | 6 | 7.9% | 27 | 8.5% |
| 18-19 | 7 | 10.0% | 5 | 6.3% | 2 | 2.2% | 2 | 2.6% | 16 | 5.0% |
| 19-20 | 2 | 2.9% | 2 | 2.5% | 1 | 1.1% | 1 | 1.3% | 6 | 1.9% |
| 20-21 | 1 | 1.4% | 1 | 1.3% | 1 | 1.1% | 1 | 1.3% | 4 | 1.3% |
| 21-22 | 1 | 1.4% | 1 | 1.3% | 1 | 1.1% | 1 | 1.3% | 4 | 1.3% |
| 22-23 | 1 | 1.4% | 0 | 0.0% | 1 | 1.1% | 1 | 1.3% | 3 | 0.9% |
| 23-00 | 1 | 1.4% | 1 | 1.3% | 1 | 1.1% | 0 | 0.0% | 3 | 0.9% |



| YEAR | ROAD_SECTION_ID | THROUGH_DISTANCE_START | THROUGH_DISTANCE_END | SITE | GAZETTAL_DIRECTION | AADT | PC_CLASS_0A | PC_CLASS_0B | PC_CLASS_1A | PC_CLASS_1B | PC_CLASS_1C | PC_CLASS_1D |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2020 | 46A | 101.008 | 113.73 | 60067 | TA | 627 | 73.43 | 26.57 | 73.43 | 14.94 | 5.31 | 6.32 |
| 2020 | 46A | 101.008 | 113.73 | 60067 | TB | 1,226 | 76.29 | 23.71 | 76.29 | 11.96 | 4.9 | 6.85 |
| 2020 | 46A | 101.008 | 113.73 | 60067 | TG | 599 | 79.3 | 20.7 | 79.3 | 8.84 | 4.46 | 7.4 |
| 2020 | 46A | 113.73 | 116.835 | 61084 | TA | 789 | 84.74 | 15.26 | 84.74 | 9.12 | 3.16 | 2.98 |
| 2020 | 46A | 113.73 | 116.835 | 61084 | TB | 1,568 | 77.59 | 22.41 | 77.59 | 15.77 | 3.59 | 3.05 |
| 2020 | 46A | 113.73 | 116.835 | 61084 | TG | 779 | 70.36 | 29.64 | 70.36 | 22.48 | 4.04 | 3.12 |
| 2020 | 46A | 116.835 | 119.758 | 160067 | TA | 2,890 | 88.78 | 11.22 | 88.78 | 9.14 | 1.27 | 0.81 |
| 2020 | 46A | 116.835 | 119.758 | 160067 | TB | 5,798 | 90.42 | 9.58 | 90.42 | 7.52 | 1.23 | 0.83 |
| 2020 | 46A | 116.835 | 119.758 | 160067 | TG | 2,908 | 91.9 | 8.1 | 91.9 | 6.05 | 1.2 | 0.85 |
| 2020 | 472 | 0 | 3.988 | 60126 | TA | 336 | 85.69 | 14.31 | 85.69 | 8.87 | 1.46 | 3.98 |
| 2020 | 472 | 0 | 3.988 | 60126 | TB | 669 | 80.61 | 19.39 | 80.61 | 13.55 | 1.71 | 4.13 |
| 2020 | 472 | 0 | 3.988 | 60126 | TG | 333 | 75.48 | 24.52 | 75.48 | 18.28 | 1.96 | 4.28 |
| 2020 | 472 | 3.988 | 11.88 | 61286 | TA | 544 | 80.38 | 19.62 | 80.38 | 16.21 | 1.13 | 2.28 |
| 2020 | 472 | 3.988 | 11.88 | 61286 | TB | 1,120 | 83.43 | 16.57 | 83.43 | 13.14 | 1.06 | 2.37 |
| 2020 | 472 | 3.988 | 11.88 | 61286 | TG | 576 | 86.28 | 13.72 | 86.28 | 10.26 | 1.01 | 2.45 |
| 2021 | 46A | 113.73 | 116.835 | 61084 | TA | 700 | 80.39 | 19.61 | 80.39 | 12.64 | 3.38 | 3.59 |
| 2021 | 46A | 113.73 | 116.835 | 61084 | TB | 1,402 | 74.79 | 25.21 | 74.79 | 18.07 | 3.77 | 3.37 |
| 2021 | 46A | 113.73 | 116.835 | 61084 | TG | 702 | 69.18 | 30.82 | 69.18 | 23.49 | 4.18 | 3.15 |
| 2021 | 46A | 116.835 | 119.758 | 160067 | TA | 2,878 | 87.27 | 12.73 | 87.27 | 10.47 | 1.41 | 0.85 |
| 2021 | 46A | 116.835 | 119.758 | 160067 | TB | 6,195 | | | | | | |
| 2021 | 46A | 116.835 | 119.758 | 160067 | TG | 3,317 | 87.37 | 12.63 | 87.37 | 10.46 | 1.38 | 0.79 |
| 2021 | 472 | 0 | 3.988 | 60126 | TA | 336 | 85.69 | 14.31 | 85.69 | 8.87 | 1.46 | 3.98 |
| 2021 | 472 | 0 | 3.988 | 60126 | TB | 669 | 80.61 | 19.39 | 80.61 | 13.55 | 1.71 | 4.13 |
| 2021 | 472 | 0 | 3.988 | 60126 | TG | 333 | 75.48 | 24.52 | 75.48 | 18.28 | 1.96 | 4.28 |
| 2021 | 472 | 3.988 | 11.88 | 61286 | TA | 624 | 86.68 | 13.32 | 86.68 | 9.34 | 1.17 | 2.81 |
| 2021 | 472 | 3.988 | 11.88 | 61286 | TB | 1,264 | 84.31 | 15.69 | 84.31 | 11.28 | 1.31 | 3.1 |
| 2021 | 472 | 3.988 | 11.88 | 61286 | TG | 640 | 82.03 | 17.97 | 82.03 | 13.16 | 1.43 | 3.38 |

| GROWTH_PC_1YR | GROWTH_PC_5YR | GROWTH_PC_10YR | COLLECTION_YEAR | PC_CLASS_2A | PC_CLASS_2B | PC_CLASS_2C | PC_CLASS_2D | PC_CLASS_2E | PC_CLASS_2F | PC_CLASS_2G | PC_CLASS_2H | PC_CLASS_2I |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.46 | 0.91 | 2.14 | 2020 | 70.12 | 3.31 | 12.48 | 1.73 | 0.73 | 0.38 | 0.79 | 0.59 | 3.55 |
| 0.49 | 0.89 | 1.87 | 2020 | 72.74 | 3.55 | 9.64 | 1.64 | 0.68 | 0.27 | 0.53 | 0.63 | 3.47 |
| -0.5 | 0.92 | 1.61 | 2020 | 75.51 | 3.79 | 6.66 | 1.56 | 0.62 | 0.15 | 0.26 | 0.68 | 3.37 |
| | | -0.85 | 2020 | 81.21 | 3.53 | 7.43 | 1.16 | 0.53 | 0.23 | 0.41 | 0.46 | 2.06 |
| | | -0.85 | 2020 | 74.62 | 2.97 | 13.99 | 1.2 | 0.58 | 0.42 | 0.65 | 0.44 | 2.08 |
| | | -0.83 | 2020 | 67.95 | 2.41 | 20.63 | 1.23 | 0.62 | 0.62 | 0.89 | 0.42 | 2.11 |
| | | | 2020 | 86.77 | 2.01 | 7.94 | 0.99 | 0.21 | 0.17 | 0.48 | 0.15 | 0.47 |
| | | | 2020 | 88.35 | 2.07 | 6.5 | 0.8 | 0.22 | 0.15 | 0.46 | 0.13 | 0.49 |
| | | | 2020 | 89.78 | 2.12 | 5.21 | 0.62 | 0.22 | 0.14 | 0.44 | 0.11 | 0.51 |
| -9.43 | 7.27 | 6.83 | 2020 | 83.6 | 2.09 | 7.18 | 1.24 | 0.45 | 0.08 | 0.06 | 0.08 | 1.24 |
| -13.12 | 6.48 | 6.27 | 2020 | 78.56 | 2.05 | 11.85 | 1.25 | 0.45 | 0.19 | 0.12 | 0.07 | 1.33 |
| -16.54 | 5.73 | 5.74 | 2020 | 73.47 | 2.01 | 16.57 | 1.26 | 0.45 | 0.29 | 0.18 | 0.07 | 1.42 |
| -13.92 | 1 | 0.77 | 2020 | 79.06 | 1.32 | 15.22 | 0.6 | 0.39 | 0.28 | 0.09 | 0.05 | 0.71 |
| -11.04 | 1.79 | 1 | 2020 | 81.95 | 1.48 | 12.15 | 0.57 | 0.42 | 0.17 | 0.08 | 0.04 | 0.77 |
| -8.13 | 2.57 | 1.22 | 2020 | 84.65 | 1.63 | 9.26 | 0.55 | 0.45 | 0.08 | 0.06 | 0.04 | 0.83 |
| -11.28 | -7.05 | -3.28 | 2021 | 75.91 | 4.48 | 10.71 | 1.18 | 0.75 | 0.37 | 0.68 | 0.32 | 2.01 |
| -10.59 | -5.76 | -3.14 | 2021 | 71.05 | 3.74 | 16.02 | 1.24 | 0.81 | 0.58 | 0.94 | 0.3 | 1.95 |
| -9.88 | -4.24 | -2.97 | 2021 | 66.17 | 3.01 | 21.31 | 1.31 | 0.87 | 0.79 | 1.21 | 0.28 | 1.9 |
| -0.42 | | | 2021 | 85.15 | 2.12 | 9.67 | 0.54 | 0.26 | 0.22 | 0.55 | 0.11 | 0.53 |
| 6.85 | | | 2021 | | | | | | | | | |
| 14.06 | | | 2021 | 85.45 | 1.92 | 9.61 | 0.58 | 0.27 | 0.26 | 0.53 | 0.09 | 0.5 |
| -9.43 | 7.27 | 6.83 | 2021 | 83.6 | 2.09 | 7.18 | 1.24 | 0.45 | 0.08 | 0.06 | 0.08 | 1.24 |
| -13.12 | 6.48 | 6.27 | 2021 | 78.56 | 2.05 | 11.85 | 1.25 | 0.45 | 0.19 | 0.12 | 0.07 | 1.33 |
| -16.54 | 5.73 | 5.74 | 2021 | 73.47 | 2.01 | 16.57 | 1.26 | 0.45 | 0.29 | 0.18 | 0.07 | 1.42 |
| 14.71 | 4.51 | 2.47 | 2021 | 85.41 | 1.27 | 7.87 | 1.11 | 0.36 | 0.09 | 0.07 | 0.01 | 1 |
| 12.86 | 4.87 | 2.55 | 2021 | 83.18 | 1.13 | 10.19 | 0.76 | 0.33 | 0.09 | 0.11 | 0.01 | 1.1 |
| 11.11 | 5.24 | 2.63 | 2021 | 81.03 | 1 | 12.44 | 0.42 | 0.3 | 0.09 | 0.15 | 0 | 1.19 |

| PC_CLASS_2J | PC_CLASS_2K | PC_CLASS_2L | LATITUDE_START | LONGITUDE_START | LATITUDE_END | LONGITUDE_END | DESCRIPTION_START | DESCRIPTION_END |
|---|---|---|---|---|---|---|---|---|
| 6.26 | 0.06 | 0 | -24.245398 | 150.553723 | -24.35562259 | 150.5354321 | Dawson Hwy to Biloela @ Argoon T/O | Dawson(46A)/Callide(472)/Shepherdsons Rd |
| 6.78 | 0.07 | 0 | -24.245398 | 150.553723 | -24.35562259 | 150.5354321 | Dawson Hwy to Biloela @ Argoon T/O | Dawson(46A)/Callide(472)/Shepherdsons Rd |
| 7.32 | 0.08 | 0 | -24.245398 | 150.553723 | -24.35562259 | 150.5354321 | Dawson Hwy to Biloela @ Argoon T/O | Dawson(46A)/Callide(472)/Shepherdsons Rd |
| 2.84 | 0.14 | 0 | -24.35562259 | 150.5354321 | -24.38308674 | 150.5296141 | Dawson(46A)/Callide(472)/Shepherdsons Rd | Calvale Rd / Tognolini Baldwin Rd, Bilo |
| 2.92 | 0.13 | 0 | -24.35562259 | 150.5354321 | -24.38308674 | 150.5296141 | Dawson(46A)/Callide(472)/Shepherdsons Rd | Calvale Rd / Tognolini Baldwin Rd, Bilo |
| 3.01 | 0.11 | 0 | -24.35562259 | 150.5354321 | -24.38308674 | 150.5296141 | Dawson(46A)/Callide(472)/Shepherdsons Rd | Calvale Rd / Tognolini Baldwin Rd, Bilo |
| 0.73 | 0.08 | 0 | -24.38308674 | 150.5296141 | -24.40315218 | 150.5118787 | Calvale Rd / Tognolini Baldwin Rd, Bilo | Dawson Hwy(46A/46B) / Burnett Hwy (41D) |
| 0.77 | 0.06 | 0 | -24.38308674 | 150.5296141 | -24.40315218 | 150.5118787 | Calvale Rd / Tognolini Baldwin Rd, Bilo | Dawson Hwy(46A/46B) / Burnett Hwy (41D) |
| 0.81 | 0.04 | 0 | -24.38308674 | 150.5296141 | -24.40315218 | 150.5118787 | Calvale Rd / Tognolini Baldwin Rd, Bilo | Dawson Hwy(46A/46B) / Burnett Hwy (41D) |
| 3.94 | 0.04 | 0 | -24.35562 | 150.535429 | -24.36749223 | 150.5721537 | Biloela-Callide Rd to Mine @ Dawson Hwy | Biloela-Callide Rd To Biloela @ Links Rd |
| 4.1 | 0.03 | 0 | -24.35562 | 150.535429 | -24.36749223 | 150.5721537 | Biloela-Callide Rd to Mine @ Dawson Hwy | Biloela-Callide Rd To Biloela @ Links Rd |
| 4.26 | 0.02 | 0 | -24.35562 | 150.535429 | -24.36749223 | 150.5721537 | Biloela-Callide Rd to Mine @ Dawson Hwy | Biloela-Callide Rd To Biloela @ Links Rd |
| 2.27 | 0.01 | 0 | -24.36749223 | 150.5721537 | -24.338074 | 150.632114 | Biloela-Callide Rd To Biloela @ Links Rd | |
| 2.36 | 0.01 | 0 | -24.36749223 | 150.5721537 | -24.338074 | 150.632114 | Biloela-Callide Rd To Biloela @ Links Rd | |
| 2.44 | 0.01 | 0 | -24.36749223 | 150.5721537 | -24.338074 | 150.632114 | Biloela-Callide Rd To Biloela @ Links Rd | |
| 3.4 | 0.18 | 0.01 | -24.35562259 | 150.5354321 | -24.38308674 | 150.5296141 | Dawson(46A)/Callide(472)/Shepherdsons Rd | Calvale Rd / Tognolini Baldwin Rd, Bilo |
| 3.21 | 0.15 | 0.01 | -24.35562259 | 150.5354321 | -24.38308674 | 150.5296141 | Dawson(46A)/Callide(472)/Shepherdsons Rd | Calvale Rd / Tognolini Baldwin Rd, Bilo |
| 3.02 | 0.12 | 0.01 | -24.35562259 | 150.5354321 | -24.38308674 | 150.5296141 | Dawson(46A)/Callide(472)/Shepherdsons Rd | Calvale Rd / Tognolini Baldwin Rd, Bilo |
| 0.77 | 0.08 | 0 | -24.38308674 | 150.5296141 | -24.40315218 | 150.5118787 | Calvale Rd / Tognolini Baldwin Rd, Bilo | Dawson Hwy(46A/46B) / Burnett Hwy (41D) |
| | | | -24.38308674 | 150.5296141 | -24.40315218 | 150.5118787 | Calvale Rd / Tognolini Baldwin Rd, Bilo | Dawson Hwy(46A/46B) / Burnett Hwy (41D) |
| 0.74 | 0.05 | 0 | -24.38308674 | 150.5296141 | -24.40315218 | 150.5118787 | Calvale Rd / Tognolini Baldwin Rd, Bilo | Dawson Hwy(46A/46B) / Burnett Hwy (41D) |
| 3.94 | 0.04 | 0 | -24.35562 | 150.535429 | -24.36749223 | 150.5721537 | Biloela-Callide Rd to Mine @ Dawson Hwy | Biloela-Callide Rd To Biloela @ Links Rd |
| 4.1 | 0.03 | 0 | -24.35562 | 150.535429 | -24.36749223 | 150.5721537 | Biloela-Callide Rd to Mine @ Dawson Hwy | Biloela-Callide Rd To Biloela @ Links Rd |
| 4.26 | 0.02 | 0 | -24.35562 | 150.535429 | -24.36749223 | 150.5721537 | Biloela-Callide Rd to Mine @ Dawson Hwy | Biloela-Callide Rd To Biloela @ Links Rd |
| 2.78 | 0.03 | 0 | -24.36749223 | 150.5721537 | -24.338074 | 150.632114 | Biloela-Callide Rd To Biloela @ Links Rd | |
| 3.07 | 0.03 | 0 | -24.36749223 | 150.5721537 | -24.338074 | 150.632114 | Biloela-Callide Rd To Biloela @ Links Rd | |
| 3.35 | 0.03 | 0 | -24.36749223 | 150.5721537 | -24.338074 | 150.632114 | Biloela-Callide Rd To Biloela @ Links Rd | |

| SITE | SITE_TYPE | DESCRIPTION | SPEED_LIMIT | ROAD_SECTION_ID | THROUGH_DISTANCE | LATITUDE | LONGITUDE | DATUM | ROAD_NAME |
|---|---|---|---|---|---|---|---|---|---|
| 60067 | Coverage | 1,475m N of Forestry Rd, Mt Murchison | 100 | 46A | 105.086 | -24.27884411 | 150.541122 | GDA94 | DAWSON HIGHWAY (GLADSTONE - BILOELA) |
| 60126 | Coverage | 875m E of Dawson Hwy, Dakenba | 100 | 472 | 0.875 | -24.35783671 | 150.5436966 | GDA94 | BILOELA - CALLIDE ROAD |
| 61084 | Coverage | 600m S Biolela Callide Rd, Mt Murchison | 100 | 46A | 114.325 | -24.3607998 | 150.5341753 | GDA94 | DAWSON HIGHWAY (GLADSTONE - BILOELA) |
| 61286 | Coverage | 275m E of Shorts Rd, Mount Murchison | 100 | 472 | 4.265 | -24.36763794 | 150.5748615 | GDA94 | BILOELA - CALLIDE ROAD |
| 160067 | Coverage | 55m S of Bell St, Biloela | 60 | 46A | 119.265 | -24.4002212 | 150.5154645 | GDA94 | DAWSON HIGHWAY (GLADSTONE - BILOELA) |

| LOCALITY | DISTRICT | DISTRICT_NAME | REGION | REGION_NAME | LGA_ID | LGA_NAME |
|---|---|---|---|---|---|---|
| Callide | 404 | Fitzroy | 314 | Central Queensland | 370 | Banana Shire |
| Mount Murchison | 404 | Fitzroy | 314 | Central Queensland | 370 | Banana Shire |
| Dakenba | 404 | Fitzroy | 314 | Central Queensland | 370 | Banana Shire |
| Mount Murchison | 404 | Fitzroy | 314 | Central Queensland | 370 | Banana Shire |
| Biloela | 404 | Fitzroy | 314 | Central Queensland | 370 | Banana Shire |

NORTHERN CONSULTING engineers

# APPENDIX E

Northern Consulting Engineers – Traffic Generation Spreadsheet and Intersection Warrants

| Development - Particulars | | |
|---|---|---|
| Construction Commencement | 2023 | year |
| Construction Duration | 52 | weeks |
| Construction Duration (Assumed 6 days/week) | 312 | days |
| Operations Commencement | 2024 | year |
| Operational Design Life | 30 | years |
| Operational Design Life | 1560 | weeks |
| Operational Design Life (Assumed 5 days/week) | 7800 | days |

Construction Phase - Development Generated Traffic Volumes

| Solar Array System | | | | |
|---|---|---|---|---|
| **Expected MWp** | **200** | | | |
| | MWp per Container | Movements (One way only) | Weight per Container (kg) | Total Weight Moved |
| Modules | 0.18 | 1,111 | 15,500 | 8,610,250 |
| Inverter Stations | 2.00 | 100 | 15,500 | 775,000 |
| Fixing System | 0.15 | 1,333 | 20,500 | 13,663,250 |
| Switchgear | 200.00 | 1 | 50,000 | 25,000 |
| Power Transformer | 200.00 | 1 | 50,000 | 25,000 |
| Pile | 0.13 | 1,600 | 20,500 | 16,400,000 |
| Tube | 0.13 | 1,600 | 19,500 | 15,600,000 |
| Tracker | 0.13 | 1,600 | 13,000 | 10,400,000 |
| Balance of System | 0.75 | 267 | 15,500 | 2,069,250 |
| Earthworks / Road Materials | 0.13 | 1,600 | 15,500 | 12,400,000 |
| Total Heavy Vehicle Movements | | 9,213 | Average Payload (kg) | 8,875 |
| Average Daily Heavy Vehicle Movements | | 30 | HV/day | |

| Construction Labour (Vehicle trips per day one way) | | |
|---|---|---|
| Daily on Site Labour | 0.08 | 15 |
| Daily Mini Bus Activity | 0.03 | 6 |
| Additional Daily Cars | 0.03 | 5 |
| Total Light Vehicle Movements (per day) | | 26 |

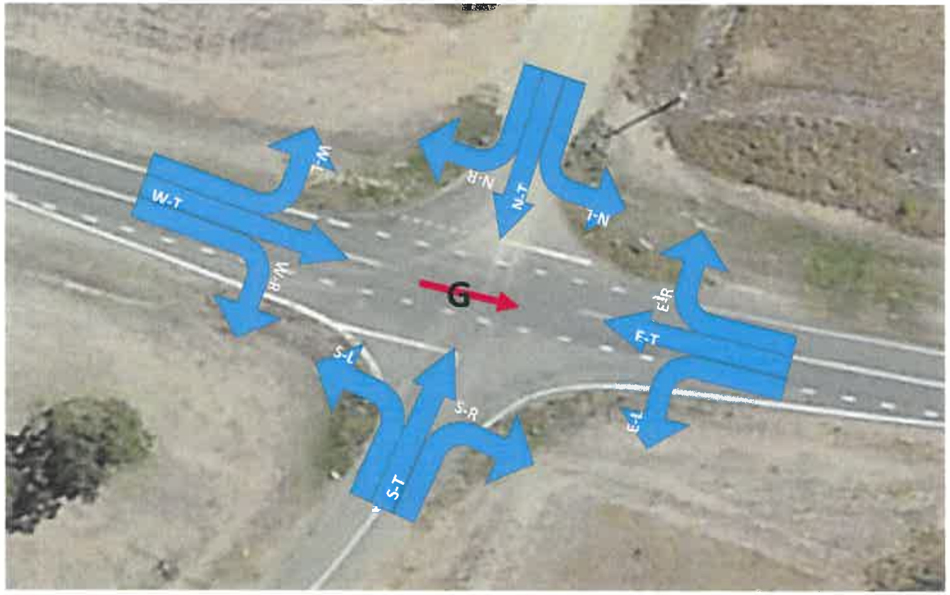
Operational Phase - Development Generated Traffic Volumes

| Operational traffic Light Vehicles (per day one way) | |
|---|---|
| Management / Office | 6.000 |
| Electrical maintenance crew | 1.000 |
| Cleaning (Panel) crew (Annually - 20 veh per event) | 0.077 |
| Total Light Vehicle Movements (per day one way) | 7.077 |

| Operational traffic Heavy Vehicles (per day one way) | |
|---|---|
| Water Supply drinking (1 x monthly) | 0.046 |
| Water Supply Cleaning (Annually - 2 HV's per event) | 0.008 |
| Total Heavy Vehicle Movements (per day one way) | 0.054 |

| YEAR | ROAD_SECTION_ID | SITE | GAZETTAL_DIRECTION | AADT | PC_CLASS_1A | PC_CLASS_1B | PC_CLASS_1C | PC_CLASS_1D | GROWTH_PC_5YR | GROWTH_PC_10YR | COLLECTION_YEAR |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2020 | 46A | 60067 | TA | 627 | 73.43 | 14.94 | 5.31 | 6.32 | 0.91 | 2.14 | 2020 |
| 2020 | 46A | 60067 | TB | 1,226 | 76.29 | 11.96 | 4.9 | 6.85 | 0.89 | 1.87 | 2020 |
| 2020 | 46A | 60067 | TG | 599 | 79.3 | 8.84 | 4.46 | 7.4 | 0.92 | 1.61 | 2020 |
| 2020 | 46A | 61084 | TA | 789 | 84.74 | 9.12 | 3.16 | 2.98 | | -0.85 | 2020 |
| 2020 | 46A | 61084 | TB | 1,568 | 77.59 | 15.77 | 3.59 | 3.05 | | -0.85 | 2020 |
| 2020 | 46A | 61084 | TG | 779 | 70.36 | 22.48 | 4.04 | 3.12 | | -0.83 | 2020 |
| 2020 | 46A | 160067 | TA | 2,890 | 88.78 | 9.14 | 1.27 | 0.81 | | | 2020 |
| 2020 | 46A | 160067 | TB | 5,798 | 90.42 | 7.52 | 1.23 | 0.83 | | | 2020 |
| 2020 | 46A | 160067 | TG | 2,908 | 91.9 | 6.05 | 1.2 | 0.85 | | | 2020 |
| 2020 | 472 | 60126 | TA | 336 | 85.69 | 8.87 | 1.46 | 3.98 | 7.27 | 6.83 | 2020 |
| 2020 | 472 | 60126 | TB | 669 | 80.61 | 13.55 | 1.71 | 4.13 | 6.48 | 6.27 | 2020 |
| 2020 | 472 | 60126 | TG | 333 | 75.48 | 18.28 | 1.96 | 4.28 | 5.73 | 5.74 | 2020 |
| 2020 | 472 | 61286 | TA | 544 | 80.38 | 16.21 | 1.13 | 2.28 | 1 | 0.77 | 2020 |
| 2020 | 472 | 61286 | TB | 1,120 | 83.43 | 13.14 | 1.06 | 2.37 | 1.79 | 1 | 2020 |
| 2020 | 472 | 61286 | TG | 576 | 86.28 | 10.26 | 1.01 | 2.45 | 2.57 | 1.22 | 2020 |
| 2021 | 46A | 61084 | TA | 700 | 80.39 | 12.64 | 3.38 | 3.59 | -7.05 | -3.28 | 2021 |
| 2021 | 46A | 61084 | TB | 1,402 | 74.79 | 18.07 | 3.77 | 3.37 | -5.76 | -3.14 | 2021 |
| 2021 | 46A | 61084 | TG | 702 | 69.18 | 23.49 | 4.18 | 3.15 | -4.24 | -2.97 | 2021 |
| 2021 | 46A | 160067 | TA | 2,878 | 87.27 | 10.47 | 1.41 | 0.85 | | | 2021 |
| 2021 | 46A | 160067 | TB | 6,195 | | | | | | | 2021 |
| 2021 | 46A | 160067 | TG | 3,317 | 87.37 | 10.46 | 1.38 | 0.79 | | | 2021 |
| 2021 | 472 | 60126 | TA | 336 | 85.69 | 8.87 | 1.46 | 3.98 | 7.27 | 6.83 | 2021 |
| 2021 | 472 | 60126 | TB | 669 | 80.61 | 13.55 | 1.71 | 4.13 | 6.48 | 6.27 | 2021 |
| 2021 | 472 | 60126 | TG | 333 | 75.48 | 18.28 | 1.96 | 4.28 | 5.73 | 5.74 | 2021 |
| 2021 | 472 | 61286 | TA | 624 | 86.68 | 9.34 | 1.17 | 2.81 | 4.51 | 2.47 | 2021 |
| 2021 | 472 | 61286 | TB | 1,264 | 84.31 | 11.28 | 1.31 | 3.1 | 4.87 | 2.55 | 2021 |
| 2021 | 472 | 61286 | TG | 640 | 82.03 | 13.16 | 1.43 | 3.38 | 5.24 | 2.63 | 2021 |


Sites 60126 and 61286 are to be used in conjunction to calculate the traffic at the Biloela Callide Road / Shorts Road / Linkes Road intersection




East Approach = ID 61286
West Approach = ID 60126

| Site ID | Gazettal / AM/PM | Approach Direction | Volume | Growth % | Year Recorded | Class 1A | Class 1B | Class 1C | Class 1D |
|---|---|---|---|---|---|---|---|---|---|
| 60126 | G / AM | W | 69 | 5.74% | 2021 | 75.48 | 18.28 | 1.96 | 4.28 |
| 60126 | G / PM | W | 27 | 5.74% | 2021 | 75.48 | 18.28 | 1.96 | 4.28 |
| 60126 | G / PM 2 | W | 16 | 5.74% | 2021 | 75.48 | 18.28 | 1.96 | 4.28 |
| 60126 | AG / AM | W | 26 | 6.83% | 2021 | 85.69 | 8.87 | 1.46 | 3.98 |
| 60126 | AG / PM | W | 26 | 6.83% | 2021 | 85.69 | 8.87 | 1.46 | 3.98 |
| 60126 | AG / PM 2 | W | 46 | 6.83% | 2021 | 85.69 | 8.87 | 1.46 | 3.98 |
| 61286 | G / AM | E | 171 | 2.63% | 2021 | 82.03 | 13.16 | 1.43 | 3.38 |
| 61286 | G / PM | E | 61 | 2.63% | 2021 | 82.03 | 13.16 | 1.43 | 3.38 |
| 61286 | G / PM 2 | E | 40 | 2.63% | 2021 | 82.03 | 13.16 | 1.43 | 3.38 |
| 61286 | AG / AM | E | 72 | 2.47% | 2021 | 86.68 | 9.34 | 1.17 | 2.81 |
| 61286 | AG / PM | E | 75 | 2.47% | 2021 | 86.68 | 9.34 | 1.17 | 2.81 |
| 61286 | AG / PM 2 | E | 158 | 2.47% | 2021 | 86.68 | 9.34 | 1.17 | 2.81 |

| Approach ID | Approach Road | Turn Movement | Peak AM Traffic | Peak PM Traffic | Peak PM 2 Traffic |
|---|---|---|---|---|---|
| W-T | Biloela Callide Road | West Approach - Through | 26 | 26 | 46 |
| W-L | Biloela Callide Road | West Approach - Left | 0 | 0 | 0 |
| W-R | Biloela Callide Road | West Approach - Right | 0 | 0 | 0 |
| N-T | Shorts Road | North Approach - Through | 0 | 0 | 0 |
| N-L | Shorts Road | North Approach - Left | 0 | 0 | 0 |
| N-R | Shorts Road | North Approach - Right | 0 | 0 | 0 |
| E-T | Biloela Callide Road | East Approach - Through | 69 | 27 | 16 |
| E-L | Biloela Callide Road | East Approach - Left | 46 | 49 | 112 |
| E-R | Biloela Callide Road | East Approach - Right | 0 | 0 | 0 |
| S-T | Linkes Road | South Approach - Through | 0 | 0 | 0 |
| S-L | Linkes Road | South Approach - Left | 0 | 0 | 0 |
| S-R | Linkes Road | South Approach - Right | 102 | 34 | 24 |

BACKGROUND PEAKS

| | | |
|---|---|---|
| Description of entity | | SID 60126 |
| **Linear** Growth Equation **A = rt+P** | | |
| Year - Traffic Survey Data Collected | | 2021 |
| Year - Commencement of Use | | *2024* |
| Year - Projected Design Horizon | | *2024* |
| AADT (G) [Traffic Flow in Gazettal Direction] | | *69* |
| AADT (A) [Traffic Flow Against Gazettal Direction] | | *26* |
| AADT (B) [Traffic Flow Both Directions] | | - |
| **(G)** | Future value including growth rate | **80.9** |
| **(A)** | Future value including growth rate | **31.3** |
| **(B)** | Future value including growth rate | - |
| **P** | Initial value | (G), (A) or (B) above |
| **r** | Annual growth rate G (percent) | 5.74% |
| **r** | Annual growth rate AG (percent) | 6.83% |

| | | |
|---|---|---|
| Description of entity | | SID 60126 |
| **Continuos Compound** Growth Equation **A = P .e**$^{\wedge rt}$ | | |
| Year - Traffic Survey Data Collected | | 2021 |
| Year - Commencement of Use | | *2024* |
| Year - Projected Design Horizon | | *2024* |
| AADT (G) [Traffic Flow in Gazettal Direction] | | *69* |
| AADT (A) [Traffic Flow Against Gazettal Direction] | | *26* |
| AADT (B) [Traffic Flow Both Directions] | | - |
| **(G)** | Future value including growth rate | **82.0** |
| **(A)** | Future value including growth rate | **31.9** |
| **(B)** | Future value including growth rate | - |
| **P** | Initial value | (G), (A) or (B) above |
| **r** | Annual growth rate G (percent) | 5.74% |
| **r** | Annual growth rate AG (percent) | 6.83% |
| **e** | Continous Growth | exp |
| **t** | Number of year projected. | 3.0 |

| Description of entity | | SID 60126 |
|---|---|---|
| **Linear** Growth Equation **A = rt+P** | | |
| Year - Traffic Survey Data Collected | | 2021 |
| Year - Commencement of Use | | *2024* |
| Year - Projected Design Horizon | | *2024* |
| AADT (G) [Traffic Flow in Gazettal Direction] | | *16* |
| AADT (A) [Traffic Flow Against Gazettal Direction] | | *46* |
| AADT (B) [Traffic Flow Both Directions] | | - |
| **(G)** | Future value including growth rate | **18.8** |
| **(A)** | Future value including growth rate | **55.4** |
| **(B)** | Future value including growth rate | - |
| **P** | Initial value | (G), (A) or (B) above |
| **r** | Annual growth rate G (percentl) | 5.74% |
| **r** | Annual growth rate AG (percent) | 6.83% |

| Description of entity | | SID 60126 |
|---|---|---|
| **Continuos Compound** Growth Equation **A = P .e$^{\wedge rt}$** | | |
| Year - Traffic Survey Data Collected | | 2021 |
| Year - Commencement of Use | | *2024* |
| Year - Projected Design Horizon | | *2024* |
| AADT (G) [Traffic Flow in Gazettal Direction] | | *16* |
| AADT (A) [Traffic Flow Against Gazettal Direction] | | *46* |
| AADT (B) [Traffic Flow Both Directions] | | - |
| **(G)** | Future value including growth rate | **19.0** |
| **(A)** | Future value including growth rate | **56.5** |
| **(B)** | Future value including growth rate | - |
| **P** | Initial value | (G), (A) or (B) above |
| **r** | Annual growth rate G (percent) | 5.74% |
| **r** | Annual growth rate AG (percent) | 6.83% |
| **e** | Continous Growth | exp |
| **t** | Number of year projected. | 3.0 |

| | | |
|---|---|---|
| Description of entity | | SID 60126 |
| **Linear** Growth Equation **A = rt+P** | | |
| Year - Traffic Survey Data Collected | | 2021 |
| Year - Commencement of Use | | *2024* |
| Year - Projected Design Horizon | | *2034* |
| AADT (G) [Traffic Flow in Gazettal Direction] | | *69* |
| AADT (A) [Traffic Flow Against Gazettal Direction] | | *26* |
| AADT (B) [Traffic Flow Both Directions] | | - |
| **(G)** | Future value including growth rate | **120.5** |
| **(A)** | Future value including growth rate | **49.1** |
| **(B)** | Future value including growth rate | - |
| **P** | Initial value | (G), (A) or (B) above |
| **r** | Annual growth rate G (percentl) | 5.74% |
| **r** | Annual growth rate AG (percent) | 6.83% |

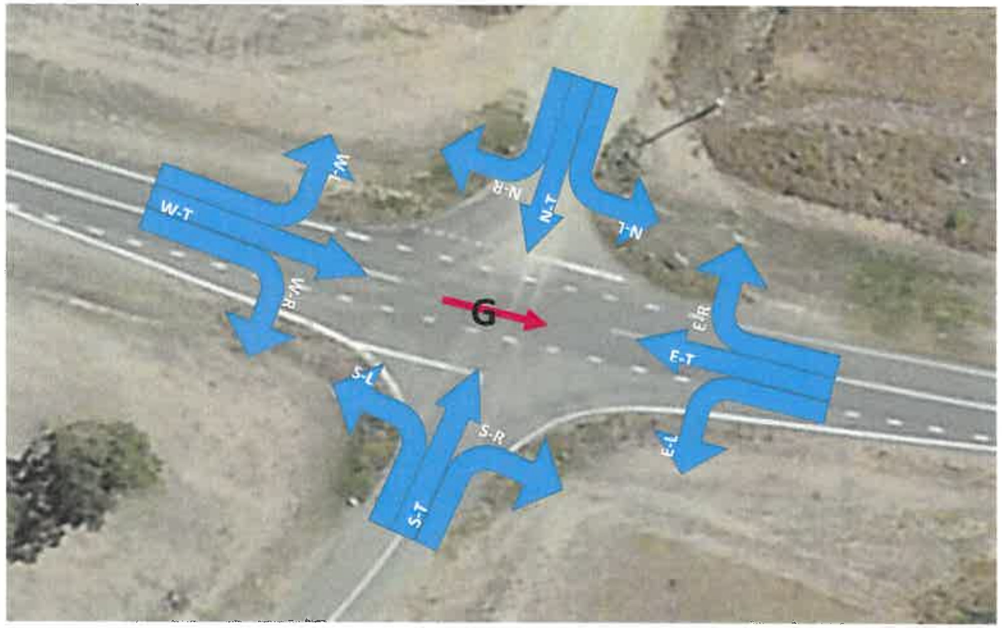
| | | |
|---|---|---|
| Description of entity | | SID 60126 |
| **Continuos Compound** Growth Equation **A = P .e^rt** | | |
| Year - Traffic Survey Data Collected | | 2021 |
| Year - Commencement of Use | | *2024* |
| Year - Projected Design Horizon | | *2034* |
| AADT (G) [Traffic Flow in Gazettal Direction] | | *69* |
| AADT (A) [Traffic Flow Against Gazettal Direction] | | *26* |
| AADT (B) [Traffic Flow Both Directions] | | - |
| **(G)** | Future value including growth rate | **145.5** |
| **(A)** | Future value including growth rate | **63.2** |
| **(B)** | Future value including growth rate | - |
| **P** | Initial value | (G), (A) or (B) above |
| **r** | Annual growth rate G (percent) | 5.74% |
| **r** | Annual growth rate AG (percent) | 6.83% |
| **e** | Continous Growth | exp |
| **t** | Number of year projected. | 13.0 |

| Description of entity | | SID 60126 |
|---|---|---|
| **Linear** Growth Equation **A = rt+P** | | |
| Year - Traffic Survey Data Collected | | 2021 |
| Year - Commencement of Use | | *2024* |
| Year - Projected Design Horizon | | *2034* |
| AADT (G) [Traffic Flow in **Gazettal Direction**] | | *16* |
| AADT (A) [Traffic Flow Against Gazettal Direction] | | *46* |
| AADT (B) [Traffic Flow Both Directions] | | - |
| **(G)** | Future value including growth rate | **27.9** |
| **(A)** | Future value including growth rate | **86.8** |
| **(B)** | Future value including growth rate | - |
| **P** | Initial value | (G), (A) or (B) above |
| **r** | Annual growth rate G (percentl) | 5.74% |
| **r** | Annual growth rate AG (percent) | 6.83% |

| Description of entity | | SID 60126 |
|---|---|---|
| **Continuos Compound** Growth Equation **A = P .e$^{\wedge rt}$** | | |
| Year - Traffic Survey Data Collected | | 2021 |
| Year - Commencement of Use | | *2024* |
| Year - Projected Design Horizon | | *2034* |
| AADT (G) [Traffic Flow in Gazettal Direction] | | *16* |
| AADT (A) [Traffic Flow Against Gazettal Direction] | | *46* |
| AADT (B) [Traffic Flow Both Directions] | | - |
| **(G)** | Future value including growth rate | **33.7** |
| **(A)** | Future value including growth rate | **111.8** |
| **(B)** | Future value including growth rate | - |
| **P** | Initial value | (G), (A) or (B) above |
| **r** | Annual growth rate G (percent) | 5.74% |
| **r** | Annual growth rate AG (percent) | 6.83% |
| **e** | Continous Growth | exp |
| **t** | Number of year projected. | 13.0 |

| | | |
|---|---|---|
| Description of entity | | SID 60067 |
| **Linear** Growth Equation **A = rt+P** | | |
| Year - Traffic Survey Data Collected | | 2020 |
| Year - Commencement of Use | | *2024* |
| Year - Projected Design Horizon | | *2022* |
| AADT (B) [Traffic Flow Both Directions] | | *1226* |
| **(B)** | Future value including growth rate | **1271.9** |
| **P** | Initial value | (G), (A) or (B) above |
| **r** | Annual growth rate B (percentl) | 1.87% |

| | | |
|---|---|---|
| Description of entity | | SID 60067 |
| **Continuos Compound** Growth Equation **A = P .e**$^{\wedge rt}$ | | |
| Year - Traffic Survey Data Collected | | 2020 |
| Year - Commencement of Use | | *2024* |
| Year - Projected Design Horizon | | *2022* |
| AADT (B) [Traffic Flow Both Directions] | | *1226* |
| **(B)** | Future value including growth rate | **1272.7** |
| **P** | Initial value | (G), (A) or (B) above |
| **r** | Annual growth rate B (percent) | 1.87% |
| **e** | Continous Growth | exp |
| **t** | Number of year projected. | 2.0 |




East Approach = ID 61286
West Approach = ID 60126

| Site ID | Gazettal / AM/PM | Approach Direction | Volume 2024 | Volume 2034 | Year Recorded | Class 1A | Class 1B | Class 1C | Class 1D |
|---|---|---|---|---|---|---|---|---|---|
| 60126 | G / AM | W | 81 | 121 | 2021 | 75.48 | 18.28 | 1.96 | 4.28 |
| 60126 | G / PM 2 | W | 19 | 28 | 2021 | 75.48 | 18.28 | 1.96 | 4.28 |
| 60126 | AG / AM | W | 32 | 50 | 2021 | 85.69 | 8.87 | 1.46 | 3.98 |
| 60126 | AG / PM 2 | W | 56 | 87 | 2021 | 85.69 | 8.87 | 1.46 | 3.98 |
| 61286 | G / AM | E | 185 | 230 | 2021 | 82.03 | 13.16 | 1.43 | 3.38 |
| 61286 | G / PM 2 | E | 44 | 54 | 2021 | 82.03 | 13.16 | 1.43 | 3.38 |
| 61286 | AG / AM | E | 78 | 96 | 2021 | 86.68 | 9.34 | 1.17 | 2.81 |
| 61286 | AG / PM 2 | E | 170 | 209 | 2021 | 86.68 | 9.34 | 1.17 | 2.81 |
| | | | | | | 82.47 | 12.4125 | 1.505 | 3.6125 |

| Approach ID | Approach Road | Turn Movement | Peak AM 2024 Traffic | Peak PM 2 2024 Traffic | Peak AM 2034 | Peak PM 2 2034 Traffic |
|---|---|---|---|---|---|---|
| W-T | Biloela Callide Road | West Approach - Through | 32 | 56 | 50 | 87 |
| W-L | Biloela Callide Road | West Approach - Left | 0 | 0 | 0 | 0 |
| W-R | Biloela Callide Road | West Approach - Right | 0 | 0 | 0 | 0 |
| N-T | Shorts Road | North Approach - Through | 0 | 0 | 0 | 0 |
| N-L | Shorts Road | North Approach - Left | 0 | 0 | 0 | 0 |
| N-R | Shorts Road | North Approach - Right | 0 | 0 | 0 | 0 |
| E-T | Biloela Callide Road | East Approach - Through | 81 | 19 | 121 | 28 |
| E-L | Biloela Callide Road | East Approach - Left | 46 | 114 | 46 | 122 |
| E-R | Biloela Callide Road | East Approach - Right | 0 | 0 | 0 | 0 |
| S-T | Linkes Road | South Approach - Through | 0 | 0 | 0 | 0 |
| S-L | Linkes Road | South Approach - Left | 0 | 0 | 0 | 0 |
| S-R | Linkes Road | South Approach - Right | 104 | 25 | 109 | 26 |

BACKGROUND PEAKS 2024-2034

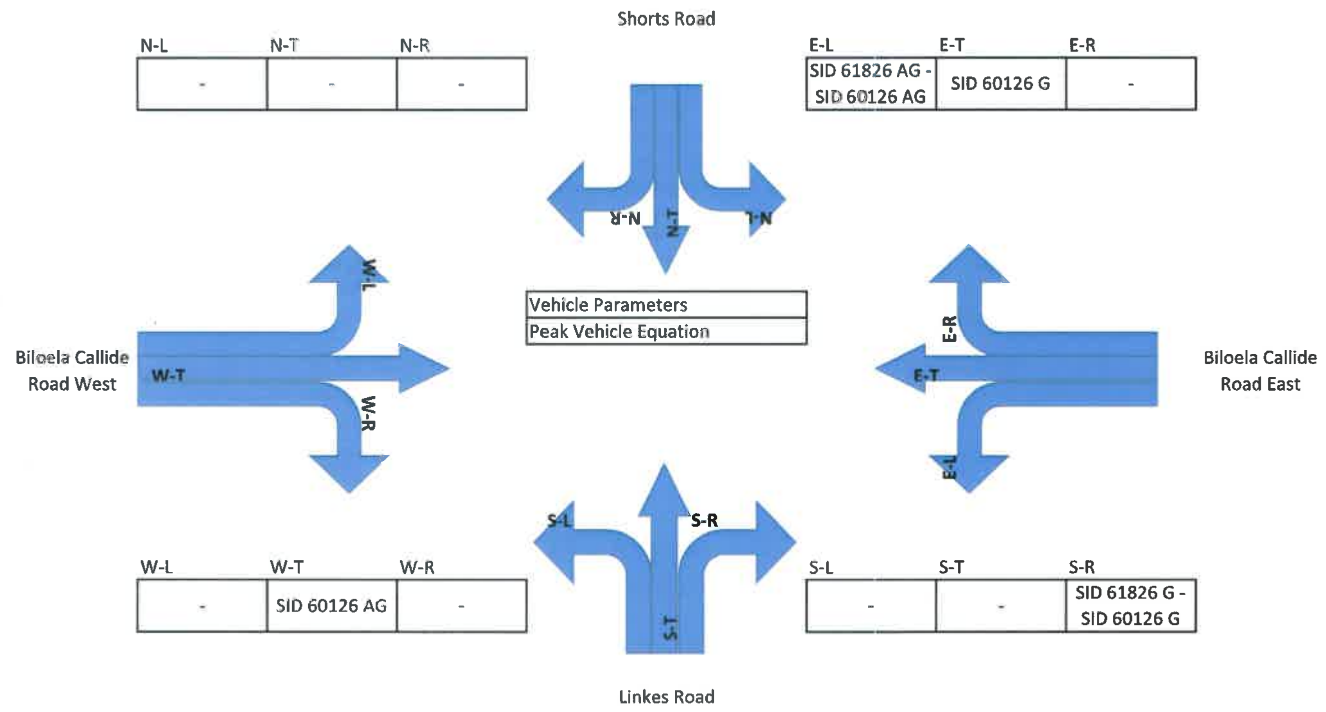
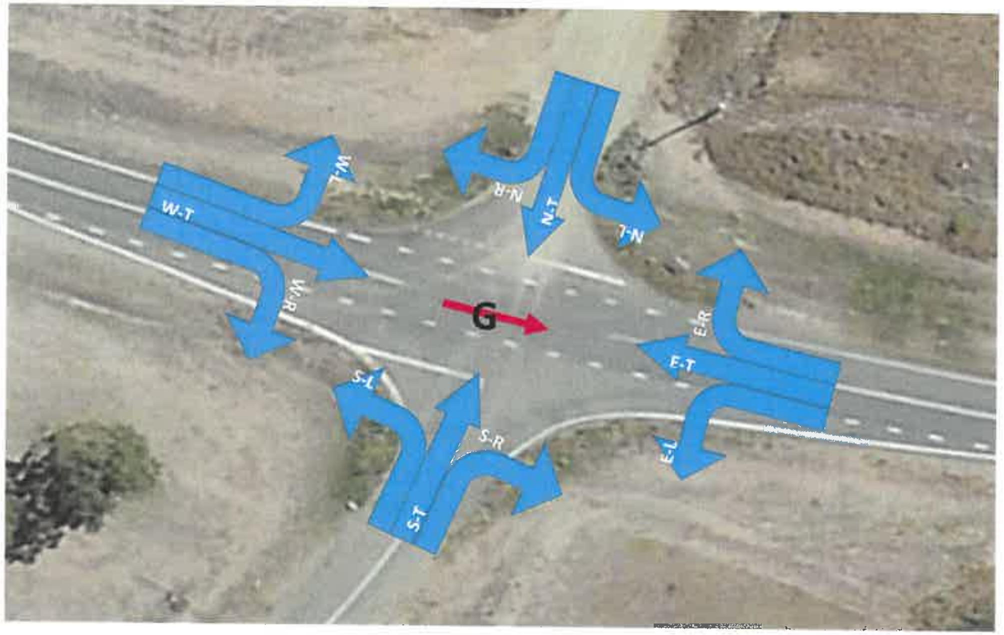

Shorts Road
N-L
N-T
N-R
-
-
-
E-L
E-T
E-R
SID 61826 AG - SID 60126 AG
SID 60126 G
-
N-R
N-T
N-L
Vehicle Parameters
Peak Vehicle Equation
W-L
W-T
W-R
E-R
E-T
E-L
Biloela Callide Road West
Biloela Callide Road East
S-L
S-R
S-T
W-L
W-T
W-R
-
SID 60126 AG
-
S-L
S-T
S-R
-
-
SID 61826 G - SID 60126 G
Linkes Road

Figure 2-4




East Approach = ID 61286
West Approach = ID 60126

Construction Dev traffic to be applied to 2024 year. Heavy vehicles are to be 100% W-L movements and 100% N-R movements. Light vehicles are to be 100% S-T in the AM and 100% N-T in the PM.

Operational Dev traffic to be applied to the 2034 year. Heavy vehicles are to be 100% W-L movements and 100% N-R movements. Light vehicles are to be 100% S-T in the AM and 100% N-T in the PM.

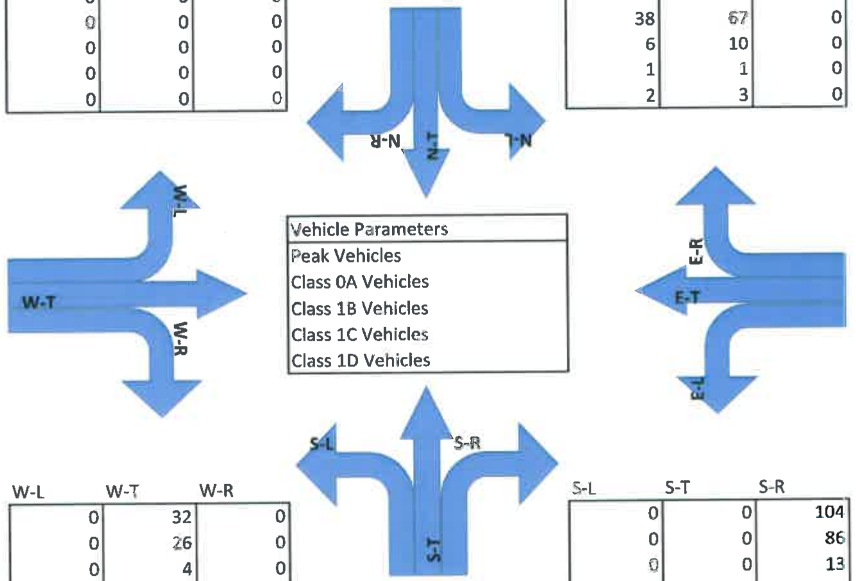
| Site ID | Gazettal / AM/PM | Approach Direction | Volume 2024 | Volume 2034 | Year Recorded | Class 1A | Class 1B | Class 1C | Class 1D |
|---|---|---|---|---|---|---|---|---|---|
| 60126 | G / AM | W | 81 | 121 | 2021 | 75.48 | 18.28 | 1.96 | 4.28 |
| 60126 | G / PM 2 | W | 19 | 28 | 2021 | 75.48 | 18.28 | 1.96 | 4.28 |
| 60126 | AG / AM | W | 32 | 50 | 2021 | 85.69 | 8.87 | 1.46 | 3.98 |
| 60126 | AG / PM 2 | W | 56 | 87 | 2021 | 85.69 | 8.87 | 1.46 | 3.98 |
| 61286 | G / AM | E | 185 | 230 | 2021 | 82.03 | 13.16 | 1.43 | 3.38 |
| 61286 | G / PM 2 | E | 44 | 54 | 2021 | 82.03 | 13.16 | 1.43 | 3.38 |
| 61286 | AG / AM | E | 78 | 96 | 2021 | 86.68 | 9.34 | 1.17 | 2.81 |
| 61286 | AG / PM 2 | E | 170 | 209 | 2021 | 86.68 | 9.34 | 1.17 | 2.81 |
| | | | | | | 82.47 | 12.4125 | 1.505 | 3.6125 |

| Approach ID | Approach Road | Turn Movement | Peak AM 2024 Traffic | Peak PM 2 2024 Traffic | Peak AM 2034 | Peak PM 2 2034 Traffic |
|---|---|---|---|---|---|---|
| W-T | Biloela Callide Road | West Approach - Through | 32 | 56 | 50 | 87 |
| W-L | Biloela Callide Road | West Approach - Left | 30 | 30 | 1 | 1 |
| W-R | Biloela Callide Road | West Approach - Right | 0 | 0 | 0 | 0 |
| N-T | Shorts Road | North Approach - Through | 0 | 26 | 0 | 7 |
| N-L | Shorts Road | North Approach - Left | 0 | 0 | 0 | 0 |
| N-R | Shorts Road | North Approach - Right | 30 | 30 | 1 | 1 |
| E-T | Biloela Callide Road | East Approach - Through | 81 | 19 | 121 | 28 |
| E-L | Biloela Callide Road | East Approach - Left | 46 | 114 | 46 | 122 |
| E-R | Biloela Callide Road | East Approach - Right | 0 | 0 | 0 | 0 |
| S-T | Linkes Road | South Approach - Through | 26 | 0 | 7 | 0 |
| S-L | Linkes Road | South Approach - Left | 0 | 0 | 0 | 0 |
| S-R | Linkes Road | South Approach - Right | 104 | 25 | 109 | 26 |

DEV PEAKS 2024-2034

| N-L | N-T | N-R |
|---|---|---|
| 0 | 0 | 0 |
| 0 | 0 | 0 |
| 0 | 0 | 0 |
| 0 | 0 | 0 |
| 0 | 0 | 0 |

| E-L | E-T | E-R |
|---|---|---|
| 46 | 81 | 0 |
| 38 | 67 | 0 |
| 6 | 10 | 0 |
| 1 | 1 | 0 |
| 2 | 3 | 0 |



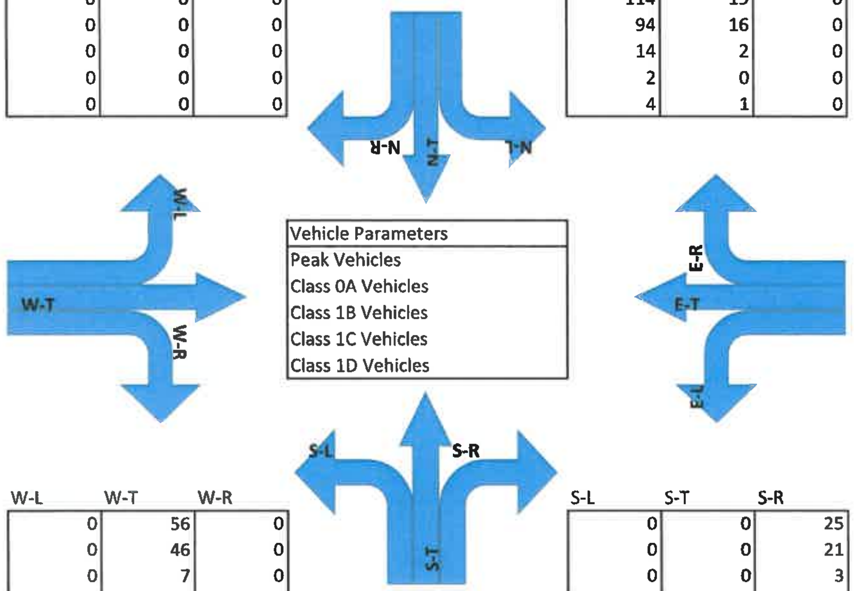

| Vehicle Parameters |
|---|
| Peak Vehicles |
| Class 0A Vehicles |
| Class 1B Vehicles |
| Class 1C Vehicles |
| Class 1D Vehicles |

| W-L | W-T | W-R |
|---|---|---|
| 0 | 32 | 0 |
| 0 | 26 | 0 |
| 0 | 4 | 0 |
| 0 | 0 | 0 |
| 0 | 1 | 0 |

| S-L | S-T | S-R |
|---|---|---|
| 0 | 0 | 104 |
| 0 | 0 | 86 |
| 0 | 0 | 13 |
| 0 | 0 | 2 |
| 0 | 0 | 4 |

| N-L | N-T | N-R |
|---|---|---|
| 0 | 0 | 0 |
| 0 | 0 | 0 |
| 0 | 0 | 0 |
| 0 | 0 | 0 |
| 0 | 0 | 0 |

| E-L | E-T | E-R |
|---|---|---|
| 114 | 19 | 0 |
| 94 | 16 | 0 |
| 14 | 2 | 0 |
| 2 | 0 | 0 |
| 4 | 1 | 0 |

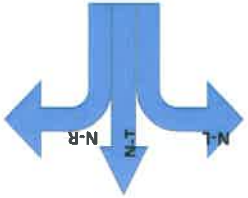



| Vehicle Parameters |
|---|
| Peak Vehicles |
| Class 0A Vehicles |
| Class 1B Vehicles |
| Class 1C Vehicles |
| Class 1D Vehicles |

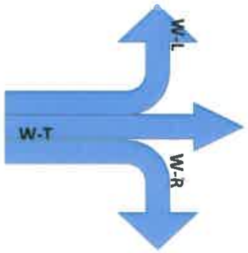
| W-L | W-T | W-R |
|---|---|---|
| 0 | 56 | 0 |
| 0 | 46 | 0 |
| 0 | 7 | 0 |
| 0 | 1 | 0 |
| 0 | 2 | 0 |

| S-L | S-T | S-R |
|---|---|---|
| 0 | 0 | 25 |
| 0 | 0 | 21 |
| 0 | 0 | 3 |
| 0 | 0 | 0 |
| 0 | 0 | 1 |

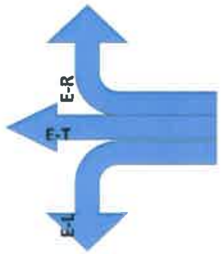
| N-L | N-T | N-R |
|---|---|---|
| 0 | 0 | 0 |
| 0 | 0 | 0 |
| 0 | 0 | 0 |
| 0 | 0 | 0 |
| 0 | 0 | 0 |

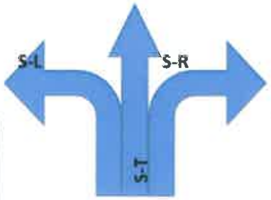



| E-L | E-T | E-R |
|---|---|---|
| 46 | 121 | 0 |
| 38 | 100 | 0 |
| 6 | 15 | 0 |
| 1 | 2 | 0 |
| 2 | 4 | 0 |




| Vehicle Parameters |
|---|
| Peak Vehicles |
| Class 0A Vehicles |
| Class 1B Vehicles |
| Class 1C Vehicles |
| Class 1D Vehicles |



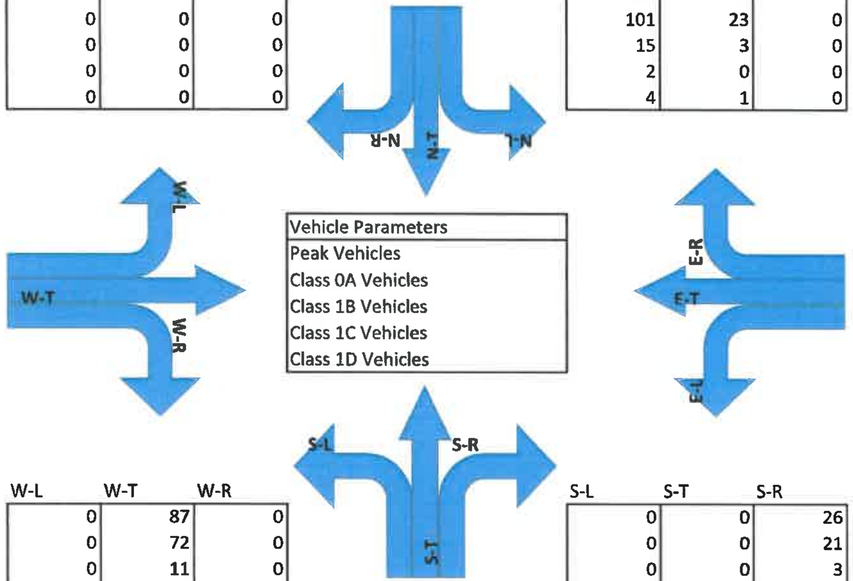




| W-L | W-T | W-R |
|---|---|---|
| 0 | 50 | 0 |
| 0 | 41 | 0 |
| 0 | 6 | 0 |
| 0 | 1 | 0 |
| 0 | 2 | 0 |

| S-L | S-T | S-R |
|---|---|---|
| 0 | 0 | 109 |
| 0 | 0 | 90 |
| 0 | 0 | 14 |
| 0 | 0 | 2 |
| 0 | 0 | 4 |

| Vehicle Parameters | N-L | N-T | N-R |
|---|---|---|---|
| Peak Vehicles | 0 | 0 | 0 |
| Class 0A Vehicles | 0 | 0 | 0 |
| Class 1B Vehicles | 0 | 0 | 0 |
| Class 1C Vehicles | 0 | 0 | 0 |
| Class 1D Vehicles | 0 | 0 | 0 |

| Vehicle Parameters | E-L | E-T | E-R |
|---|---|---|---|
| Peak Vehicles | 122 | 28 | 0 |
| Class 0A Vehicles | 101 | 23 | 0 |
| Class 1B Vehicles | 15 | 3 | 0 |
| Class 1C Vehicles | 2 | 0 | 0 |
| Class 1D Vehicles | 4 | 1 | 0 |




Vehicle Parameters
Peak Vehicles
Class 0A Vehicles
Class 1B Vehicles
Class 1C Vehicles
Class 1D Vehicles

| Vehicle Parameters | W-L | W-T | W-R |
|---|---|---|---|
| Peak Vehicles | 0 | 87 | 0 |
| Class 0A Vehicles | 0 | 72 | 0 |
| Class 1B Vehicles | 0 | 11 | 0 |
| Class 1C Vehicles | 0 | 1 | 0 |
| Class 1D Vehicles | 0 | 3 | 0 |

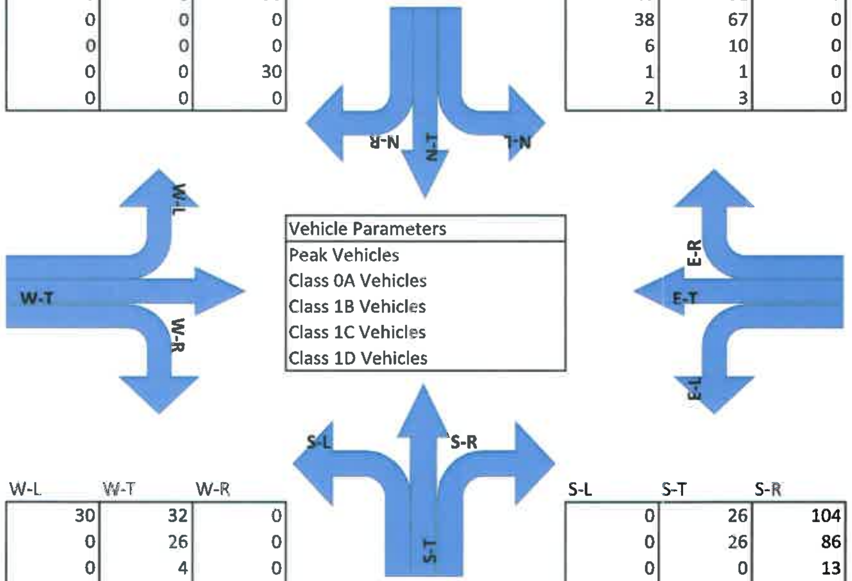
| Vehicle Parameters | S-L | S-T | S-R |
|---|---|---|---|
| Peak Vehicles | 0 | 0 | 26 |
| Class 0A Vehicles | 0 | 0 | 21 |
| Class 1B Vehicles | 0 | 0 | 3 |
| Class 1C Vehicles | 0 | 0 | 0 |
| Class 1D Vehicles | 0 | 0 | 1 |

Shorts Road

| N-L | N-T | N-R |
|---|---|---|
| 0 | 0 | 30 |
| 0 | 0 | 0 |
| 0 | 0 | 0 |
| 0 | 0 | 30 |
| 0 | 0 | 0 |

| E-L | E-T | E-R |
|---|---|---|
| 46 | 81 | 0 |
| 38 | 67 | 0 |
| 6 | 10 | 0 |
| 1 | 1 | 0 |
| 2 | 3 | 0 |

Biloela Callide Road West




| Vehicle Parameters |
|---|
| Peak Vehicles |
| Class 0A Vehicles |
| Class 1B Vehicles |
| Class 1C Vehicles |
| Class 1D Vehicles |

Biloela Callide Road East

| W-L | W-T | W-R |
|---|---|---|
| 30 | 32 | 0 |
| 0 | 26 | 0 |
| 0 | 4 | 0 |
| 30 | 0 | 0 |
| 0 | 1 | 0 |

Linkes Road

| S-L | S-T | S-R |
|---|---|---|
| 0 | 26 | 104 |
| 0 | 26 | 86 |
| 0 | 0 | 13 |
| 0 | 0 | 2 |
| 0 | 0 | 4 |

Shorts Road

| N-L | N-T | N-R |
|---|---|---|
| 0 | 26 | 30 |
| 0 | 26 | 0 |
| 0 | 0 | 0 |
| 0 | 0 | 30 |
| 0 | 0 | 0 |

| E-L | E-T | E-R |
|---|---|---|
| 114 | 19 | 0 |
| 94 | 16 | 0 |
| 14 | 2 | 0 |
| 2 | 0 | 0 |
| 4 | 1 | 0 |

Biloela Callide Road West

| Vehicle Parameters |
|---|
| Peak Vehicles |
| Class 0A Vehicles |
| Class 1B Vehicles |
| Class 1C Vehicles |
| Class 1D Vehicles |

Biloela Callide Road East

| W-L | W-T | W-R |
|---|---|---|
| 30 | 56 | 0 |
| 0 | 46 | 0 |
| 0 | 7 | 0 |
| 30 | 1 | 0 |
| 0 | 2 | 0 |

Linkes Road

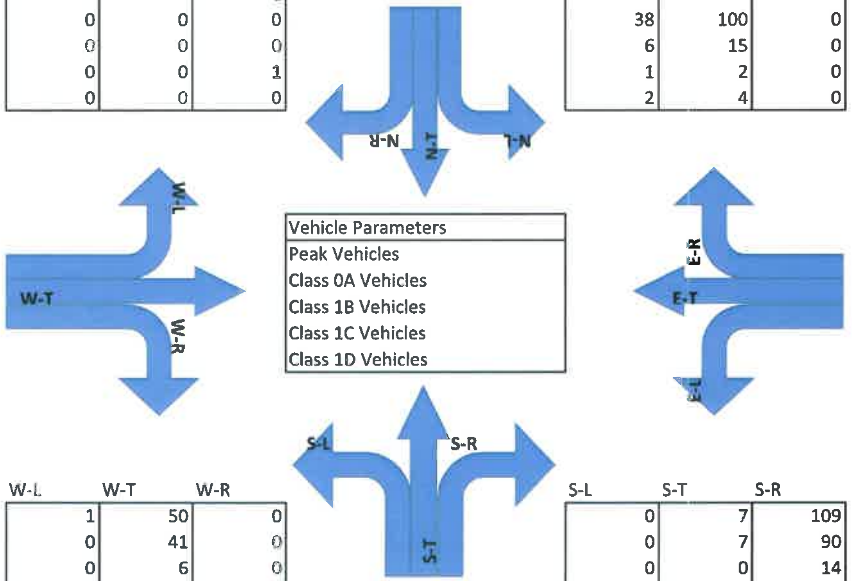
| S-L | S-T | S-R |
|---|---|---|
| 0 | 0 | 25 |
| 0 | 0 | 21 |
| 0 | 0 | 3 |
| 0 | 0 | 0 |
| 0 | 0 | 1 |

Shorts Road

| N-L | N-T | N-R |
|---|---|---|
| 0 | 0 | 1 |
| 0 | 0 | 0 |
| 0 | 0 | 0 |
| 0 | 0 | 1 |
| 0 | 0 | 0 |

| E-L | E-T | E-R |
|---|---|---|
| 46 | 121 | 0 |
| 38 | 100 | 0 |
| 6 | 15 | 0 |
| 1 | 2 | 0 |
| 2 | 4 | 0 |

Biloela Callide Road West




| Vehicle Parameters |
|---|
| Peak Vehicles |
| Class 0A Vehicles |
| Class 1B Vehicles |
| Class 1C Vehicles |
| Class 1D Vehicles |

Biloela Callide Road East

| W-L | W-T | W-R |
|---|---|---|
| 1 | 50 | 0 |
| 0 | 41 | 0 |
| 0 | 6 | 0 |
| 1 | 1 | 0 |
| 0 | 2 | 0 |

Linkes Road

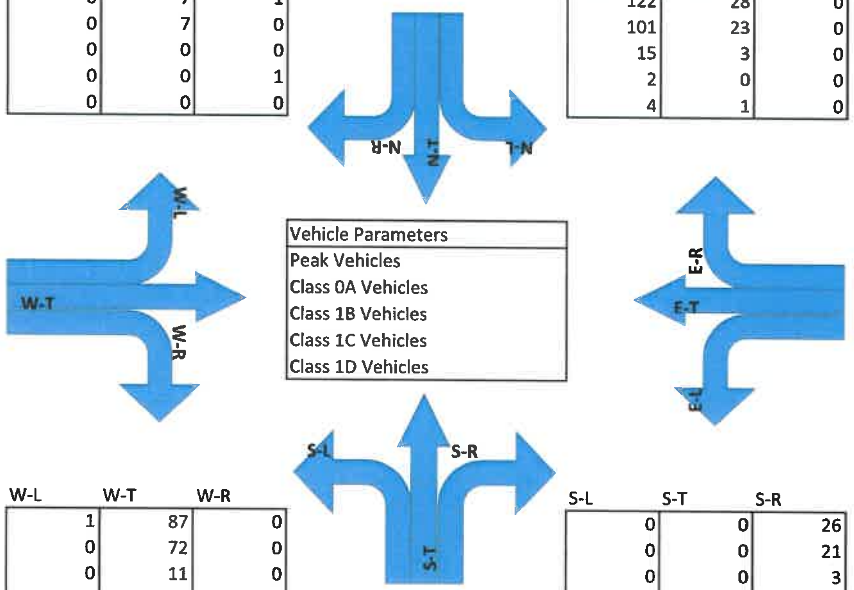
| S-L | S-T | S-R |
|---|---|---|
| 0 | 7 | 109 |
| 0 | 7 | 90 |
| 0 | 0 | 14 |
| 0 | 0 | 2 |
| 0 | 0 | 4 |

Shorts Road

| Vehicle Parameters | N-L | N-T | N-R |
|---|---|---|---|
| Peak Vehicles | 0 | 7 | 1 |
| Class 0A Vehicles | 0 | 7 | 0 |
| Class 1B Vehicles | 0 | 0 | 0 |
| Class 1C Vehicles | 0 | 0 | 1 |
| Class 1D Vehicles | 0 | 0 | 0 |

| Vehicle Parameters | E-L | E-T | E-R |
|---|---|---|---|
| Peak Vehicles | 122 | 28 | 0 |
| Class 0A Vehicles | 101 | 23 | 0 |
| Class 1B Vehicles | 15 | 3 | 0 |
| Class 1C Vehicles | 2 | 0 | 0 |
| Class 1D Vehicles | 4 | 1 | 0 |

Biloela Callide Road West



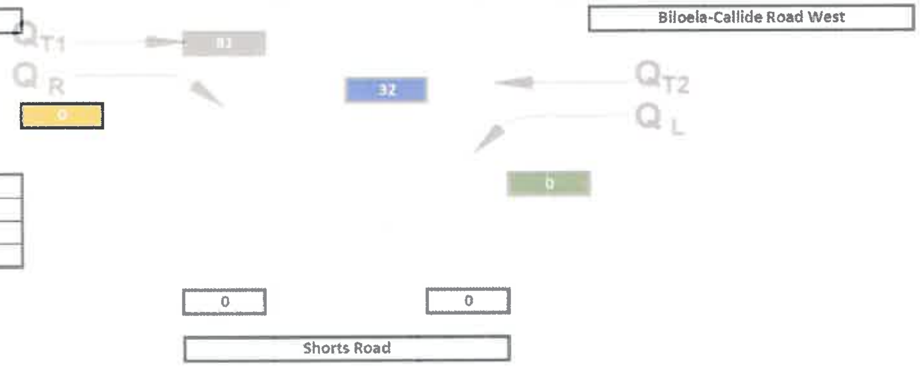

Biloela Callide Road East

| Vehicle Parameters | W-L | W-T | W-R |
|---|---|---|---|
| Peak Vehicles | 1 | 87 | 0 |
| Class 0A Vehicles | 0 | 72 | 0 |
| Class 1B Vehicles | 0 | 11 | 0 |
| Class 1C Vehicles | 1 | 1 | 0 |
| Class 1D Vehicles | 0 | 3 | 0 |

Linkes Road

| Vehicle Parameters | S-L | S-T | S-R |
|---|---|---|---|
| Peak Vehicles | 0 | 0 | 26 |
| Class 0A Vehicles | 0 | 0 | 21 |
| Class 1B Vehicles | 0 | 0 | 3 |
| Class 1C Vehicles | 0 | 0 | 0 |
| Class 1D Vehicles | 0 | 0 | 1 |

Figure 2.27: Calculation of the major road traffic volume $Q_M$




| |
|---|
| 2024 |
| Callide Solar Farm |
| Background Traffic |
| Turn Movements Only |

| | | |
|---|---|---|
| QL | 0 | veh/hr |
| QML | 32 | veh/hr |
| QR | 0 | veh/hr |
| QMR | 111 | veh/hr |

| Road type | Turn type | Splitter island | $Q_M$ (veh/h) |
|---|---|---|---|
| Two-lane two-way | Right | No | $= Q_{T1} + Q_{T2} + Q_L$ |
| | | Yes | $= Q_{T1} + Q_{T2}$ |
| | Left | Yes or no | $= Q_{T2}$ |

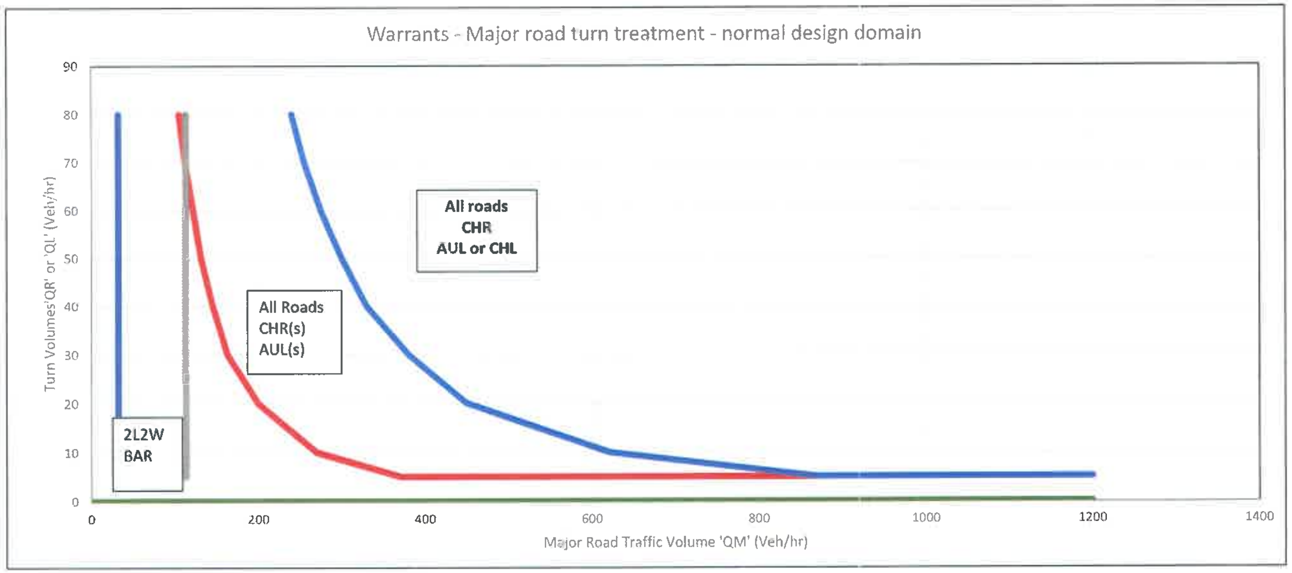



Fig 2.27 Background 2024 AM

Figure 2.27: Calculation of the major road traffic volume $Q_M$

Biloela-Callide Road East

Biloela-Callide Road West


| |
|---|
| 2024 |
| Callide Solar Farm |
| Construction Traffic |
| Turn Movements Only |

| | | |
|---|---|---|
| QL | 30 | veh/hr |
| QML | 32 | veh/hr |
| QR | 0 | veh/hr |
| QMR | 143 | veh/hr |

0

30

Shorts Road

| Road type | Turn type | Splitter island | $Q_M$ (veh/h) |
|---|---|---|---|
| Two-lane two-way | Right | No | $= Q_{T1} + Q_{T2} + Q_L$ |
| | | Yes | $= Q_{T1} + Q_{T2}$ |
| | Left | Yes or no | $= Q_{T2}$ |

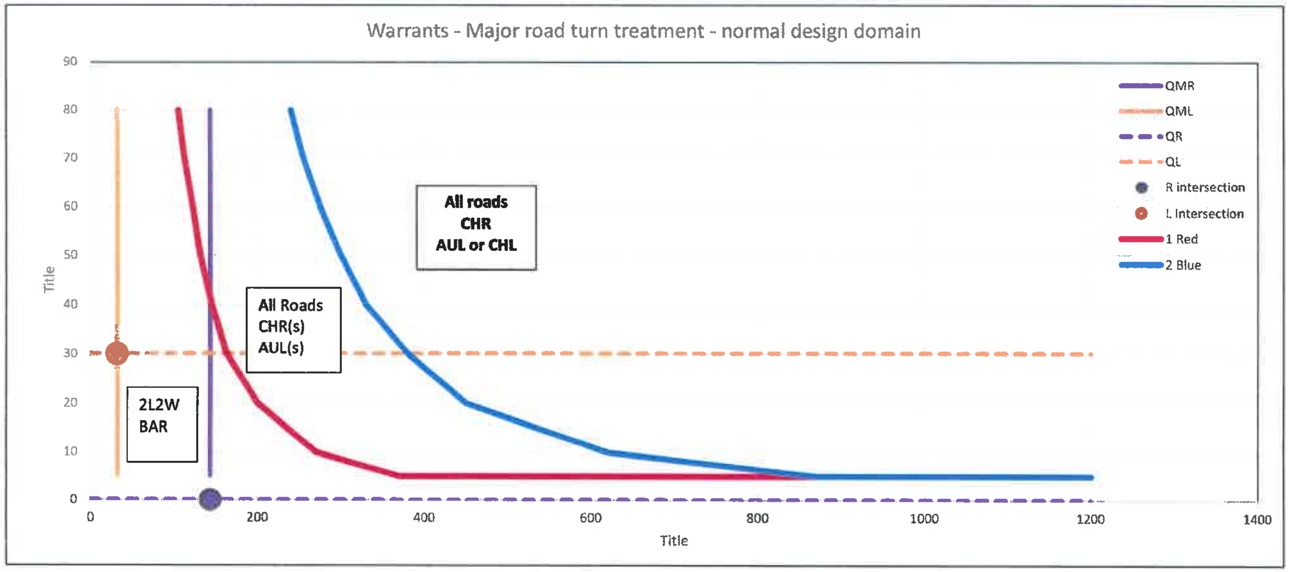
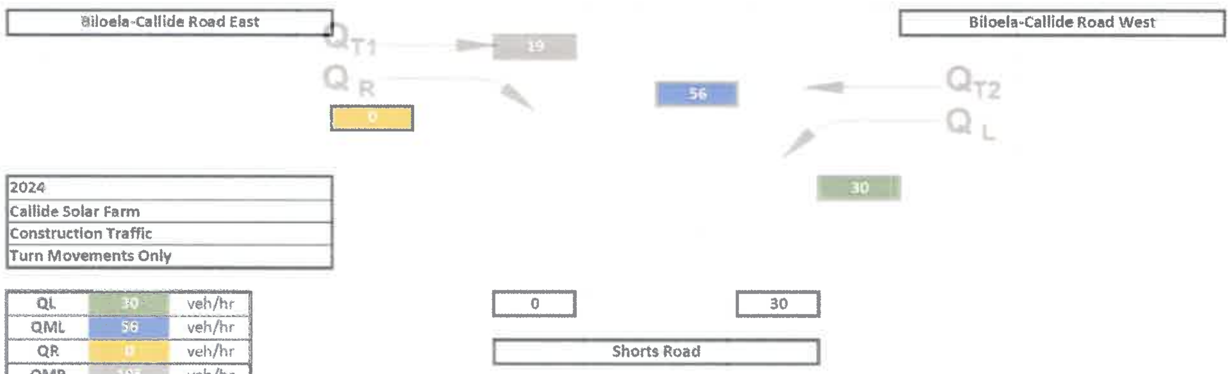



Fig 2.27 DEV 2024 AM

Figure 2.27: Calculation of the major road traffic volume $Q_M$




| |
|---|
| 2024 |
| Callide Solar Farm |
| Construction Traffic |
| Turn Movements Only |

| | | |
|---|---|---|
| QL | 30 | veh/hr |
| QML | 56 | veh/hr |
| QR | 0 | veh/hr |
| QMR | 105 | veh/hr |

| Road type | Turn type | Splitter island | $Q_M$ (veh/h) |
|---|---|---|---|
| Two-lane two-way | Right | No | $= Q_{T1} + Q_{T2} + Q_L$ |
| | | Yes | $= Q_{T1} + Q_{T2}$ |
| | Left | Yes or no | $= Q_{T2}$ |

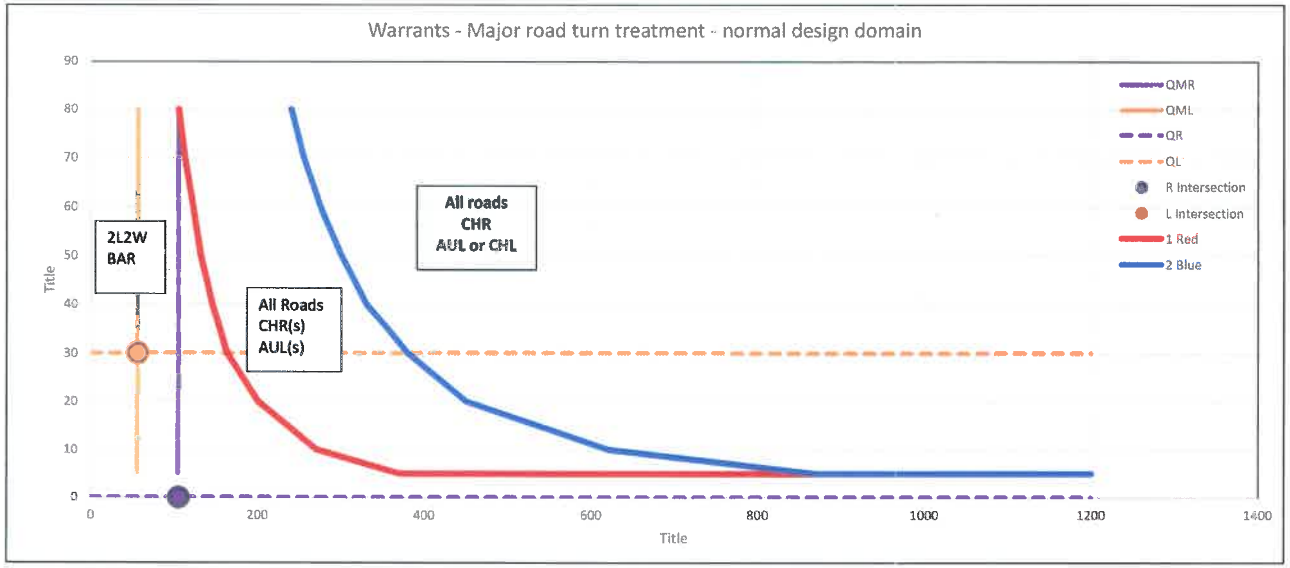



Fig 2.27 DEV 2024 PM

Figure 2.27: Calculation of the major road traffic volume $Q_M$


| | |
|---|---|
| 2034 | |
| Callide Solar Farm | |
| Operational Traffic | |
| Turn Movements Only | |

| | | |
|---|---|---|
| QL | 1 | veh/hr |
| QML | 50 | veh/hr |
| QR | 0 | veh/hr |
| QMR | 121 | veh/hr |

| Road type | Turn type | Splitter island | $Q_M$ (veh/h) |
|---|---|---|---|
| Two-lane two-way | Right | No | $= Q_{T1} + Q_{T2} + Q_L$ |
| | | Yes | $= Q_{T1} + Q_{T2}$ |
| | Left | Yes or no | $= Q_{T2}$ |

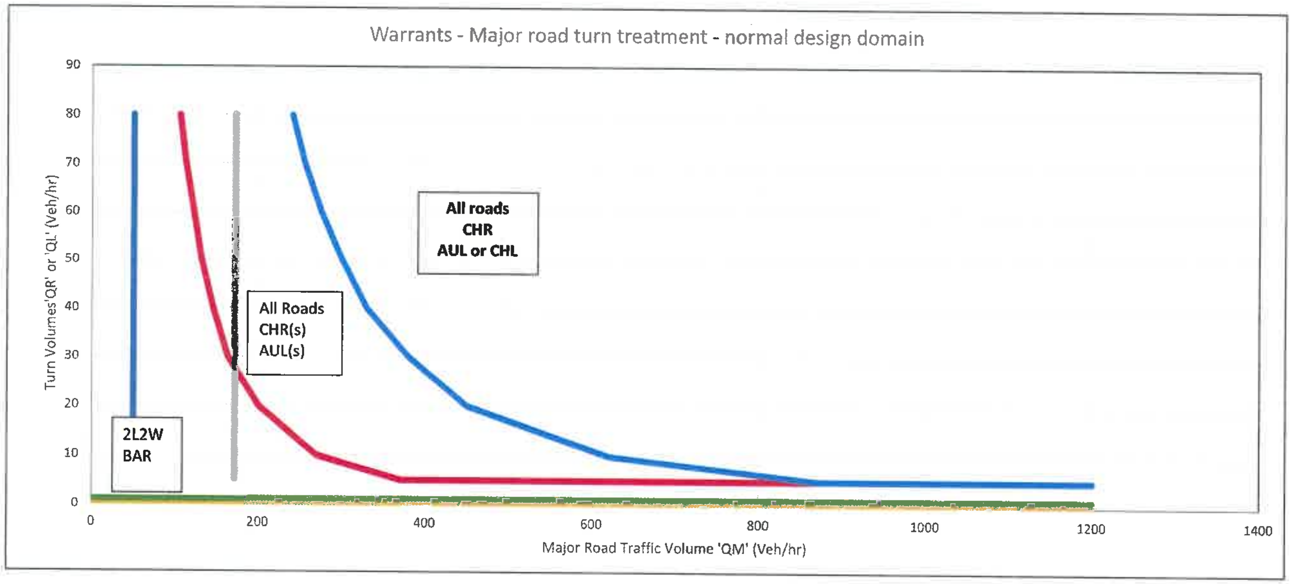
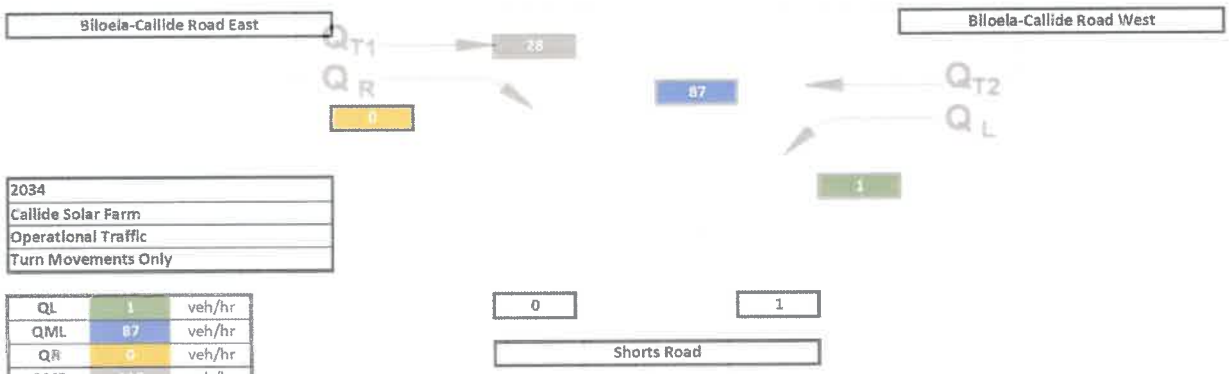



Fig 2.27 DEV 2034 AM

Figure 2.27: Calculation of the major road traffic volume $Q_M$




| |
|---|
| 2034 |
| Callide Solar Farm |
| Operational Traffic |
| Turn Movements Only |

| | | |
|---|---|---|
| QL | 1 | veh/hr |
| QML | 87 | veh/hr |
| QR | 0 | veh/hr |
| QMR | 116 | veh/hr |

| Road type | Turn type | Splitter island | $Q_M$ (veh/h) |
|---|---|---|---|
| Two-lane two-way | Right | No | $= Q_{T1} + Q_{T2} + Q_L$ |
| | | Yes | $= Q_{T1} + Q_{T2}$ |
| | Left | Yes or no | $= Q_{T2}$ |

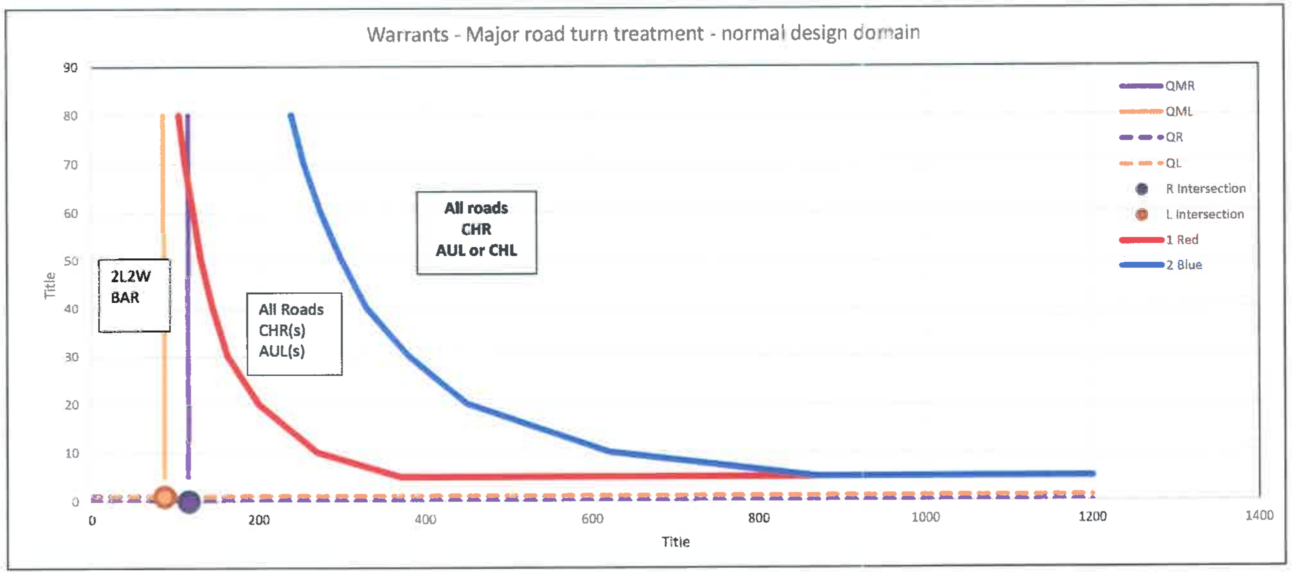



Fig 2.27 DEV 2034 PM

NORTHERN CONSULTING engineers

# APPENDIX F

SIDRA Results Reports, Table and User Defined Traffic Data

# USER REPORT FOR SITE

## Project: 221116-MJ2370-Callide_Solar_Project

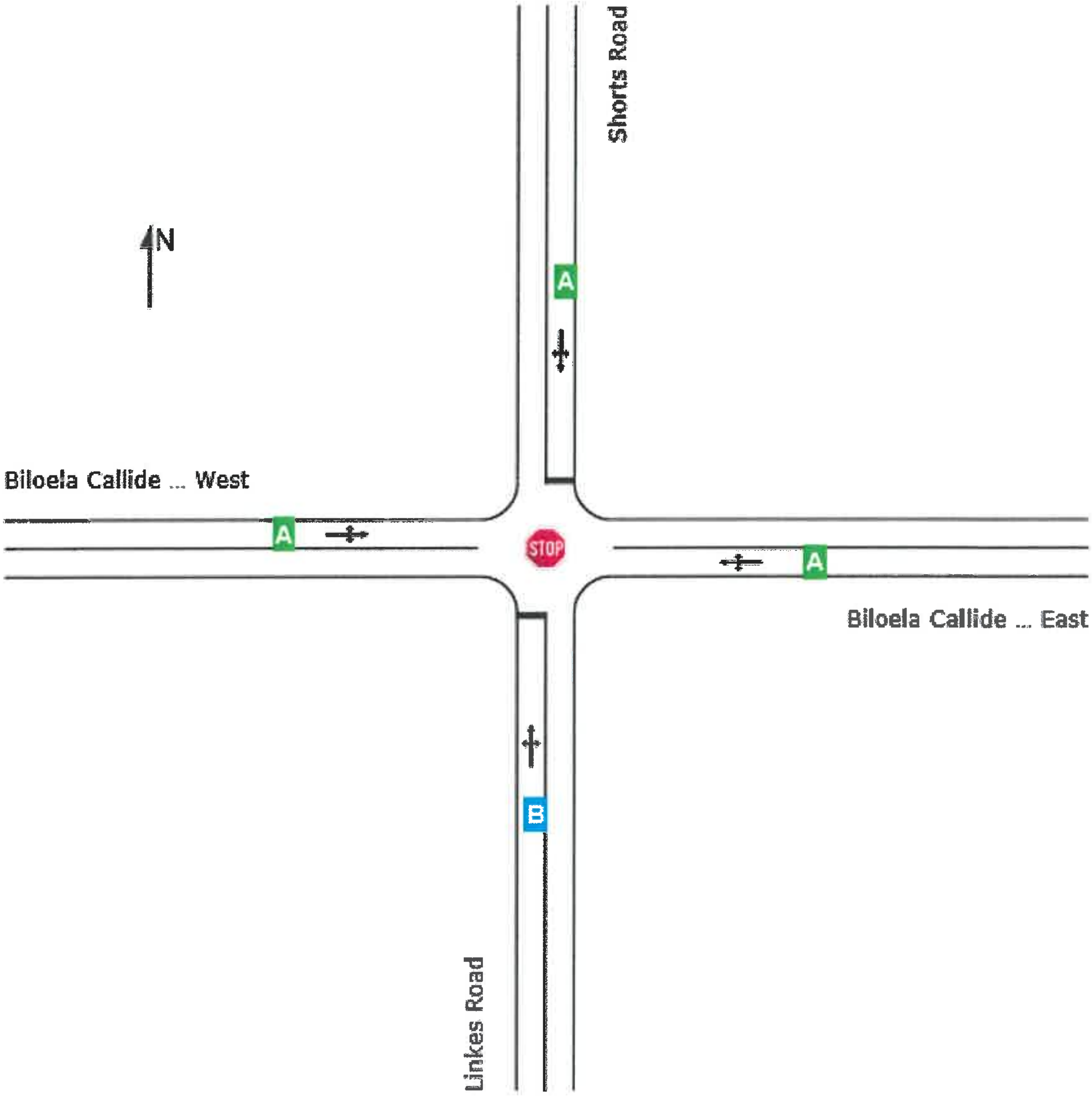
Output produced by SIDRA INTERSECTION Version: 9.1.1.200 Template: NCE Short

## Site: 101 [Background 2024 AM Peak (Site Folder: General)]

Callide Solar Power Station
Site Category: Existing Design
Stop (Two-Way)

### LOS Summary

| | Approaches | | | | Intersection |
|---|---|---|---|---|---|
| | South | East | North | West | |
| LOS | B | NA (TWSC) | A | NA (TWSC) | NA (TWSC) |




Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).

**Vehicle Movement Performance**

| Mov ID | Turn | Mov Class | Demand Flows | Arrival Flows | Deg. Satn | Aver. Delay | Level of Service | 95% Back Of Queue | Prop. Que | Eff. Stop | Aver. No. of | Aver. Speed |
|---|---|---|---|---|---|---|---|---|---|---|---|---|

| | | | [ Total | HV ] | [ Total | HV ] | | | | [ Veh. | Dist ] | | Rate | Cycles | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | veh/h | % | veh/h | % | v/c | sec | | veh | m | | | | km/h |
| South: Linkes Road | | | | | | | | | | | | | | | |
| 1 | L2 | All MCs | 1 | 0.0 | 1 | 0.0 | 0.161 | 10.0 | LOS A | 0.6 | 5.0 | 0.33 | 0.94 | 0.33 | 70.5 |
| 2 | T1 | All MCs | 1 | 0.0 | 1 | 0.0 | 0.161 | 10.0 | LOS A | 0.6 | 5.0 | 0.33 | 0.94 | 0.33 | 70.5 |
| 3 | R2 | All MCs | 111 | 18.1 | 111 | 18.1 | 0.161 | 12.0 | LOS B | 0.6 | 5.0 | 0.33 | 0.94 | 0.33 | 62.6 |
| Approach | | | 113 | 17.8 | 113 | 17.8 | 0.161 | 12.0 | LOS B | 0.6 | 5.0 | 0.33 | 0.94 | 0.33 | 62.7 |
| East: Biloela Callide Road East | | | | | | | | | | | | | | | |
| 4 | L2 | All MCs | 46 | 13.6 | 46 | 13.6 | 0.086 | 8.3 | LOS A | 0.0 | 0.1 | 0.00 | 0.24 | 0.00 | 73.9 |
| 5 | T1 | All MCs | 85 | 17.3 | 85 | 17.3 | 0.086 | 0.0 | LOS A | 0.0 | 0.1 | 0.00 | 0.24 | 0.00 | 92.6 |
| 6 | R2 | All MCs | 1 | 0.0 | 1 | 0.0 | 0.086 | 7.4 | LOS A | 0.0 | 0.1 | 0.00 | 0.24 | 0.00 | 81.7 |
| Approach | | | 133 | 15.9 | 133 | 15.9 | 0.086 | 3.0 | NA | 0.0 | 0.1 | 0.00 | 0.24 | 0.00 | 85.0 |
| North: Shorts Road | | | | | | | | | | | | | | | |
| 7 | L2 | All MCs | 1 | 0.0 | 1 | 0.0 | 0.003 | 9.6 | LOS A | 0.0 | 0.1 | 0.18 | 0.90 | 0.18 | 72.2 |
| 8 | T1 | All MCs | 1 | 0.0 | 1 | 0.0 | 0.003 | 9.9 | LOS A | 0.0 | 0.1 | 0.18 | 0.90 | 0.18 | 72.1 |
| 9 | R2 | All MCs | 1 | 0.0 | 1 | 0.0 | 0.003 | 9.6 | LOS A | 0.0 | 0.1 | 0.18 | 0.90 | 0.18 | 72.0 |
| Approach | | | 3 | 0.0 | 3 | 0.0 | 0.003 | 9.7 | LOS A | 0.0 | 0.1 | 0.18 | 0.90 | 0.18 | 72.1 |
| West: Biloela Callide Road West | | | | | | | | | | | | | | | |
| 10 | L2 | All MCs | 1 | 0.0 | 1 | 0.0 | 0.021 | 7.8 | LOS A | 0.0 | 0.1 | 0.02 | 0.04 | 0.02 | 86.1 |
| 11 | T1 | All MCs | 33 | 16.1 | 33 | 16.1 | 0.021 | 0.0 | LOS A | 0.0 | 0.1 | 0.02 | 0.04 | 0.02 | 98.2 |
| 12 | R2 | All MCs | 1 | 0.0 | 1 | 0.0 | 0.021 | 8.1 | LOS A | 0.0 | 0.1 | 0.02 | 0.04 | 0.02 | 86.0 |
| Approach | | | 35 | 15.2 | 35 | 15.2 | 0.021 | 0.5 | NA | 0.0 | 0.1 | 0.02 | 0.04 | 0.02 | 97.4 |
| All Vehicles | | | 283 | 16.4 | 283 | 16.4 | 0.161 | 6.3 | NA | 0.6 | 5.0 | 0.14 | 0.50 | 0.14 | 75.4 |

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).

Vehicle movement LOS values are based on average delay per movement.

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).

Two-Way Sign Control Capacity Model: SIDRA Standard.

Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.

Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

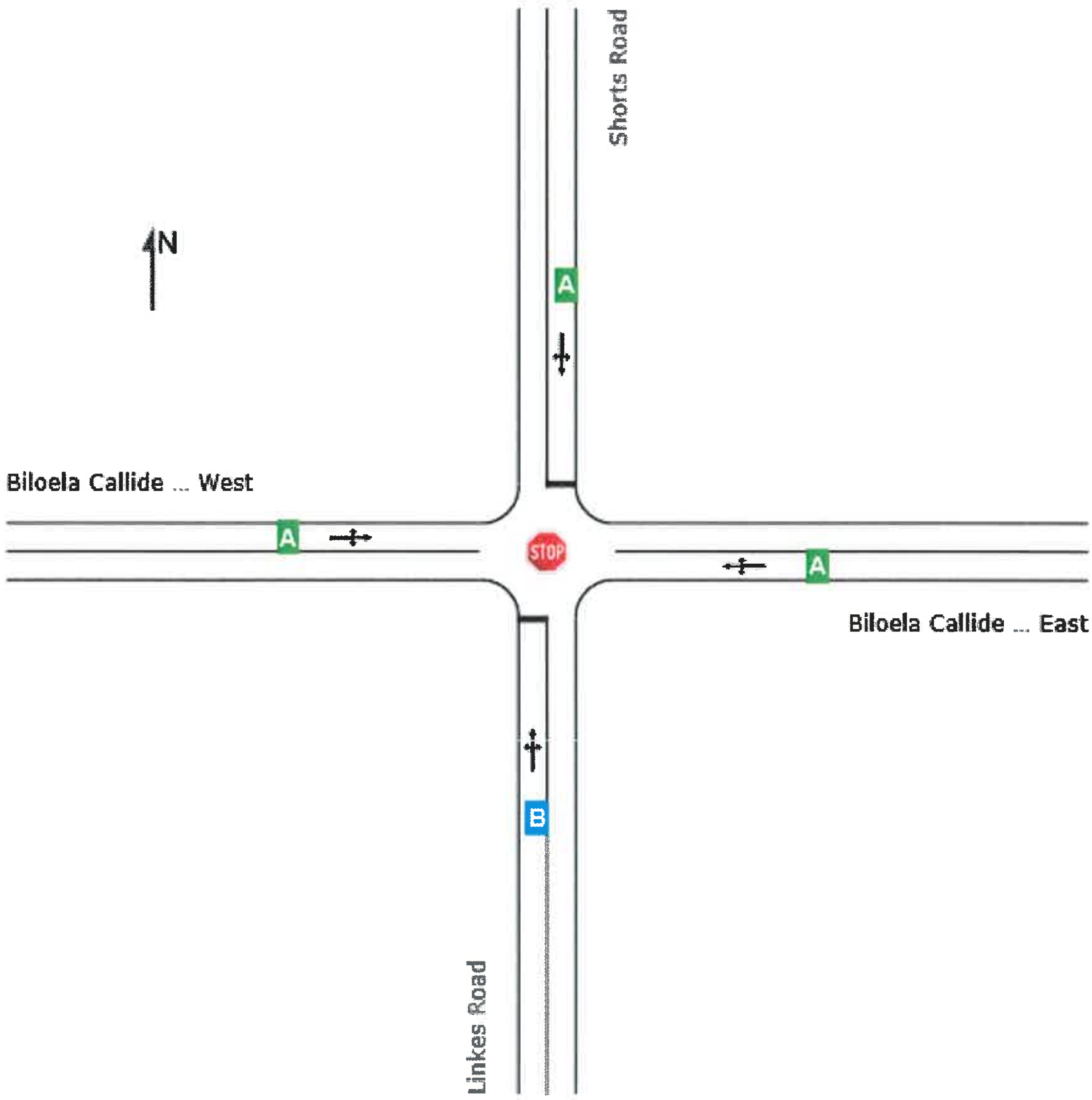
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

## Site: 101 [Background 2024 PM Peak (Site Folder: General)]

Callide Solar Power Station
Site Category: Existing Design
Stop (Two-Way)

### LOS Summary

| | Approaches | | | | Intersection |
|---|---|---|---|---|---|
| | South | East | North | West | |
| LOS | B | NA (TWSC) | A | NA (TWSC) | NA (TWSC) |




Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).

**Vehicle Movement Performance**

| Mov ID | Turn | Mov Class | Demand Flows | Arrival Flows | Deg. Satn | Aver. Delay | Level of Service | 95% Back Of Queue | Prop. Que | Eff. Stop | Aver. No. of | Aver. Speed |
|---|---|---|---|---|---|---|---|---|---|---|---|---|

| | | | [ Total | HV ] | [ Total | HV ] | | | | [ Veh. | Dist ] | | Rate | Cycles | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | veh/h | % | veh/h | % | v/c | sec | | veh | m | | | | km/h |
| South: Linkes Road | | | | | | | | | | | | | | | |
| 1 | L2 | All MCs | 1 | 0.0 | 1 | 0.0 | 0.038 | 9.6 | LOS A | 0.1 | 1.0 | 0.27 | 0.92 | 0.27 | 70.9 |
| 2 | T1 | All MCs | 1 | 0.0 | 1 | 0.0 | 0.038 | 9.8 | LOS A | 0.1 | 1.0 | 0.27 | 0.92 | 0.27 | 70.9 |
| 3 | R2 | All MCs | 26 | 16.0 | 26 | 16.0 | 0.038 | 11.5 | LOS B | 0.1 | 1.0 | 0.27 | 0.92 | 0.27 | 63.5 |
| Approach | | | 28 | 14.8 | 28 | 14.8 | 0.038 | 11.3 | LOS B | 0.1 | 1.0 | 0.27 | 0.92 | 0.27 | 64.0 |
| East: Biloela Callide Road East | | | | | | | | | | | | | | | |
| 4 | L2 | All MCs | 120 | 17.5 | 120 | 17.5 | 0.094 | 8.4 | LOS A | 0.0 | 0.1 | 0.00 | 0.57 | 0.00 | 67.2 |
| 5 | T1 | All MCs | 20 | 15.8 | 20 | 15.8 | 0.094 | 0.0 | LOS A | 0.0 | 0.1 | 0.00 | 0.57 | 0.00 | 84.5 |
| 6 | R2 | All MCs | 1 | 0.0 | 1 | 0.0 | 0.094 | 7.4 | LOS A | 0.0 | 0.1 | 0.00 | 0.57 | 0.00 | 75.3 |
| Approach | | | 141 | 17.2 | 141 | 17.2 | 0.094 | 7.2 | NA | 0.0 | 0.1 | 0.00 | 0.57 | 0.00 | 69.2 |
| North: Shorts Road | | | | | | | | | | | | | | | |
| 7 | L2 | All MCs | 1 | 0.0 | 1 | 0.0 | 0.003 | 9.8 | LOS A | 0.0 | 0.1 | 0.21 | 0.88 | 0.21 | 72.2 |
| 8 | T1 | All MCs | 1 | 0.0 | 1 | 0.0 | 0.003 | 10.1 | LOS B | 0.0 | 0.1 | 0.21 | 0.88 | 0.21 | 72.2 |
| 9 | R2 | All MCs | 1 | 0.0 | 1 | 0.0 | 0.003 | 9.3 | LOS A | 0.0 | 0.1 | 0.21 | 0.88 | 0.21 | 72.0 |
| Approach | | | 3 | 0.0 | 3 | 0.0 | 0.003 | 9.7 | LOS A | 0.0 | 0.1 | 0.21 | 0.88 | 0.21 | 72.2 |
| West: Biloela Callide Road West | | | | | | | | | | | | | | | |
| 10 | L2 | All MCs | 1 | 0.0 | 1 | 0.0 | 0.039 | 7.8 | LOS A | 0.0 | 0.1 | 0.01 | 0.02 | 0.01 | 86.6 |
| 11 | T1 | All MCs | 59 | 17.9 | 59 | 17.9 | 0.039 | 0.0 | LOS A | 0.0 | 0.1 | 0.01 | 0.02 | 0.01 | 99.0 |
| 12 | R2 | All MCs | 1 | 0.0 | 1 | 0.0 | 0.039 | 7.8 | LOS A | 0.0 | 0.1 | 0.01 | 0.02 | 0.01 | 86.6 |
| Approach | | | 61 | 17.2 | 61 | 17.2 | 0.039 | 0.3 | NA | 0.0 | 0.1 | 0.01 | 0.02 | 0.01 | 98.5 |
| All Vehicles | | | 234 | 16.7 | 234 | 16.7 | 0.094 | 5.9 | NA | 0.1 | 1.0 | 0.04 | 0.48 | 0.04 | 74.3 |

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).

Vehicle movement LOS values are based on average delay per movement.

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).

Two-Way Sign Control Capacity Model: SIDRA Standard.

Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.

Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

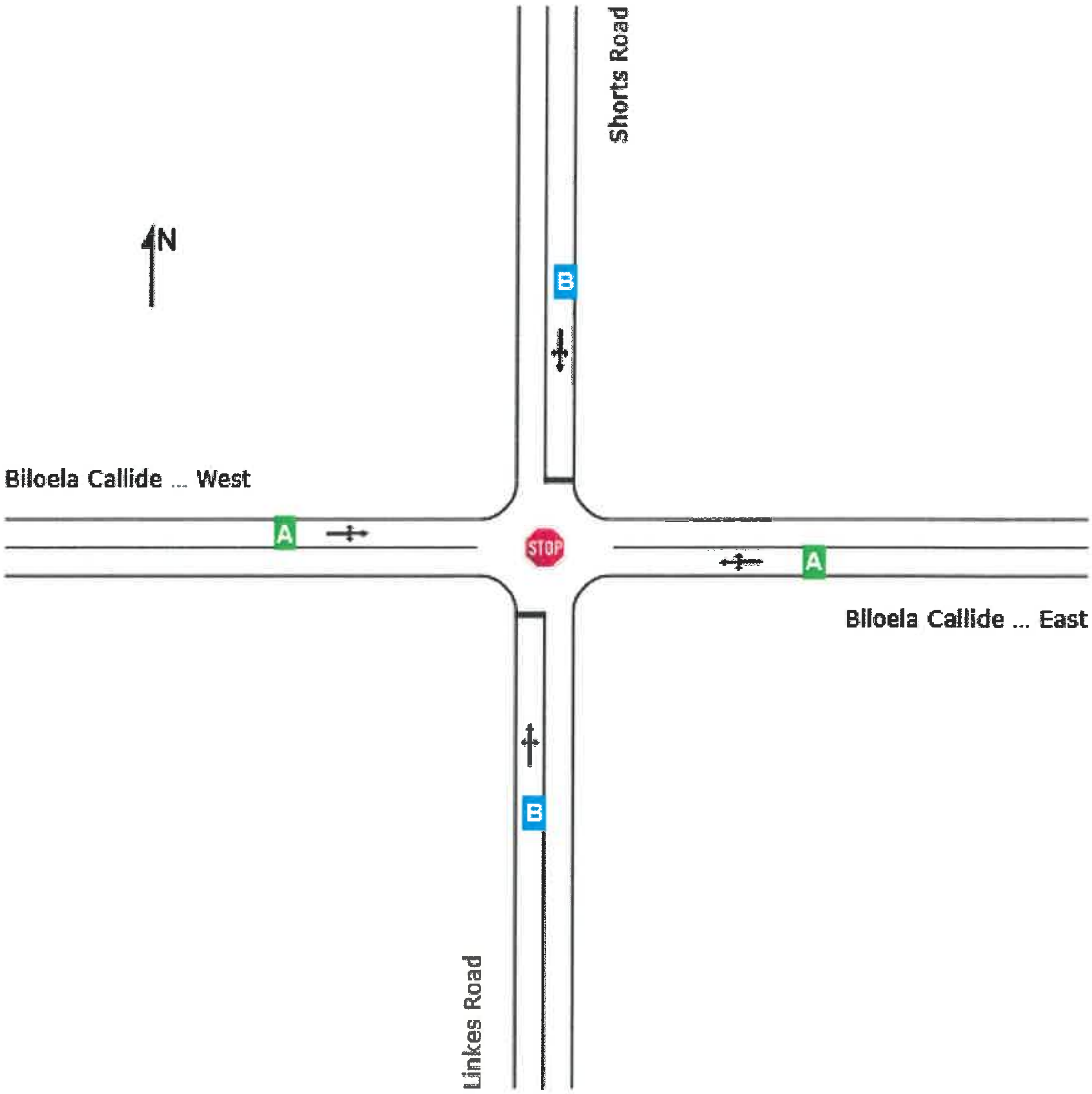
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

## Site: 101 [Background 2034 AM Peak (Site Folder: General)]

Callide Solar Power Station
Site Category: Existing Design
Stop (Two-Way)

### LOS Summary

| | Approaches | | | | Intersection |
|---|---|---|---|---|---|
| | South | East | North | West | |
| LOS | B | NA (TWSC) | B | NA (TWSC) | NA (TWSC) |




Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).

**Vehicle Movement Performance**

| Mov ID | Turn | Mov Class | Demand Flows | Arrival Flows | Deg. Satn | Aver. Delay | Level of Service | 95% Back Of Queue | Prop. Que | Eff. Stop | Aver. No. of | Aver. Speed |
|---|---|---|---|---|---|---|---|---|---|---|---|---|

| | | | [ Total | HV ] | [ Total | HV ] | | | | [ Veh. | Dist ] | | Rate | Cycles | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | veh/h | % | veh/h | % | v/c | sec | | veh | m | | | | km/h |
| South: Linkes Road | | | | | | | | | | | | | | | |
| 1 | L2 | All MCs | 1 | 0.0 | 1 | 0.0 | 0.191 | 10.2 | LOS B | 0.7 | 5.9 | 0.41 | 0.95 | 0.41 | 69.3 |
| 2 | T1 | All MCs | 1 | 0.0 | 1 | 0.0 | 0.191 | 10.5 | LOS B | 0.7 | 5.9 | 0.41 | 0.95 | 0.41 | 69.3 |
| 3 | R2 | All MCs | 116 | 18.2 | 116 | 18.2 | 0.191 | 13.1 | LOS B | 0.7 | 5.9 | 0.41 | 0.95 | 0.41 | 61.7 |
| Approach | | | 118 | 17.9 | 118 | 17.9 | 0.191 | 13.0 | LOS B | 0.7 | 5.9 | 0.41 | 0.95 | 0.41 | 61.8 |
| East: Biloela Callide Road East | | | | | | | | | | | | | | | |
| 4 | L2 | All MCs | 49 | 19.1 | 49 | 19.1 | 0.115 | 8.5 | LOS A | 0.0 | 0.1 | 0.00 | 0.19 | 0.00 | 72.5 |
| 5 | T1 | All MCs | 127 | 17.4 | 127 | 17.4 | 0.115 | 0.0 | LOS A | 0.0 | 0.1 | 0.00 | 0.19 | 0.00 | 94.3 |
| 6 | R2 | All MCs | 1 | 0.0 | 1 | 0.0 | 0.115 | 7.4 | LOS A | 0.0 | 0.1 | 0.00 | 0.19 | 0.00 | 83.0 |
| Approach | | | 178 | 17.8 | 178 | 17.8 | 0.115 | 2.4 | NA | 0.0 | 0.1 | 0.00 | 0.19 | 0.00 | 87.0 |
| North: Shorts Road | | | | | | | | | | | | | | | |
| 7 | L2 | All MCs | 1 | 0.0 | 1 | 0.0 | 0.003 | 9.7 | LOS A | 0.0 | 0.1 | 0.25 | 0.87 | 0.25 | 71.9 |
| 8 | T1 | All MCs | 1 | 0.0 | 1 | 0.0 | 0.003 | 10.4 | LOS B | 0.0 | 0.1 | 0.25 | 0.87 | 0.25 | 71.9 |
| 9 | R2 | All MCs | 1 | 0.0 | 1 | 0.0 | 0.003 | 10.1 | LOS B | 0.0 | 0.1 | 0.25 | 0.87 | 0.25 | 71.7 |
| Approach | | | 3 | 0.0 | 3 | 0.0 | 0.003 | 10.1 | LOS B | 0.0 | 0.1 | 0.25 | 0.87 | 0.25 | 71.8 |
| West: Biloela Callide Road West | | | | | | | | | | | | | | | |
| 10 | L2 | All MCs | 1 | 0.0 | 1 | 0.0 | 0.035 | 7.8 | LOS A | 0.0 | 0.1 | 0.02 | 0.03 | 0.02 | 86.5 |
| 11 | T1 | All MCs | 53 | 18.0 | 53 | 18.0 | 0.035 | 0.0 | LOS A | 0.0 | 0.1 | 0.02 | 0.03 | 0.02 | 98.8 |
| 12 | R2 | All MCs | 1 | 0.0 | 1 | 0.0 | 0.035 | 8.2 | LOS A | 0.0 | 0.1 | 0.02 | 0.03 | 0.02 | 86.5 |
| Approach | | | 55 | 17.3 | 55 | 17.3 | 0.035 | 0.3 | NA | 0.0 | 0.1 | 0.02 | 0.03 | 0.02 | 98.3 |
| All Vehicles | | | 354 | 17.6 | 354 | 17.6 | 0.191 | 5.7 | NA | 0.7 | 5.9 | 0.14 | 0.43 | 0.14 | 77.7 |

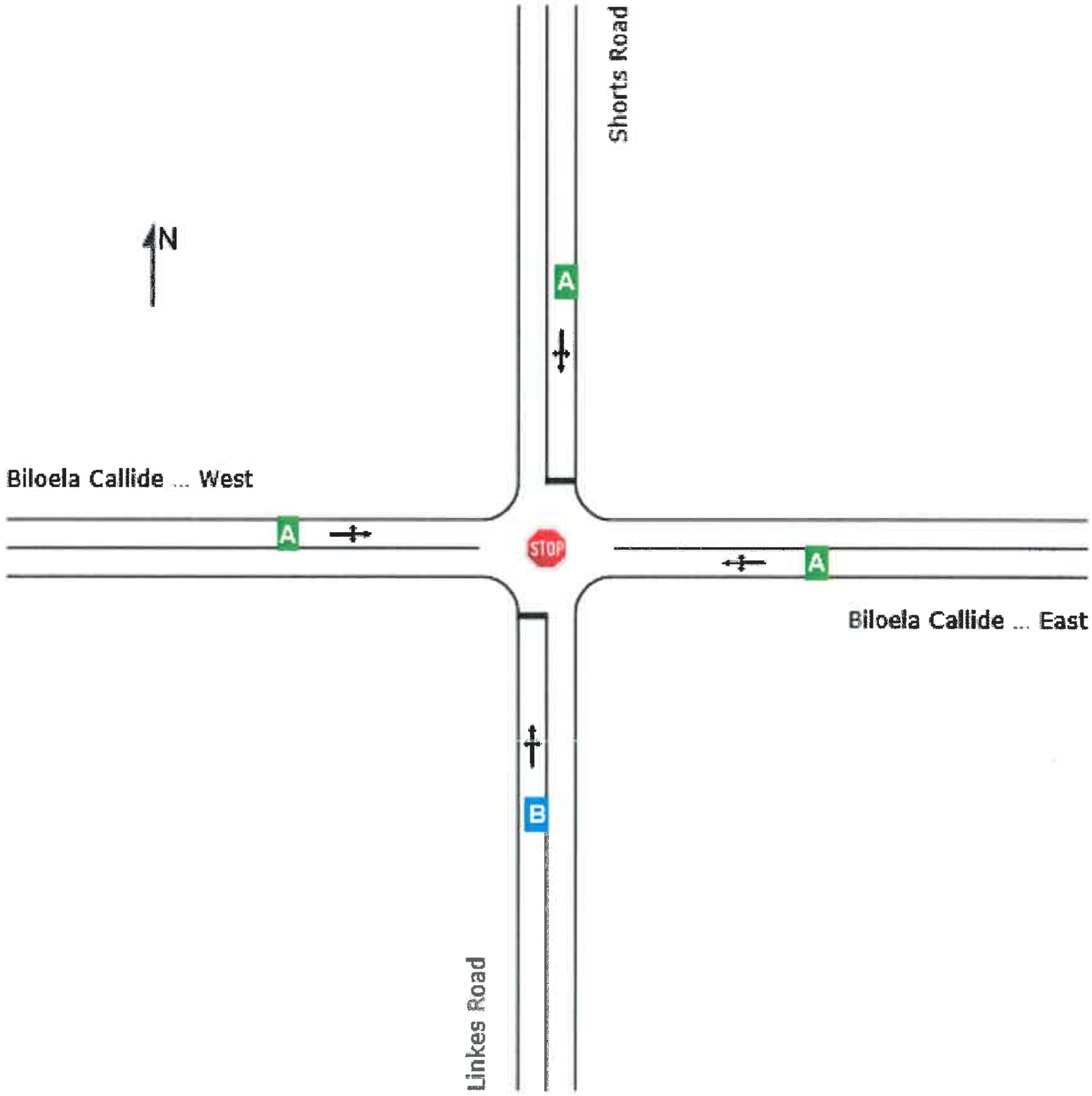
Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
Two-Way Sign Control Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

## Site: 101 [Background 2034 PM Peak (Site Folder: General)]

Callide Solar Power Station
Site Category: Existing Design
Stop (Two-Way)

### LOS Summary

| | Approaches | | | | Intersection |
|---|---|---|---|---|---|
| | South | East | North | West | |
| LOS | B | NA (TWSC) | A | NA (TWSC) | NA (TWSC) |




Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).

**Vehicle Movement Performance**

| Mov ID | Turn | Mov Class | Demand Flows | Arrival Flows | Deg. Satn | Aver. Delay | Level of Service | 95% Back Of Queue | Prop. Que | Eff. Stop | Aver. No. of | Aver. Speed |
|---|---|---|---|---|---|---|---|---|---|---|---|---|

| | | | [ Total | HV ] | [ Total | HV ] | | | | [ Veh. | Dist ] | | Rate | Cycles | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | veh/h | % | veh/h | % | v/c | sec | | veh | m | | | | km/h |
| South: Linkes Road | | | | | | | | | | | | | | | |
| 1 | L2 | All MCs | 1 | 0.0 | 1 | 0.0 | 0.041 | 9.6 | LOS A | 0.1 | 1.1 | 0.32 | 0.91 | 0.32 | 70.4 |
| 2 | T1 | All MCs | 1 | 0.0 | 1 | 0.0 | 0.041 | 10.1 | LOS B | 0.1 | 1.1 | 0.32 | 0.91 | 0.32 | 70.4 |
| 3 | R2 | All MCs | 26 | 16.0 | 26 | 16.0 | 0.041 | 12.0 | LOS B | 0.1 | 1.1 | 0.32 | 0.91 | 0.32 | 63.1 |
| Approach | | | 28 | 14.8 | 28 | 14.8 | 0.041 | 11.8 | LOS B | 0.1 | 1.1 | 0.32 | 0.91 | 0.32 | 63.6 |
| East: Biloela Callide Road East | | | | | | | | | | | | | | | |
| 4 | L2 | All MCs | 128 | 17.2 | 128 | 17.2 | 0.104 | 8.4 | LOS A | 0.0 | 0.1 | 0.00 | 0.55 | 0.00 | 67.8 |
| 5 | T1 | All MCs | 28 | 14.8 | 28 | 14.8 | 0.104 | 0.0 | LOS A | 0.0 | 0.1 | 0.00 | 0.55 | 0.00 | 85.1 |
| 6 | R2 | All MCs | 1 | 0.0 | 1 | 0.0 | 0.104 | 7.5 | LOS A | 0.0 | 0.1 | 0.00 | 0.55 | 0.00 | 75.8 |
| Approach | | | 158 | 16.7 | 158 | 16.7 | 0.104 | 6.9 | NA | 0.0 | 0.1 | 0.00 | 0.55 | 0.00 | 70.4 |
| North: Shorts Road | | | | | | | | | | | | | | | |
| 7 | L2 | All MCs | 1 | 0.0 | 1 | 0.0 | 0.003 | 9.9 | LOS A | 0.0 | 0.1 | 0.26 | 0.86 | 0.26 | 72.0 |
| 8 | T1 | All MCs | 1 | 0.0 | 1 | 0.0 | 0.003 | 10.4 | LOS B | 0.0 | 0.1 | 0.26 | 0.86 | 0.26 | 72.0 |
| 9 | R2 | All MCs | 1 | 0.0 | 1 | 0.0 | 0.003 | 9.6 | LOS A | 0.0 | 0.1 | 0.26 | 0.86 | 0.26 | 71.8 |
| Approach | | | 3 | 0.0 | 3 | 0.0 | 0.003 | 10.0 | LOS A | 0.0 | 0.1 | 0.26 | 0.86 | 0.26 | 72.0 |
| West: Biloela Callide Road West | | | | | | | | | | | | | | | |
| 10 | L2 | All MCs | 1 | 0.0 | 1 | 0.0 | 0.059 | 7.8 | LOS A | 0.0 | 0.1 | 0.01 | 0.02 | 0.01 | 86.9 |
| 11 | T1 | All MCs | 92 | 17.2 | 92 | 17.2 | 0.059 | 0.0 | LOS A | 0.0 | 0.1 | 0.01 | 0.02 | 0.01 | 99.3 |
| 12 | R2 | All MCs | 1 | 0.0 | 1 | 0.0 | 0.059 | 7.8 | LOS A | 0.0 | 0.1 | 0.01 | 0.02 | 0.01 | 86.8 |
| Approach | | | 94 | 16.9 | 94 | 16.9 | 0.059 | 0.2 | NA | 0.0 | 0.1 | 0.01 | 0.02 | 0.01 | 99.0 |
| All Vehicles | | | 283 | 16.4 | 283 | 16.4 | 0.104 | 5.2 | NA | 0.1 | 1.1 | 0.04 | 0.41 | 0.04 | 76.9 |

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).

Vehicle movement LOS values are based on average delay per movement.

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).

Two-Way Sign Control Capacity Model: SIDRA Standard.

Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.

Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

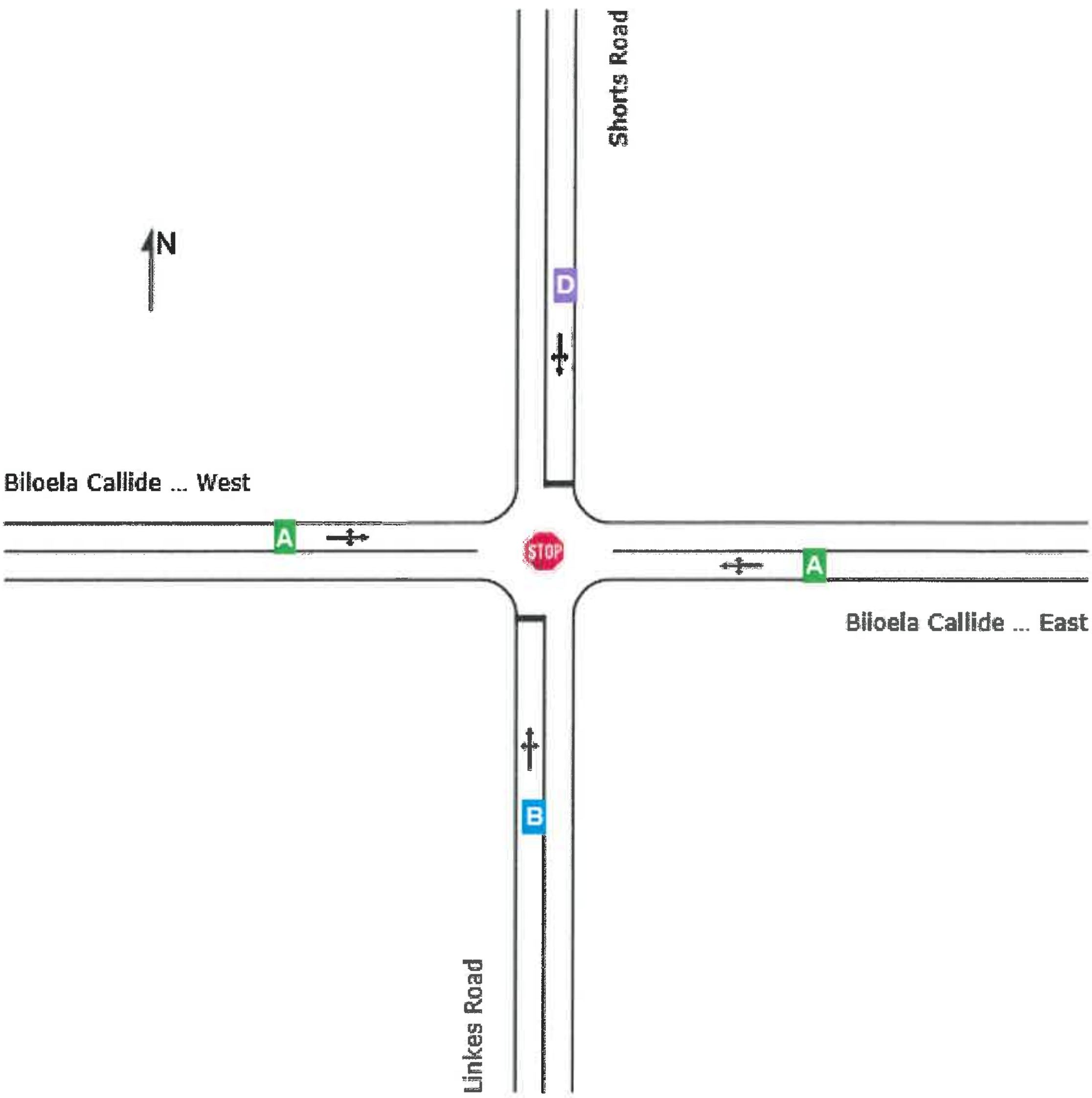
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

## Site: 101 [Construction 2024 AM Peak (Site Folder: General)]

Callide Solar Power Station
Site Category: Existing Design
Stop (Two-Way)

### LOS Summary

| | Approaches | | | | Intersection |
|---|---|---|---|---|---|
| | South | East | North | West | |
| LOS | B | NA (TWSC) | D | NA (TWSC) | NA (TWSC) |




Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).

**Vehicle Movement Performance**

| Mov ID | Turn | Mov Class | Demand Flows | Arrival Flows | Deg. Satn | Aver. Delay | Level of Service | 95% Back Of Queue | Prop. Que | Eff. Stop | Aver. No. of | Aver. Speed |
|---|---|---|---|---|---|---|---|---|---|---|---|---|

| | | | [ Total | HV ] | [ Total | HV ] | | | | [ Veh. | Dist ] | | Rate | Cycles | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | veh/h | % | veh/h | % | v/c | sec | | veh | m | | | | km/h |
| South: Linkes Road | | | | | | | | | | | | | | | |
| 1 | L2 | All MCs | 1 | 0.0 | 1 | 0.0 | 0.189 | 10.0 | LOS A | 0.7 | 5.9 | 0.35 | 0.93 | 0.35 | 70.5 |
| 2 | T1 | All MCs | 27 | 0.0 | 27 | 0.0 | 0.189 | 10.5 | LOS B | 0.7 | 5.9 | 0.35 | 0.93 | 0.35 | 70.5 |
| 3 | R2 | All MCs | 111 | 18.1 | 111 | 18.1 | 0.189 | 12.1 | LOS B | 0.7 | 5.9 | 0.35 | 0.93 | 0.35 | 62.6 |
| Approach | | | 139 | 14.4 | 139 | 14.4 | 0.189 | 11.7 | LOS B | 0.7 | 5.9 | 0.35 | 0.93 | 0.35 | 64.1 |
| East: Biloela Callide Road East | | | | | | | | | | | | | | | |
| 4 | L2 | All MCs | 46 | 13.6 | 46 | 13.6 | 0.086 | 8.3 | LOS A | 0.0 | 0.1 | 0.00 | 0.24 | 0.00 | 73.9 |
| 5 | T1 | All MCs | 85 | 17.3 | 85 | 17.3 | 0.086 | 0.0 | LOS A | 0.0 | 0.1 | 0.00 | 0.24 | 0.00 | 92.6 |
| 6 | R2 | All MCs | 1 | 0.0 | 1 | 0.0 | 0.086 | 7.5 | LOS A | 0.0 | 0.1 | 0.00 | 0.24 | 0.00 | 81.7 |
| Approach | | | 133 | 15.9 | 133 | 15.9 | 0.086 | 3.0 | NA | 0.0 | 0.1 | 0.00 | 0.24 | 0.00 | 85.0 |
| North: Shorts Road | | | | | | | | | | | | | | | |
| 7 | L2 | All MCs | 1 | 0.0 | 1 | 0.0 | 0.143 | 9.7 | LOS A | 0.5 | 11.9 | 0.51 | 1.04 | 0.51 | 56.5 |
| 8 | T1 | All MCs | 1 | 0.0 | 1 | 0.0 | 0.143 | 10.3 | LOS B | 0.5 | 11.9 | 0.51 | 1.04 | 0.51 | 56.5 |
| 9 | R2 | All MCs | 32 | 100.0 | 32 | 100.0 | 0.143 | 26.0 | LOS D | 0.5 | 11.9 | 0.51 | 1.04 | 0.51 | 38.0 |
| Approach | | | 34 | 93.8 | 34 | 93.8 | 0.143 | 25.0 | LOS D | 0.5 | 11.9 | 0.51 | 1.04 | 0.51 | 38.8 |
| West: Biloela Callide Road West | | | | | | | | | | | | | | | |
| 10 | L2 | All MCs | 32 | 100.0 | 32 | 100.0 | 0.064 | 11.1 | LOS B | 0.0 | 0.1 | 0.01 | 0.34 | 0.01 | 41.4 |
| 11 | T1 | All MCs | 33 | 16.1 | 33 | 16.1 | 0.064 | 0.0 | LOS A | 0.0 | 0.1 | 0.01 | 0.34 | 0.01 | 85.9 |
| 12 | R2 | All MCs | 1 | 0.0 | 1 | 0.0 | 0.064 | 7.7 | LOS A | 0.0 | 0.1 | 0.01 | 0.34 | 0.01 | 76.4 |
| Approach | | | 65 | 56.5 | 65 | 56.5 | 0.064 | 5.5 | NA | 0.0 | 0.1 | 0.01 | 0.34 | 0.01 | 56.5 |
| All Vehicles | | | 371 | 29.5 | 371 | 29.5 | 0.189 | 8.7 | NA | 0.7 | 11.9 | 0.18 | 0.59 | 0.18 | 64.4 |

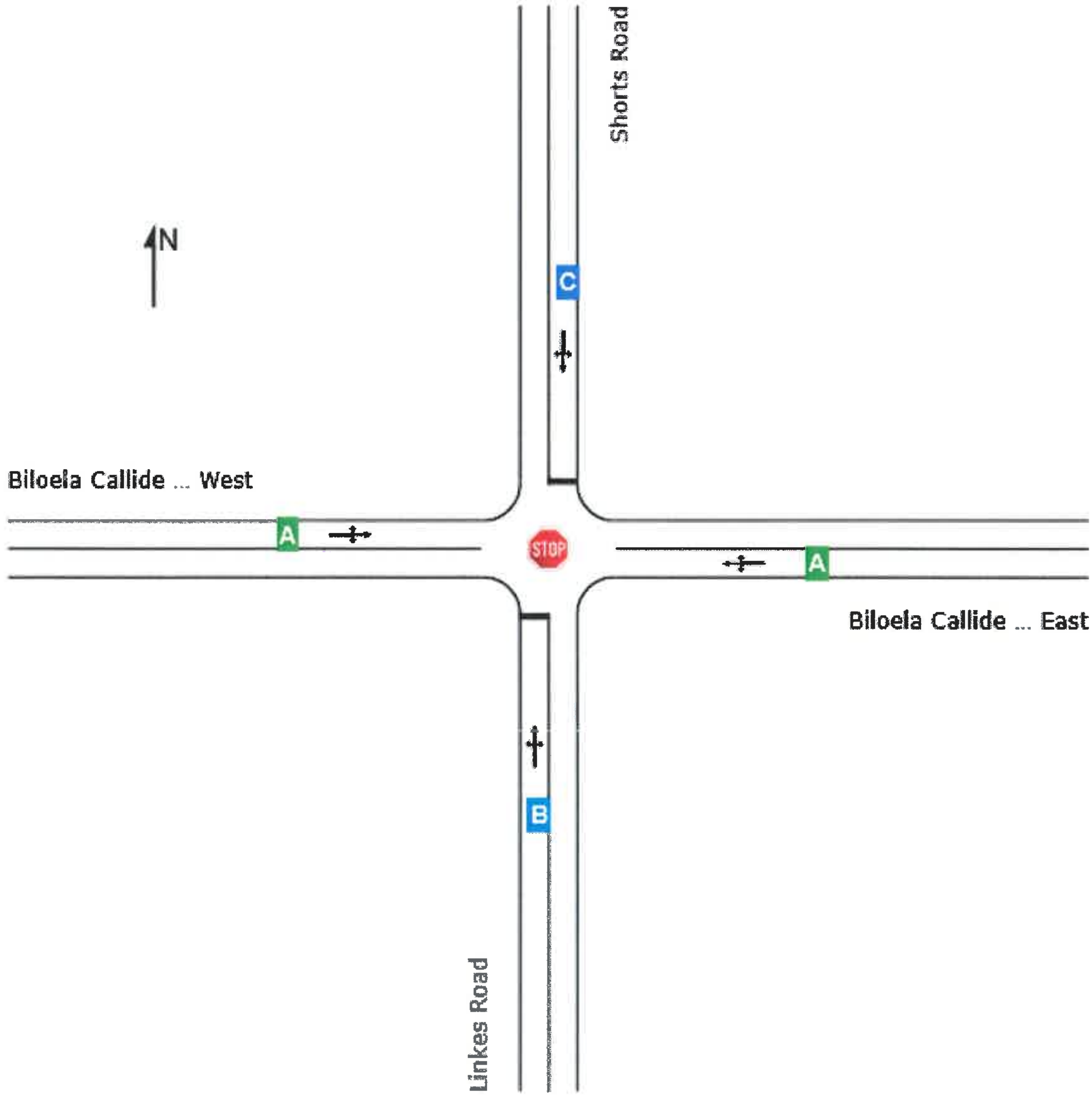
Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
Two-Way Sign Control Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

## Site: 101 [Construction 2024 PM Peak (Site Folder: General)]

Callide Solar Power Station
Site Category: Existing Design
Stop (Two-Way)

### LOS Summary

| | Approaches | | | | Intersection |
|---|---|---|---|---|---|
| | South | East | North | West | |
| LOS | B | NA (TWSC) | C | NA (TWSC) | NA (TWSC) |




Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).

**Vehicle Movement Performance**

| Mov ID | Turn | Mov Class | Demand Flows | Arrival Flows | Deg. Satn | Aver. Delay | Level of Service | 95% Back Of Queue | Prop. Que | Eff. Stop | Aver. No. of | Aver. Speed |
|---|---|---|---|---|---|---|---|---|---|---|---|---|

| | | | [ Total | HV ] | [ Total | HV ] | | | | [ Veh. | Dist ] | | Rate | Cycles | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | veh/h | % | veh/h | % | v/c | sec | | veh | m | | | | km/h |
| South: Linkes Road | | | | | | | | | | | | | | | |
| 1 | L2 | All MCs | 1 | 0.0 | 1 | 0.0 | 0.039 | 9.6 | LOS A | 0.1 | 1.1 | 0.29 | 0.92 | 0.29 | 70.7 |
| 2 | T1 | All MCs | 1 | 0.0 | 1 | 0.0 | 0.039 | 10.3 | LOS B | 0.1 | 1.1 | 0.29 | 0.92 | 0.29 | 70.7 |
| 3 | R2 | All MCs | 26 | 16.0 | 26 | 16.0 | 0.039 | 11.7 | LOS B | 0.1 | 1.1 | 0.29 | 0.92 | 0.29 | 63.3 |
| Approach | | | 28 | 14.8 | 28 | 14.8 | 0.039 | 11.6 | LOS B | 0.1 | 1.1 | 0.29 | 0.92 | 0.29 | 63.8 |
| East: Biloela Callide Road East | | | | | | | | | | | | | | | |
| 4 | L2 | All MCs | 120 | 17.5 | 120 | 17.5 | 0.094 | 8.4 | LOS A | 0.0 | 0.1 | 0.01 | 0.57 | 0.01 | 67.2 |
| 5 | T1 | All MCs | 20 | 15.8 | 20 | 15.8 | 0.094 | 0.0 | LOS A | 0.0 | 0.1 | 0.01 | 0.57 | 0.01 | 84.5 |
| 6 | R2 | All MCs | 1 | 0.0 | 1 | 0.0 | 0.094 | 7.6 | LOS A | 0.0 | 0.1 | 0.01 | 0.57 | 0.01 | 75.3 |
| Approach | | | 141 | 17.2 | 141 | 17.2 | 0.094 | 7.2 | NA | 0.0 | 0.1 | 0.01 | 0.57 | 0.01 | 69.2 |
| North: Shorts Road | | | | | | | | | | | | | | | |
| 7 | L2 | All MCs | 1 | 0.0 | 1 | 0.0 | 0.146 | 9.8 | LOS A | 0.5 | 8.7 | 0.42 | 0.99 | 0.42 | 64.1 |
| 8 | T1 | All MCs | 27 | 0.0 | 27 | 0.0 | 0.146 | 10.6 | LOS B | 0.5 | 8.7 | 0.42 | 0.99 | 0.42 | 64.1 |
| 9 | R2 | All MCs | 32 | 100.0 | 32 | 100.0 | 0.146 | 22.1 | LOS C | 0.5 | 8.7 | 0.42 | 0.99 | 0.42 | 41.2 |
| Approach | | | 60 | 52.6 | 60 | 52.6 | 0.146 | 16.6 | LOS C | 0.5 | 8.7 | 0.42 | 0.99 | 0.42 | 49.6 |
| West: Biloela Callide Road West | | | | | | | | | | | | | | | |
| 10 | L2 | All MCs | 32 | 100.0 | 32 | 100.0 | 0.082 | 11.1 | LOS B | 0.0 | 0.1 | 0.01 | 0.24 | 0.01 | 42.0 |
| 11 | T1 | All MCs | 59 | 17.9 | 59 | 17.9 | 0.082 | 0.0 | LOS A | 0.0 | 0.1 | 0.01 | 0.24 | 0.01 | 89.1 |
| 12 | R2 | All MCs | 1 | 0.0 | 1 | 0.0 | 0.082 | 7.7 | LOS A | 0.0 | 0.1 | 0.01 | 0.24 | 0.01 | 79.0 |
| Approach | | | 92 | 46.0 | 92 | 46.0 | 0.082 | 3.9 | NA | 0.0 | 0.1 | 0.01 | 0.24 | 0.01 | 64.2 |
| All Vehicles | | | 321 | 31.8 | 321 | 31.8 | 0.146 | 8.4 | NA | 0.5 | 8.7 | 0.11 | 0.59 | 0.11 | 62.7 |

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).

Vehicle movement LOS values are based on average delay per movement.

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).

Two-Way Sign Control Capacity Model: SIDRA Standard.

Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.

Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

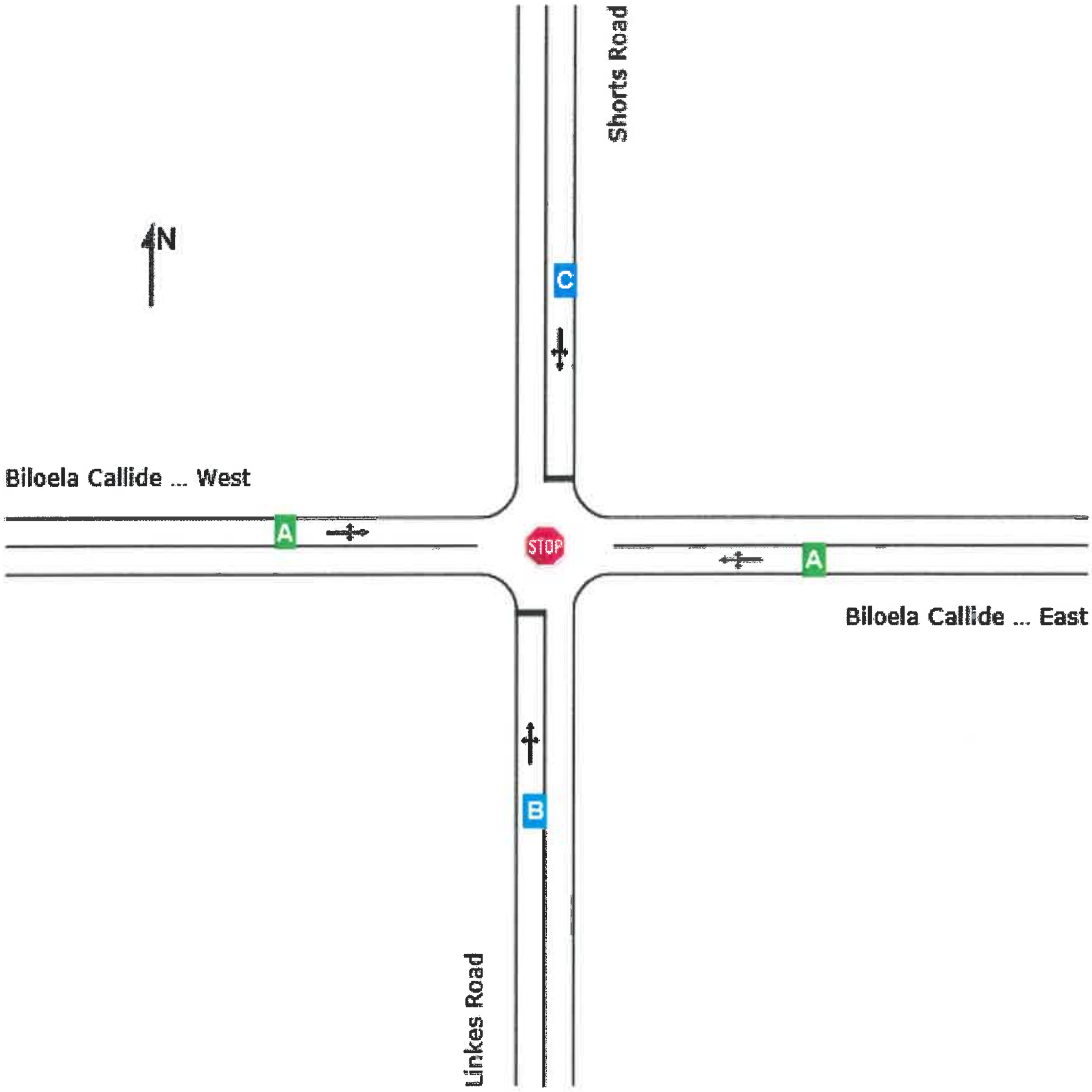
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

## Site: 101 [Operation 2034 AM Peak (Site Folder: General)]

Callide Solar Power Station
Site Category: Existing Design
Stop (Two-Way)

### LOS Summary

| | Approaches | | | | Intersection |
|---|---|---|---|---|---|
| | South | East | North | West | |
| LOS | B | NA (TWSC) | C | NA (TWSC) | NA (TWSC) |




Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).

## Vehicle Movement Performance

| Mov ID | Turn | Mov Class | Demand Flows | Arrival Flows | Deg. Satn | Aver. Delay | Level of Service | 95% Back Of Queue | Prop. Que | Eff. Stop | Aver. No. of | Aver. Speed |
|---|---|---|---|---|---|---|---|---|---|---|---|---|

| | | | [ Total | HV ] | [ Total | HV ] | | | | [ Veh. | Dist ] | | Rate | Cycles | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | veh/h | % | veh/h | % | v/c | sec | | veh | m | | | | km/h |
| South: Linkes Road | | | | | | | | | | | | | | | |
| 1 | L2 | All MCs | 1 | 0.0 | 1 | 0.0 | 0.198 | 10.2 | LOS B | 0.7 | 6.1 | 0.42 | 0.95 | 0.42 | 69.3 |
| 2 | T1 | All MCs | 7 | 0.0 | 7 | 0.0 | 0.198 | 10.5 | LOS B | 0.7 | 6.1 | 0.42 | 0.95 | 0.42 | 69.3 |
| 3 | R2 | All MCs | 116 | 18.2 | 116 | 18.2 | 0.198 | 13.1 | LOS B | 0.7 | 6.1 | 0.42 | 0.95 | 0.42 | 61.7 |
| Approach | | | 124 | 16.9 | 124 | 16.9 | 0.198 | 12.9 | LOS B | 0.7 | 6.1 | 0.42 | 0.95 | 0.42 | 62.2 |
| East: Biloela Callide Road East | | | | | | | | | | | | | | | |
| 4 | L2 | All MCs | 49 | 19.1 | 49 | 19.1 | 0.115 | 8.5 | LOS A | 0.0 | 0.1 | 0.00 | 0.19 | 0.00 | 72.5 |
| 5 | T1 | All MCs | 127 | 17.4 | 127 | 17.4 | 0.115 | 0.0 | LOS A | 0.0 | 0.1 | 0.00 | 0.19 | 0.00 | 94.3 |
| 6 | R2 | All MCs | 1 | 0.0 | 1 | 0.0 | 0.115 | 7.4 | LOS A | 0.0 | 0.1 | 0.00 | 0.19 | 0.00 | 83.0 |
| Approach | | | 178 | 17.8 | 178 | 17.8 | 0.115 | 2.4 | NA | 0.0 | 0.1 | 0.00 | 0.19 | 0.00 | 87.0 |
| North: Shorts Road | | | | | | | | | | | | | | | |
| 7 | L2 | All MCs | 1 | 0.0 | 1 | 0.0 | 0.007 | 9.7 | LOS A | 0.0 | 0.3 | 0.37 | 0.87 | 0.37 | 65.2 |
| 8 | T1 | All MCs | 1 | 0.0 | 1 | 0.0 | 0.007 | 10.4 | LOS B | 0.0 | 0.3 | 0.37 | 0.87 | 0.37 | 65.1 |
| 9 | R2 | All MCs | 1 | 100.0 | 1 | 100.0 | 0.007 | 25.9 | LOS D | 0.0 | 0.3 | 0.37 | 0.87 | 0.37 | 41.7 |
| Approach | | | 3 | 33.3 | 3 | 33.3 | 0.007 | 15.3 | LOS C | 0.0 | 0.3 | 0.37 | 0.87 | 0.37 | 54.9 |
| West: Biloela Callide Road West | | | | | | | | | | | | | | | |
| 10 | L2 | All MCs | 1 | 100.0 | 1 | 100.0 | 0.036 | 11.1 | LOS B | 0.0 | 0.1 | 0.01 | 0.03 | 0.01 | 42.3 |
| 11 | T1 | All MCs | 53 | 18.0 | 53 | 18.0 | 0.036 | 0.0 | LOS A | 0.0 | 0.1 | 0.01 | 0.03 | 0.01 | 98.6 |
| 12 | R2 | All MCs | 1 | 0.0 | 1 | 0.0 | 0.036 | 8.1 | LOS A | 0.0 | 0.1 | 0.01 | 0.03 | 0.01 | 86.3 |
| Approach | | | 55 | 19.2 | 55 | 19.2 | 0.036 | 0.4 | NA | 0.0 | 0.1 | 0.01 | 0.03 | 0.01 | 95.9 |
| All Vehicles | | | 360 | 17.8 | 360 | 17.8 | 0.198 | 5.8 | NA | 0.7 | 6.1 | 0.15 | 0.43 | 0.15 | 77.1 |

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).

Vehicle movement LOS values are based on average delay per movement.

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).

Two-Way Sign Control Capacity Model: SIDRA Standard.

Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.

Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

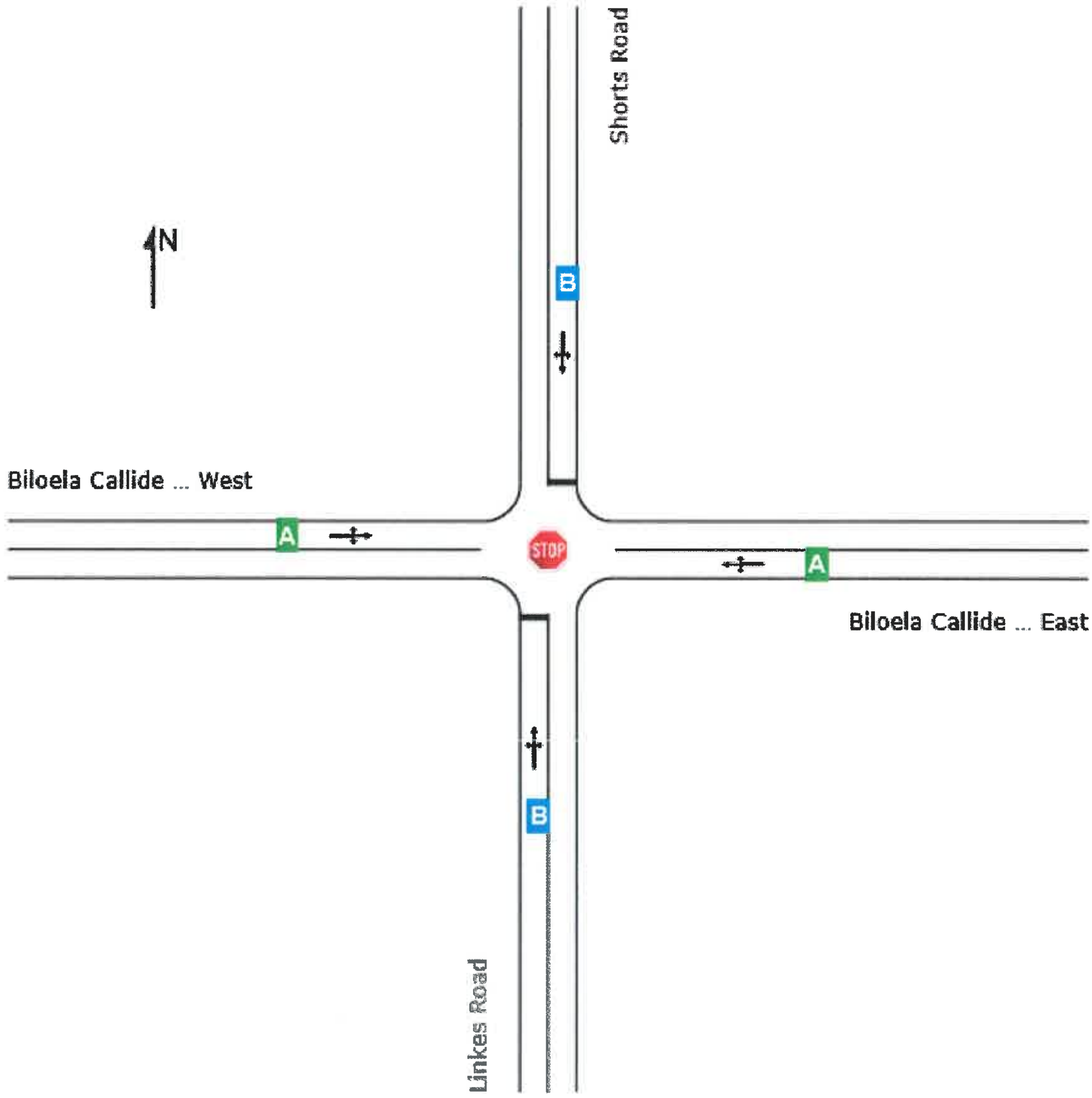
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

## Site: 101 [Operation 2034 PM Peak (Site Folder: General)]

Callide Solar Power Station
Site Category: Existing Design
Stop (Two-Way)

### LOS Summary

| | Approaches | | | | Intersection |
|---|---|---|---|---|---|
| | South | East | North | West | |
| LOS | B | NA (TWSC) | B | NA (TWSC) | NA (TWSC) |




Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).

**Vehicle Movement Performance**

| Mov ID | Turn | Mov Class | Demand Flows | Arrival Flows | Deg. Satn | Aver. Delay | Level of Service | 95% Back Of Queue | Prop. Que | Eff. Stop | Aver. No. of | Aver. Speed |
|---|---|---|---|---|---|---|---|---|---|---|---|---|

| | | | [ Total | HV ] | [ Total | HV ] | | | | [ Veh. | Dist ] | | Rate | Cycles | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | veh/h | % | veh/h | % | v/c | sec | | veh | m | | | | km/h |
| South: Linkes Road | | | | | | | | | | | | | | | |
| 1 | L2 | All MCs | 1 | 0.0 | 1 | 0.0 | 0.041 | 9.6 | LOS A | 0.1 | 1.1 | 0.32 | 0.91 | 0.32 | 70.3 |
| 2 | T1 | All MCs | 1 | 0.0 | 1 | 0.0 | 0.041 | 10.1 | LOS B | 0.1 | 1.1 | 0.32 | 0.91 | 0.32 | 70.3 |
| 3 | R2 | All MCs | 26 | 16.0 | 26 | 16.0 | 0.041 | 12.0 | LOS B | 0.1 | 1.1 | 0.32 | 0.91 | 0.32 | 63.0 |
| Approach | | | 28 | 14.8 | 28 | 14.8 | 0.041 | 11.9 | LOS B | 0.1 | 1.1 | 0.32 | 0.91 | 0.32 | 63.5 |
| East: Biloela Callide Road East | | | | | | | | | | | | | | | |
| 4 | L2 | All MCs | 128 | 17.2 | 128 | 17.2 | 0.104 | 8.4 | LOS A | 0.0 | 0.1 | 0.00 | 0.55 | 0.00 | 67.8 |
| 5 | T1 | All MCs | 28 | 14.8 | 28 | 14.8 | 0.104 | 0.0 | LOS A | 0.0 | 0.1 | 0.00 | 0.55 | 0.00 | 85.1 |
| 6 | R2 | All MCs | 1 | 0.0 | 1 | 0.0 | 0.104 | 7.5 | LOS A | 0.0 | 0.1 | 0.00 | 0.55 | 0.00 | 75.8 |
| Approach | | | 158 | 16.7 | 158 | 16.7 | 0.104 | 6.9 | NA | 0.0 | 0.1 | 0.00 | 0.55 | 0.00 | 70.4 |
| North: Shorts Road | | | | | | | | | | | | | | | |
| 7 | L2 | All MCs | 1 | 0.0 | 1 | 0.0 | 0.013 | 9.9 | LOS A | 0.0 | 0.4 | 0.36 | 0.90 | 0.36 | 69.5 |
| 8 | T1 | All MCs | 7 | 0.0 | 7 | 0.0 | 0.013 | 10.5 | LOS B | 0.0 | 0.4 | 0.36 | 0.90 | 0.36 | 69.5 |
| 9 | R2 | All MCs | 1 | 100.0 | 1 | 100.0 | 0.013 | 21.6 | LOS C | 0.0 | 0.4 | 0.36 | 0.90 | 0.36 | 43.4 |
| Approach | | | 9 | 11.1 | 9 | 11.1 | 0.013 | 11.7 | LOS B | 0.0 | 0.4 | 0.36 | 0.90 | 0.36 | 65.2 |
| West: Biloela Callide Road West | | | | | | | | | | | | | | | |
| 10 | L2 | All MCs | 1 | 100.0 | 1 | 100.0 | 0.060 | 11.1 | LOS B | 0.0 | 0.1 | 0.01 | 0.02 | 0.01 | 42.7 |
| 11 | T1 | All MCs | 92 | 17.2 | 92 | 17.2 | 0.060 | 0.0 | LOS A | 0.0 | 0.1 | 0.01 | 0.02 | 0.01 | 99.2 |
| 12 | R2 | All MCs | 1 | 0.0 | 1 | 0.0 | 0.060 | 7.7 | LOS A | 0.0 | 0.1 | 0.01 | 0.02 | 0.01 | 86.8 |
| Approach | | | 94 | 18.0 | 94 | 18.0 | 0.060 | 0.2 | NA | 0.0 | 0.1 | 0.01 | 0.02 | 0.01 | 97.6 |
| All Vehicles | | | 289 | 16.7 | 289 | 16.7 | 0.104 | 5.4 | NA | 0.1 | 1.1 | 0.05 | 0.42 | 0.05 | 76.3 |

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
Two-Way Sign Control Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

| Critical Movement comparisons | | | | | | |
|---|---|---|---|---|---|---|
| Time Status | Approach Leg | Movement Ref | Deg. Saturation | LOS | Delay (sec) | Back of Queue Dist (m) |
| Background 2024 AM | Biloeala Callide Road East | T1 | 0.086 | A | 0.0 | 0.1 |
| Background 2034 AM | Biloeala Callide Road East | T1 | 0.115 | A | 0.0 | 0.1 |
| Background 2024 AM | Biloeala Callide Road East | L2 | 0.086 | A | 8.3 | 0.1 |
| Background 2034 AM | Biloeala Callide Road East | L2 | 0.115 | A | 8.5 | 0.1 |
| Background 2024 AM | Biloeala Callide Road West | T1 | 0.021 | A | 0.0 | 0.1 |
| Background 2034 AM | Biloeala Callide Road West | T1 | 0.035 | A | 0.0 | 0.1 |
| Background 2024 AM | Biloeala Callide Road West | L2 | 0.021 | A | 7.8 | 0.1 |
| Background 2034 AM | Biloeala Callide Road West | L2 | 0.035 | A | 7.8 | 0.1 |
| Background 2024 AM | Shorts Road | T1 | 0.003 | A | 9.9 | 0.1 |
| Background 2034 AM | Shorts Road | T1 | 0.003 | B | 10.4 | 0.1 |
| Background 2024 AM | Shorts Road | R2 | 0.003 | A | 9.6 | 0.1 |
| Background 2034 AM | Shorts Road | R2 | 0.003 | B | 10.1 | 0.1 |
| Background 2024 AM | Linkes Road | T1 | 0.161 | A | 10.0 | 5.0 |
| Background 2034 AM | Linkes Road | T1 | 0.191 | B | 10.5 | 5.9 |
| Background 2024 AM | Linkes Road | R2 | 0.161 | B | 12.0 | 5.0 |
| Background 2034 AM | Linkes Road | R2 | 0.191 | B | 13.1 | 5.9 |
| Background 2024 PM | Biloeala Callide Road East | T1 | 0.094 | A | 0.0 | 0.1 |
| Background 2034 PM | Biloeala Callide Road East | T1 | 0.104 | A | 0.0 | 0.1 |
| Background 2024 PM | Biloeala Callide Road East | L2 | 0.094 | A | 8.4 | 0.1 |
| Background 2034 PM | Biloeala Callide Road East | L2 | 0.104 | A | 8.4 | 0.1 |
| Background 2024 PM | Biloeala Callide Road West | T1 | 0.039 | A | 0.0 | 0.1 |
| Background 2034 PM | Biloeala Callide Road West | T1 | 0.059 | A | 0.0 | 0.1 |
| Background 2024 PM | Biloeala Callide Road West | L2 | 0.039 | A | 7.8 | 0.1 |
| Background 2034 PM | Biloeala Callide Road West | L2 | 0.059 | A | 7.8 | 0.1 |
| Background 2024 PM | Shorts Road | T1 | 0.003 | B | 10.1 | 0.1 |
| Background 2034 PM | Shorts Road | T1 | 0.003 | B | 10.4 | 0.1 |
| Background 2024 PM | Shorts Road | R2 | 0.003 | A | 9.3 | 0.1 |
| Background 2034 PM | Shorts Road | R2 | 0.003 | A | 9.6 | 0.1 |

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CONSULTING
engineers

# APPENDIX G

## NCE – Swept Path Sketch Drawing – 22/11/2022


Prime mover and semi-trailer (19 m)

| | |
|---|---|
| Overall Length | 19.000m |
| Overall Width | 2.500m |
| Overall Body Height | 4.300m |
| Min Body Ground Clearance | 0.540m |
| Track Width | 2.500m |
| Lock to lock time | 6.00s |
| Kerb to Kerb Turning Radius | 12.500m |

NORTHERN CONSULTING engineers

Civil | Structural | Forensic
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W: www.nceng.com.au

**MJ2370/SK01**
INTERSECTION UPGRADE LAYOUT
Scale 1:300 @ A3

# APPENDIX H

## NCE – Certification Statement and Authorisation

## Appendix B: Traffic impact assessment certification

### Certification of Traffic Impact Assessment Report

### Registered Professional Engineer Queensland

for

| | |
|---|---|
| Project title: | Callide Solar Power Station, Mount Murchison. 4715<br>Lot 154 on SP126053, Lot 2 on RP619032, Lot 28 on RN519, Lot 3 on RP608599<br>Traffic Impact Assessment (MJ2370-TIA) |

As a professional engineer registered by the Board of Professional Engineers of Queensland pursuant to the *Professional Engineers Act 2002* as competent in my areas of nominated expertise, I understand and recognise:

- the significant role of engineering as a profession, and that
- the community has a legitimate expectation that my certification affixed to this engineering work can be trusted, and that
- I am responsible for ensuring its preparation has satisfied all necessary standards, conduct and contemporary practice.

As the responsible RPEQ, I certify:

(i) I am satisfied that all submitted components comprising this traffic impact assessment, listed in the following table, have been completed in accordance with the *Guide to Traffic Impact Assessment* published by the Queensland Department of Transport and Main Roads and using sound engineering principles, and

(ii) where specialised areas of work have not been under my direct supervision, I have reviewed the outcomes of the work and consider the work and its outcomes as suitable for the purposes of this traffic impact assessment, and that

(iii) the outcomes of this traffic impact assessment are a true reflection of results of assessment, and that

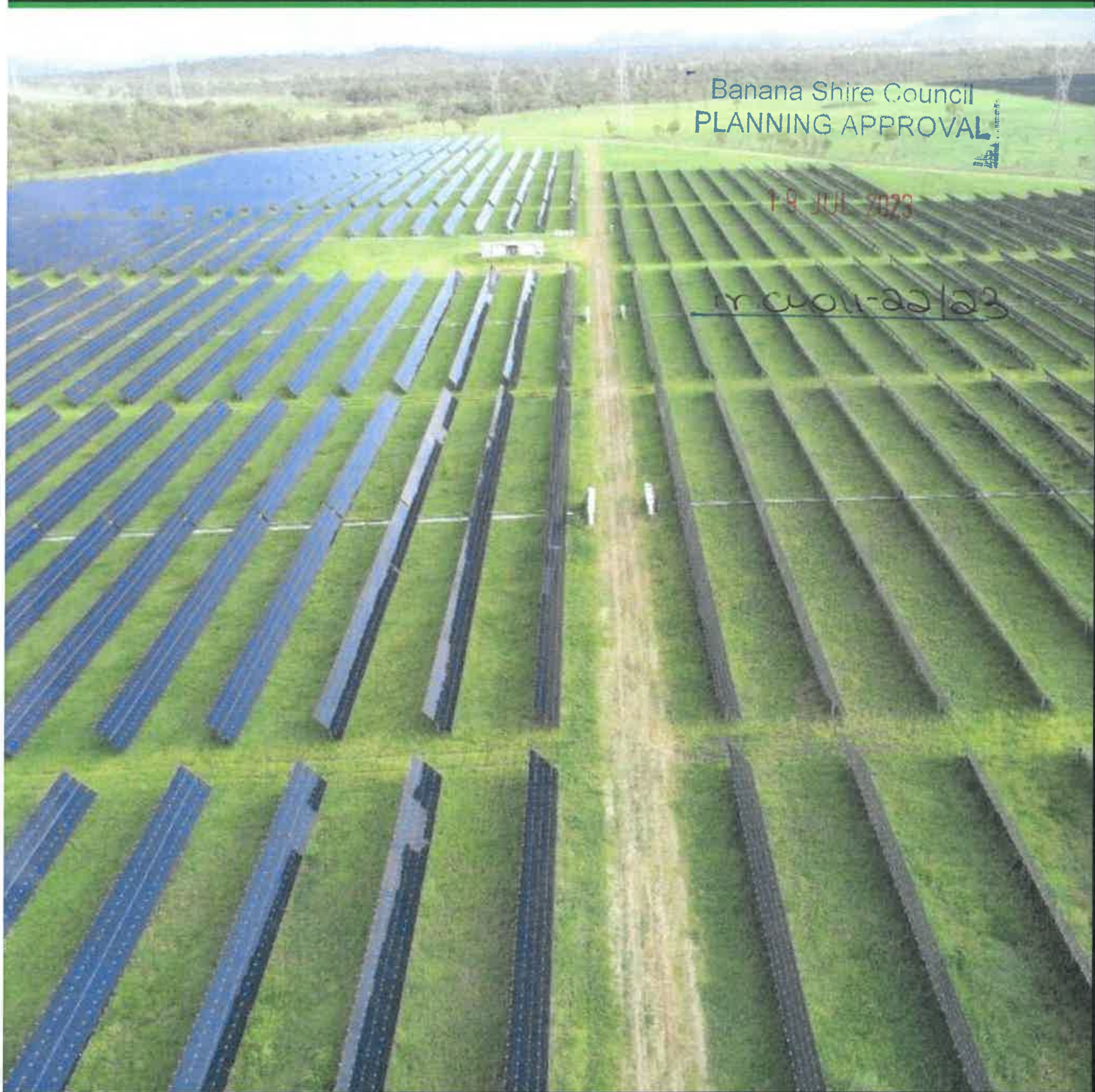
(iv) I believe the strategies recommended for mitigating impacts by this traffic impact assessment, embrace contemporary practice initiatives and will deliver the desired outcomes.

| | | | |
|---|---|---|---|
| Name: | Derek Saw | RPEQ No: | 7363 |
| RPEQ competencies: | Civil | | |
| Signature: | | Date: | 23rd Novermber 2022 |
| Postal address: | 50 Punari Street, Currajong. 4812 | | |
| Email: | derek.saw@nceng.com.au | | |

| Traffic impact assessment components to which this certification applies | ✓ |
|---|---|
| *1. Introduction* | |
| Background | ✓ |
| Scope and study area | ✓ |
| Pre-lodgement meeting notes | |
| *2. Existing Conditions* | |
| Land use and zoning | ✓ |
| Adjacent land uses / approvals | ✓ |
| Surrounding road network details | ✓ |
| Traffic volumes | ✓ |
| Intersection and network performance | ✓ |
| Road safety issues | ✓ |
| Site access | ✓ |
| Public transport (if applicable) | ✓ |
| Active transport (if applicable) | ✓ |
| Parking (if applicable) | ✓ |
| Pavement (if applicable) | ✓ |
| Transport infrastructure (if applicable) | ✓ |
| *3. Proposed Development Details* | |
| Development site plan | ✓ |
| Operational details (including year of opening of each stage and any relevant catchment / market analysis) | ✓ |
| Proposed access and parking | ✓ |
| *4. Development Traffic* | |
| Traffic generation (by development stage if relevant and considering light and heavy vehicle trips) | ✓ |
| Trip distribution | ✓ |
| Development traffic volumes on the network | ✓ |
| *5. Impact Assessment and Mitigation* | |
| With and without development traffic volumes | ✓ |
| Construction traffic impact assessment and mitigation (if applicable) | ✓ |
| Road safety impact assessment and mitigation | ✓ |
| Access and frontage impact assessment and mitigation | ✓ |
| Intersection delay impact assessment and mitigation | ✓ |
| Road link capacity assessment and mitigation | |
| Pavement impact assessment and mitigation | |
| Transport infrastructure impact assessment and mitigation | ✓ |
| Other impacts assessment relevant to the specific development type / location (if applicable) | ✓ |

| Traffic impact assessment components to which this certification applies | ✓ |
|---|---|
| *6. Conclusions and Recommendations* | |
| Summary of impacts and mitigation measures proposed | ✓ |
| Certification statement and authorisation | ✓ |
| *[change above and / or insert other component as needed]* | |

civil IQ





Surface Water and Flood Impact Assessment Report

# Callide Solar Power Station

Reference No. EDF-002
Prepared for Edify Energy
9 November 2022

## Document Control

| | |
|---|---|
| Document | Surface Water and Flood Impact Assessment Report |
| File Location | Z:\Civil IQ Doc\Projects\EDF-002-Callide Solar Farm SWMP\08. Reporting |
| Project Name: | Callide Solar Power Station |
| Project Number: | EDF-002 |
| Revision Number | A |

## Revision History

| Revision No. | Date | Prepared By | Reviewed By | Approved For Issue By |
|---|---|---|---|---|
| A | 9 November 2022 | Mark Hausfeld | Peter Gibson | Mark Hausfeld |

## Issue Register

| Distribution List | Date Issued | Number of Copies |
|---|---|---|
| Edify Energy | 9 November 2022 | 1 |

## civil IQ Company Details

| | |
|---|---|
| Approved by | Mark Hausfeld (RPEQ: 12608) |
| Address | 21 Dyer Street, Pallarenda, QLD, 4810 |
| Signature | Mark Hausfeld |
| Telephone | 0434 940 509 |
| Email | mark@civil-iq.com.au |

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# Appendices

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# Executive summary

Edify Energy proposes to develop a solar power station at Mount Murchison in Central Queensland, associated within an investigation area of approximately 515.4 Ha, with an anticipated development footprint of approximately 466 Ha. This Surface Water and Flood Impact Assessment report is to address the Banana Shire Planning Scheme requirements relevant to stormwater and flooding.

The subject site is located within an agricultural area, with the CS Energy Callide Power Station located directly adjacent to the proposed eastern boundary, Biloela Callide Road and Callide Creek to the south, and Moura Rail System directly adjacent to the northern boundary. Shorts Road traverses through the centre of the site. The township of Biloela is located approximately 8 km south-west of the site.

The fall of the site is generally from north to south, with a level of 230 m Australian height datum (AHD) to the north and approximately 180 m AHD to the south. Several low points and gullies are located through the site with a stream order 1 watercourse located on the eastern side, directly adjacent to the Callide Power Station. There are several small farm dams located upstream and downstream within the vicinity of the site, and numerous contour bank features within the proposed project footprint.

The hydrologic (rainfall-runoff) modelling was undertaken using the Watershed Bounded Network Model (WBNM) and the hydraulic modelling was undertaken using Tuflow HPC SGS (2020-10-AD). Key results of the surface water and flood impact assessment for the 1% Annual Exceedance Probability (AEP) are:

- 1% AEP depths throughout are typically highest within the identified drainage/ waterway corridors and buffer zones. There are areas of breakouts from the main channels throughout the site, however, these are predominantly less than 0.5 m in depth as a maximum, with flows occurring as sheet flows.
- Due to the lack of sufficient terrain data in the northern section of the site, the watercourse buffer areas have been assessed and considered adequate for containment of higher channelised water depths, with shallow sheet flows perceived to typically occur in the northern areas, consistent with modelling observations throughout for the 1% AEP.
- The flood hazard mapping results within drainage lines and watercourses are typically contained within the nominated watercourse buffer zones throughout with associated hazards higher than H3. There are isolated occurrences where the flood hazard mapping marginally exceeds the H2 hazard category, however, this is largely associated with existing contour banks where concentrated sheet flows increase in depth locally. Localised modifications to landforms during future design stages are likely to resolve these localised hazards
- The solar arrays have been assessed to not have a significant impact on run off volumes, peaks, or times to peak, when associated with the provision of good vegetative ground cover throughout to replicate the existing scenario
- The laydown area footprint is approximately 5.9 Ha with an associated increase of approximately 1.2% of the proposed maximum development footprint of 466 Ha, resulting in an insignificant increase in 1% AEP flows relative to the proposed project extents and the greater regional Lake Callide catchment. A minimum freeboard of 300 mm for the peak 1% AEP storm event level is to be determined for habitable buildings and critical infrastructure during future project development. Diversion of external catchment flows for an approximate 60 Ha catchment is to be achieved through diversions channels/ bunding of the laydown area.
- A treatment train approach is required to be adopted, with tertiary implementation measures, such as bioretention basins or wetlands, within the laydown area development footprint to treat to the leading practice pollutant reduction targets prior to discharge to the receiving environment
- Erosion and Sediment Control measures are to be developed during the project development in accordance with the requirements of the Best Practice Erosion and Sediment Control Guidelines, IECA (2008), and in context of anticipated construction methods for the extent of works

The following key limitations are identified for the project to be addressed during the next project stages:

- Sufficient LiDAR data was not available for the upper extents of the Project area. This data is required to confirm extents of hazard flows in the upper catchment to confirm proposed extents of the solar array layout
- The Moura Rail system upstream of the Project site, and associated culverts crossings, were not within the limits of the hydraulic model. Inclusion of these would provide for accurate assessment of flow distribution. It is noted that inclusion of these features may actually bypass flow along the rail line south-west away from the Project site.
- Project development of site infrastructure within the laydown area

# 1 Introduction

Edify Energy has engaged Civil IQ to prepare a Surface Water and Flood Impact Assessment report to accompany Edify Energy's overarching planning report for submission to Banana Shire Council (BSC). The planning report will support the Development Application (DA) for a Development Permit for a Material Change of Use – Public Facility – Other (Solar PV Power Station, with battery energy storage system) for proposed development of the Callide Solar Power Station project.

## 1.1 Background

Edify Energy proposes to develop a solar power station at Mount Murchison in Central Queensland, associated within an investigation area of approximately 515.4 Ha, with an anticipated development footprint of approximately 466 Ha. The proposed development is on multiple land parcels described as Lot 28 on RN519, Lot 3 on RP608599, Lot 2 on RP619032 and Lot 154 on SP126053, with the proposed development footprint shown in Figure 1.

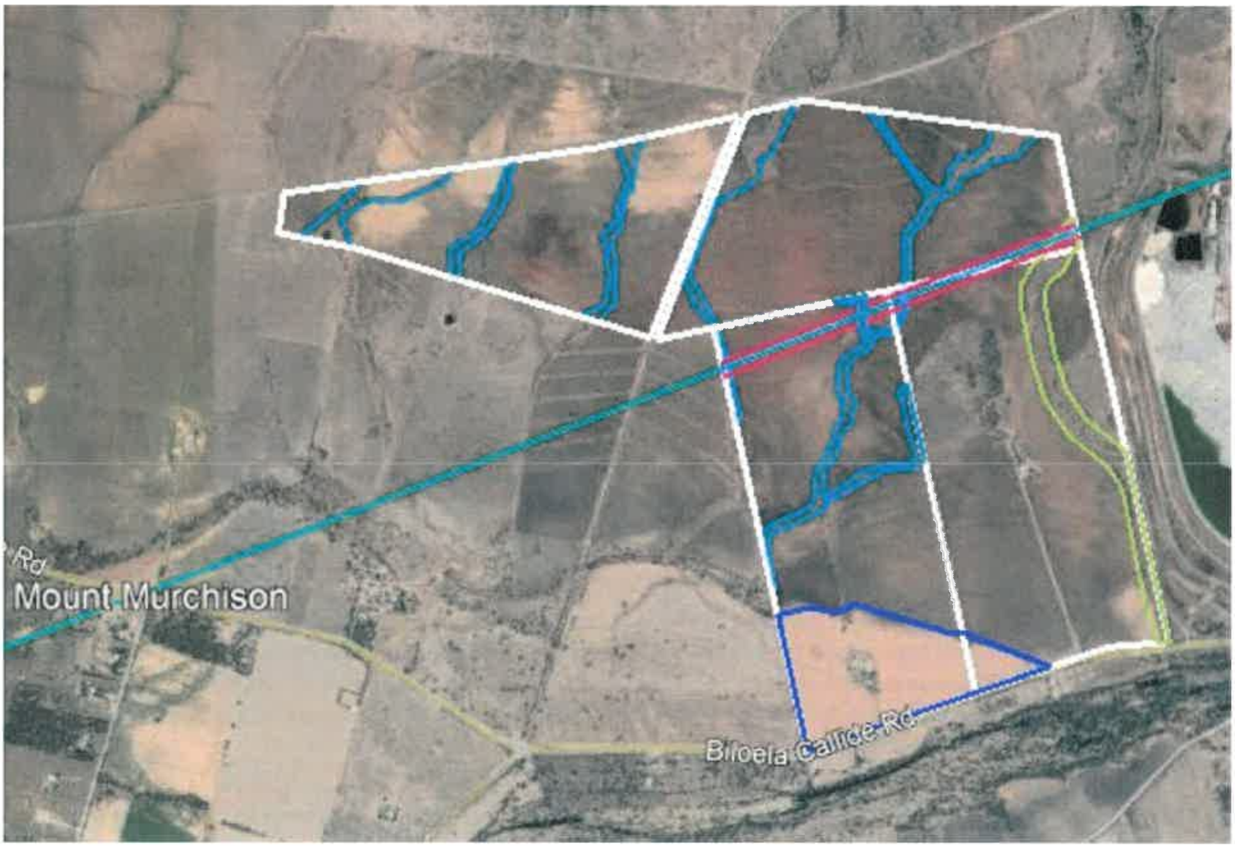



*Figure 1: Site location*

## 1.2 Purpose and objectives

The purpose of the Surface Water and Flood Impact Assessment report is to address Part 6, Section 6.3, Table 6.3.2 of the Banana Shire Planning Scheme. All relevant requirements have been documented in Appendix A to address how the Performance Outcomes have been addressed in the report, with specific references provided.

## 1.3 Scope of works

The scope of works for the project is to develop a stormwater management plan, hydrological model and 2d hydraulic flood model to meet assessment requirements as summarised below:

- Delineate external and internal catchments associated with the project site
- Develop a hydrologic model for input into the hydraulic models

- Build a flood model for the site
- Assess the 1% Annual Exceedance Probability (AEP) design event to Australian Rainfall and Runoff (ARR) 2019 requirements
- Assess impacts of the proposed development footprint inclusive of solar arrays, internal access roads and site laydown and infrastructure areas, as shown by the proposed site layout provided in Appendix B
- Develop mapping of key flood modelling results for the 1% AEP including flooding depths and hazard mapping

## 1.4 Site description

The subject site is located within an agricultural area, with the CS Energy Callide Power Station located directly adjacent to the proposed eastern boundary, Biloela Callide Road and Callide Creek to the south, and Moura Rail System directly adjacent to the northern boundary. Shorts Road traverses through the centre of the site. The township of Biloela is located approximately 8 km south-west of the site.

The fall of the site is generally from north to south, with a level of 230 m Australian height datum (AHD) to the north and approximately 180 m AHD to the south. Several low points and gullies are located through the site with a stream order 1 watercourse located on the eastern side, directly adjacent to the Callide Power Station. There are several small farm dams located upstream and downstream within the vicinity of the site, and numerous contour bank features within the proposed project footprint.

# 2 Data

## 2.1 Topographic data

Queensland Government topographic data was sourced for the project consisting of the following:

- Biloela Thangool 2011 1m DEM tif data
- SRTM derived 1 second digital surface model version 3
- QTopo online topographic maps data

The 1m DEM data sourced does not cover the footprint of the entire site, as demonstrated in Figure 2.

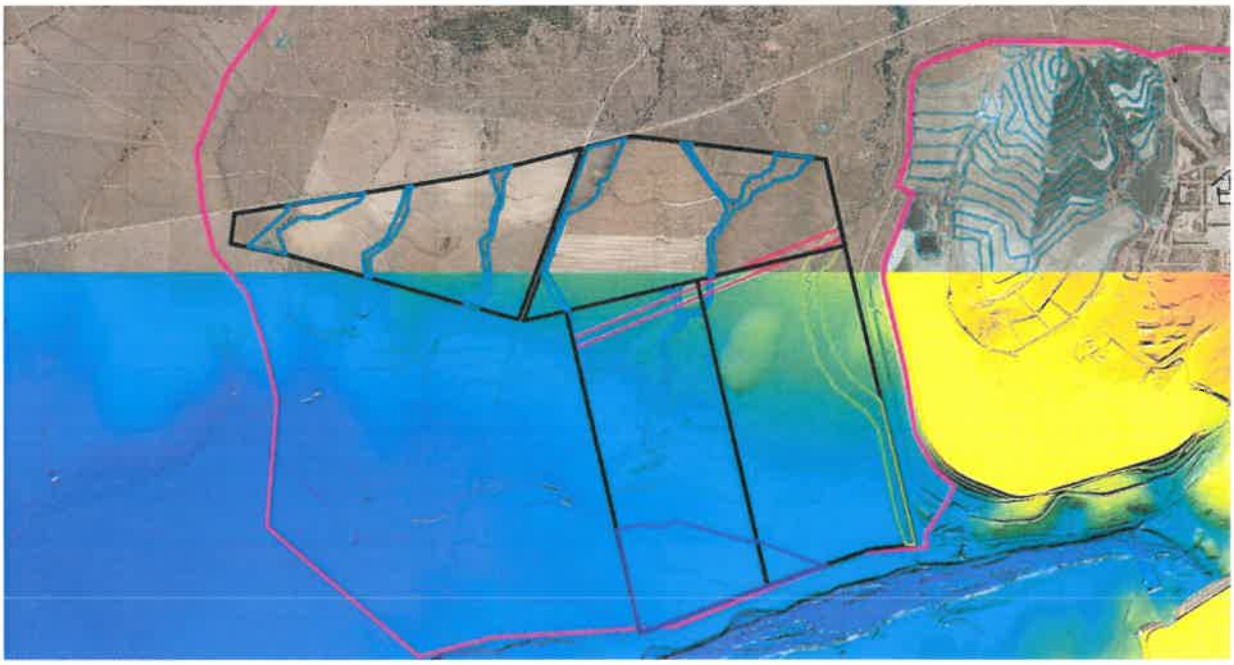


*Figure 2: LiDAR data extents relative to the site footprint*

## 2.2 Design rainfall data

Intensity Frequency Durations (IFD) data was sourced from the Bureau of Meteorology (BoM) for site latitude and longitude (-24.3375S, 150.5875E), as provided in Table 1.

*Table 1: BoM IFD data rainfall depths – centroid gauge IFD06 (refer to Figure 3)*

| Duration | Annual Exceedance Probability (AEP) – Design rainfall intensities (mm/hr) | | | | | | |
|---|---|---|---|---|---|---|---|
| | 63.20% | 50% | 20% | 10% | 5% | 2% | 1% |
| 1 min | 2.4 | 2.66 | 3.49 | 4.04 | 4.58 | 5.28 | 5.82 |
| 2 min | 4.05 | 4.51 | 5.98 | 7.03 | 8.04 | 9.35 | 10.4 |
| 3 min | 5.71 | 6.35 | 8.39 | 9.82 | 11.2 | 13 | 14.4 |
| 4 min | 7.26 | 8.07 | 10.6 | 12.4 | 14.1 | 16.3 | 18 |
| 5 min | 8.7 | 9.66 | 12.7 | 14.7 | 16.7 | 19.3 | 21.3 |
| 10 min | 14.4 | 15.9 | 20.8 | 24 | 27.2 | 31.3 | 34.4 |
| 15 min | 18.3 | 20.3 | 26.6 | 30.7 | 34.7 | 40 | 44 |
| 20 min | 21.3 | 23.7 | 30.9 | 35.8 | 40.5 | 46.7 | 51.4 |
| 25 min | 23.7 | 26.3 | 34.4 | 39.8 | 45.2 | 52.2 | 57.5 |
| 30 min | 25.6 | 28.4 | 37.2 | 43.2 | 49 | 56.7 | 62.6 |

| Duration | Annual Exceedance Probability (AEP) – Design rainfall intensities (mm/hr) | | | | | | |
|---|---|---|---|---|---|---|---|
| | 63.20% | 50% | 20% | 10% | 5% | 2% | 1% |
| 45 min | 29.7 | 33 | 43.5 | 50.6 | 57.7 | 67 | 74.2 |
| 1 hour | 32.6 | 36.2 | 47.8 | 55.8 | 63.7 | 74.2 | 82.4 |
| 1.5 hour | 36.5 | 40.5 | 53.6 | 62.8 | 72 | 84.2 | 93.9 |
| 2 hour | 39.1 | 43.5 | 57.6 | 67.7 | 77.7 | 91.2 | 102 |
| 3 hour | 42.9 | 47.7 | 63.3 | 74.4 | 85.7 | 101 | 113 |
| 4.5 hour | 46.7 | 52 | 69.2 | 81.5 | 94.1 | 112 | 126 |
| 6 hour | 49.7 | 55.3 | 73.8 | 87 | 101 | 120 | 135 |
| 9 hour | 54.3 | 60.5 | 81 | 95.8 | 111 | 133 | 151 |
| 12 hour | 57.9 | 64.5 | 86.8 | 103 | 120 | 145 | 164 |
| 18 hour | 63.5 | 71 | 96.4 | 115 | 135 | 164 | 187 |
| 24 hour | 67.9 | 76.1 | 104 | 126 | 148 | 181 | 207 |
| 30 hour | 71.6 | 80.3 | 111 | 134 | 160 | 196 | 225 |
| 36 hour | 74.7 | 83.9 | 117 | 142 | 170 | 209 | 241 |
| 48 hour | 79.7 | 89.8 | 126 | 155 | 187 | 231 | 268 |
| 72 hour | 86.8 | 98.3 | 140 | 174 | 212 | 265 | 309 |
| 96 hour | 91.7 | 104 | 149 | 186 | 228 | 286 | 335 |
| 120 hour | 95.1 | 108 | 155 | 194 | 237 | 298 | 350 |
| 144 hour | 97.6 | 111 | 159 | 197 | 242 | 304 | 357 |
| 168 hour | 99.5 | 113 | 161 | 198 | 242 | 305 | 357 |

## 2.3 Drainage structures

Drainage structure information was not available for the Moura Railway System at the northern boundary of the site for this assessment. Therefore, conservatively, drainage structure information has not been incorporated into the hydraulic model.

# 3 Flood impact assessment and flood modelling

## 3.1 Hydrologic assessment

The hydrologic (rainfall-runoff) modelling was undertaken using the Watershed Bounded Network Model (WBNM) WBNM calculates flood runoff from rainfall hyetographs, allowing hydrographs to be calculated. Figure 3 presents the layout of the WBNM hydrologic model. It is noted that the full spatial rainfall gradient was with the red points indicating the IFD gauge locations.

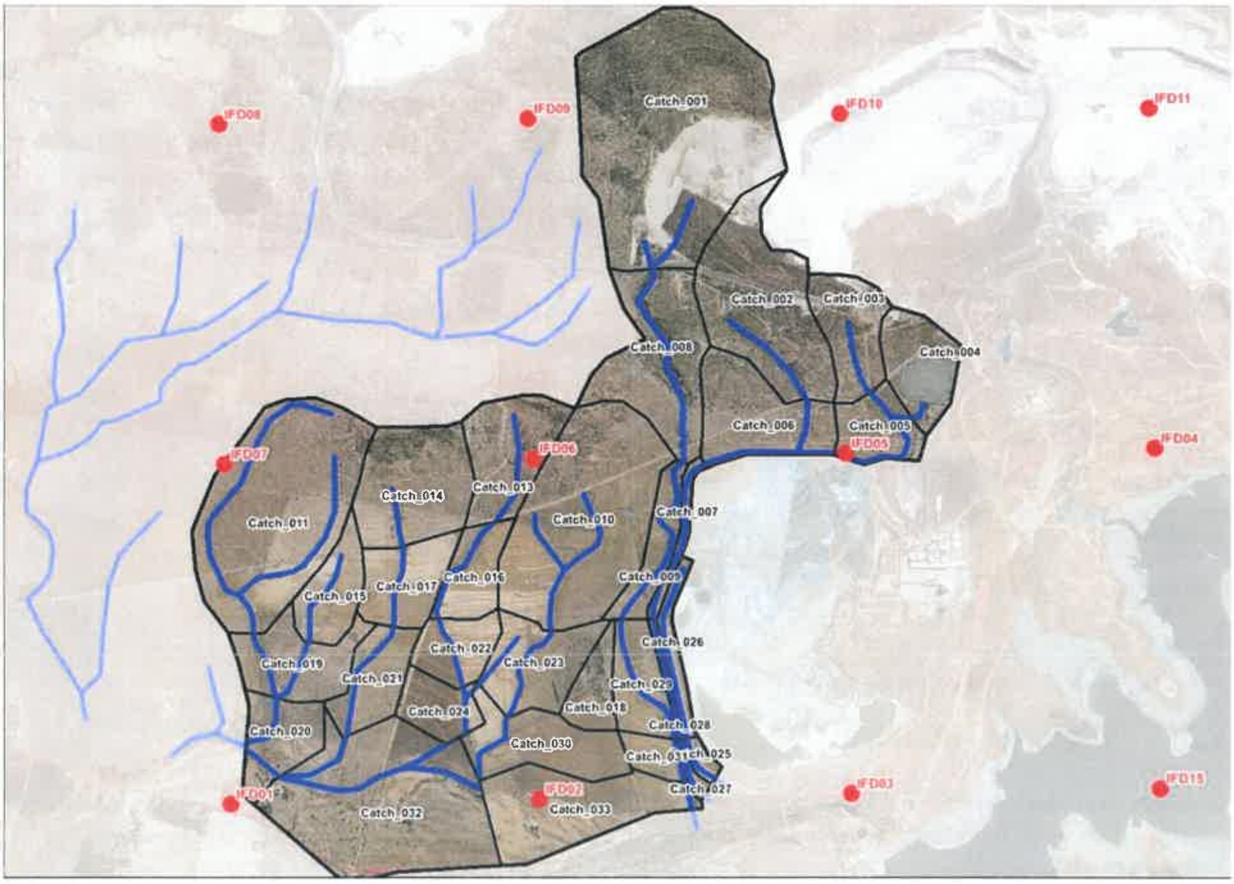


*Figure 3: WBNM model layout showing design rainfall gauge locations*

### 3.1.1 Catchments

The area of assessment incorporates the site and relevant catchments to the Mount Isa Rail line. Sub-catchments were delineated based on Department of Natural Resources and Mines (DNRM) 1 m Aerial Laser Survey (ALS) (conducted 2011) and Geoscience Australia (GA) 5 m DEM-H elevation data, as illustrated on Figure 1 in Appendix B and summarised in Table 2.

*Table 2: Sub-catchment summary*

| ID | Area (ha) | ID | Area (ha) |
|---|---|---|---|
| Catch_001 | 267.5 | Catch_021 | 39.3 |
| Catch_002 | 116.7 | Catch_022 | 32.2 |
| Catch_003 | 48.2 | Catch_023 | 55.7 |
| Catch_004 | 46.1 | Catch_024 | 28.4 |
| Catch_005 | 35.1 | Catch_029 | 37.0 |
| Catch_006 | 69.4 | Catch_030 | 59.4 |

| ID | Area (ha) | ID | Area (ha) |
|---|---|---|---|
| Catch_008 | 95.2 | Catch_031 | 15.3 |
| Catch_009 | 30.4 | Catch_007 | 11.1 |
| Catch_010 | 177.3 | Catch_026 | 16.9 |
| Catch_011 | 185.7 | Catch_025 | 6.1 |
| Catch_013 | 63.2 | Catch_028 | 5.6 |
| Catch_014 | 83.1 | Catch_027 | 4.2 |
| Catch_015 | 36.6 | Catch_033 | 87.7 |
| Catch_016 | 34.4 | Catch_032 | 181.5 |
| Catch_017 | 45.0 | Catch_020 | 40.8 |
| Catch_018 | 23.9 | **TOTAL** | **2031.3** |
| Catch_019 | 52.3 | | |

Current best practices were adopted to estimate design storm runoff for the existing catchment conditions, including the following model parameters:

- 0% fraction impervious
- 1.3 catchment lag factor
- BoM 2016 design rainfall depths and intensities, refer to Table 1.
- ARR, Geosciences Australia, (2019) temporal patterns
- Initial storm loss of 10 mm
- Continuing storm loss of 1.5 mm/hr

The 1% AEP, 1 to 12 hour durations and temporal ensembles were simulated in the hydrological model. Adopting the default WBNM catchment lag factor of 1.6, and default ARR Data Hub initial loss and median pre-burst losses the WBNM peak flow estimates were approximately 40% lower than Regional Flood Frequency Estimate (RFFE) calculations. Noting the significant difference between estimates and lack of additional information to support a robust model calibration process, the WBNM catchment lag parameter was reduced to 1.3 and a constant storm initial loss of 10 mm was adopted such that WBNM peak flow estimates were higher and thus closer to RFFE estimates, producing conservative outcomes.

### 3.1.2 Verification

Model calibration to historical events could not be performed as there are no pluvio-rainfall stations, historic stream gauges, or anecdotal records of historic storms within the model area. Therefore, results were validated to a RFFE as presented in Table 3

In context of the RFFE assessment, the catchment shape for the RFFE verification is not regular due to the large Callide Power Station site which diverts flow around its perimeter and retains significant flows on site. Nonetheless, the RFFE is a meaningful order of magnitude check to confirm that the WBNM estimates are reasonable. For the RFFE assessment, the total WBNM model was passed through catchment 020 and therefore the peak WBNM flows presented in Table 3 are for the 20.3 km$^2$ catchment

*Table 3: Design storm validation (catchment 020 – 20.3 km$^2$ upstream area)*

| AEP (%) | Peak Flow (m$^3$/s) | |
|---|---|---|
| | WBNM (median storm) | RFFE |
| 5 | 144 | 131 |
| 2 | 176 | 190 |
| 1 | 204 | 243 |

The above results indicate a reasonable WBNM model validation to meet the assessment objectives.

### 3.1.3 Critical duration

Peak flows from the WBNM model were reviewed at the upstream limits of the TUFLOW model to determine the critical durations required for the hydraulic assessment. The results of the WBNM modelling for the 1% AEP are summarised in Table 4. The TUFLOW model accordingly enveloped the results of the 60-minute duration with storm ID 5105 and the 90-minute duration storm with ID 5329.

*Table 4: WBNM critical duration assessment*

| Catchment | Duration and Storm ID | 1% AEP Peak Flow |
|---|---|---|
| Catchment 7 | 90-minute, Storm ID 5329 | 48.9 $m^3/s$ |
| Catchment 9 | 90-minute, Storm ID 5329 | 47.4 $m^3/s$ |
| Catchment 11 | 60-minute, Storm ID 5105 | 31.8 $m^3/s$ |
| Catchment 15 | 60-minute, Storm ID 5105 | 8.1 $m^3/s$ |

## 3.2 Hydraulic assessment

The hydraulic modelling was undertaken using Tuflow HPC SGS (2020-10-AD). Tuflow is a hydraulic and hydrodynamic modelling software package.

### 3.2.1 Model setup

The Tuflow model was developed to incorporate the following parameters into the model:

- Topography is based on DNRM ALS data with a 2 m model grid
- Natural contour banks applied as 'thin' break lines
- Inflow polygons with the appropriate local/ total hydrographs applied
- Normal depth applied to downstream model boundary
- Global Manning's n for light vegetation/ grass / field – 0.05

### 3.2.2 Limitations

The following key limitations are identified for the TUFLOW assessment to be resolved during the next project stages:

- LiDAR data was not available for the upper limits of the Project area. Desirably this would be obtained to confirm extents of hazard flows in the upper catchment to confirm proposed extents solar array layout
- The Moura Rail system upstream of the Project site, and associated culverts crossings, were not within the limits of the hydraulic model. Inclusion of these would provide for accurate assessment of flow distribution. It is noted that inclusion of these features may actually bypass flow along the rail line SW away from the Project site.
- Downstream boundary conditions were nominal low flow conditions. The 1% AEP Callide Creek flood extents should be identified from separate Council commissioned study to confirm that development footprint of the Solar Arrays is outside the limits of this regional flooding

### 3.2.3 Hydraulic modelling results

The hydraulic modelling results are discussed in this section with reference to the results mapping provided in Appendix D.

#### 3.2.3.1 Proposed infrastructure

The infrastructure inputs and parameters for the proposed development footprint are summarised below:

- PV solar panels array blocks are proposed to be supported on piled foundations. There is no increase in imperviousness or concentration of flows associated with the rain shadow of the solar panel arrays. Stormwater sheet flows evenly from the downslope of the panels and discharges directly to the existing in-situ ground conditions, and is mobilised for infiltration and surface flows, replicating the existing catchment scenario and characteristics. Reference to a research paper documenting the basis for hydrological impacts is discussed in detail in Section 4.2.1.

- Unsealed access roads are proposed through the site and are to be constructed at-grade to maintain sheet flow characteristics of the existing site. Surface flows over roads discharge directly to adjacent pervious catchments, avoiding concentration of flows throughout. Therefore, the effective impervious area is not increased.
- The development area of the of the site laydown area is approximately 5.9 Ha, as referenced to the layout in Appendix B, and equates to an approximate 1.2% increase in imperviousness relative to the proposed maximum development footprint area of 466 Ha. In context of the relative scale of the laydown area, this is not considered significant to the development of a hydraulic model relative to the existing scenario.

#### 3.2.3.2 Water depth and flood extents results

Water depth and flood extents results for the 1% AEP storm event are provided in Appendix D. The results show that water depths throughout are typically highest within the identified drainage/ waterway corridors and buffer zones. There are areas of breakouts from the main channels throughout the site, however, these are predominantly less than 0.5 m in depth as a maximum, with flows occurring as sheet flows.

The mapping shows areas of breakout flows concentrate against the contour banks throughout, where localised depths increase in locations. The contour banks are a distinct feature of the existing terrain and generally assist with flow management on the site and should be retained in coordination with the solar arrays layouts as part of future project development and design. In consideration of the solar array's layouts, the location and extent of the existing contour banks shall be retained or amended as required to allow for suitable foundation and freeboard above the existing levels. Lower height contour banks are also recommended, and additional or interim contour banks throughout to reduce localised flows depths as required, and to replicate the existing flow regime

The water level at the southern extent of the site is associated with localised increased depths due to boundary conditions associated with the hydraulic model. This area is associated with a proposed bushfire and access buffer width of 10 m.

From the review of the hydraulic modelling results, and in context of the lack of sufficient terrain data in the northern section of the site, the watercourse buffer areas are considered adequate for containment of higher channelised water depths, with shallow sheet flows perceived to typically occur in the northern areas, consistent with modelling observations throughout. Additional LiDAR data or similar survey is required in the northern section of the site to validate this assessment during future project stages, as discussed in Section 2.1.

#### 3.2.3.3 Flood hazard results

Flood hazard results for the 1% AEP storm event are provided in Appendix D.

To understand the impacts of flood hazard, reference is made to Section 7.2.7 of ARR 2019. Figure 6.7.9 guidance on indexing of flood hazard, relative to the depth and velocity of flooding and stormwater flows. An extract of Section 7.2.7 of this guideline has been provided in Appendix E for reference. Figure 6.7.9 show various hazard classifications from H1 to H6 and limiting classification combinations required for depth and velocity.

H1 and H2 are the lowest hazard categories and are considered the benchmark for the development footprint for assessment relative to a 1% AEP event. The range of characteristics are defined as below:

- H1 – generally safe for vehicles, people and buildings
- H2 – unsafe for small vehicles. In a 1% AEP event, access to site by any means typically would not occur
- Classification limit $d*v <= 0.3\ m^2/s$ to $<= 0.6\ m^2/s$
- Limiting still water depth = 0.3 m – 0.5m
- Limiting velocity = 2.0 m/s

The flood hazard mapping results within drainage lines and watercourses are typically contained within the nominated watercourse buffer zones throughout with associated hazards higher than H3. There are isolated occurrences where the flood hazard mapping exceeds the H2 hazard category, however, this is largely associated with existing contour banks where concentrated sheet flows increase in depth locally. Localised modifications to landforms during future design stages are likely to resolve these localised hazards, as discussed in Section 3.2.3.2. Also as discussed in Section 3.2.3.2, additional LiDAR data is required in the northern section of the site to validate this assessment during future project stages.

# 4 Surface water assessment

The impacts of flooding for the 1% AEP have been documented in Section 3 of the report. The surface water assessment is associated with development of the site in context of the following three elements:

- Stormwater quantity – management of stormwater flows from the proposed site to minimise all impacts to the receiving environment
- Stormwater quality – management of increased pollutant loads primarily associated with mobilisation of nutrients and suspended solids within the development footprint from increased impervious surfaces
- Erosion and sediment control – management of soil and water throughout the construction phase of the project in coordination with construction staging, removal of vegetation and exposure of underlying soils, and coordination with proposed stormwater quantity and quality infrastructure measures

## 4.1 Stormwater management approach

The approach for the management of surface water is associated with:

- The solar facility development – consisting predominantly of solar panels arrays and unsealed access roads for the majority of the site in reference to the proposed layout shown in Appendix B
- The laydown areas and associated infrastructure is located within a total area of approximately 5.9 Ha, as shown by the footprint within the yellow border in Figure 4.

The surface water assessment for these areas is fundamentally different, therefore, are addressed and discussed separately within this Section.


*Figure 4: laydown development footprint area of ~5.9 Ha*

## 4.2 Solar arrays development

### 4.2.1 Stormwater quantity

The intent for the stormwater quantity assessment for the developed solar facility site is to maintain existing surface sheet flows over predominantly existing vegetated surfaces. The solar panel arrays and unsealed access roads insignificantly impact the effective impervious areas of surfaces for the project.

There is an overall negligible hydrologic impact associated with the solar arrays in the 1% AEP event upon discharge to the downstream receiving environment, in reference to the research paper entitled Hydrologic Response of Solar Farms (Cook et al, 2013) provided in Appendix C. This paper states that the solar arrays do not have a significant impact on run off volumes, peaks, or times to peak, when associated with the provision of good vegetative ground cover throughout to replicate the existing scenario. Additionally, the kinetic energy of flow from the solar panels has increased potential to cause erosion at the base of the panels, reiterating the importance for effective grassing/ vegetation to be adopted at this interface, for the life of the project.

The development footprint of the solar panel arrays is associated with a low hazard category below H2 throughout, and d*V ratio <0.6, during the 1% AEP event. The site layout in Appendix B shows that concentrated flow is associated with Two Mile Creek and adjacent localised gullies, the development footprint contains only low hazard sheet flow.

At-grade unsealed access roads, and causeway crossings of creeks, will require ongoing maintenance over the life of the project, and grassing/ vegetation is be maintained for the footprint of the solar arrays to replicate the existing scenario as close as possible over the operational phase of the project.

### 4.2.2 Stormwater quality

No stormwater quality treatment measures are associated with the solar farm development area. The effective impervious area of the solar panel arrays and the at-grade access roads is insignificant and does not impact surface flows and infiltration compared to the existing scenario.

### 4.2.3 Erosion and sediment control

Erosion and Sediment Control measures are to be developed during the project development in accordance with the requirements of the Best Practice Erosion and Sediment Control Guidelines, IECA (2008) to meet the following objectives:

- Management of overland flow through the site
- Implementation of vegetation regrowth
- Implementation of soil erosion protection measures
- Minimising disturbance

Erosion and sediment control measures for the solar farm development area are associated with the following infrastructure and construction works:

- At-grade unsealed access tracks and causeways at watercourse/ gully crossings
- Piled foundations for solar panel arrays
- Installation of underground medium voltage network
- Installation of security fencing
- Integration of the works with existing contour bank landforms

Development of erosion control measures for the project are to be developed in consideration of the following:

- Early planning, design and implementation of an ESCP that identifies soil and water management issues and objectives, and is maintained, supervised and monitored for effectiveness.
- Site construction works can be staged, and construction works developed to minimise areas of exposure to achieve no greater than 2500 m$^2$ of exposed soils or achieve a soil loss rate less than 75 t/ Ha/ year. This will require implementation of Type 3 controls, typically consisting of sediment fence treatment
- Allowance for sedimentation basins within the exposure footprint of the unsealed access roads for localised containment of sediment laden water
- Placement of rock check dams or coir fibre logs along access roads to slow velocities and dissipate energy for potential long run lengths dependent on staging
- Construction of diversion drains on the upstream side of unsealed access roads, within the proposed access road footprint, to capture clean water flows and discharge downstream to stabilised landforms
- Stockpiles, where required for access road construction predominantly, are to have sediment fences to control any potential sediment laden flows
- Undertake construction activities during the dry season, where possible, to reduce likelihood of rainfall mobilising sediments during stormwater runoff

- If construction during the wet season must occur, isolation of workspace to reduce inflow and runoff to be completed prior to works commencing.

A detailed ESCP will be required prior to the commencement of construction once detailed design for the site has been undertaken.

### 4.2.4 Earthworks

Earthworks for the solar panel array development area are anticipated to be minor with no significant filling proposed. Civil works for the development area include:

- Construction of 200 mm depth at-grade gravel access tracks and causeways, requiring excavation to required depth
- Installation of solar array panels on pier footings, requiring localised excavation of piers to required foundation level
- Excavation for electrical cabling, requiring trenching to required depths
- Replication and/ or reconfiguration of contour banks and existing landform features
- Revegetation/ grassing with natural specifies to replicate the existing scenario

## 4.3 Laydown areas and associated infrastructure

### 4.3.1 Stormwater quantity

The stormwater quantity management measures for the laydown area footprint are provided in Figure 5, and is impacted by the following catchments:

- External upstream catchment north of laydown areas – 60 Ha
- Laydown area footprint combined catchment area – 5.9 Ha


*Figure 5: Proposed diversion bunds/ channels for the laydown area and associated infrastructure*

For the northern portion of the laydown area, the existing watercourse intercepts the external catchment flows. There are break out flows for the 1% AEP storm event from the watercourse however, as shown in the flood depth and extents figures in Appendix D. A diversion bund or channel will need to be designed to intercept and divert these flows back to the watercourse and downstream.

For the southern portion of the laydown area, two diversion channels and bunds will be required to capture and convey the external 1% AEP flows away from the area and discharge to the downstream watercourse, in coordination with other works in the vicinity including solar arrays, fencing and the transmission line easement (shown as the green corridor in Figure 5).

A minimum freeboard of 300 mm for the peak 1% AEP storm event level is to be determined for habitable buildings and critical infrastructure during future project development.

As discussed in Section 3.2.3.1, the laydown area footprint is associated with an increase of approximately 1.2% of the proposed maximum footprint of 466 Ha, resulting in an insignificant increase in 1% AEP flows relative to the proposed project extents and the greater regional Lake Callide catchment as shown in Figure 6. In context of this relative comparison of local and regional catchment areas, the increase in imperviousness associated with the laydown area is insignificant. Further development of the layout of the laydown area, and actual impervious extents within the 5.9 Ha footprint needs to be developed during future project development and stages.

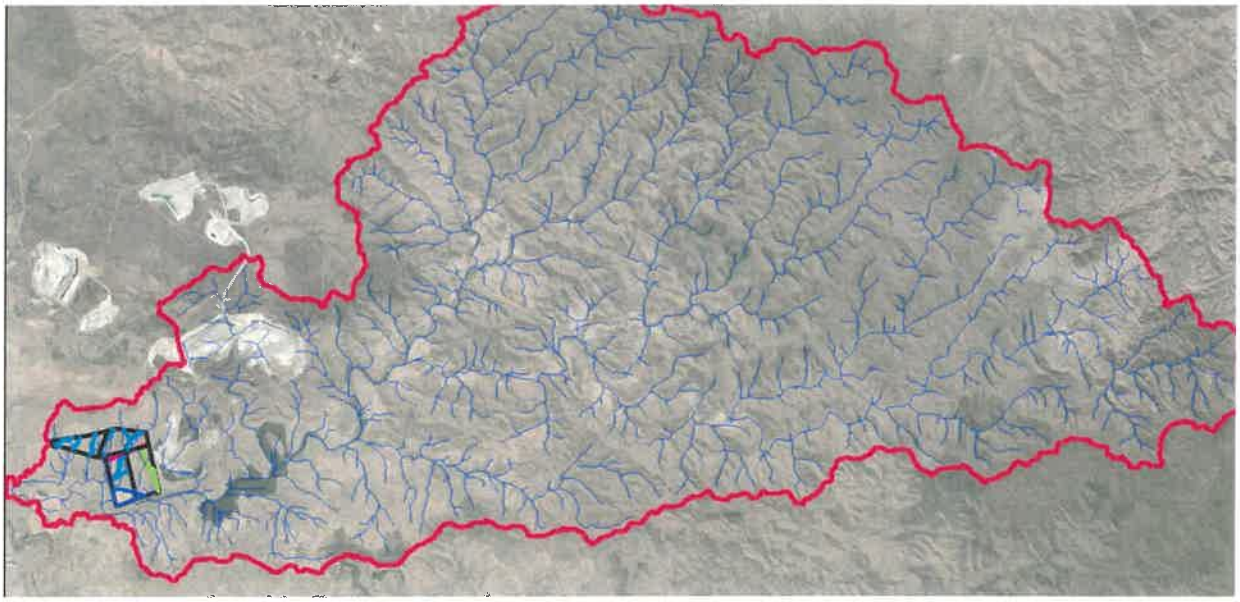


*Figure 6: Relative comparison of proposed total development site footprint and Lake Callide catchment*

### 4.3.2 Stormwater quality

The overarching design objectives for water sensitive urban design (WSUD) is referenced to the State Planning Policy (SPP), 2017, Appendix B, Table B, for Western Queensland, for mean annual pollutant load reductions for the laydown development footprint, are:

- >= 85% reduction in total suspended solids load
- >= 60% reduction in total phosphorus load
- >= 45% reduction on total nitrogen load
- >= 90% reduction in gross pollutant load

To meet the required pollution reduction targets, a treatment train approach is required to be adopted, with tertiary implementation measures, such as bioretention basins or wetlands, proposed within the laydown area development footprint to treat to the required levels prior to discharge to the receiving environment. An end of the line sizing for tertiary treatment measures has been conservatively sized based on a 5.9 Ha of development area. Preliminary sizing requirements for two tertiary treatment options are:

- Bioretention basin – 1.5% of effective impervious area (EIA)
- Constructed wetland – 4% of EIA

A summary of the concept sizing of each is summarised in Table 5.

*Table 5: Tertiary treatment measures concept sizing*

| Laydown development area ($m^2$) | Bioretention Basin Sizing ($m^2$) | Constructed Wetland Sizing ($m^2$) |
|---|---|---|
| 59,000 | 885 | 2,360 |

Incorporation of a bioretention basin provides the most efficient use of area, however, it has potential outletting issues on flat sites, and ongoing operation and maintenance requirements. A wetland requires significantly more surface area to achieve required tertiary treatment levels. A treatment train approach incorporating the whole laydown development area is required to be developed at future design stages. The use of leading practice proprietary products may also be an option, including tertiary level treatment of WSUD pollutants.

### 4.3.3 Erosion and sediment control

Erosion and Sediment Control objectives are as previously stated in Section 4.2.3 associated with the development of the approximate 5.9 Ha laydown footprint area. Although construction works and staging will be associated with this area, Type 1 erosion and sediment control implementation measures will be a requirement, associated with an annual soil loss rate greater than 150 t/Ha/yr. Type 1 treatment measures are essentially appropriately sized sediment basins to the requirements of IECA (2008). The design and implementation of erosion control measures for the site is to be undertaken in consideration of the following:

- Early construction and stabilisation of the external catchment diversion channel/ bunds to divert external flows away from the laydown development footprint construction works
- Early construction and stabilisation of the proposed sedimentation basin and associated dirty water connectivity through swales, channels, pipes etc
- Construct the sediment basin to sizing determined from a detailed ESCP to be developed during future design stages. The sedimentation basin should be coordinated with WSUD requirements and location of the treatment train and tertiary treatment measures.
- Stockpiles, where required, for management of imported and excavated topsoil and material
- Implementation of stabilised site access at entry and exit locations to manage sediment removal from construction plant before leaving the construction site
- Undertake construction activities during the dry season, where possible, to reduce likelihood of rainfall mobilising sediments in runoff
- If construction works occur during the wet season, isolation of workspaces is required to be completed to reduce inflow and runoff prior to works commencing.

A detailed ESCP will be required prior to the commencement of construction once detailed design for the site has been undertaken.

### 4.3.4 Earthworks

Potential earthworks and civil works for the laydown development area include:

- Cut and fill of earthworks to form building pad levels for buildings and as required for associated infrastructure, to be developed during future project development
- Construction of 1% AEP diversion channels/ bunds, and excavation for drainage works requiring excavation to formation and invert levels
- Construction of water quality treatment infrastructure with excavation to required design depths
- Construction of car parking, pavements, road crossing accesses etc, with excavation to foundation and sub-grade levels throughout
- Installation of underground services with excavation to designed depths and inverts

## 4.4 Lawful Point of Discharge

Section 3.9 of the Queensland Urban Drainage Manual (QUDM), Fourth Edition (IPWEA Queensland, 2017) describes that the lawful point of discharge must comply with all laws (Federal, State, Local and common law), and is the developer's responsibility that it is compliant to all laws in carrying out stormwater and development works including not causing a nuisance. However, Section 3.9.1 of QUDM also states that the term 'lawful point of discharge' has no prescribed legal meaning, but states a process for determination of the lawful point of discharge as:

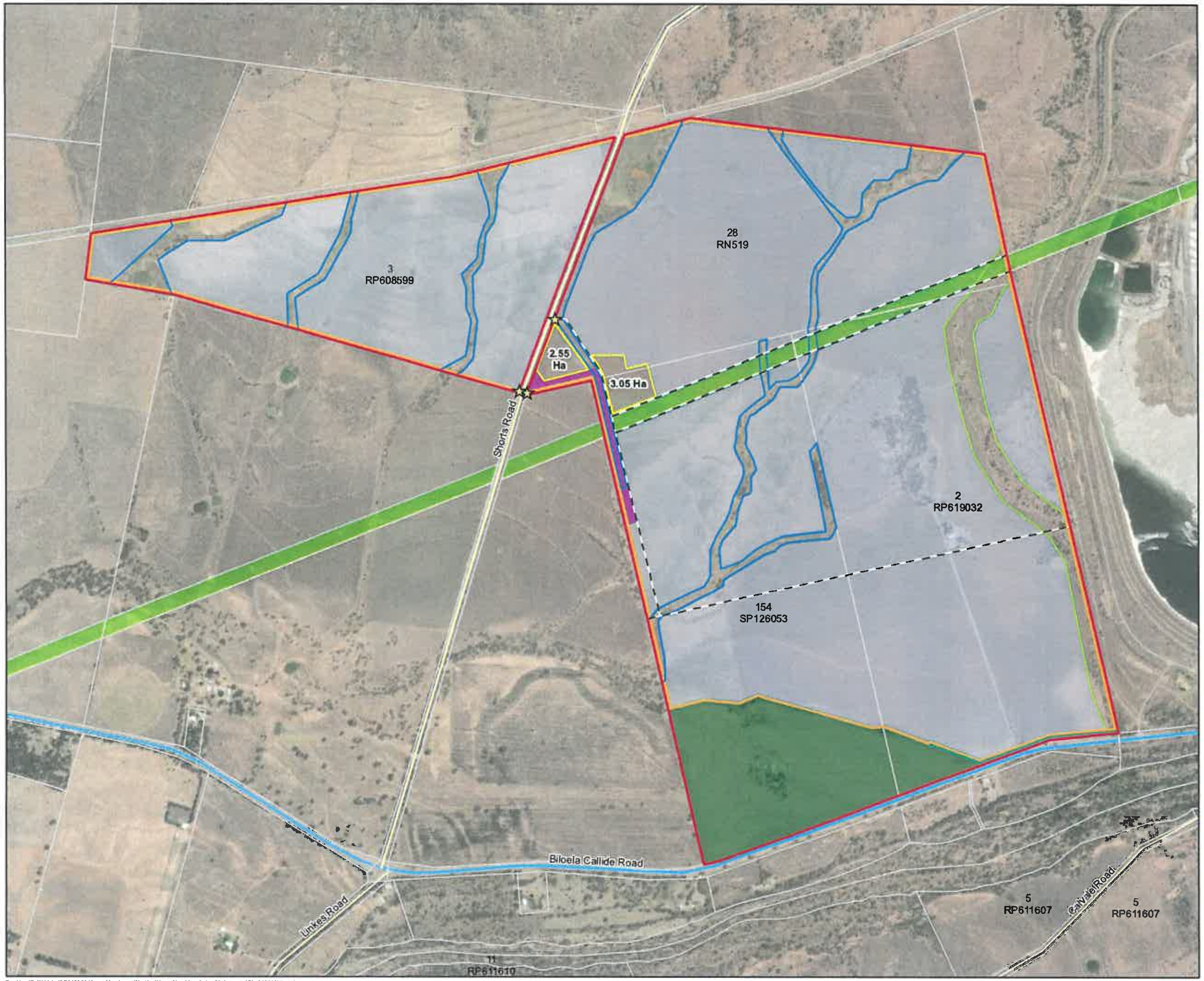
- Whether the proposed development will alter the site's stormwater discharge characteristics in a manner that may substantially damage a third-party property:
  - If not, then no further steps are required to obtain tenure for a lawful point of discharge

Therefore, from the outcomes of the flood modelling and assessment undertaken for the 1% AEP, the proposed development discharges to existing watercourses and drainage features on the site and has insignificant impacts on the flow regime of the site, and regional and local catchments. Therefore, the proposed site discharges are lawful point of discharge.

# Appendix A **Assessment of Performance Outcomes**

| Performance outcomes | Acceptable outcomes | Response |
|---|---|---|
| **Division 7 - Development Standards Code - Table 6.7.1 - October 2005** | | |
| **Stormwater Drainage** | | |
| **PO12**<br>Stormwater drainage is designed and constructed to provide adequate capacity for existing and anticipated development at predicted design flows and velocity. | **AO12.1**<br>Stormwater drainage, including inter-allotment drainage is in accordance with the CMDG. | Stormwater drainage associated with the solar arrays has adequate capacity for existing and anticipated development as documented in Section 3.2.3.2 and 3.2.3.3 of the report for flood modelling results, and Section 4.2.1, in accordance with the intent of the CDMG.<br><br>Stormwater drainage associated with the laydowns and associated infrastructure is documented in Section 4.3.1 of the report, in accordance with the intent of the CDMG. |
| **PO17**<br>On-site and off-site erosion and sedimentation is minimised, whether drainage is via formed drainage systems or runoff from the site. | **AO13.1(RAD)**<br>Erosion and Sediment control measures are designed and constructed in accordance with the CMDG. | Management of on-site and off-site erosion potential is documented in Section 4.2.3 in reference to the solar arrays, and Section 4.3.3 in reference to the laydown areas and associated infrastructure. The requirements are in accordance with IECA (2008) and to meet the intent of the CDMG. |
| **Division 8 - Development Design Code - Table 6.8.1** | | |
| **Stormwater Drainage** | | |
| **PO16**<br>Stormwater drainage (including interallotment drainage) is designed and constructed to:<br>(1) provide a design capacity able to accommodate existing and anticipated development and flows;<br>(2) ensure that inundation of private and public buildings located in flood prone areas occurs only on rare occasions and that, in such events, surface flow routes convey floodwaters below the prescribed velocity/depth limits; .<br>(3) provide convenience and safety for pedestrians and traffic in frequent stormwater flows by controlling those flows within prescribed limits;<br>(4) maximise the retention of incident rainfall and runoff within each catchment consistent with the planned use and the characteristics of that catchment. | **AO16.1**<br>The design of stormwater drainage shall be in accordance with the CMDG.<br>**AO16.2**<br>Development applications are to comply with the "Flood Level Plan for Determination of Floor Levels" for the Town of Banana in particular, Note: The floor height of buildings will be governed by this plan.<br>**AO16.3**<br>Water Sensitive Urban Design Principles will be based on demonstrated best practice.<br>**AO16.4**<br>Stormwater quality is to meet the requirements of Environmental Protection (Water) Policy 2009.<br>Note: Water quality objectives and environmental values for Queensland waters are contained within Schedule 1 of the Environmental Protection (Water) Policy 2009. Water quality objectives are locally specific and vary between and within river catchments | **AO16.1**<br>The design capacity of the solar arrays is documented in Section 4.2.1 of the report, with the laydown areas and associated infrastructure documented in Section 4.3.1 of the report, to meet the intent of the CDMG<br>**AO16.2**<br>A minimum freeboard for buidlings and critical infrastructure has been specified as a minimum of 300 mm above the peak 1% AEP water level<br>**AO16.3**<br>WSUD principles have been demonstrated in Section 4.2.2 for the solar arrays and Section 4.3.2 for the laydown areas and associated infrastructure. The approach is based on leading practice WSUD guidance<br>**AO16.4**<br>The requirements for development reference the State Planning Policy 2017 requirements for pollution reduction targets, which in turn references the requirements of the Environmental Protection (Water) Policy 2009, and more recent revisions, as documented in Section 4.2.2 and Section 4.3.2 of the report. |
| **PO17**<br>Sub-surface drainage is provided to drain water from structures to ensure their satisfactory performance. | **AO17.1(RAD)**<br>The design of sub-surface drainage is to be in accordance with the CMDG. | Sub-surface drainage is to be associated with future structures development footprint works at the detailed design stage upon development of detailed layouts. |
| **PO18**<br>On-site and off-site erosion and sedimentation is minimised, whether drainage is via formed drainage systems or runoff from the site.<br><br>Where development involves works, sediment fences, earth berms and temporary drainage are provided and located to prevent sediment being transported to adjoining properties, roads and/or drainage systems. | **AO18.1(RAD)**<br>Erosion and sediment control measures are employed during works to prevent run-off in accordance with the Soil Erosion and Sediment Control Guidelines for Queensland, the Queensland Urban Drainage Manual (QUDM) and the CMDG. | Management of on-site and off-site erosion potential is documented in Section 4.2.3 in reference to the solar arrays, and Section 4.3.3 in reference to the laydown areas and associated infrastructure. The requirements are in accordance with IECA (2008) and to meet the intent of the CDMG, and the Queensland Urban Drainage Manual |

# Appendix B Proposed Development Layout




**LEGEND**

- Proposed / Existing Access
- New Farm Fences
- State Controlled Road
- Local Road
- Cadastre
- Site Boundary
- Solar Array Disturbance Footprint
- Vegetation Buffer (7m wide)
- Bushfire/Access Buffer (10m wide) and Security Fence
- Livestock Laneway / Yard
- Optional BESS Location / Site Office / Laydown Area / Substation
- Drainage Line
- Watercourse Buffer (approx. 100m wide)
- Transmission Line Easement
- Flood Area

N

0 250 500 750 1,000
Metres
APPROX SCALE 14,000 @ A3
GDA 2020 MGA Zone 56

**Disclaimer:** While all reasonable care has been taken to ensure the information contained on this map is up to date and accurate, no guarantee is given that the information portrayed is free from error or omission. Please verify the accuracy of all information prior to use.

DATA SOURCES
Imagery from Esri basemap layer.
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PR151484-1
**Preliminary Site Layout**
Callide Solar Power Station

Tracking ID W:\Jobs\PR151376 Mount Murchison\Working\MountMurchisonSolar-SiteLayout_A3L_20221117.mxd
Compiled: 17 November 2022

# Appendix C Hydrologic Response of Solar Farms Paper

# Hydrologic Response of Solar Farms

Lauren M. Cook, S.M.ASCE[1]; and Richard H. McCuen, M.ASCE[2]

**Abstract:** Because of the benefits of solar energy, the number of solar farms is increasing; however, their hydrologic impacts have not been studied. The goal of this study was to determine the hydrologic effects of solar farms and examine whether or not storm-water management is needed to control runoff volumes and rates. A model of a solar farm was used to simulate runoff for two conditions: the pre- and postpaneled conditions. Using sensitivity analyses, modeling showed that the solar panels themselves did not have a significant effect on the runoff volumes, peaks, or times to peak. However, if the ground cover under the panels is gravel or bare ground, owing to design decisions or lack of maintenance, the peak discharge may increase significantly with storm-water management needed. In addition, the kinetic energy of the flow that drains from the panels was found to be greater than that of the rainfall, which could cause erosion at the base of the panels. Thus, it is recommended that the grass beneath the panels be well maintained or that a buffer strip be placed after the most downgradient row of panels. This study, along with design recommendations, can be used as a guide for the future design of solar farms. **DOI:** 10.1061/(ASCE)HE.1943-5584.0000530. © *2013 American Society of Civil Engineers.*

**CE Database subject headings:** Hydrology; Land use; Solar power; Floods; Surface water; Runoff; Stormwater management.

**Author keywords:** Hydrology; Land use change; Solar energy; Flooding; Surface water runoff; Storm-water management.



## Introduction

Storm-water management practices are generally implemented to reverse the effects of land-cover changes that cause increases in volumes and rates of runoff. This is a concern posed for new types of land-cover change such as the solar farm. Solar energy is a renewable energy source that is expected to increase in importance in the near future. Because solar farms require considerable land, it is necessary to understand the design of solar farms and their potential effect on erosion rates and storm runoff, especially the impact on offsite properties and receiving streams. These farms can vary in size from 8 ha (20 acres) in residential areas to 250 ha (600 acres) in areas where land is abundant.

The solar panels are impervious to rain water; however, they are mounted on metal rods and placed over pervious land. In some cases, the area below the panel is paved or covered with gravel. Service roads are generally located between rows of panels. Although some panels are stationary, others are designed to move so that the angle of the panel varies with the angle of the sun. The angle can range, depending on the latitude, from 22° during the summer months to 74° during the winter months. In addition, the angle and direction can also change throughout the day. The issue posed is whether or not these rows of impervious panels will change the runoff characteristics of the site, specifically increase runoff volumes or peak discharge rates. If the increases are hydrologically significant, storm-water management facilities may be needed. Additionally, it is possible that the velocity of water draining from the edge of the panels is sufficient to cause erosion of the soil below the panels, especially where the maintenance roadways are bare ground.

The outcome of this study provides guidance for assessing the hydrologic effects of solar farms, which is important to those who plan, design, and install arrays of solar panels. Those who design solar farms may need to provide for storm-water management. This study investigated the hydrologic effects of solar farms, assessed whether or not storm-water management might be needed, and if the velocity of the runoff from the panels could be sufficient to cause erosion of the soil below the panels.

## Model Development

Solar farms are generally designed to maximize the amount of energy produced per unit of land area, while still allowing space for maintenance. The hydrologic response of solar farms is not usually considered in design. Typically, the panels will be arrayed in long rows with separations between the rows to allow for maintenance vehicles. To model a typical layout, a unit width of one panel was assumed, with the length of the downgradient strip depending on the size of the farm. For example, a solar farm with 30 rows of 200 panels each could be modeled as a strip of 30 panels with space between the panels for maintenance vehicles. Rainwater that drains from the upper panel onto the ground will flow over the land under the 29 panels on the downgradient strip. Depending on the land cover, infiltration losses would be expected as the runoff flows to the bottom of the slope.

To determine the effects that the solar panels have on runoff characteristics, a model of a solar farm was developed. Runoff in the form of sheet flow without the addition of the solar panels served as the prepaneled condition. The paneled condition assumed a downgradient series of cells with one solar panel per ground cell. Each cell was separated into three sections: wet, dry, and spacer.

The dry section is that portion directly underneath the solar panel, unexposed directly to the rainfall. As the angle of the panel from the horizontal increases, more of the rain will fall directly onto

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the ground; this section of the cell is referred to as the wet section. The spacer section is the area between the rows of panels used by maintenance vehicles. Fig. 1 is an image of two solar panels and the spacer section allotted for maintenance vehicles. Fig. 2 is a schematic of the wet, dry, and spacer sections with their respective dimensions. In Fig. 1, tracks from the vehicles are visible on what is modeled within as the spacer section. When the solar panel is horizontal, then the length longitudinal to the direction that runoff will occur is the length of the dry and wet sections combined. Runoff from a dry section drains onto the downgradient spacer section. Runoff from the spacer section flows to the wet section of the next downgradient cell. Water that drains from a solar panel falls directly onto the spacer section of that cell.

The length of the spacer section is constant. During a storm event, the loss rate was assumed constant for the 24-h storm because a wet antecedent condition was assumed. The lengths of the wet and dry sections changed depending on the angle of the solar panel. The total length of the wet and dry sections was set equal to the length of one horizontal solar panel, which was assumed to be 3.5 m. When a solar panel is horizontal, the dry section length would equal 3.5 m and the wet section length would be zero. In the paneled condition, the dry section does not receive direct rainfall because the rain first falls onto the solar panel then drains onto the spacer section. However, the dry section does infiltrate some of the runoff that comes from the upgradient wet section. The wet section was modeled similar to the spacer section with rain falling directly onto the section and assuming a constant loss rate.

For the presolar panel condition, the spacer and wet sections are modeled the same as in the paneled condition; however, the cell does not include a dry section. In the prepaneled condition, rain falls directly onto the entire cell. When modeling the prepaneled condition, all cells receive rainfall at the same rate and are subject to losses. All other conditions were assumed to remain the same such that the prepaneled and paneled conditions can be compared.

Rainfall was modeled after an natural resources conservation service (NRCS) Type II Storm (McCuen 2005) because it is an accurate representation of actual storms of varying characteristics that are imbedded in intensity-duration-frequency (IDF) curves. For each duration of interest, a dimensionless hyetograph was developed using a time increment of 12 s over the duration of the storm (see Fig. 3). The depth of rainfall that corresponds to each storm magnitude was then multiplied by the dimensionless hyetograph. For a 2-h storm duration, depths of 40.6, 76.2, and 101.6 mm were used for the 2-, 25-, and 100-year events. The 2- and 6-h duration hyetographs were developed using the center portion of the 24-h storm, with the rainfall depths established with the Baltimore IDF curve. The corresponding depths for a 6-h duration were 53.3, 106.7, and 132.1 mm, respectively. These magnitudes were chosen to give a range of storm conditions.

During each time increment, the depth of rain is multiplied by the cell area to determine the volume of rain added to each section of each cell. This volume becomes the storage in each cell. Depending on the soil group, a constant volume of losses was subtracted from the storage. The runoff velocity from a solar panel was calculated using Manning's equation, with the hydraulic radius for sheet flow assumed to equal the depth of the storage on the panel (Bedient and Huber 2002). Similar assumptions were made to compute the velocities in each section of the surface sections.

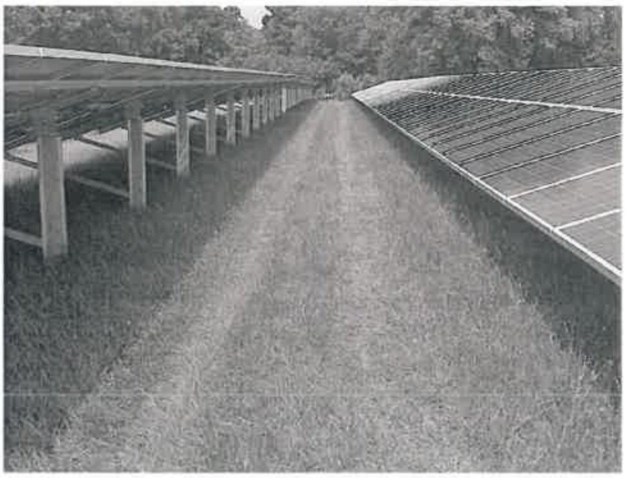

**Fig. 1.** Maintenance or "spacer" section between two rows of solar panels (photo by John E. Showler, reprinted with permission)

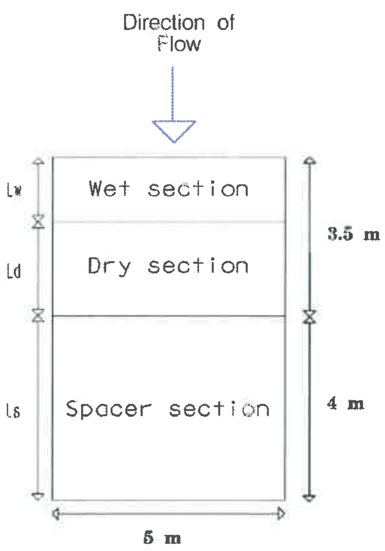


**Fig. 2.** Wet, dry, and spacer sections of a single cell with lengths *Lw*, *Ls*, and *Ld* with the solar panel covering the dry section

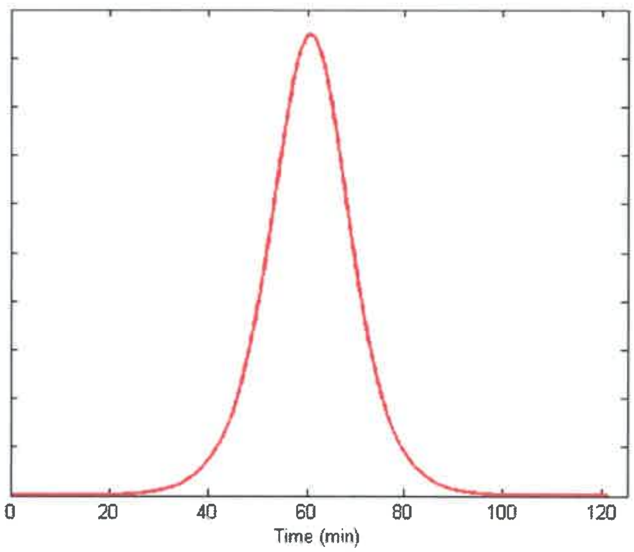


**Fig. 3.** Dimensionless hyetograph of 2-h Type II storm

Runoff from one section to the next and then to the next downgradient cell was routed using the continuity of mass. The routing coefficient depended on the depth of flow in storage and the velocity of runoff. Flow was routed from the wet section to the dry section to the spacer section, with flow from the spacer section draining to the wet section of the next cell. Flow from the most downgradient cell was assumed to be the outflow. Discharge rates and volumes from the most downgradient cell were used for comparisons between the prepaneled and paneled conditions.

## Alternative Model Scenarios

To assess the effects of the different variables, a section of 30 cells, each with a solar panel, was assumed for the base model. Each cell was separated individually into wet, dry, and spacer sections. The area had a total ground length of 225 m with a ground slope of 1% and width of 5 m, which was the width of an average solar panel. The roughness coefficient (Engman 1986) for the silicon solar panel was assumed to be that of glass, 0.01. Roughness coefficients of 0.15 for grass and 0.02 for bare ground were also assumed. Loss rates of 0.5715 cm/h (0.225 in./h) and 0.254 cm/h (0.1 in./h) for B and C soils, respectively, were assumed.

The prepaneled condition using the 2-h, 25-year rainfall was assumed for the base condition, with each cell assumed to have a good grass cover condition. All other analyses were made assuming a paneled condition. For most scenarios, the runoff volumes and peak discharge rates from the paneled model were not significantly greater than those for the prepaneled condition. Over a total length of 225 m with 30 solar panels, the runoff increased by 0.26 $m^3$, which was a difference of only 0.35%. The slight increase in runoff volume reflects the slightly higher velocities for the paneled condition. The peak discharge increased by 0.0013 $m^3$, a change of only 0.31%. The time to peak was delayed by one time increment, i.e., 12 s. Inclusion of the panels did not have a significant hydrologic impact.

### Storm Magnitude

The effect of storm magnitude was investigated by changing the magnitude from a 25-year storm to a 2-year storm. For the 2-year storm, the rainfall and runoff volumes decreased by approximately 50%. However, the runoff from the paneled watershed condition increased compared to the prepaneled condition by approximately the same volume as for the 25-year analysis, 0.26 $m^3$. This increase represents only a 0.78% increase in volume. The peak discharge and the time to peak did not change significantly. These results reflect runoff from a good grass cover condition and indicated that the general conclusion of very minimal impacts was the same for different storm magnitudes.

### Ground Slope

The effect of the downgradient ground slope of the solar farm was also examined. The angle of the solar panels would influence the velocity of flows from the panels. As the ground slope was increased, the velocity of flow over the ground surface would be closer to that on the panels. This could cause an overall increase in discharge rates. The ground slope was changed from 1 to 5%, with all other conditions remaining the same as the base conditions.

With the steeper incline, the volume of losses decreased from that for the 1% slope, which is to be expected because the faster velocity of the runoff would provide less opportunity for infiltration. However, between the prepaneled and paneled conditions, the increase in runoff volume was less than 1%. The peak discharge and the time to peak did not change. Therefore, the greater ground slope did not significantly influence the response of the solar farm.

### Soil Type

The effect of soil type on the runoff was also examined. The soil group was changed from B soil to C soil by varying the loss rate. As expected, owing to the higher loss rate for the C soil, the depths of runoff increased by approximately 7.5% with the C soil when compared with the volume for B soils. However, the runoff volume for the C soil condition only increased by 0.17% from the prepaneled condition to the paneled condition. In comparison with the B soil, a difference of 0.35% in volume resulted between the two conditions. Therefore, the soil group influenced the actual volumes and rates, but not the relative effect of the paneled condition when compared to the prepaneled condition.

### Panel Angle

Because runoff velocities increase with slope, the effect of the angle of the solar panel on the hydrologic response was examined. Analyses were made for angles of 30° and 70° to test an average range from winter to summer. The hydrologic response for these angles was compared to that of the base condition angle of 45°. The other site conditions remained the same. The analyses showed that the angle of the panel had only a slight effect on runoff volumes and discharge rates. The lower angle of 30° was associated with an increased runoff volume, whereas the runoff volume decreased for the steeper angle of 70° when compared with the base condition of 45°. However, the differences (~0.5%) were very slight. Nevertheless, these results indicate that, when the solar panel was closer to horizontal, i.e., at a lower angle, a larger difference in runoff volume occurred between the prepaneled and paneled conditions. These differences in the response result are from differences in loss rates.

The peak discharge was also lower at the lower angle. At an angle of 30°, the peak discharge was slightly lower than at the higher angle of 70°. For the 2-h storm duration, the time to peak of the 30° angle was 2 min delayed from the time to peak of when the panel was positioned at a 70° angle, which reflects the longer travel times across the solar panels.

### Storm Duration

To assess the effect of storm duration, analyses were made for 6-h storms, testing magnitudes for 2-, 25-, and 100-year return periods, with the results compared with those for the 2-h rainfall events. The longer storm duration was tested to determine whether a longer duration storm would produce a different ratio of increase in runoff between the prepaneled and paneled conditions. When compared to runoff volumes from the 2-h storm, those for the 6-h storm were 34% greater in both the paneled and prepaneled cases. However, when comparing the prepaneled to the paneled condition, the increase in the runoff volume with the 6-h storm was less than 1% regardless of the return period. The peak discharge and the time-to-peak did not differ significantly between the two conditions. The trends in the hydrologic response of the solar farm did not vary with storm duration.

### Ground Cover

The ground cover under the panels was assumed to be a native grass that received little maintenance. For some solar farms, the area beneath the panel is covered in gravel or partially paved because the panels prevent the grass from receiving sunlight. Depending on the



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volume of traffic, the spacer cell could be grass, patches of grass, or bare ground. Thus, it was necessary to determine whether or not these alternative ground-cover conditions would affect the runoff characteristics. This was accomplished by changing the Manning's $n$ for the ground beneath the panels. The value of $n$ under the panels, i.e., the dry section, was set to 0.015 for gravel, with the value for the spacer or maintenance section set to 0.02, i.e., bare ground. These can be compared to the base condition of a native grass ($n = 0.15$). A good cover should promote losses and delay the runoff.

For the smoother surfaces, the velocity of the runoff increased and the losses decreased, which resulted in increasing runoff volumes. This occurred both when the ground cover under the panels was changed to gravel and when the cover in the spacer section was changed to bare ground. Owing to the higher velocities of the flow, runoff rates from the cells increased significantly such that it was necessary to reduce the computational time increment. Fig. 4(a) shows the hydrograph from a 30-panel area with a time increment of 12 s. With a time increment of 12 s, the water in each cell is discharged at the end of every time increment, which results in no attenuation of the flow; thus, the undulations shown in Fig. 4(a) result. The time increment was reduced to 3 s for the 2-h storm, which resulted in watershed smoothing and a rational hydrograph shape [Fig. 4(b)]. The results showed that the storm runoff

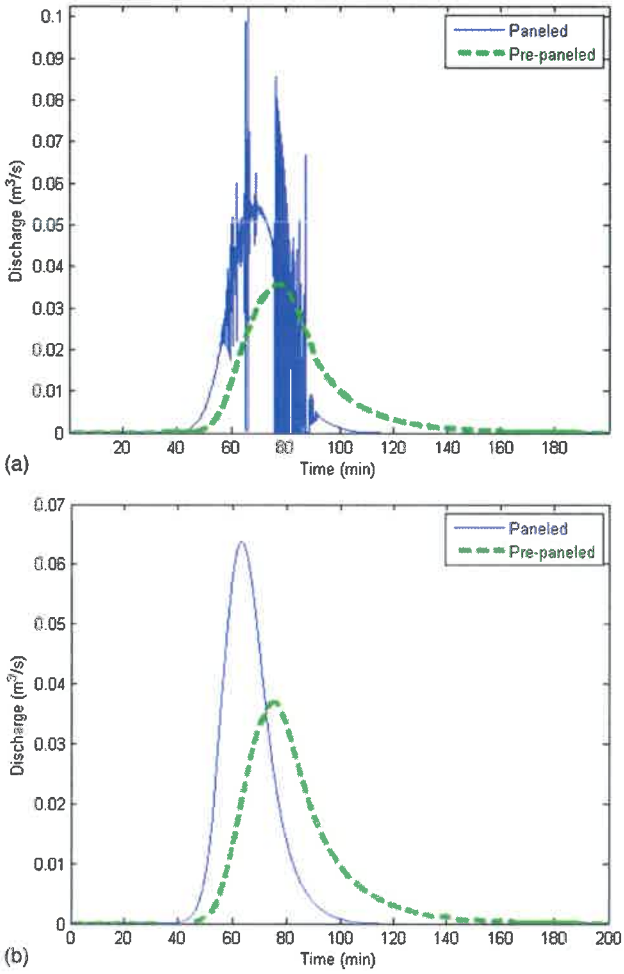


**Fig. 4.** Hydrograph with time increment of (a) 12 s; (b) 3 s with Manning's $n$ for bare ground

increased by 7% from the grass-covered scenario to the scenario with gravel under the panel. The peak discharge increased by 73% for the gravel ground cover when compared with the grass cover without the panels. The time to peak was 10 min less with the gravel than with the grass, which reflects the effect of differences in surface roughness and the resulting velocities.

If maintenance vehicles used the spacer section regularly and the grass cover was not adequately maintained, the soil in the spacer section would be compacted and potentially the runoff volumes and rates would increase. Grass that is not maintained has the potential to become patchy and turn to bare ground. The grass under the panel may not get enough sunlight and die. Fig. 1 shows the result of the maintenance trucks frequently driving in the spacer section, which diminished the grass cover.

The effect of the lack of solar farm maintenance on runoff characteristics was modeled by changing the Manning's $n$ to a value of 0.02 for bare ground. In this scenario, the roughness coefficient for the ground under the panels, i.e., the dry section, as well as in the spacer cell was changed from grass covered to bare ground ($n = 0.02$).The effects were nearly identical to that of the gravel. The runoff volume increased by 7% from the grass-covered to the bare-ground condition. The peak discharge increased by 72% when compared with the grass-covered condition. The runoff for the bare-ground condition also resulted in an earlier time to peak by approximately 10 min. Two other conditions were also modeled, showing similar results. In the first scenario, gravel was placed directly under the panel, and healthy grass was placed in the spacer section, which mimics a possible design decision. Under these conditions, the peak discharge increased by 42%, and the volume of runoff increased by 4%, which suggests that storm-water management would be necessary if gravel is placed anywhere.

Fig. 5 shows two solar panels from a solar farm in New Jersey. The bare ground between the panels can cause increased runoff rates and reductions in time of concentration, both of which could necessitate storm-water management. The final condition modeled involved the assumption of healthy grass beneath the panels and bare ground in the spacer section, which would simulate the condition of unmaintained grass resulting from vehicles that drive over the spacer section. Because the spacer section is 53% of the cell, the change in land cover to bare ground would reduce losses and decrease runoff travel times, which would cause runoff to amass as it

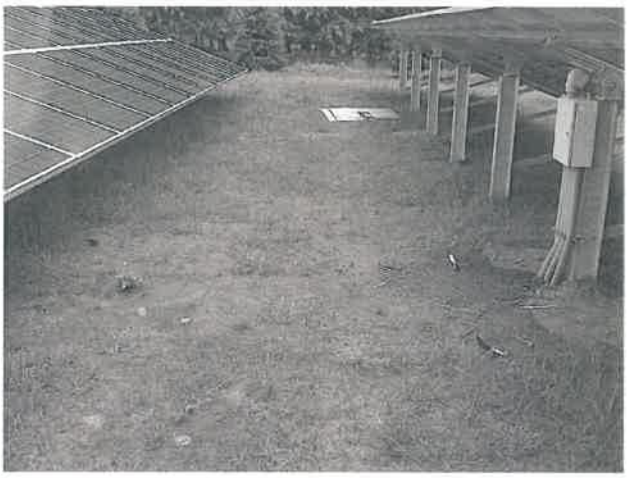

**Fig. 5.** Site showing the initiation of bare ground below the panels, which increases the potential for erosion (photo by John Showler, reprinted with permission)



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moves downgradient. With the spacer section as bare ground, the peak discharge increased by 100%, which reflected the increases in volume and decrease in timing. These results illustrate the need for maintenance of the grass below and between the panels.

## Design Suggestions

With well-maintained grass underneath the panels, the solar panels themselves do not have much effect on total volumes of the runoff or peak discharge rates. Although the panels are impervious, the rainwater that drains from the panels appears as runoff over the downgradient cells. Some of the runoff infiltrates. If the grass cover of a solar farm is not maintained, it can deteriorate either because of a lack of sunlight or maintenance vehicle traffic. In this case, the runoff characteristics can change significantly with both runoff rates and volumes increasing by significant amounts. In addition, if gravel or pavement is placed underneath the panels, this can also contribute to a significant increase in the hydrologic response.

If bare ground is foreseen to be a problem or gravel is to be placed under the panels to prevent erosion, it is necessary to counteract the excess runoff using some form of storm-water management. A simple practice that can be implemented is a buffer strip (Dabney et al. 2006) at the downgradient end of the solar farm. The buffer strip length must be sufficient to return the runoff characteristics with the panels to those of runoff experienced before the gravel and panels were installed. Alternatively, a detention basin can be installed.

A buffer strip was modeled along with the panels. For approximately every 200 m of panels, or 29 cells, the buffer must be 5 cells long (or 35 m) to reduce the runoff volume to that which occurred before the panels were added. Even if a gravel base is not placed under the panels, the inclusion of a buffer strip may be a good practice when grass maintenance is not a top funding priority. Fig. 6 shows the peak discharge from the graveled surface versus the length of the buffer needed to keep the discharge to prepaneled peak rate.

Water draining from a solar panel can increase the potential for erosion of the spacer section. If the spacer section is bare ground, the high kinetic energy of water draining from the panel can cause soil detachment and transport (Garde and Raju 1977; Beuselinck et al. 2002). The amount and risk of erosion was modeled using the velocity of water coming off a solar panel compared with the velocity and intensity of the rainwater. The velocity of panel

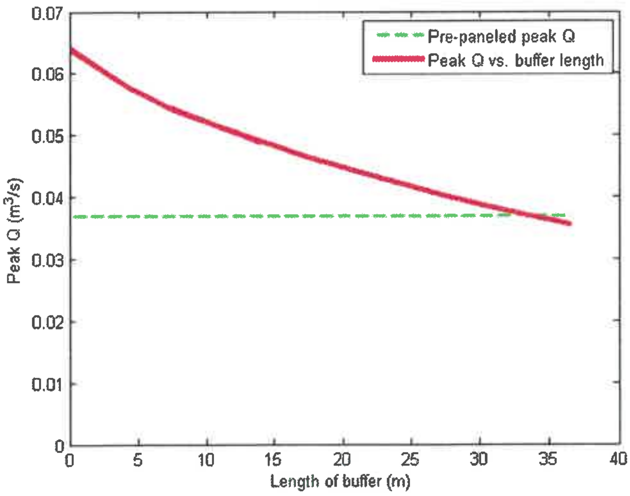


**Fig. 6.** Peak discharge over gravel compared with buffer length

runoff was calculated using Manning's equation, and the velocity of falling rainwater was calculated using the following:

$$V_t = 120\, d_r^{0.35} \tag{1}$$

where $d_r$ = diameter of a raindrop, assumed to be 1 mm. The relationship between kinetic energy and rainfall intensity is

$$K_e = 916 + 330 \log_{10} i \tag{2}$$

where $i$ = rainfall intensity (in./h) and $K_e$ = kinetic energy (ft-tons per ac-in. of rain) of rain falling onto the wet section and the panel, as well as the water flowing off of the end of the panel (Wischmeier and Smith 1978). The kinetic energy (Salles et al. 2002) of the rainfall was greater than that coming off the panel, but the area under the panel (i.e., the product of the length, width, and cosine of the panel angle) is greater than the area under the edge of the panel where the water drains from the panel onto the ground. Thus, dividing the kinetic energy by the respective areas gives a more accurate representation of the kinetic energy experienced by the soil. The energy of the water draining from the panel onto the ground can be nearly 10 times greater than the rain itself falling onto the ground area. If the solar panel runoff falls onto an unsealed soil, considerable detachment can result (Motha et al. 2004). Thus, because of the increased kinetic energy, it is possible that the soil is much more prone to erosion with the panels than without. Where panels are installed, methods of erosion control should be included in the design.

## Conclusions

Solar farms are the energy generators of the future; thus, it is important to determine the environmental and hydrologic effects of these farms, both existing and proposed. A model was created to simulate storm-water runoff over a land surface without panels and then with solar panels added. Various sensitivity analyses were conducted including changing the storm duration and volume, soil type, ground slope, panel angle, and ground cover to determine the effect that each of these factors would have on the volumes and peak discharge rates of the runoff.

The addition of solar panels over a grassy field does not have much of an effect on the volume of runoff, the peak discharge, nor the time to peak. With each analysis, the runoff volume increased slightly but not enough to require storm-water management facilities. However, when the land-cover type was changed under the panels, the hydrologic response changed significantly. When gravel or pavement was placed under the panels, with the spacer section left as patchy grass or bare ground, the volume of the runoff increased significantly and the peak discharge increased by approximately 100%. This was also the result when the entire cell was assumed to be bare ground.

The potential for erosion of the soil at the base of the solar panels was also studied. It was determined that the kinetic energy of the water draining from the solar panel could be as much as 10 times greater than that of rainfall. Thus, because the energy of the water draining from the panels is much higher, it is very possible that soil below the base of the solar panel could erode owing to the concentrated flow of water off the panel, especially if there is bare ground in the spacer section of the cell. If necessary, erosion control methods should be used.

Bare ground beneath the panels and in the spacer section is a realistic possibility (see Figs. 1 and 5). Thus, a good, well-maintained grass cover beneath the panels and in the spacer section is highly recommended. If gravel, pavement, or bare ground is



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deemed unavoidable below the panels or in the spacer section, it may necessary to add a buffer section to control the excess runoff volume and ensure adequate losses. If these simple measures are taken, solar farms will not have an adverse hydrologic impact from excess runoff or contribute eroded soil particles to receiving streams and waterways.


## Acknowledgments

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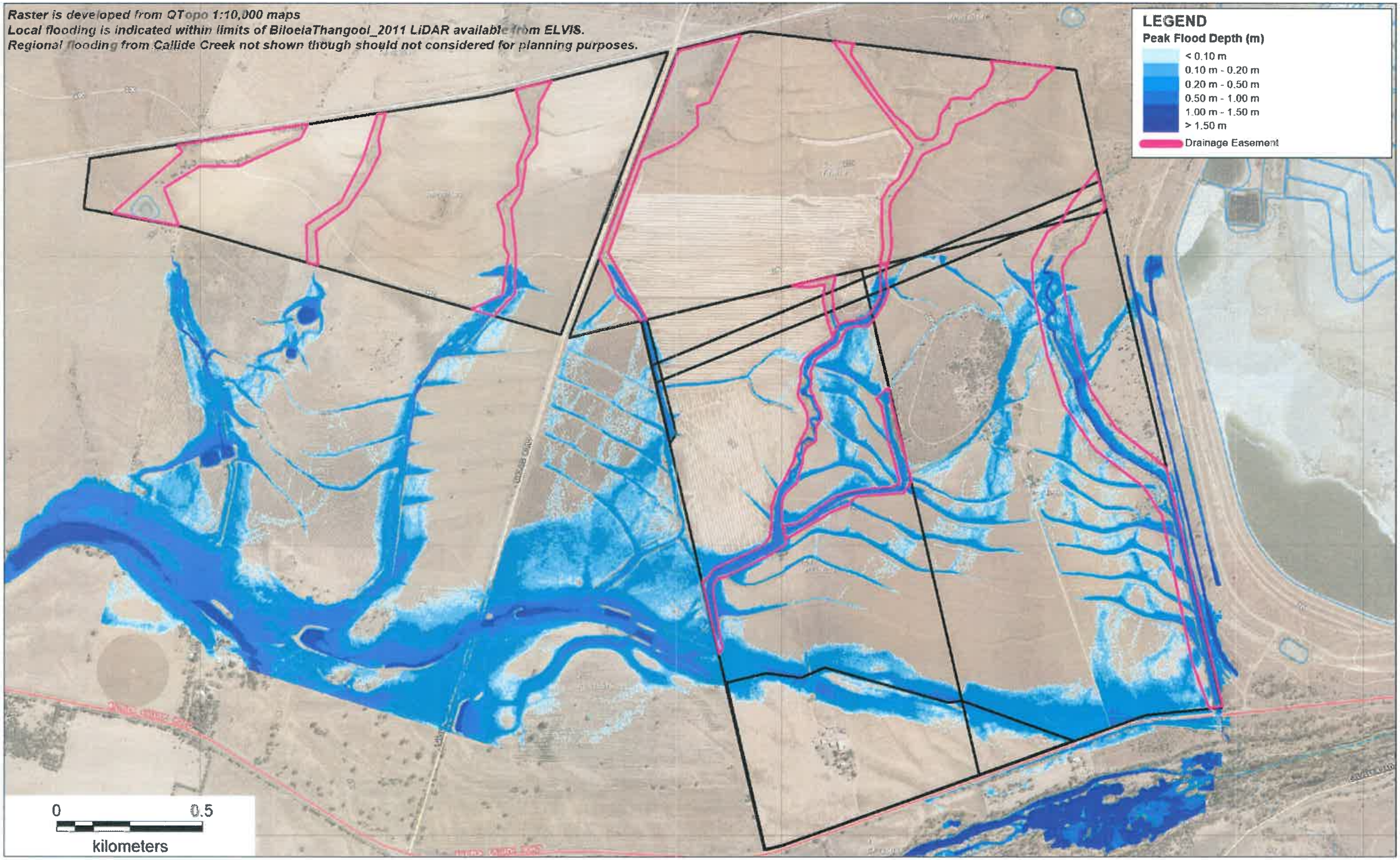
# Appendix D Hydraulic modelling

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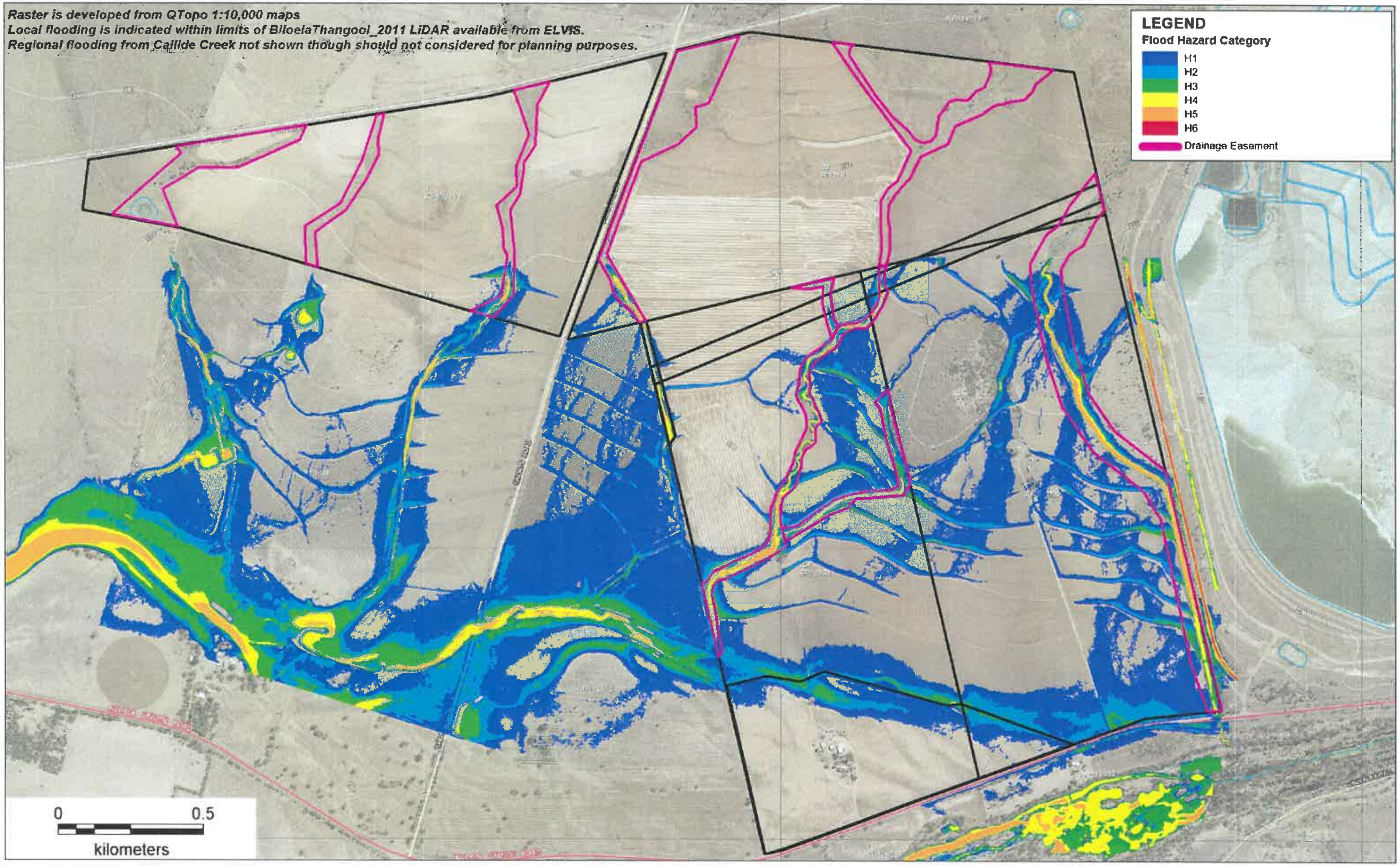


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# Appendix E ARR 2019 flood hazard guidance extract

vehicles or building thresholds separately. In many instances, this will suit the requirements of specific analyses. For example, if the required assessment is to determine whether a road evacuation route is trafficable for a given flood event, then the vehicle stability threshold curves should be applied. Likewise, if the assessment is to determine which buildings would be suitable for shelter in place during a PMF event, then the building stability thresholds for flood hazard should be used in the analysis.

## 7.2.7. General Flood Hazard Curves

When dealing with specific floodplain management or emergency management analysis there may be a clear need to use specific thresholds as described above. However, particularly in a preliminary assessment of risks or as part of a constraints analysis such as might be applied as part of a strategic floodplain management assessment, there is also an acknowledged need for a combined set of hazard vulnerability curves, which can be used as a general classification of flood hazard on a floodplain. A suggested set of curves based on the referenced thresholds presented above is provided in Figure 6.7.9.

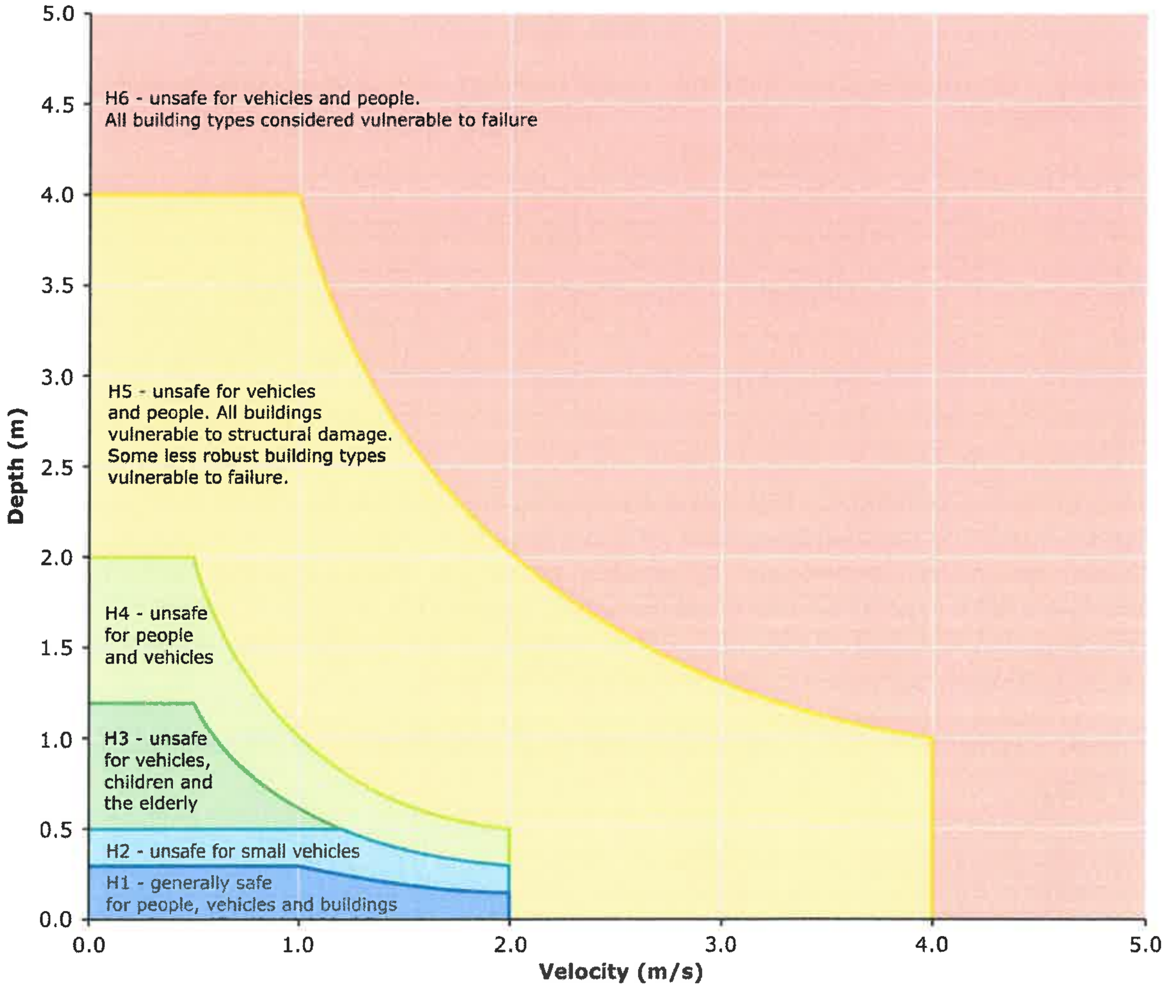


Figure 6.7.9. Combined Flood Hazard Curves (Smith et al., 2014)

The combined flood hazard curves presented in Figure 6.7.9 set hazard thresholds that relate to the vulnerability of the community when interacting with floodwaters. The combined curves are divided into hazard classifications that relate to specific vulnerability thresholds as described in Table 6.7.3. Table 6.7.4 provides the limits for the classifications in Table 6.7.3

Table 6.7.3. Combined Hazard Curves - Vulnerability Thresholds (Smith et al., 2014)

| Hazard Vulnerability Classification | Description |
|---|---|
| H1 | Generally safe for vehicles, people and buildings. |
| H2 | Unsafe for small vehicles. |
| H3 | Unsafe for vehicles. children and the elderly. |
| H4 | Unsafe for vehicles and people. |
| H5 | Unsafe for vehicles and people. All buildings vulnerable to structural damage. Some less robust buildings subject to failure. |
| H6 | Unsafe for vehicles and people. All building types considered vulnerable to failure. |

Table 6.7.4. Combined Hazard Curves - Vulnerability Thresholds Classification Limits (Smith et al., 2014)

| Hazard Vulnerability Classification | Classification Limit (D and V in combination) | Limiting Still Water Depth (D) | Limiting Velocity (V) |
|---|---|---|---|
| H1 | D*V ≤ 0.3 | 0.3 | 2.0 |
| H2 | D*V ≤ 0.6 | 0.5 | 2.0 |
| H3 | D*V ≤ 0.6 | 1.2 | 2.0 |
| H4 | D*V ≤ 1.0 | 2.0 | 2.0 |
| H5 | D*V ≤ 4.0 | 4.0 | 4.0 |
| H6 | D*V > 4.0 | - | - |

Importantly, the vulnerability thresholds identified in the flood hazard curves described above can be applied to the best description of flood behaviour available for a subject site. In this regard, the hazard curves can be applied equally to flood behaviour estimates from measured data, simpler 1D numerical modelling approaches, through to complex 2D model estimates with the level of accuracy and uncertainty of the flood hazard estimate linked to the method used to derive the flood behaviour estimate.

## 7.2.8. Isolation, Effective Warning Time, Rate of Rise and Time of Day

The effective warning time available to respond to a flood event, the rate of rise of floodwaters, the time of day a flood occurs, and isolation from safety by floodwaters and impassable terrain are all factors that may increase the potential for people to be exposed to hazardous flood situations. These factors are important considerations that influence the vulnerability of communities to flooding and are important considerations in managing flood risk.

### 7.2.8.1. Isolation

As outlined in AEM Handbook 7 (AEMI, 2014), flooding can isolate parts of the landscape and cut-off evacuation routes to flood-free land. This can result in dangerous situations,

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# Landscape Character and Visual Impact Assessment

**Callide Solar Power Station**

28 February 2023

# Landscape Character and Visual Impact Assessment
# Callide Solar Power Station

AE1206
February 2023

| Version V3 | | |
|---|---|---|
| Issued to | | |
| Claire Driessen, Project Manager, Edify | | |
| Prepared by | Reviewed by | Approved by |
| Jacqueline Mallinson, Senior Spatial Analyst, Accent Environmental | Michael Cramer, Director Accent Environmental | Michael Cramer, Director |

| Previous versions | | | |
|---|---|---|---|
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| | V2 | 8 December 2022 | Submission to Banana Shire Council |



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## Figures

## Tables

## GLOSSARY

| | |
|---|---|
| Applicant | Entity applying for development approval, in this case, Edify (Edify Energy Pty Ltd, may also be termed proponent). |
| alternating current | Alternating current (AC) is an electric current which periodically reverses direction, in contrast to direct current (DC) which flows only in one direction. |
| direct current | An electric current flowing in one direction only. |
| project site | The project site, is the area within which the solar arrays, BESS, substation, office and supporting facilities will be located. |
| magnitude | The measurement of the scale, form and character of a development proposal when compared to the existing condition. In the case of visual assessment this also relates to how far the proposal is from the viewer. Combined with sensitivity, magnitude provides a measurement of impact (TfNSW 2020a). |
| mitigation | The action of reducing the severity and magnitude of the impacts of the proposed project. |
| power conversion unit | Device used to convert power from one form to another e.g. from DC to AC or changing the voltage or frequency. |
| project site boundary | The boundary around the project site. |
| Sensitivity | The sensitivity of a landscape character zone or view and its capacity to absorb change of the nature of the proposal. In the case of visual impact this also relates to the type of viewer and number of viewers (TfNSW 2020a). |
| Substation | A set of equipment reducing the high voltage of electrical power transmission to that suitable for supply to consumers. |
| Transformer | Transformers are used to increase or decrease the alternating voltages in electric power applications. |

## ABBREVIATIONS

| | |
|---|---|
| AC | alternating current |
| AHD | Australian Height Datum |
| BESS | battery energy storage system |
| BSC | Banana Shire Council |
| CCTV | closed circuit television |
| DA | Development Application |
| DC | direct current |
| DEM | digital elevation model |
| DPE | Department of Planning and Environment |
| EIS | environmental impact statement |
| ELVIS | Elevation and Depth – Foundation Spatial Data |
| ha | hectares |
| HV | high voltage |
| IBRA | Interim Biogeographic Regionalisation for Australia |
| km | kilometre |
| kV | kilovolt |
| LCVIA | landscape character visual impact assessment |
| LCZ | Landscape character zone |
| LGA | Local Government Area |
| LIIEMA | Landscape Institute and the Institute of Environmental Management and Assessment |

| | |
|---|---|
| LSSE | Large-scale Solar Energy Guideline |
| m | metres |
| MSES | Matter of State Environmental Significance |
| MW | megawatts |
| O&M | operations and maintenance |
| PCT | plant community type |
| PCU | power conversion unit |
| PV | photovoltaic |
| QLD | Queensland |
| SF | solar Farm |
| ZTI | zone of theoretical influence |
| SPS | Solar Power Station |
| TfNSW | Transport for New South Wales |
| VIA | visual impact assessment |
| VP | viewpoint |
| WWBW | waterway barrier works |

# 1 INTRODUCTION

## 1.1 Project overview

Accent Environmental Pty Ltd (Accent) has been commissioned by Edify Energy (Edify) to undertake a landscape character and visual impact assessment to support a Development Application (DA) to Banana Shire Council (BSC). Edify is proposing to develop a solar energy project 8 km northeast of Biloela and 110 km south of Rockhampton in Central Queensland – the Callide Solar Power Station (Callide SPS) (see Figure 1.1).

This landscape character and visual impact assessment delivers an objective statement of the probable impacts on the landscape character and visual environment resulting from the construction of the proposed development. The report outlines the results from site assessment, describing the present landscape character. It documents the assessment of visual impact resulting from the proposal and proposes suitable management measures.

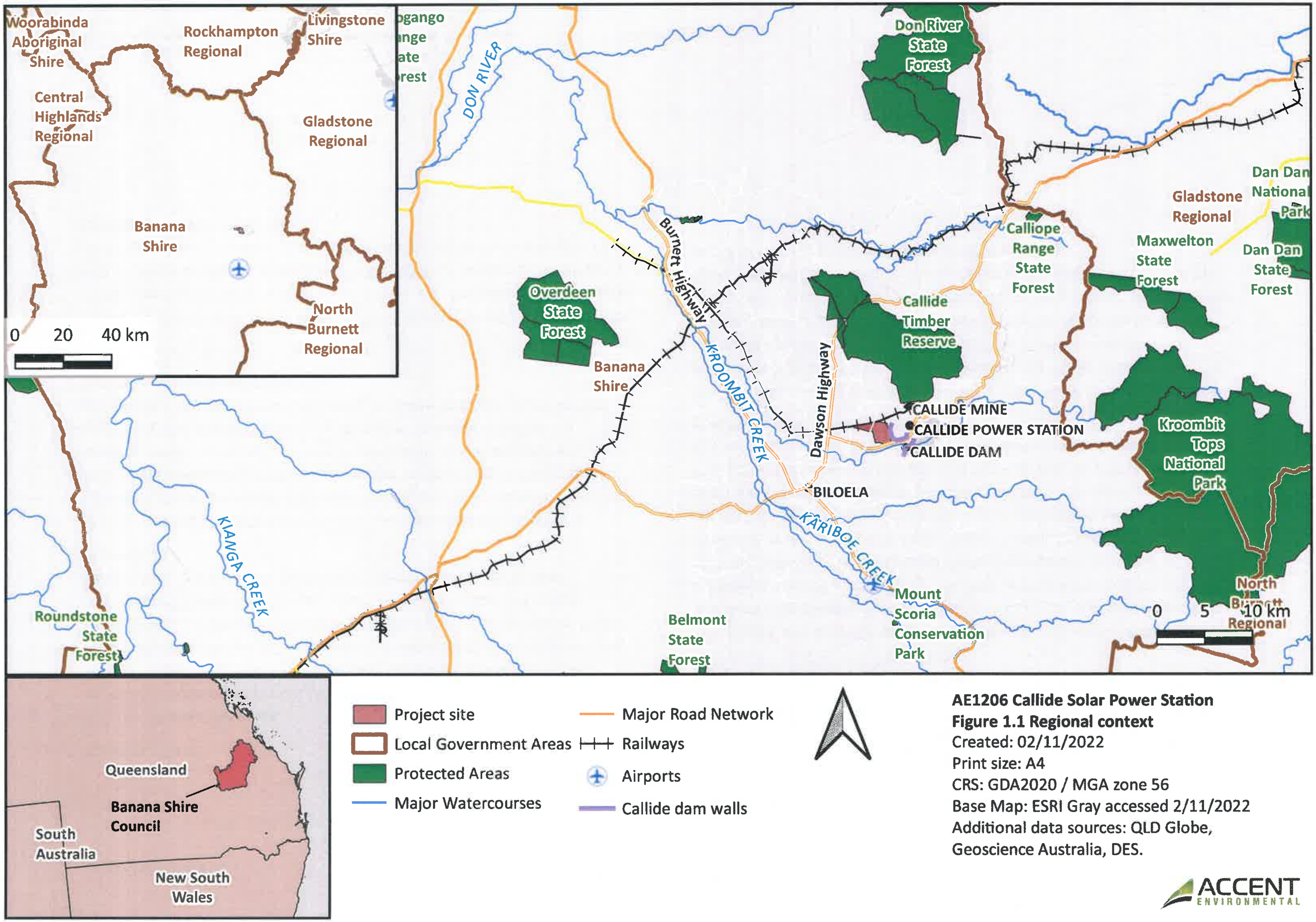
## 1.2 Study area

The proposed Callide SPS is located within the Banana Shire Council local government area (LGA), as shown on Figure 1.1. The LGA is located within the Clarence Lowlands Bioregion of NSW IBRA v.7 Region (IBRA 2020). The region has a variety of land uses including agriculture, mining and energy generation (BSC 2021).

The nearest major road to the proposed Callide SPS is the Burnett Highway (a north-south oriented road) approximately 9 km west of the proposed development footprint. Site access is expected to be off Shorts Road, via Biloela Callide Road, with access points from Shorts Road which bisects the site (Figure 1.2).

The project site includes sections on the east and west of Shorts Road with a combined area of approximately 525 ha of rural land. The project footprint occupies approximately 400 ha of land within the project site, with the remaining land excluded from development, primarily to minimise environmental impacts. Avoided areas include drainage lines running through the property, a flood layer designated by the BSC in the southwest of the property, and easements along the creek running along the eastern boundary of the site and the existing 132 kV transmission line (see Figure 1.2). The existing transmission line and easement run east/ west through the footprint.

The site slopes from 234 m AHD in the northwest to 175 m AHD in the southeast across the site and is surrounded by higher elevations including elevations 100 m higher than the site to the north of the development footprint. Whilst this local elevation is not favourable for immediate visual amenity, receptors beyond these higher elevations will have their view obscured by the topography. Existing vegetation to the south of the site provides further visual buffering.




**AE1206 Callide Solar Power Station**
**Figure 1.1 Regional context**
Created: 02/11/2022
Print size: A4
CRS: GDA2020 / MGA zone 56
Base Map: ESRI Gray accessed 2/11/2022
Additional data sources: QLD Globe, Geoscience Australia, DES.

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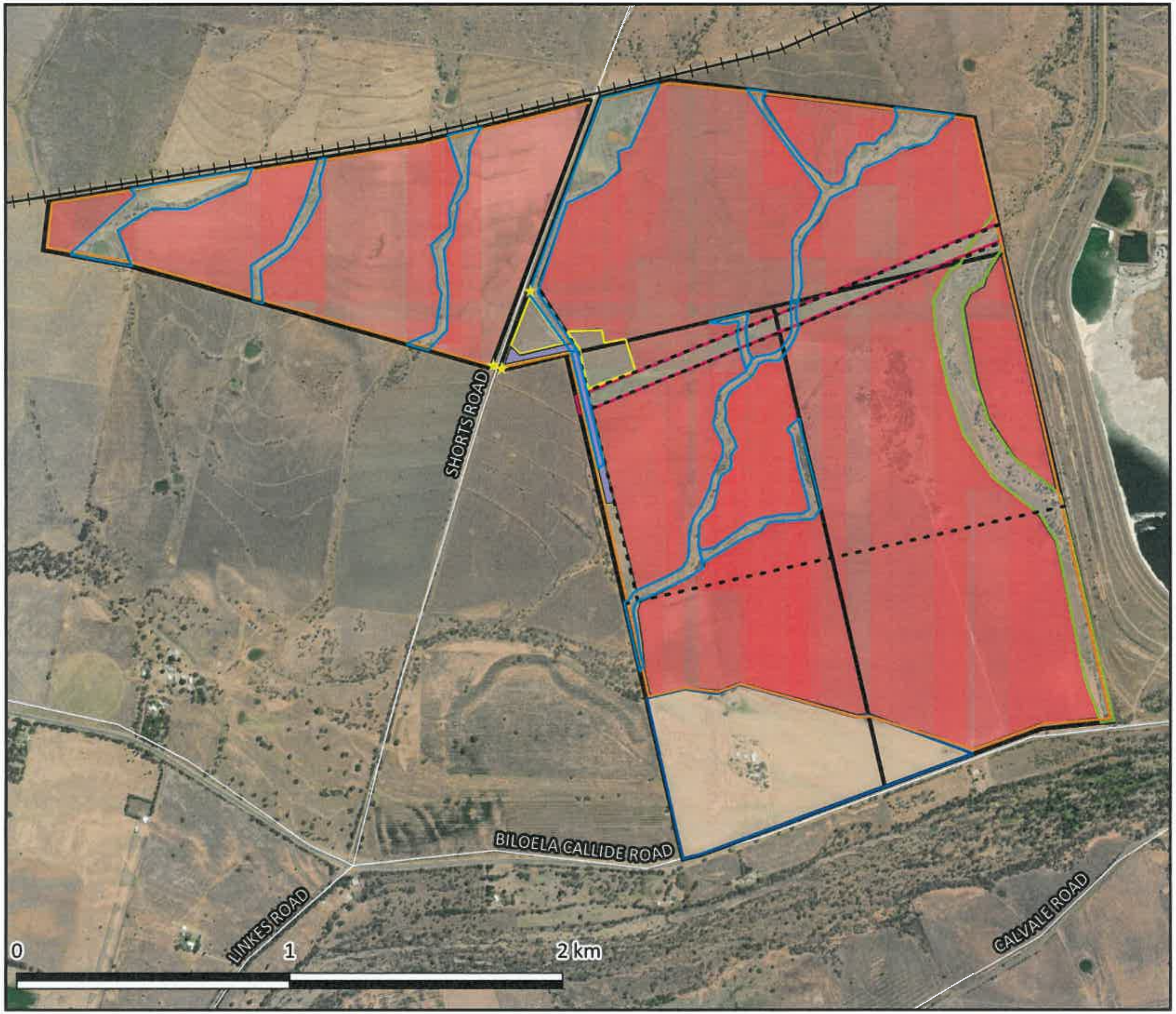


Lot boundaries
Flood Layer exclusion
Waterway buffer
Transmission easement
New farm fences
Drainage lines
optional BESS location/ Site office Laydown Area/ Substation
Livestock Laneway yard
Bushfire/ Access Buffer (10m wide) and security fence
Solar array disturbance footprint
proposed/ existing access

**AE1206 Callide SPS**
**Figure 1.2 Site layout**

Created: 24/02/2023
Print size: A4
CRS: GDA2020 / MGA zone 56
Additional data sources:
Google satellite

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## 1.3 Proposed development

### 1.3.1 Overview

The proposed Callide SPS is a utility scale solar energy development that would generate up to 200 MW (AC) of renewable electricity. Solar energy will be captured by thousands of solar photovoltaic modules, known more commonly as solar panels.

Access to the project area will be via Shorts Road which bisects the development footprint (see Figure 1.2).

General information about the project is provided in Table 1.1 and the project layout is shown in Figure 1.2.

The key visual elements of the project include:

- solar panels interconnected to form solar arrays
- inverters and integrated transformers combined in prefabricated enclosures (one inverter and transformer for each solar array)
- metal mounting structures
- above-ground DC cabling
- central 33 kV switchboard (ring main unit)
- battery energy storage system (BESS) units comprising sealed lithium-ion batteries housed in enclosures that resemble shipping containers in dimensions and appearance and are up to 3 m in height
- a high voltage (HV) substation, fitted with lightning rods, to connect the SPS to the national transmission network (see Figure 1.2).
- a prefabricated operations and maintenance (O&M) building.
- permanent staff and contractor car parking area
- two permanent all-weather site accesses
- internal vehicle access tracks (4 m wide) leading to solar arrays and power control units (PCUs)
- perimeter safety fencing and a fixed, closed-circuit television (CCTV) system
- temporary site compound, lay-down area, and equipment storage areas during construction.

The high voltage substation would be installed adjacent to an existing 132 kV transmission line to the east of the site. The BESS units would be consolidated in a single location next to the substation (centralised) (see Figure 1.2).

Table 1.1 Project overview

| Component | Description |
|---|---|
| **Local Government** | Banana Shire Council |
| **Planning Scheme** | Banana Shire Planning Scheme |
| **Land Use Zone** | Rural use |
| **Planning Overlays** | The site is subject to multiple Planning Scheme overlays:<br>• Agricultural Land Class overlay<br>• Catchment overlay<br>• Extractive Industry overlay<br>• Bushfire Prone Land overlay<br>• Flood Map overlay (note: the area subject to the Flood Map overlay is to be excluded from the proposed footprint or development area). |

| Component | Description |
|---|---|
| **Existing Use** | Small crops and fodder, non-irrigated |
| **Vehicle Entry Points** | Via Shorts Road |
| **Topography** | Gently undulating, generally sloping from northeast to southwest |
| **Waterways** | One unnamed vegetation management watercourse/drainage line, Stream order 1, traverses NE to SE of the subject land and would flow into Callide Creek.<br>The northern portion of the watercourse/drain is also mapped as a Qld waterway for waterway barrier works (WWBW) - moderate.<br>The full length of the watercourse/drain within the subject land is mapped under the regulated vegetation management map as Category R – reef regrowth watercourse vegetation.<br>Finally, the same watercourse/drain is mapped as a Matter of State Environmental Significance (MSES) regulated vegetation (category R – GBR riverine). There is some vegetation along this watercourse/drain, as well as the other unmapped drainage lines traversing typically from north to south through the subject land. |
| **Vegetation** | Cropped land, mostly devoid of other vegetation cover, patch of established trees, some vegetation growth along drainage lines and the vegetation management watercourse. |
| **Fauna** | Not known |

| Component | Description |
|---|---|
| **Heritage places** | Not known |
| **Existing services** | 132 kv transmission line runs approximately W/E through the subject land |
| **Exclusions/ constraints** | Areas of the subject land have already been excluded from the development area or potential footprint. These exclusion areas include:<br>• the SW corner, which represents the Banana Planning Scheme Flood Map Overlay area<br>• the vegetation management watercourse/drainage line (Stream order 1) / WWBW portion / Cat R – reef regrowth watercourse vegetation / MSES regulated vegetation (category R – GBR riverine)<br>• electricity easement<br>• several unmapped drainage lines. |
| **Surrounding Uses** | The surrounding land uses:<br>• Callide Power Station (coal-fired) and tailings dams immediately to the east<br>• Biloela-Callide Road adjoining to the south and Callide Creek and rural land to the south<br>• rural land to the southwest<br>• Moura System Rail line adjacent to the northern boundary of the development footprint. |

### 1.3.2 Solar arrays

The proposed solar arrays will be 70 to 90 m long and approximately 7 m apart. The height of the solar panels will vary across the day as they track the path of the sun; however, the maximum height will not exceed 4.2 m. The solar arrays will be positioned in a north-south alignment and tilt along a single axis in an east to west movement. Each solar panel will be fixed to a metal mounting structure, piled or screwed into the ground without the need for any concrete.

An example of solar panel arrays is shown in Figure 1.3 and a visual representation of the SF components is shown in Figure 1.4.

*Figure 1.3 An example of Solar Farm array blocks*

### 1.3.3 Battery storage

Lithium-ion batteries will be installed in a secure, climate-controlled BESS unit. These batteries allow the storage of power on site which will be distributed to the network outside of the sunlight hours. The modules and configuration of the batteries will be finalised later based on the evolving technology selection. The BESS units shown in Figure 1.4 are an example of a centralised BESS.

### 1.3.4 Power conversion units

Within each array block is a power conversion unit (PCU) which contains the central inverters, step-up transformers and switchgear which convert DC electricity collected from the panels into AC electricity and steps up the voltage to a medium voltage level of 33 kV. The 33 kV lines from the PCUs will be gathered and fed into a single underground cable connecting to the on-site substation.

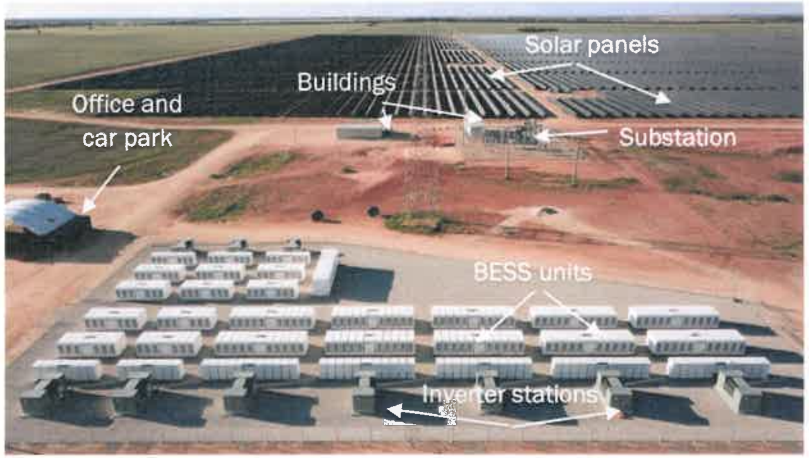



*Figure 1.4 Visual representation of site components*

### 1.3.5 Substation

A high voltage substation will convert the on-site AC reticulated 33 kV electricity to high voltage level of 132kV. The 132 kV supply will then be connected into the grid via a high voltage transmission line. High voltage cabling will be installed in accordance with Australian Standards.

The substation footprint will be approximately 150 m x 200 m (see Figure 1.2). The substation will provide switching and protection of the electrical network and will be fenced separately from the SPS for safety and operational reasons. The connection into the existing transmission line will be owned and operated by the Network Operator, Powerlink Queensland. This will form part of the National Transmission Network. The maximum height of the substation is not expected to exceed 10 m.

### 1.3.6 Site access and internal roads

The site entry points will be from Shorts Road which bisects the site as shown in Figure 1.2. Access points are currently unmade and will be further determined in detailed design.

### 1.3.7 Operations and maintenance building

An operations and maintenance building will be constructed at the site. The dimensions of the building are expected to be approximately 10 m by 8 m and single storey, with a height of up to 5 m. The building is expected to be constructed using neutral Colourbond style materials and accommodate the site office (toilet, kitchen, first aid room, meeting room, reception area).

### 1.3.8 Parking

During operations, operational and maintenance staff vehicles will be accommodated on-site within a vehicle parking area located adjacent to the site office. During construction, vehicles will be parked either at designated laydown areas, storage locations, or where construction activities are occurring.

### 1.3.9 Site fencing/security

To ensure public safety, security fencing will surround the project site using a single high security fence including screening around entire project site. The height of the fence will be approximately 2 m. In addition, to ensure public safety and operational separation, the substation and the adjacent BESS would have its own security fence.

Site fencing would typically be constructed of cyclone fencing material and would feature CCTV security cameras mounted at regular intervals.

### 1.3.10 External lighting

Lighting requirements will be minimal. Lighting would be provided for security reasons and for staff and contractors using the site facilities. External lighting at the project would be restricted to the area where the maintenance shed, permanent site office and yard would be located. All external lighting around buildings would be faced downwards.

### 1.3.11 Operation

During the operational phase of the project, approximately eight full-time equivalent personnel will be required to support the project's operation. The primary activities conducted on site will include day-to-day routine operations, maintenance of infrastructure, and general site maintenance and security. Operation of the solar farm will also likely be supported by local contractors for tasks such as repairs, minor works, weed/vegetation management, fencing and cleaning. The hours of operation will be the normal operating hours of the solar power station will be during daylight hours between the hours of sunrise (say) 7:00 am to sunset 6:00 pm.

#### 1.3.12 Planning context

Callide SPS falls within the Banana Shire Council LGA and is subject to the Banana Shire Council Planning Scheme and this LCVIA is further subject to the 2022 Policy 114 relating to landscape and visual impact assessment within the LGA.

## 1.4 Activities and structures that may have a visual impact

Activities and structures associated with the phases of the proposed Solar Farm development have the potential to have a visual impact on sensitive receivers in the vicinity of the site. These are discussed below.

### 1.4.1 Construction

A number of activities that are likely to occur in the construction (or pre-construction) phase of the proposed development may be visible from areas surrounding the project site, including:

- ongoing detailed site assessment including technical investigations
- various minor civil works at the site access point
- construction facilities, including portable structures and laydown areas
- various construction and directional signage
- excavations and earthworks
- construction-related vehicles and equipment gaining access to site from Shorts Road
- various construction activities such as erection of solar panels and associated electrical infrastructure works
- the use of lighting at night for site security.

The majority of pre-construction and construction activities would be unlikely to result in an unacceptable level of visual impact due to their duration and temporary nature. Construction is expected to take approximately 18 months.

### 1.4.2 Operation

As the number/frequency and type of activities undertaken during the operational phase of the project are minimal, the impacts will be associated less with site activities and more with the presence of structures on site, as follows:

- the presence and operation of the solar arrays and their daily tracking of the sun
- the presence of the BESS units and substation
- the presence of associated infrastructure such as inverter enclosures, gathering and transmission lines, and operations and maintenance building
- the presence of internal access roads
- the presence of fencing and minor site signage
- vehicles and equipment gaining access to site for operations and undertaking maintenance activities

As the operation phase of the proposed Solar Facility is expected to last for 30 years, visual impacts during operations need to be carefully assessed.

### 1.4.3 Decommissioning

At the end of the project's operational life, the project site will be decommissioned. During decommissioning, all above ground infrastructure (and below ground infrastructure to a depth of 1000 mm) will be removed. Key elements of project decommissioning with associated visual impacts are expected to include:

- disconnection of the BESS from the Powerlink connection point at the substation
- disconnection and removal of the solar panels
- removal of all buildings and equipment, with materials recycled wherever possible
- removal of steel framework/supports and cabling for recycling
- removal of underground infrastructure
- removal of fencing (unless requested otherwise by the landholder or relevant authorities)
- site rehabilitation, remediation (if required), and return to pre-existing land use (unless otherwise agreed with the landholder or relevant authorities).

# 2 METHODOLOGY

## 2.1 Guidelines

This landscape character and visual impact assessment is based on a combination of professional qualitative judgement and commonly accepted industry criteria and guidelines, as outlined below:

- Landscape Institute and Institute of Environmental Management & Assessment '*Guidelines for Landscape and Visual Impact Assessment (GLVIA 3)*' (LIIEMA 2013).
- Christine Tudor for Natural England '*An approach to landscape sensitivity assessment – to inform spatial planning and land management* '(Natural England 2019). This document expands on the guidance given by GLVIA 3 for the assessment of landscape and visual susceptibility and value for specific development on specific parcels of land.
- Transport for NSW (TfNSW) *Guideline for landscape character and visual impact assessment* (TfNSW 2020a).
- TfNSW *Beyond the Pavement 2020: Urban design approach and procedures for road and maritime infrastructure planning, design and construction* (TfNSW 2020b).
- NSW Department of Planning and Environment (DPE) *Draft Large-Scale Solar Energy Guideline* (Technical supplement) (DPE 2022) (used to undertake preliminary visual assessment and determine sensitive receiver visual impact rating).
- Banana Shire Council (BSC) *Landscape and Visual Impact Assessment* Policy 114 (BSC 2022).

The assessment was undertaken to:

- assess the existing landscape character within the vicinity of the proposed development footprint
- determine the extent and nature of the potential visual impact of the proposed solar arrays and associated buildings and site infrastructure on the surrounding areas
- identify the need for, and propose, any measures to mitigate and minimise any potential visual impacts.

The assessment involved the following general methodology:

- a desktop review of aerial photography to identify landscape character and potential visual receptors
- open-source elevation data from the Queensland government via ELVIS and QLD Globe
- ground-truthing of desktop research by Accent representatives on 19 and 20 October 2022, during which viewpoints were finalised and photographed to reflect key views of sensitive receivers of the project site
- brief discussions with the sensitive receivers in order to take the most representative photographs and record the specific sensitivities of receivers
- description and evaluation of the existing landscape character and visual environment based on ground truthing and desktop research
- assessment of potential visual impacts of project night lighting on surrounding residences, scenic/significant vistas, air traffic and road corridors
- assessment of the degree of potential reflective visual nuisance (glare and glint) based on the proposed solar arrays, buildings and the existing environment
- preparation of photomontages from key viewpoints
- visual impact assessment using grading matrices, taking into consideration the sensitivity of the landscape and receptors and magnitude of any likely site development impacts

- preparation of operational mitigation and management measures, including consideration of the necessity for site landscaping and visual screening
- consideration of the outcomes of previous community consultation undertaken during the EIS process.

## 2.2 Landscape character assessment criteria

The Landscape Character Assessment is the "*process of identifying and describing variation in the character of the landscape. It seeks to identify and explain the unique combination of elements and features (characteristics) that make landscapes distinctive. This process results in the production of a Landscape Character Assessment*" (LIIEMA, 2013).

As outlined in the LIIEMA (2013) it is important to assess landscape impact and visual impact separately although they are connected. The landscape baseline assessment outlined below also informs the visual assessment in Section **4.** The effects of the development on the landscape should be assessed as effects on an environmental resource.

In assessing the landscape character effects of a development, the primary considerations are:

- landscape baseline made up of the pre-existing landscape elements and characteristics which describe the landscape character
- sensitivity of the landscape resource and its ability to absorb change
- scale or magnitude of the landscape effects resulting from the development.

Combining these elements enables the impact on the landscape character as a result of the development to be assessed.

### 2.2.1 Sensitivity of landscape resource

The sensitivity of the landscape resource as a receptor is assigned based on the baseline landscape character and the value attached to it. It also considers the susceptibility of the landscape character to disturbance or change due to development.

As defined in the guidance document *An approach to landscape sensitivity assessment – to inform spatial planning and land management* (Natural England 2019), landscape sensitivity refers to:

> *"Within the context of spatial planning and land management, landscape sensitivity is a term applied to landscape character and the associated visual resource, combining judgements of their susceptibility to the specific development type / development scenario or other change being considered together with the value(s) related to that landscape and visual resource. Landscape sensitivity may be regarded as a measure of the resilience, or robustness, of a landscape to withstand specified change arising from development types or land management practices, without undue negative effects on the landscape and visual baseline and their value."*

The criteria in Table 2.1 outlines categories of sensitivity adapted from LIIEMA guidelines (2013) and the NSW LSSE guidelines (2022).

*Table 2.1 Rating criteria for Landscape Resource Sensitivity*

| Sensitivity rating | Landscape resource criteria |
|---|---|
| **Very high** | Nationally designated/valued/ protected landscape and landscape features; strong/distinctive landscape characteristics: absence of landscape detractors. Rare receptor in excellent condition. A landscape receptor extremely sensitive to disturbance or change in character due to the development proposals. No potential or very limited potential for substitution or replacement. |
| **High** | Locally designated valued landscape and features: many distinctive landscape characteristics: very few landscape detractors. Uncommon receptor in good condition. A landscape receptor sensitive to disturbance or change in character due to the development proposals. Limited potential for substitution or replacement. |
| **Medium** | Undesignated landscape and features: some distinctive landscape characteristics: few landscape detractors. A relatively common receptor in fair condition. A landscape receptor with a moderate level of sensitivity to disturbance or change in character due to the development proposals. Some potential for substitution or replacement. |
| **Low** | Undesignated landscape and features: few distinctive landscape characteristics: presence of landscape detractors. A common receptor in poor condition. A landscape receptor with limited sensitivity to disturbance or change in character due to the development proposals. Clear potential for substitution or replacement. receptor with very limited sensitivity to disturbance or change in character due to the development proposals. Good potential for substitution or replacement. |
| **Very low** | Undesignated landscape and features: absence of distinctive landscape characteristics: presence of many landscape detractors. A common receptor in very poor condition. A landscape receptor with very limited sensitivity to disturbance or change in character due to the development proposals. Good potential for substitution or replacement. |

### 2.2.2 Scale or magnitude of landscape effects

In assessing the magnitude of landscape effects as the result of a development, the magnitude of change includes the scale of change, the geographic extent and duration and reversibility of change. Also referred to as landscape susceptibility, which can be defined as:

> *"Within the context of spatial planning and land management, landscape susceptibility is the degree to which a defined landscape and its associated visual qualities and attributes might respond to the specific development type / development scenario or other change without undue negative effects on landscape character and the visual resource"* (Natural England 2019)

The criteria used to determine the magnitude of effects on the landscape as a receptor is outlined in Table 2.2 adapted from LIIEMA (2013) guidelines.

*Table 2.2 Rating criteria for Landscape Resource Magnitude*

| Magnitude rating | Criteria |
|---|---|
| **Very high** | Total loss of or major alteration to key elements/ features/ characteristics of the baseline condition. Addition of elements which strongly conflict with the key characteristics of the existing landscape. Large scale effects influencing several landscape types or character areas. |
| **High** | Notable loss or alteration to one or more key elements/ features/ characteristics of the baseline condition. Addition of elements that are prominent and may conflict with the key characteristics of the of the existing landscape. Effects at the scale of the landscape type or character areas within which the proposal lies. |
| **Medium** | Partial loss or alteration to one or more key elements/ features/ characteristics of the baseline condition. Addition of elements that may be evident but do not necessarily conflict with the key characteristics of the of the existing landscape. Effects within the immediate landscape setting of the site. |
| **Low** | Minor loss or alteration to one or more key elements/ features/ characteristics of the baseline condition. Addition of elements that may not be uncharacteristic within the existing landscape. Effects at the site level (within the development itself). |
| **Very Low** | Barely discernible loss or alteration to one or more key elements/ features/ characteristics of the baseline condition. Addition of elements not uncharacteristic within the existing landscape. Effects only experienced on parts of the site at a very localised level. |

## 2.3 Visual impact assessment criteria

In assessing the visual effects of a development, the primary considerations are:

- the changes in the character of the available views as a result of the development
- the changes in the visual amenity of the visual receptors. (LIIEMA 2013)

In assessing views some key considerations to help categorise impacts include:

- the extent of view that would be impacted by the development (horizontal magnitude)
- proportion of development or features that would be visible
- distance of viewpoint from development (i.e. whether the proximity or panoramic view might be greatest of concern)
- where the views are and the duration of impact or transient nature of impact (e.g. when viewed from a moving vehicle)
- sensitivity of visual receivers.

In order to categorise and rate these visual effects Accent has consulted the NSW *Large-Scale Solar Energy Guideline* (DPE 2022) which provides criteria for ranking visual sensitivity and visual magnitude that incorporate the key considerations outlined above.

The overall methodology in assessing visual impact including receptor and viewpoint selection, impact assessment and mitigation development is outlined in Figure 2.1.

The visual impact of the project is determined using the flowchart in Figure 2.1 and risk matrices in Tables 2.3-2.6.

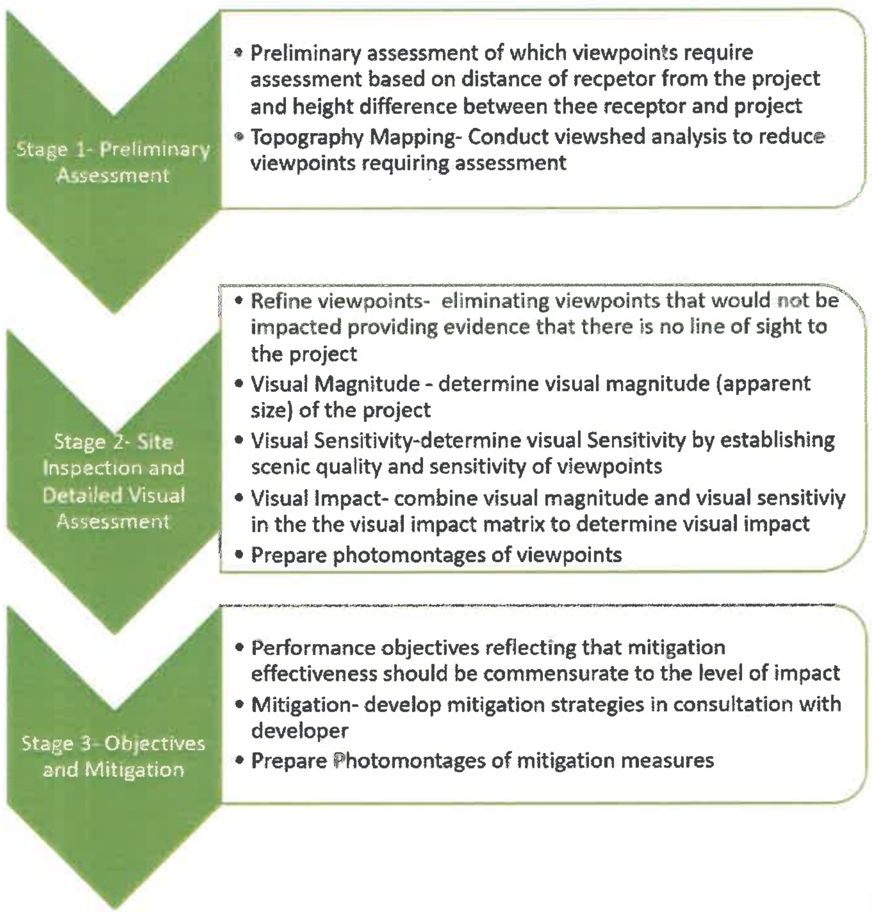



*Figure 2.1 Flowchart for assessing visual impact of a proposal (DPIE 2021)*

The visual sensitivity and magnitude of each viewpoint (reflecting the views of the sensitive receivers) is combined to determine a visual impact rating using Table 2.3.

*Table 2.3 Visual Impact Matrix (DPE 2022)*

| | High Sensitivity | Moderate Sensitivity | Low Sensitivity | Very Low Sensitivity |
|---|---|---|---|---|
| **High Visual Magnitude** | High | High | Moderate | Low |
| **Moderate Visual Magnitude** | High | Moderate | Low | Very Low |
| **Low Visual Magnitude** | Moderate | Low | Very Low | Very Low |
| **Very Low Visual Magnitude** | Low | Very Low | Very Low | Very Low |

N.B. Visual impacts are also subjective and stakeholder consultation is important in determining appropriate ratings and mitigation of visual impacts.

### 2.3.1 Receivers

According to the Landscape Institute and Institute of Environmental Management and Assessment (LIIEMA), visual receivers (or receptors) are individuals and/or defined groups of people who have the potential to be affected by a proposal. Furthermore, LIIEMA (2013) states that:

> *"The zone of theoretical visibility identifies land that, theoretically, is visually connected with the proposal and this is refined by site survey to confirm the extent of visibility. But in parts of this area there will be relatively few people to experience the effects of the proposal on views. The baseline studies must therefore identify the people within the area who will be affected by the changes in views and visual amenity [these people are] usually referred to as "visual receptors". They may include people living in the area, people who work there, people passing through road, rail or other forms of transport, people visiting promoted landscapes or attractions, and people engaged in recreation of different types."*

LIIEMA also says that:

> *"The visual receptors most susceptible to change are generally likely to include:*
>
> - *residents at home*
> - *people, whether residents or visitors, who are engaged in outdoor recreation, including use of public rights of way, whose attention or interest is likely to be focused on the landscape and on particular views*
> - *visitors to heritage assets, or to other attractions, where views of the surroundings are an important contributor to the experience*
> - *communities where views contribute to the landscape setting enjoyed by residents in the area.*
>
> *Travellers on road, rail or other transport routes tend to fall into an intermediate category of moderate susceptibility to change. Where travel involves recognised scenic routes awareness of views is likely to be particularly high."*

When considering sensitivity, LIIEMA comments, saying that:

> *"It is important to remember at the outset that visual receptors are all people. Each visual receptor, meaning the particular person or group of people likely to be affected at a specific viewpoint, should be assessed in terms of both their susceptibility to change in views and visual amenity and also the value attached to particular views."*

For the Callide SPS, visual receptors fall into three main categories:

- people living at residences near the project site (e.g. those listed in Table 4.1 in Section 4) and moving around their properties
- recreational users of Lake Callide and surrounds (to the east of the proposed SPS between 1-5 km from the development site footprint (see Figure 4.1 in Section 4)
- road users (generally local people, agricultural related traffic and freight) using main roads such as the Biloela-Callide Road and smaller roads such as Shorts Road.

### 2.3.2 Sensitivity

Visual sensitivity refers to the character of a setting, the quality of the view and how sensitive it is to the proposed change. Combined with magnitude, sensitivity provides a measure of impact. Visual sensitivity relates to the direction and the composition of the view. Views from habitable room windows, outdoor areas of the home yard residence are treated as sensitive receivers. Views from residual land beyond the home yard area (such as cropping/grazing land, recreational land, etc.) are treated as less sensitive receivers. The greater the distance between the visual receiver and the proposal, the lesser the visual sensitivity of that visual receiver.

The definitions in Table 2.4 and 2.5 are adapted from Department of Planning and Environment (DPE) *NSW Large-Scale Solar Energy Guideline* (Technical Supplement) (DPE 2022). These definitions align with LIIEMA (2013), Banana Shire Council Policy 114 and *Environmental Impact Assessment Guidance Note – Guidelines for landscape character and visual impact assessment* (TfNSW 2020a). Accent considers DPE's definitions to give greater detail and have particular reference to the subject- solar farms and the location- Australia and so have been used for this assessment.

The higher the scenic quality of the landscape, the greater the significance of introducing a new development, and therefore the higher the sensitivity. A place with a more consistent character would also be more visually sensitive to new development than a place with less consistency.

The visual sensitivity is determined by considering both the viewer sensitivity (Table 2.4) and scenic quality class (Table 2.5). A visual sensitivity rating should be assigned to each viewpoint: High, Moderate Low or Very Low. Where the viewer sensitivity and scenic quality class make it difficult to determine a balanced rating a conservative approach should be used to assign a rating (DPE 2022).

*Table 2.4 Viewer Sensitivity Criteria (adapted from DPE 2022)*

| Viewer Sensitivity | Definition |
|---|---|
| **High** | • Dwellings in residential areas and rural villages<br>• Historic rural homesteads/ residences on the national, state or local heritage list |
| **Moderate** | • rural dwelling Primary view from dwellings in rural areas), large lot residential areas and in environmental or conservation areas<br>• Tourist and visitor accommodation and places of worship (such as bed and breakfasts, motels, hotels)<br>• Tourist uses in tourist areas<br>• Publicly accessible green and open spaces including picnic areas, parks, public recreation areas<br>• Town centres and central business districts |
| **Low** | • Secondary view from dwellings in rural areas, large lot residential areas and in environmental or conservation areas<br>• Tourist roads and scenic drives<br>• Walking tracks and navigable waterways<br>• Cemeteries, memorial parks |
| **Very Low** | • No place of residence present<br>• Local sealed and unsealed roads<br>• Passenger rail lines with daily daylight services<br>• State highways, freeways and classified main roads<br>• Walking tracks and navigable waterways<br>• Private recreation areas and sporting fields |

*Table 2.5 Scenic Quality Class definitions from DPE (2022)*

| Viewpoint type | Low viewpoint sensitivity | Moderate viewpoint sensitivity | High viewpoint sensitivity |
|---|---|---|---|
| **Landforms** | • Large expanses of flat or gently undulating terrain<br>• Indistinct, dissected or unbroken landforms that provide little illusion of spatial definition or landmarks with which to orient | • Steep, hilly and undulating ranges that are not visually dominant<br>• Broad shallow valleys<br>• Moderately deep gorges or moderately steep valley walls<br>• Minor rock outcrops | • Isolated peaks, steep rocky ridges, cones or escarpments with distinctive form and/or colour contrast that become focal points<br>• Large areas of distinctive rock outcrops or boulders. Well defined, steep sided valley gorges. Visually prominent lakes, reservoirs, rivers, streams and swamps. |
| **Vegetation** | • Extensively cleared and cropped areas with very limited variation in colour and texture<br>• Pastoral areas, human created paddocks, pastures or grasslands and associated buildings typical of grazing lands | • Predominantly open forest or woodland combined with some natural openings in patterns that offer some visual relief<br>• Vegetative stands that exhibit a range of size, form, colour, texture and spacing including human influenced vegetation such as vineyards, and orchards | • Strongly defined patterns with combinations of native forest, naturally appearing openings, streamside vegetation and/or scattered exotics<br>• Distinctive stands of vegetation that may create unusual forms, colours or textures in comparison to surrounding vegetation |
| **Waterbodies** | • Absence of natural waterbody<br>• Farm dams, irrigation canals or stormwater infrastructure | • Intermittent streams, lakes, rivers, swamps and reservoirs | • Visually prominent lakes, reservoirs, rivers, streams, wetlands and swamps<br>• Presence of harbour, inlet, bay or open ocean<br>• Natural waterbody absent |
| **Social/ Cultural** | • Places of worship, cemeteries/memorial parks, private open spaces | • Local heritage sites<br>• Distinguishable entry ways to a regional city | • Culturally important sites, world heritage areas, national parks/ reserves,<br>• Commonwealth and state heritage sites |
| **Human presence** | • Dominating presence of infrastructure, human settlements, highly modified landscapes and higher density populations, industrial areas, agricultural transport or electricity infrastructure | • Dispersed yet evident presence of human settlement such as villages, small towns, isolated pockets of production and industry, lower scale and trafficked transport infrastructure | • Natural/ undisturbed landscape<br>• Minimal evidence of human presence and production |

### 2.3.3 Magnitude

The magnitude of a visual effect is the degree of change that the visual landscape undergoes as a result of the proposed development. It is the measurement of the overall scale, form and character of a development proposal when compared to the existing condition. Four categories are used in ranking the magnitude of a proposal (high, moderate, low, very low).

Magnitude takes into consideration the distance between the viewer and the proposal. Judging the magnitude of visual effects takes account of the:

- scale of the change within the view with respect to the addition (or loss) of elements in the view and change to its composition (including the proportion of the view that is taken up by the proposed development)
- degree of change and/or integration of any new features or changes in the landscape in terms of form, scale and mass, line height, colour and texture
- nature of the view of the proposed development and whether the views are permanent, full, partial or glimpses (LIIEMA 2013).

For our allocation of a rating for magnitude, Accent considers the guidelines put forth by LIIEMA and the quantitative tools described in *NSW LSSE guidelines* (DPE 2022). These guidelines consider the vertical and horizontal magnitude of the proposed project when assigning a magnitude rating.

**Preliminary Assessment of Magnitude**

A preliminary tool is also used to determine which receptors have a magnitude significant enough to require further assessment. The preliminary assessment requires calculating an "indicative field of vertical magnitude", is rated in degrees between 1 and 4+ as demonstrated in Figure 2.2 where 1 degree represents the lowest vertical magnitude to 4+ degrees the highest. These zones are determined by the following steps:

- measure the distance between each viewpoint and the proposed project footprint
- determine the height difference between the PV array and each viewpoint. This height difference does not consider existing natural mitigating factors such as topography and vegetation.
- plot each viewpoint on the Vertical Magnitude Tool (Figure 2.2) to determine the degree of indicative vertical field of view.

The horizontal magnitude is determined by measuring the worst-case horizontal field of view, the extent is measured disregarding the impacts of topography, vegetation or existing infrastructure. The indicative field of vertical magnitude and worst-case horizontal field of view are combined using Table 2.6 to determine whether further detailed assessment is required.

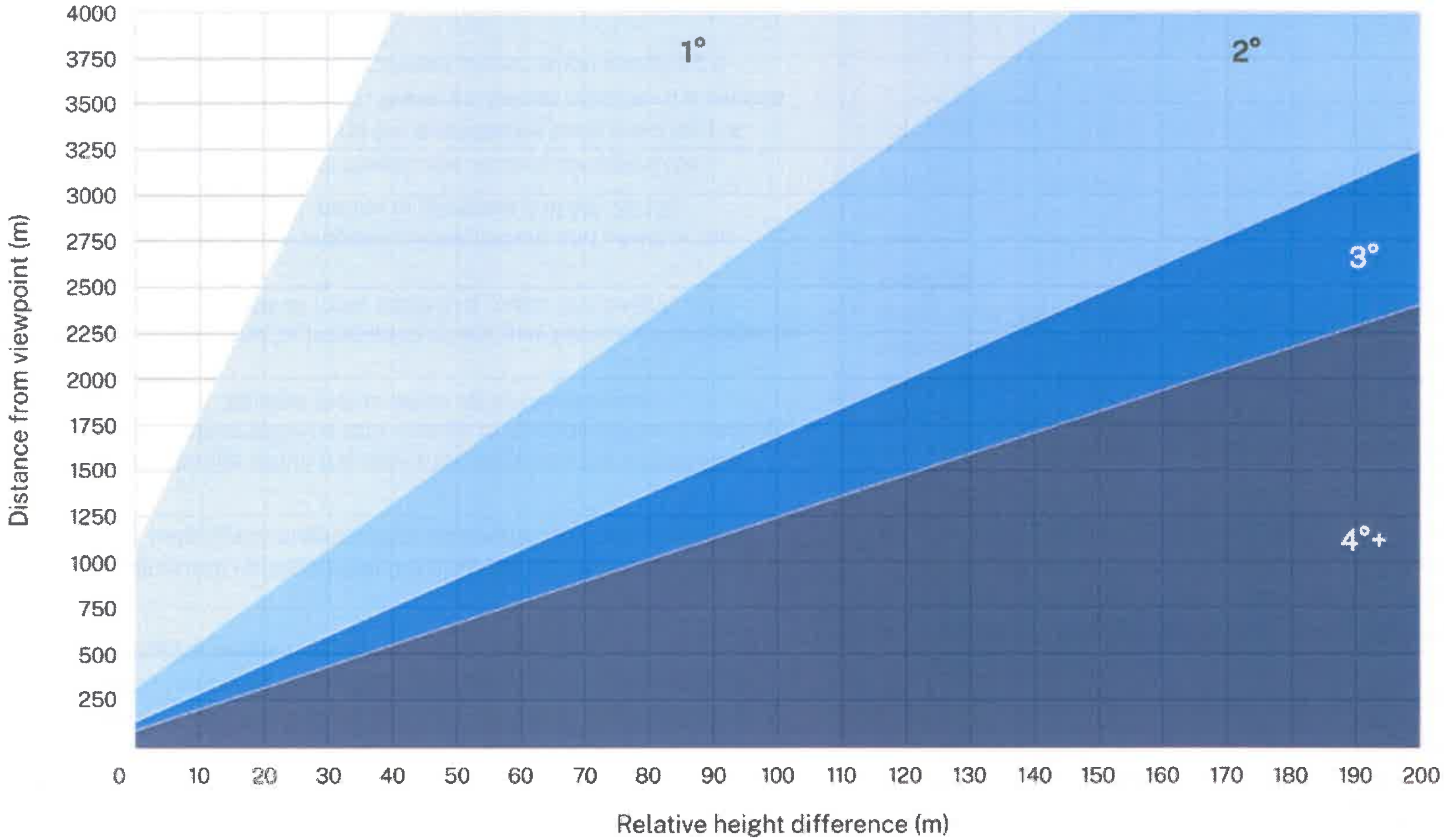



*Figure 2.2 Preliminary Visual Assessment Tool (DPIE 2022)*

*Table 2.6 Determination of receptors requiring further assessment (DPE 2022)*

| Horizontal field of view of project | 1° vertical field of view | 2° vertical field of view | 3° vertical field of view | 4° vertical field of view |
|---|---|---|---|---|
| 1-10 | No assessment required | No assessment required | No assessment required | No assessment required |
| 11-20 | No assessment required | No assessment required | No assessment required | Assessment required |
| 21-30 | No assessment required | No assessment required | Assessment required for all viewpoints except road/rail | Assessment required |
| 31-40 | No assessment required | Assessment required for all viewpoints except road/rail | Assessment required for all viewpoints except road/rail | Assessment required |
| 41-50 | No assessment required | Assessment required for all viewpoints except road/rail | Assessment required | Assessment required |
| 51-60 | No assessment required | Assessment required for all viewpoints except road/rail | Assessment required | Assessment required |
| 61-70 | No assessment required | Assessment required | Assessment required | Assessment required |
| 71-130 | Assessment required for all viewpoints except road/rail | Assessment required | Assessment required | Assessment required |
| 130+ | Assessment required | Assessment required | Assessment required | Assessment required |

### Detailed Assessment of magnitude

For receptors requiring further assessment the following methodology was followed, informed by both LIIEMA (2013) and DPE (2022) best practice. For each receptor a representative viewpoint was selected. At each viewpoint photographs were taken in the direction of the development, taking pictures in portrait using a fixed frame 50 mm lens camera with tripod at regular intervals with at least a 30 % overlap to enable merging of the images to provide a 180-degree panoramic field of view. Using this imagery, photomontages are created by overlaying a 3D rendering of the proposed solar infrastructure. To determine a magnitude rating,

Accent has consulted the LSSE guidelines which provide a grid to be overlaid on photomontages to aid in measuring visual magnitude. Each grid cell is equivalent to one vertical degree and ten horizontal degrees. The magnitude rating is then given, based on the number of cells occupied by solar infrastructure, as shown in Table 2.7.

*Table 2.7 Visual magnitude thresholds (DPE 2022)*

| Number of occupied cells | Visual magnitude rating |
|---|---|
| **1-6** | Very Low |
| **7-12** | Low |
| **13-21** | Moderate |
| **22-30** | High |
| **31+** | Very High |

### Photomontage creation

The viewpoint photography captured from each representative viewpoint is comprised of multiple photographs taken in portrait using a fixed frame 50 mm lens camera with tripod (set to 1.5 m) at regular intervals with at least a 30 % overlap. These images are merged in Adobe Photoshop (Adobe 2019) to provide a 180-degree panoramic image. The co-ordinates of each viewpoint are recorded on a digital map during the site visit. The photography represents the current view from each viewpoint.

To illustrate the potential view following development, a 3D model was created within a 3D GIS environment. 3D solar arrays were placed across the maximum solar panel extent. The GIS environment utilises a digital elevation model to project the 3D model of the development.

The individual solar panel arrays were produced within Energy3D (Xie et al 2018) software to the project height, length and tilt specification. The modelled arrays for Callide had a greater ground clearance than is optimal for the program which was addressed during final surface alterations.

Within the 3D GIS environment, a virtual camera is set up to the exact co-ordinates, direction of view, pitch and height of the viewpoint to align with the site photography. The resulting 3D rendered image is exported and overlaid on the 180-degree viewpoint photography. Known survey points including topography, building locations, transmission poles or other infrastructure (or predetermined points) within the photographic view and identified within the digital model must align to ensure accuracy. Following alignment, the overlaid 3D rendered image is reduced to only the solar infrastructure. Final improvements to surfaces of panels were made to provide photorealistic textures and details in the final photomontages. See Figures 2.3 and 2.4.

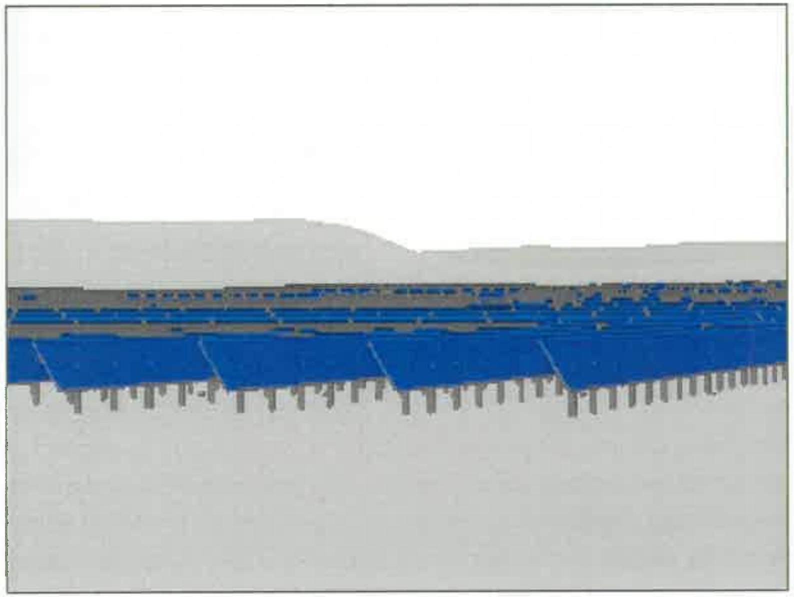


*Figure 2.3 Example of a viewpoint visualisation with solar arrays within a 3D GIS Scene*

*Figure 2.4 Example of the same viewpoint extent following overlaying of 3D model and amendments to surfaces.*

# 3 LANDSCAPE CHARACTER ASSESSMENT

## 3.1 Purpose

This section outlines the existing local landscape character to gain a general understanding of the visual environment on which the influence of the Callide Solar Power Station development will be assessed.

The Landscape Character Assessment is the '*process of identifying and describing variation in the character of the landscape. It seeks to identify and explain the unique combination of elements and features (characteristics) that make landscapes distinctive. This process results in the production of a Landscape Character Assessment*' (LIIEMA, 2013)

As outlined in the LIIEMA (2013), it is important to assess landscape and visual impact separately although they are connected. The landscape baseline assessment outlined below also informs the visual assessment in Section 4. The effects on the landscape should be assessed as effects on an environmental resource.

## 3.2 Landscape baseline description

### 3.2.1 Landscape elements

**Topography**

The proposed development footprint has minimal topographic relief. However, to the north, east and west hills with elevations from 340 m (immediately north of the development footprint) to over 520 m (to the northeast and southeast of the development footprint). These higher elevations surrounding the immediate landscape give a distinct character to the landscape. The higher elevations are a feature of views in most directions and add to the value of these views. The views associated with vantage points from these higher locations are also more valuable due to the panoramic views available. The development footprint itself ranges from 175 m AHD in the southwestern extent to 234 m AHD in the northwestern extent. The southwestern extent of the property is also identified as a floodplain due to its low elevation and as such is excluded from development footprint.

There are several distinct mountains in the wider landscape including Mount Murchison (524 m). To the west in the direction of Biloela the elevations are lower and less variable.

**Waterways**

Within the project lots there are multiple drainage lines with associated vegetation that will be retained. During the site visit in October 2022 the waterways encountered were dry. In the local area Callide Creek (located to the south of the proposed project) is a distinctive part of the landscape with a wide section of riparian vegetation which is also classed as a regional corridor. During the site visit, large colonies of flying foxes roosting along the creek were present. In addition to waterways, there are Lake Callide and the Callide dam to the southeast of the project. The lake is visible from higher elevations and along the Lake Callide Drive, along which there are several holiday homes and a campsite which overlook the lake (looking away from the proposed development footprint). The waterways and lake form elements of the unique landscape character.

The overall footprint lies within the Callide Creek catchment.

### Built elements

Callide is associated with the Callide Power Station and Callide Mine, both within 3 km of the site and visible from all locations in the immediate area (see Figure 3.2). The power station infrastructure is highly visible including cooling towers and smokestacks. In addition to the power station, the associated electrical infrastructure dominates the landscape with large transmission towers visible across the landscape on both sides of the high elevations to the north of the development footprint. The Callide Dam is also a significant built element of the landscape with a capacity of 136,300 ML. Whilst the mine is not as visually dominant, it is part of the landscape character, with the large area host to several open pit mines. Aside from the large built landscape elements there are small local transmission lines and buildings and equipment associated with agriculture. The residential properties are few, scattered throughout the landscape and associated with the potential sensitive receptors identified in Section 4.1.

Scattered throughout the landscape there are both made and unmade rural roads, many of which are flanked by vegetation. These roads include Biloela-Callide Road, Shorts Road, Calvale Road and Linkes Road. During the site visit it was evident that the majority of road users (particularly of the Biloela-Callide Road) were associated with the power station although there was a small number of tourist roads close to the Callide Lake and local residents would also be utilising these roads.

### Vegetation

The immediate landscape is a patchwork of agricultural cropping and grazing land with vegetation on slopes and along the creeks and rivers which host riverine vegetation reserves. Some, but not all roads are flanked by roadside vegetation and where residential homes are present there is associated property boundary vegetation and landscaping in most cases.

There are densely vegetated areas within the larger landscape including the Callide Timber Reserve approximately 3 km northeast of the development footprint adjacent to the Callide Mine, Overdeen State Forest approximately 27 km west and Kroombit Top National Park approximately 22 km east (see Figure 1.1).

Within the development footprint no remnant vegetation is present; however, the pre-clearance broad vegetation groups and regional ecosystems are outlined in Table 3.1. Prior to extensive clearing the immediate landscape was dominated by broad vegetation groups (BVG) 25a and 16c. Although not remnant vegetation, the existing vegetation along drainage lines within the development footprint will be retained.

*Table 3.1 Regional Ecosystems (REs) present within the Callide SPS development footprint (DES 2022)*

| RE Number | Description |
|---|---|
| **11.9.5** | *Acacia harpophylla* and/or *Casuarina cristata* or *Acacia harpophylla* open forest to woodland. Casuarina cristata is more common in southern parts of the bioregion. A prominent low tree or tall shrub layer dominated by species such as *Geijera parviflora* and. The topography includes gently undulating plains, valley floors and undulating foot slopes and rarely on low hills. The soils are generally deep texture-contrast and cracking clays. The cracking clays are usually black or grey to brown or reddish-brown in colour, |

| RE Number | Description |
|---|---|
| | often self-mulching and sometimes with gilgai microrelief in flatter areas. Some texture contrast soils are shallow to only moderately deep. (BVG 25a) |
| 11.3.2 | *Eucalyptus populnea* woodland to open woodland. Occasionally, *E. melanophloia* or *E. crebra* may be present. A secondary tree layer may occur and include species such as *Geijera parviflora, Eremophila mitchellii, Acacia salicina, Cassia brewsteri*, and *Acacia excelsa*. The ground layer is dominated by a range of tussock grasses, *including Chloris spp., Enteropogon spp.*, and *Aristida spp*. Occurs on Cainozoic alluvial plains with variable soil types including texture contrast, deep uniform clays, massive earths and sometimes cracking clays. (BVG1M: 17a) |
| 11.3.4 | *Eucalyptus tereticornis* woodland to open forest. Other tree species that may be present include *E. camaldulensis, Corymbia tessellaris, C. clarksoniana, E. melanophloia, E. platyphylla* or *Angophora floribunda. E. crebra* and *Lophostemon suaveolens* may be locally common. A shrub layer is usually absent, and a grassy ground layer is prominent, and may include any *of Bothriochloa bladhii subsp. bladhii, Aristida spp., Heteropogon contortus, Dichanthium spp*. and *Themeda triandra.* Occurs on Cainozoic alluvial plains and terraces. Occurs on variety of soils, including deep cracking clays, medium to fine textured soils, and deep texture-contrast soils. (BVG1M: 16c) |
| 11.3.6 | *Eucalyptus melanophloia* woodland to open woodland, generally with a grassy ground layer. Occasional *E. populnea, E, crebra, Corymbia dallachiana, E. tereticornis* may occur in the canopy. A secondary tree or tall shrub layer, including *Callitris glaucophylla, Alphitonia excelsa, Lysicarpus angustifolius* and *Petalostigma pubescens* may occur. The ground layer is usually dominated by perennial grasses. Occurs on levees and higher Cainozoic alluvial plains. Soils are usually deep red and yellow massive earths with dark brown loamy sand to sandy loam grading to light clay textures or texture contrast soils. In some areas this RE occurs on heavy cracking clay soils. (BVG1M: 17b) |

The wider landscape also consists largely of land historically cleared for agriculture and extractive industries. Vegetation (other than grassland) is predominantly found on slopes, surrounding dwellings, and along road reserves, drainage lines and fence lines.

### 3.2.2 Landscape characteristics

The land within the vicinity of the solar farm is both agricultural (typically cropping and some grazing) and extractive (with the Callide Mine and associated Coal Power Station and Dam within 2 km of the proposed development site). There are large open paddocks with scattered vegetation associated with drainage lines, roads and residential properties. The landscape is also vegetated on the hillsides surrounding the other land uses and more densely vegetated in the wider landscape although a large portion of this is a timber reserve and little remnant vegetation is present within a 5 km radius.

The immediate area is sparsely populated, with scattered homesteads accessed by surfaced roads and dirt tracks. However, there are several detracting built elements associated with the Callide Power Station and associated mine, dam and transmission lines (Figure 3.2).

### 3.2.3 Dominant landscape character

The site is located within the Callide Creek Downs sub-region of the Brigalow Belt South Bioregion of Queensland which is climatically subtropical.

The site and surrounds are made up of a patchwork of land systems (Figure 3.1). These land systems, as identified in the study *Land Systems of the Dawson-Fitzroy area of Central Queensland* (QLD 2014), are:

- Banana: Undulating plains with softwood scrub, brigalow, and eucalypt woodland, mainly in the north-eastern quarter.
- Dakenba: Brigalow country on alluvium, mainly associated with the Dawson River.
- Eurombah: Undulating plains with softwood scrub on crests and brigalow on slopes, scattered throughout but mostly in the south.
- Gelobera: Volcanic hills and mountains with eucalypt forest in north east
- Highworth: Brigalow plains, commonly gilgaied, in the centre and north (Agricultural classification A1/C1: Crop Land - Broadacre and Horticulture / Pasture Land - sown pastures, and native pasture on high fertility soils).
- Kariboe: Brigalow plains with steeper softwood scrub slopes, mainly east of Biloela.
- Kroombit: Alluvial plains, originally with eucalypt woodland, mainly in the Callide valley.
- Lawgi: Basalt tablelands with softwood scrub and minor brigalow, southeast of Biloela
- Wandoan: Undulating brigalow plains, scattered throughout the area but mainly near Wandoan (Agricultural classification A1/C1: Crop Land - Broadacre and Horticulture / Pasture Land - sown pastures, and native pasture on high fertility soils).

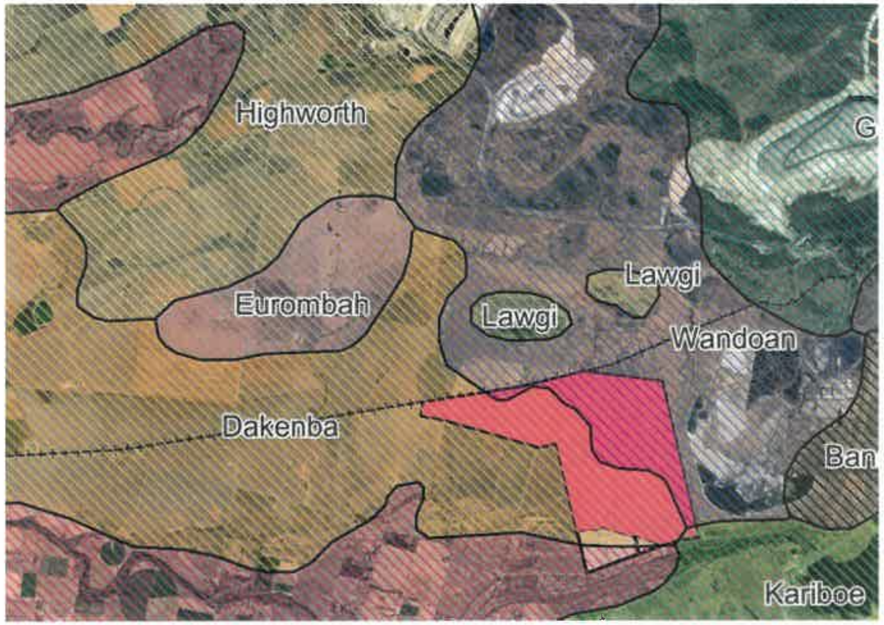



*Figure 3.1 Land Systems surrounding the Callide SPS (QLD 2014)*

The dominant character of the surrounding area is a rural undulating landscape characterised by a patchwork of extensive agricultural land, pastureland, extractive industries and sparsely vegetated slopes. In order to describe this patchwork Accent has also defined eight landscape character zones with distinct elements and character detailed in Section 3.2.4.

The development footprint also falls into two land zones Cainozoic/Proterozoic consolidated fine-grained sediments and Cainozoic alluvial plains and piedmont fans to the southern extent towards Callide Creek.

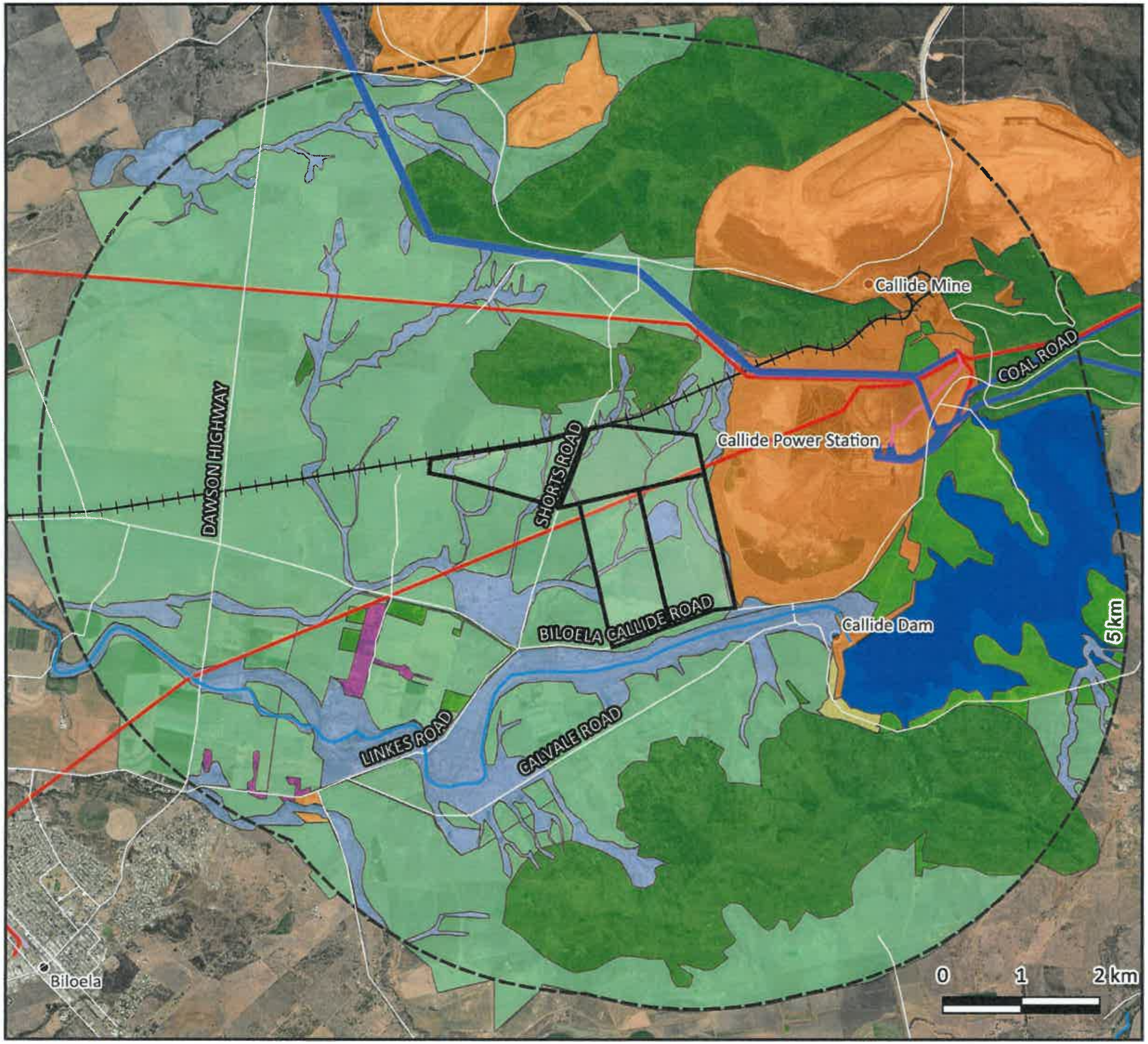
### 3.2.4 Landscape character zones

As the landscape includes distinct areas of different qualities, Accent has also considered the study area when broken down into different landscape character zones. These landscape character zones have been categorised by common visual characteristics including topography, vegetation, waterbodies and land use.

The landscape character zones (LCZs) are shown in Figure 3.2 and assessed individually in Table 3.2. In addition, photographs of the landscape surrounding the project site were taken by Accent Environmental during a site visit on 19-20 October 2022. The selection of images provided in Photos 3.1 to 3.8 illustrates the scenery typical of the existing landscape and project site, from road and paddock vantage points.

The landscape character zones within approximately 5 km of the proposed development are as follows:

- **LCZ 1 - Highly disturbed land** - includes Callide power station, Callide Dam wall, mines, scrap metal collection (Photos 3.2 and 3.5). Largely associated with Gelobera land system of Volcanic hills and mountains with eucalypt forest.
- **LCZ 2 - Agricultural plains** - large agricultural fields, primarily cropping, flat land with few to no trees (Photo 3.3).
- **LCZ 3 - Waterbody large (Callide Dam) and immediate flood plain** (no vegetation) (Photo 3.4).
- **LCZ 4 - Waterways and associated vegetation** - includes Callide Creek and minor waterways and drainage lines associated with the Kroombit land system of Alluvial plains, originally with eucalypt woodland, mainly in the Callide valley (Photo 3.7).
- **LCZ 5 - Vegetated ridges/slopes** - sparsely vegetated non-agricultural land associated with the Lagwi Land system Basalt tablelands with softwood scrub and minor brigalow to the north of the project and Kariboe land system to the southeast of the project with Brigalow plains and steeper softwood scrub slopes (Photo 3.3, 3.4and 3.6).
- **LCZ 6 - Vegetated flat land non-agricultural** - sparsely vegetated areas largely Brigalow (Photo 3.4)
- **LCZ 7 - Rural residential** - clusters of residential properties including those zoned as rural residential within local planning zone. Houses are on mid-sized plots with associated vegetation.
- **LCZ 8 - Recreational land** - recreational land use, primarily holiday rentals and the Lake Callide Campground (Photo 3.1 and 3.8).




Landscape character zones callide

- LCZ1 Highly disturbed land
- LCZ2 Agricultural plains
- LCZ 3 Waterbody (Callide Dam) and immediate floodplain
- LCZ 4 Waterways and associated vegetation
- LCZ 5 Vegetated ridges/ slopes
- LCZ 6 Non- agricultural sparsely vegetated flat land
- LCZ 7 Rural residential
- LCZ8- Recreational landuse
- Lot boundaries
- Rail line
- Roads

Major transmission lines

- 275kV
- 132kV
- 110kV

Watercourses

- Major Watercourses
- Minor Watercourses

**AE1206 Callide SPS**
**Figure 3.2: Lanscape Character Zones**

Created: 27/02/2023
Print size: A4
CRS: GDA2020 / MGA zone 56
Additional data sources: Geoscience Australia
Basemap: ESRI satellite [accessed 1/10/2022]

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Photo 3.1

Rail line adjacent to the northern boundary of the development. This is a private rail line servicing the power station and mine (LCZ1 and LCZ6)

Photo 3.2

Callide coal fired power station (LCZ1)

Photo 3.3

Topographic relief to the north of the development footprint. The elevated areas are sparsely vegetated and include several residential properties (LCZ2 and LCZ5)

Photo 3.4

Lake Callide (LZC3, LCZ5 and LCZ7)

**Photo 3.5**
**Callide Dam wall and power station (LCZ1 and LCZ8)**

**Photo 3.6 Vegetated hillsides (LCZ5)**

**Photo 3.7 Typical cattle grazing to the south of the development (LCZ2 and LCZ4 (line of vegetation in background between photo location and site))**

**Photo 3.8 Holiday rentals facing Lake Callide and away from the development (LCZ8)**

*Table 3.2 Landscape character impact by landscape character zone*

| Landscape Character Zone | Sensitivity | Magnitude | Landscape character impact |
|---|---|---|---|
| **LCZ1-Highly disturbed land** (includes Callide power station, Callide Dam wall, mines, scrap metal collection) (Photos 3.2 and 3.5). Largely associated with Gelobera land system of Volcanic hills and mountains with eucalypt forest. | **Low**<br>• Human modifications are dominant, with widespread clearing of all vegetation. The land is highly disturbed by mining and the associated infrastructure.<br>• No specific planning controls attribute special value to this landscape.<br>• The elements within this LCZ are key elements of the area with the cooling tower and smokestacks in particular providing a sense of place with visibility across all locations within the local landscape, however these elements are prominent and unlikely to be sensitive to change.<br>• Electrical components of the development such as the substation will be very similar to the existing elements of LCZ1.<br>• The LCZ demonstrates a resilience to change. | **Low**<br>• There are no proposed works within this zone.<br>• The proposed development will not detract from this LCZ.<br>• Elements of this LCZ will continue to provide a sense of place.<br>• When viewed from afar the project is not expected to compete visually with the visually dominant LCZ1.<br>• As the existing elements are manmade and industrial the addition of solar infrastructure would not be in conflict with the existing character within LCZ1<br>• Any perceived changes are only expected at a local level. | **Low** |
| **LCZ2-**<br>**Agricultural plains** | **Low** | **Low**<br>• The solar development will be entirely within LCZ2 on previously | **Low** |

| Landscape Character Zone | Sensitivity | Magnitude | Landscape character impact |
|---|---|---|---|
| large agricultural fields, primarily cropping, flat land with few to no trees (Photo 3.3). | • Account for the largest LCZ within the project site's local landscape this is a common receptor.<br>• The agricultural plains are a highly modified landscape largely cleared of native vegetation<br>• There is no particular scenic value attributed to this LCZ.<br>• The LCZ demonstrates a resilience to change. | cleared agricultural land, however this is still only a small extent of the LCZ which is dominant LCZ within the project area.<br>• Potential to graze sheep and retention of flora beneath the proposed solar arrays will aid in retaining the agricultural character of the project site.<br>• Once the operation stage of the Solar power station in complete (approximately 30 years) the land will be returned to its previous agricultural land use.<br>• The project infrastructure will be an evident change to landscape characteristics at close range however the extent is minor in relation to the extent of LCZ2. | |
| **LCZ 3-**<br>**Waterbody large (Callide Dam) and immediate flood plain (no vegetation)** | **Low**<br>• The project site and Callide Lake do not directly interact.<br>• Whilst the lake provides a scenic quality to the landscape it is a manmade earth and rock filled dam with large built elements evident such as the dam wall.<br>• The lake provides cultural landscape value with the LCZ8 | **Low**<br>• There are no proposed works within this zone.<br>• Key viewing location towards this LCZ are directed away from the proposed development and will not be impacted by the development. | **Low** |

| Landscape Character Zone | Sensitivity | Magnitude | Landscape character impact |
|---|---|---|---|
| | recreational land use associate with the views provided by the lake. | • When viewed from a distance the solar panels and lake surface will have similar visual qualities. | |
| LCZ4<br>**Waterways and associated vegetation** Includes Callide Creek and minor waterways and drainage lines associated with the Kroombit land system of Alluvial plains, originally with eucalypt woodland, mainly in the Callide valley. | **Moderate**<br>• The waterways surrounding the project including Callide Creek host native vegetation and wildlife and have ecological value.<br>• The waterways are generally lower than the surrounding landscapes and do not form a prominent feature of the wider landscape.<br>• The LCZ demonstrates some vulnerability to change due to ecological values.<br>• The LCZ also serves as a visual buffer to some of the surrounding landscape and so has the ability to absorb changes in local scenic amenity. | **Low**<br>• There are no proposed works within this zone.<br>• The riverine and drainage lines have been buffered within the development footprint to avoid impacts.<br>• This LCZ with be adjacent to the development footprint for several minor drainage lines.<br>• Minor alteration is expected to visibility of features of the baseline condition within the site.<br>• Effects are at the site level (within the development itself) the majority of this LCZ will be unaffected by the proposed development. | **Moderate-Low** |
| LCZ5<br>**Vegetated ridges/slopes:**<br>Sparsely vegetated non-agricultural land associated with the Lagwi Land system Basalt tablelands with | **Moderate**<br>• This LCZ has high scenic value and provides elevated views across the project site and also | **Low**<br>• There are no proposed works within this zone. | **Moderate-Low** |

| Landscape Character Zone | Sensitivity | Magnitude | Landscape character impact |
|---|---|---|---|
| softwood scrub and minor brigalow to the north of the project and Kariboe land system to the southeast of the project with Brigalow plains and steeper softwood scrub slopes. | forms a distinct element of the local area and its sense of place.<br>• The current scenic value from this LCZ includes views of the LCZ1 infrastructure (Callide Mine, PowerStation and dam) so the addition of solar infrastructure elements are consistent with the existing elements of the wider landscape.<br>• The LCZ demonstrates some vulnerability to change. | • The scenic amenity provided by the ridges provide a local scenic value to a small local population.<br>• When viewed from afar the project is not expected to compete visually with the visually dominant LCZ5.<br>• There will be a small change in the landscape character as the panoramic views provided by the higher elevations of this LCZ will be changed by the development infrastructure; however the additional features are compatible with the current patchwork of land uses visible.<br>• The views across the development footprint to the other higher elevation will be retained and unobscured. | |
| **LCZ6**<br>**Vegetated flat land non-agricultural** | **Low**<br>• There are only small patches of vegetated flat land that have not been cleared for agricultural use. They are largely transitional sections between other larger LCZ and do not form a significant element of the wide landscape character. | **Negligible**<br>• There are no proposed works within this zone.<br>• This LCZ is not visually prominent, and the development is not expected to change the minor landscape character value they contribute to the local area. | **Negligible** |

| Landscape Character Zone | Sensitivity | Magnitude | Landscape character impact |
|---|---|---|---|
| | • There is no particular scenic value attributed to this LCZ. | | |
| **LCZ7**<br>**Rural residential-**<br>clusters of residential properties including those zoned as rural residential within local planning zone. Houses are on mid-sized plots with associated vegetation. | **Low**<br>• LCZ7 forms a minor zone within the larger landscape.<br>• There is no particular scenic value attributed to this LCZ. | **Negligible**<br>• There are no proposed works within this zone.<br>• The rural residential areas are separated from the development footprint by both distance and topography and impacts from the development are not anticipated. | **Negligible** |
| **LCZ8- Recreational land-** recreational land use, primarily holiday rentals and the Lake Callide Campground | **Low**<br>• Whilst this is a recreational area with cultural value it is also adjacent to LCZ1 (Callide PowerStation) and the LCZ is not a pristine area, manmade structures are evident and additional built elements associated with the proposed development would not detract from the existing land use.<br>• The LCZ demonstrates some resilience to change. | **Low**<br>• There are no proposed works within this zone.<br>• There is a degree of separation between LCZ8 and the proposed development site and the two do not interact directly.<br>• A slight change in landscape may be perceived as the users of the recreational site will have to travel past the project site to reach the campground and holiday rentals. | **Low** |

## 3.3 Sensitivity of landscape resource

The overall landscape which hosts the solar farm is an undesignated landscape with some distinctive landscape characteristics. There are several landscape detractors present (including power station infrastructure, mining impacted land, transmission lines and towers). The landscape has a moderate ability to absorb change. As such the landscape receptor has limited sensitivity to disturbance or change in character due to the development.

In line with the criteria set out in Table 2.1, the sensitivity of the landscape resource in the vicinity of the development has been determined as **Medium.**

## 3.4 Scale or Magnitude of landscape effects

The Callide SPS development comprises an addition of elements to the landscape that will be evident to visual receptors. However, the addition of these elements is not in conflict with the existing landscape and the effects are only recognisable within a small portion of the immediate landscape of the development due to the local topography. None of the key elements, features or characteristics described in Sections 3.2.1-3.2.3 have been lost from the visual baseline, although there may be perceived alterations to some of these aspects of the landscape. Effects are largely at a site level with some effects within the immediate landscape.

In line with the criteria set out in Table 2.2, the Magnitude of the landscape effects due to the development has been determined as **Medium.**

# 4 VISUAL IMPACT ASSESSMENT

## 4.1 Visual receivers and viewpoint selection

Visual receivers are individuals and/or defined groups of people who have the potential to be affected by a proposal. Whether they are sensitive depends on their susceptibility to change in views and visual amenity and the value attached to particular views.

### 4.1.1 Preliminary visual assessment

Prior to detailed impact assessment, a preliminary assessment of possible receptors based upon the methodology within Technical Supplement of the NSW *Large-Scale Solar Energy Guideline* (DPE 2022) was used to reduce the number of receptors requiring detailed assessment.

The 110 non-associated residences (R1-R110) located within 5 km of the project site and four roads (Shorts Road, Biloela-Callide Road, Linkes Road and Lake Callide Drive) within 3 km of the project site (Figure 4.1) were assessed based on their distance from the site and the worst case vertical and horizontal fields of view towards the project.

The 110 residences and three roads were plotted on the DPE Preliminary Assessment Tool, based on their distance from the project site boundary and considerations of relative height, as shown in Figure 4.2. Detailed calculations are shown in Attachment 1.

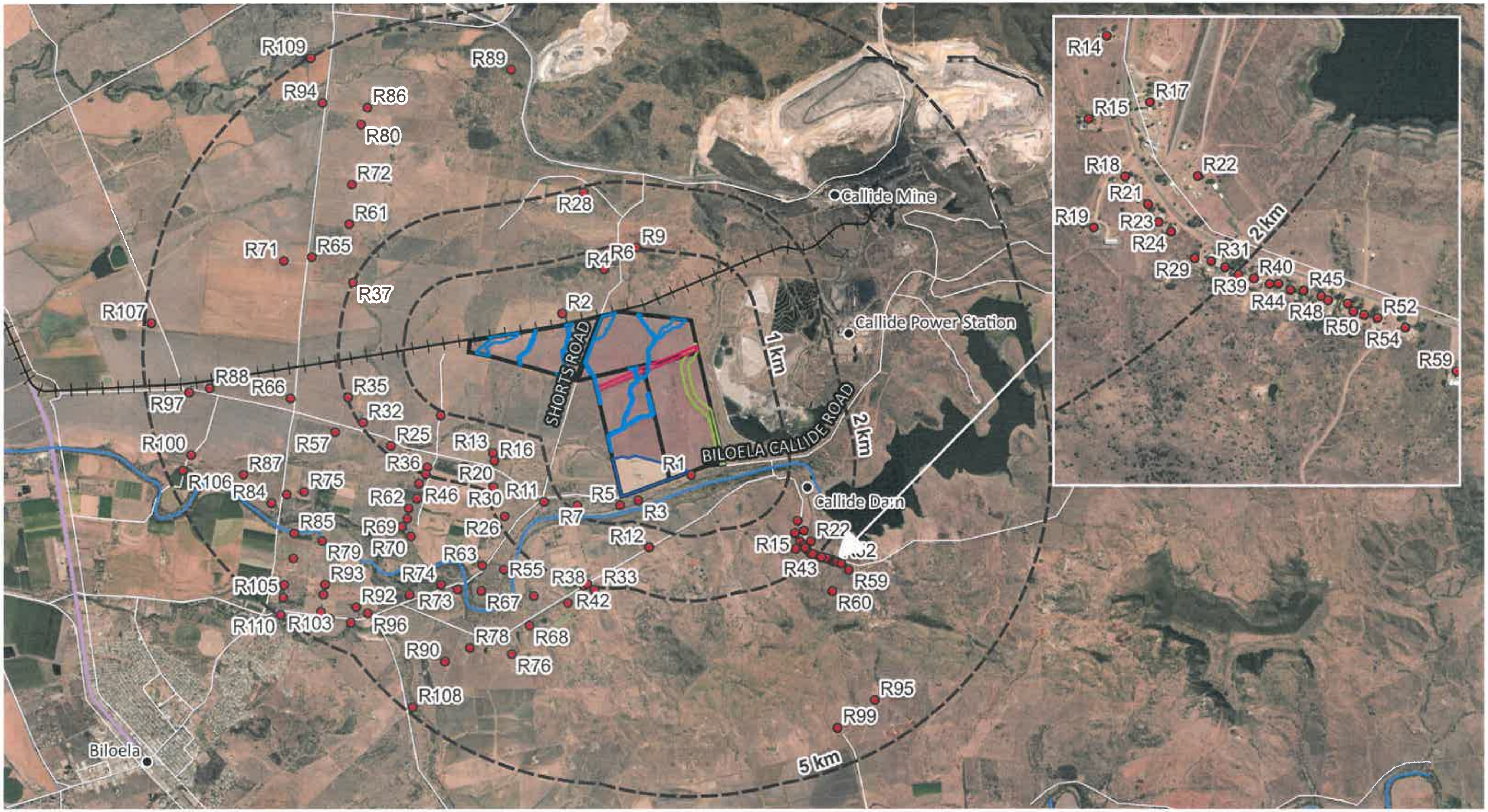
In accordance with the DPE guidelines, the number of identified receptors that warrant detailed assessment was reduced to 25 residential receptors (R1-R22, R28, R29 and R32) and four roads. The distances and directions of these receptors in relation to the site are listed in Table 4.1.

In addition to the residential receivers there is also a campground along Callide Lake Drive next to Callide Lake which is considered to be a sensitive receptor following the site visit. It is approximately 1.5 km southeast from the development footprint.

*Table 4.1 Potential sensitive receivers and location in relation to project site*

| Receiver | Distance from site footprint (m) | Direction from site |
|---|---|---|
| R1 | 60 | South |
| R2 | 189 | North |
| R3 | 658 | South |
| R4 | 698 | Southwest |
| R5 | 723 | North |
| R6 | 792 | North |
| R7 | 894 | Southwest |
| R8 | 944 | North |
| R9 | 1009 | North |
| R10 | 1064 | West |
| R11 | 1239 | Southwest |
| R12 | 1310 | South |
| R13 | 1418 | Southwest |
| R14 | 1424 | Southeast |
| R15 | 1518 | Southeast |

| Receiver | Distance from site footprint (m) | Direction from site |
| --- | --- | --- |
| R16 | 1528 | Southeast |
| R17 | 1594 | Southwest |
| R18 | 1668 | Southwest |
| R19 | 1708 | Southwest |
| R20 | 1747 | Southeast |
| R21 | 1749 | Southwest |
| R22 | 1750 | Southwest |
| R28 | 1875 | Southwest |
| R29 | 1908 | Southwest |
| R32 | 1947 | West |
| Shorts Road | Transects footprint | Runs north-south through the development footprint |
| Biloela-Callide Road | 40 (at nearest point) | South |
| Linkes Road | 1220 (at nearest point) | Southwest |
| Lake Callide Drive | 1020 (at nearest point) | Southeast |




**AE1206 Callide SPS**

**Figure 4.1 :Potential sensitive receptors**

Created: 23/11/2022

Print size: A4

CRS: GDA2020 / MGA zone 56

Additional data sources: ESRI satellite [accessed 1/10/2022]

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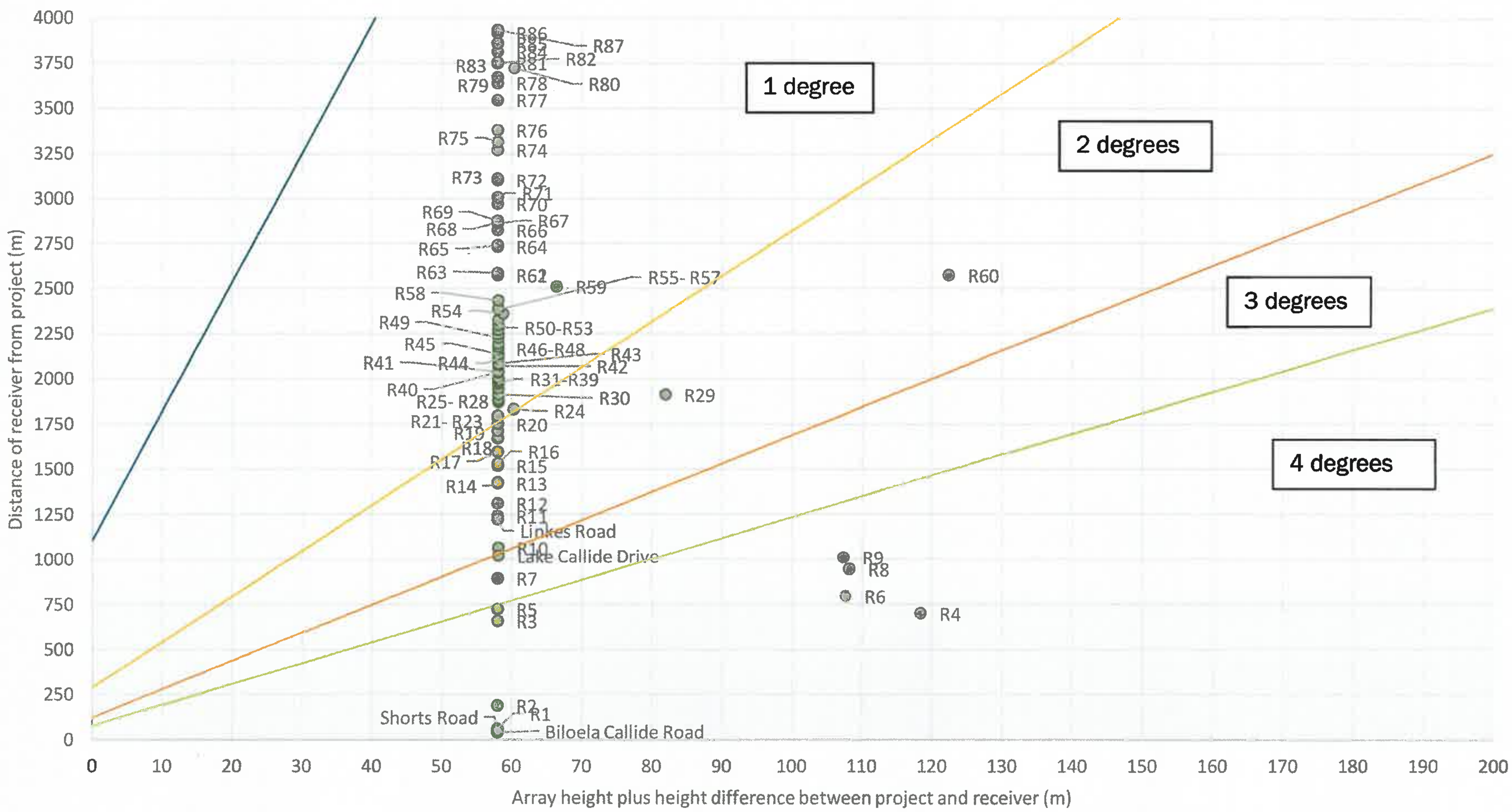



*Figure 4.2 Potential sensitive receptors plotted on DPE Preliminary Assessment Tool*

### 4.1.2 Detailed visual assessment

#### Viewshed analysis

A viewshed analysis provided a “Zone of theoretical Influence (ZTI)” for the SPS which is demonstrated in Figure 4.3. The ZTI was calculated for a 5 km radius of the site for a target height (representing the solar panel height) of 4.2 m to and observer height of 1.6 m using an open-source DEM with a 1 m resolution. The viewshed analysis does not account for vegetation which will decrease the visibility within the highlighted zone. Whilst the development is potentially visible within this ZTI, the likelihood of being discernible as a solar farm or easily distinguished from the surrounding landscape diminishes with distance.

The viewshed analysis and resulting ZTI further informed our selection of viewpoints (see Section 4.1.3).

The viewshed analysis suggests possible visibility of the solar farm infrastructure from the majority of residences R1-R110 with the exception of: R7, R28, R29, R31, R65, R71, R86, R87, R88, R89, R94, R95, R99, R100, R105, R106, R107, R108, R109, R110.

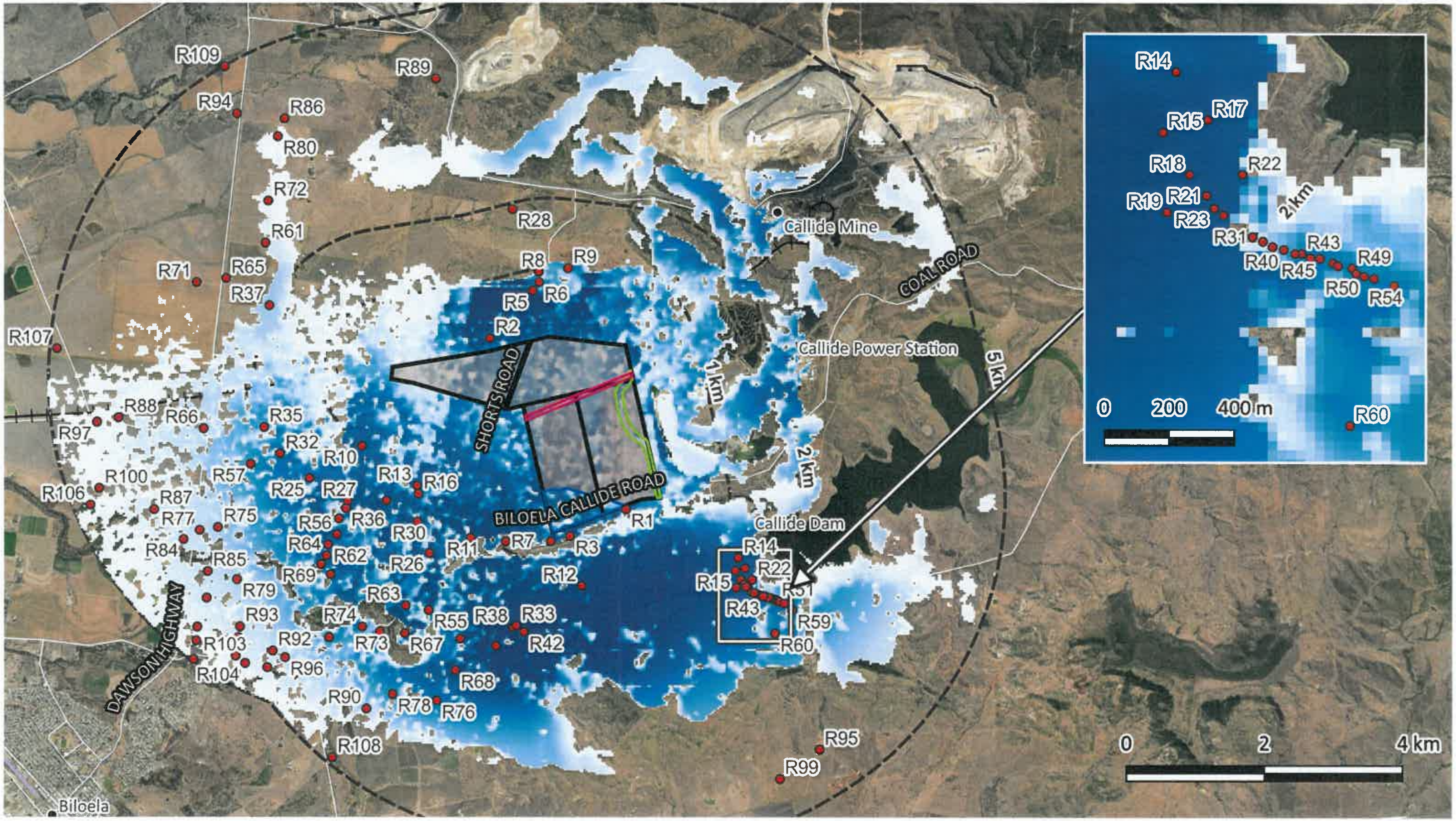
As the preliminary tool already excluded R23-27, R30-31, R33-R101 it can be assumed that the distance and height differences are sufficient to mitigate visual impacts and preclude these receivers from further assessment.

R7, R28 and R29 listed in Table 4.1 will not be considered further in this detailed visual assessment based on the findings of the viewshed analysis.

The four roads identified by the preliminary assessment are within the ZTI which has been used to determine viewpoints from these roads (see Figure 4.3):

- Shorts Road which transects the development footprint and will be the location of site access points
- Biloela-Callide Road adjacent to the southern boundary of the development footprint
- Callide Lake Drive to the southeast of the project providing access to Lake Callide
- Linkes Road to the southwest of the development footprint.

These roads in the vicinity of the project site are used primarily by local traffic (e.g. local residents travelling to and from work mainly associated with the Callide Power Station, school etc. and farm vehicles accessing farmland via local roads and transporting livestock and produce). In addition, a number of road users are tourists accessing the Lake Callide area.




5 km ZTI
Percentage of reference points visible:
- <20%
- 20-40%
- 40-60%
- 60-80%
- 80-100%
- Potential sensitive receptors
- Callide SPS maximum extent
- Lot boundaries
- Flood map overlay exclusion
- Regulated Vegetation Watercourse buffer
- Electrical easement

**AE1206 Callide SPS**
**Figure 4.3: 5 km ZTI**

Created: 11/11/2022
Print size: A4
CRS: GDA2020 / MGA zone 56
Additional data sources:
ESRI satellite [accessed 1/10/2022

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### 4.1.3 Viewpoint selection

Viewpoints (VPs) are positions looking towards the proposal that consider views from receivers.

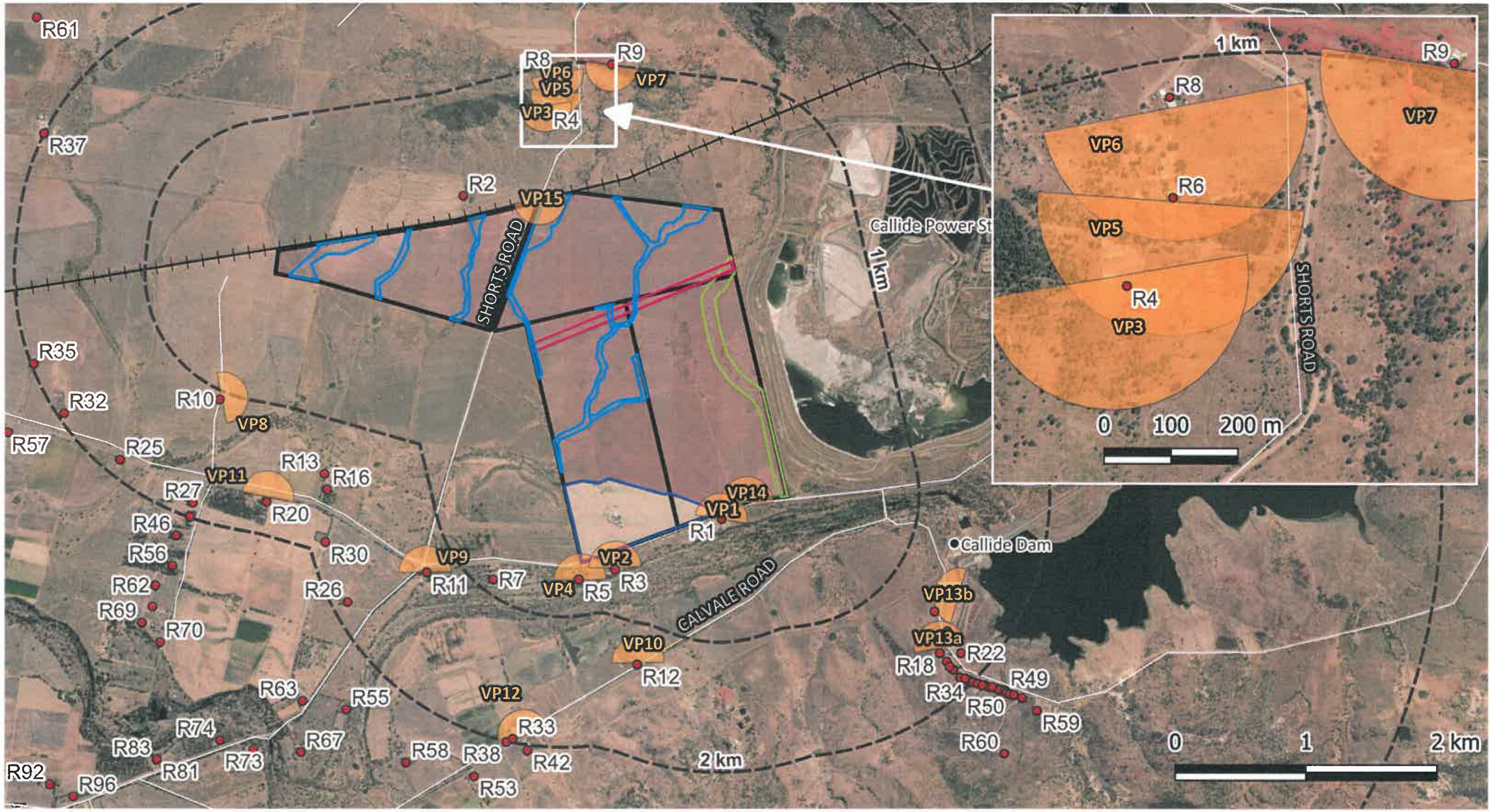
Accent has selected 16 viewpoints (VP1- VP15, including two from VP13) for analysis and photomontage preparation as listed in Table 4.2. The location, direction and extent of each viewpoint is shown in Figure 4.4.

*Table 4.2 Selected viewpoints (VP1-VP15) for analysis and photomontage*

| View-point | Description | Distance and direction from site footprint* |
|---|---|---|
| **VP1** | The view from receiver **R1** looking north towards the development footprint from the front porch of the residence | 60 m south of the proposed development footprint |
| **VP2** | The view from residence **R3** looking north towards the development footprint from the outside the living room of the residence | 660 m south of the proposed development footprint |
| **VP3** | The view from residence **R4** looking south towards the development footprint from outside the living room area on the porch of the residence | 695 m north of the proposed development footprint |
| **VP4** | The view from residence **R5** looking north towards the development footprint from the outside the kitchen of the residence | 724 m south of the proposed development footprint |
| **VP5** | The view from residence **R6** looking south towards the development footprint the balcony of the residence | 790 m north of the proposed development footprint |
| **VP6** | The view from residence **R8** looking south towards the development footprint from the porch of the residence | 942 m north of the proposed development footprint |
| **VP7** | The view from residence **R9** looking south towards the development footprint from the garden of the residence (resident not present) | 1005 m north of the proposed development footprint |
| **VP8** | The view from residence **R10** looking east towards the development footprint from the outside the residence | 1060 m west of the proposed development footprint |
| **VP9** | The view from residence **R11** looking northwest towards the development footprint from the balcony. This view is also representative of the view from Linkes Road where it intersects with Biloela Callide Road. | 1235 m southwest of the proposed development footprint |
| **VP10** | The view from residence **R12** looking north from the garden towards the development footprint | 1310 m south of the proposed development footprint |
| **VP11** | The view from the road outside **R20** looking north from the garden towards the development footprint | 1730 m southwest of the proposed development footprint |

| View-point | Description | Distance and direction from site footprint* |
|---|---|---|
| **VP12** | The view from residence **R32** and **R40** looking north from the end of the driveway towards the development footprint | 1950 m south of the proposed development footprint |
| **VP13a** | A representative view from the cluster of residences at Lake Callide looking northwest towards the development | 1570 m southeast of the proposed development footprint |
| **VP13b** | A second representative view from the cluster of residences at Lake Callide looking northwest towards the development | 1550 m southeast of the proposed development footprint |
| **VP14** | The view from the approach to the development footprint travelling west along Biloela-Callide Road | 20 m south of the proposed development footprint |
| **VP15** | The view from the approach to the development travelling south on Shorts Road selected as this has a higher elevation than other sections but is also very close to the development footprint | 50 m north of the development footprint |

*Note that discrepancies between distances in this table and Table 4.1 are due to the location of the VPs in relation to the receiver




Viewpoint directions and extents

Callide SPS maximum extent

Potential sensitive receptors

Moama System

Lot boundaries

Flood map overlay exclusion

Regulated Vegetation Watercourse buffer

Electrical easement

**AE1206 Callide SPS**

**Figure 4.4 :Viewpoints**

Created: 07/12/2022

Print size: A4

CRS: GDA2020 / MGA zone 56

Additional data sources: ESRI satellite [accessed 1/10/2022]

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A small number of residences were not represented by viewpoints as summarised below.

**R2:** Property could not be accessed during the site visit and a view from end of driveway would not have been representative. Accent personnel walked alongside the property boundary but could not easily make out the building due to vegetation and equipment (Photo 4.1). Photos from the property boundary would be looking directly at the SPS from the other side of the rail-line and are also unlikely to be representative. It is not clear if the property is currently occupied.

*Photo 4.1 R2 viewed from rail line between R2 and the development footprint obscured by vegetation*

**R13 and R16:** both residences belong to the same owner who owns the farmland adjacent to the solar farm to the west. Accent spoke with the resident during the site visit, and they did not wish for viewpoint photos to be taken. However, they also stated they had no objection to the project and upon visiting the main residence it was apparent that the home was surrounded by thick vegetation that had been planted by the resident in all directions surrounding the home which would prevent any line of sight towards the project.

## 4.2 Viewpoint impact assessment

Whether visual receivers are also sensitive receivers depends on their susceptibility to change in views and visual amenity and the value attached to particular vista. Based on the LIIEMA guidance, people living at residences are considered more susceptible to change than road users. The road users who use Biloela-Callide Road, Shorts Road, Lake Callide Drive and Linkes Road are also subject to the change in visual amenity resulting from the construction and operation of the SPS.

The potential for visual impacts at each of the viewpoints in Table 4.2 during operations is assessed below by considering the:

- nature of potential impacts
- scenic quality class of the viewpoint
- sensitivity of the receivers
- magnitude of the project impact as seen from each viewpoint
- the combination of the above elements to provide an impact rating (using the matrices in Tables 2.3-2.7).

Photomontages (Photos 4.2-4.46) have been prepared to simulate a 180-degree field of view within which the solar farm is located and may or may not be visible. The viewpoint locations are shown in Figure 4.4.

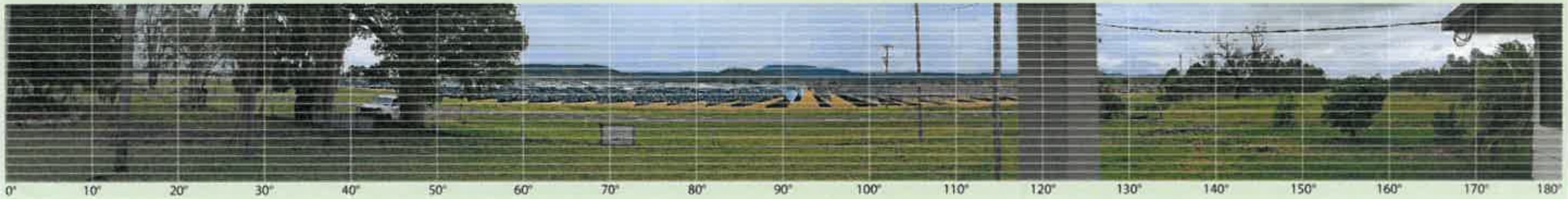
### 4.2.1 Viewpoint 1 (VP1) –


| Location: | Current view towards Callide SPS site looking north from R1 | | | | |
|---|---|---|---|---|---|
| Co-ordinates: | 29.088026 S, 153.001831 E | Date: | 20/10/2022 | Time: | 11.00 am |
| Orientation: | North | Altitude: | 191 m | Distance to project: | 60 m |
| Camera: | Pentax K-70 50mm<br>Height: 1500 mm | Weather: | Cloudy | Surveyor: | Jacqueline Mallinson (Environmental Scientist MSc BSc) |

*Photo 4.2 Current view from VP1*

*Photo 4.3 Photomontage of view from VP1 with SPS infrastructure*

*Photo 4.4 Magnitude grid tool for VP1 photomontage*




Visual Impact Rating VP1

The impact rating in Table 4.3 is determined using the matrix in Table 2.3 to consider the combination of the Sensitivity rating of the receiver and the Magnitude rating of the development from the receiver. For VP1 the final impact rating is **High.** This receiver is the closest to the project and has anticipated unobscured views of the proposed solar power station infrastructure across a 180-degree field of view. Discussions with the receptor during Accent's Site visit included discussions about possible vegetation screening along Biloela Callide Road.

*Table 4.3 Visual Impact Rating VP1*

| Distance to development | Viewpoint Type | Viewer Sensitivity | Scenic Quality Class | Visual Sensitivity rating (pre-mitigation) | Occupied Cells (10° wide 1° high) | Magnitude rating | Visual Impact rating |
|---|---|---|---|---|---|---|---|
| 60 m | Rural dwelling primary viewpoint | Moderate | Moderate | **Moderate** | 22 | **High** | **High** |

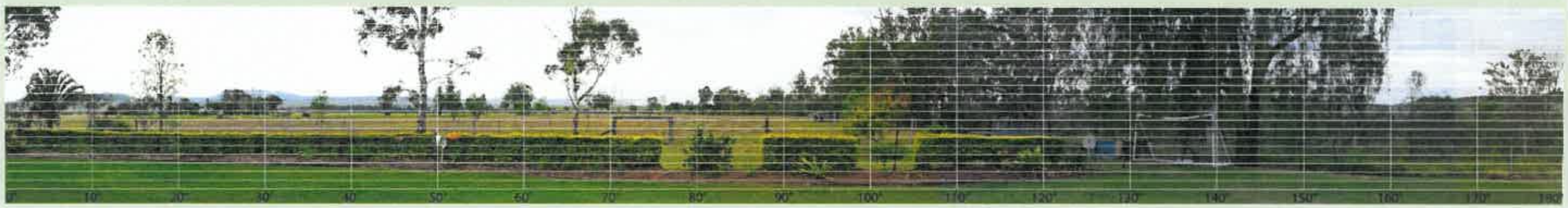
### 4.2.2 Viewpoint 2 (VP2) –


| Location: | Current view towards Callide SPS site looking north from R3 | | | | |
|---|---|---|---|---|---|
| Co-ordinates: | 150.5867369°E - 24.3681221°S | Date: | 19/10/2022 | Time: | 5:15 pm |
| Orientation: | North | Altitude: | 189 m | Distance to project: | 658 m |
| Camera: | Pentax K-70 50mm<br>Height: 1500 mm | Weather: | Cloudy | Surveyor: | Jacqueline Mallinson (Environmental Scientist MSc BSc) |

*Photo 4.5 Current view from VP2*

*Photo 4.6 Photomontage of view from VP2 with SPS infrastructure*

***Photo 4.7 Magnitude grid tool for VP2 photomontage***




### VP2 Visual Impact Rating

The impact rating as detailed in Table 4.4 is determined using the matrix in Table 2.3 to consider the combination of the Sensitivity rating of the receiver and the Magnitude rating of the development from the receiver. For VP2 the final impact rating is **Low**. Whilst this receptor (R3) is the third closest to the development footprint, the topography between the receptor and the site is advantageous to the receptor minimising visibility of the site. The intermittent vegetation between the site and receptor provides visual buffering capacity.

*Table 4.4 Visual Impact Rating VP2*

| Distance to development | Viewpoint Type | Viewer Sensitivity | Scenic Quality Class | Visual Sensitivity rating (pre-mitigation) | Occupied Cells (10° wide 1° high) | Magnitude rating | Visual Impact rating |
|---|---|---|---|---|---|---|---|
| 658 m | Rural dwelling primary viewpoint | Moderate | Moderate | **Moderate** | 6-7 | **Low** | **Low** |

### 4.2.3 Viewpoint 3 (VP3) –

| | | | | | |
|---|---|---|---|---|---|
| Location: | Current view towards Callide SPS site looking South from R4 | | | | |
| Co-ordinates: | 150.582006E -24.336083S | Date: | 19/20/2022 | Time: | 4:00 pm |
| Orientation: | South | Altitude: | 293 m | Distance to project: | 689 m |
| Camera: | Pentax K-70 50mm<br>Height: 1500 mm | Weather: | Cloudy | Surveyor: | Jacqueline Mallinson<br>(Environmental Scientist MSc) |

*Photo 4.8 Current view from VP3*

*Photo 4.9 Photomontage of view from VP3 with SPS infrastructure*

*Photo 4.10 Magnitude grid tool for VP3 photomontage*


VP3 Visual Impact Rating

The impact rating as detailed in Table 4.5 is determined using the matrix in Table 2.3 to consider the combination of the Sensitivity rating of the receiver and the Magnitude rating of the development from the receiver. For VP3 (R4) the final impact rating is **High**. Whilst this receptor (R3) is almost 700 m from the proposed development footprint the topography between the receptor and the site provides large views of the solar power station infrastructure. The receptor is at an elevation of 293 m, which is over 100 m higher than some parts of the SPS. The receptor will have visibility of most of the SPS panels, substation and BESS.

*Table 4.5 Visual Impact Rating VP3*

| Distance to development | Viewpoint Type | Viewer Sensitivity | Scenic Quality Class | Visual Sensitivity rating (pre-mitigation) | Occupied Cells (10° wide 1° high) | Magnitude rating | Visual Impact rating |
|---|---|---|---|---|---|---|---|
| 689 m | Rural dwelling primary viewpoint | Moderate | High | **High** | 29 | **High** | **High** |

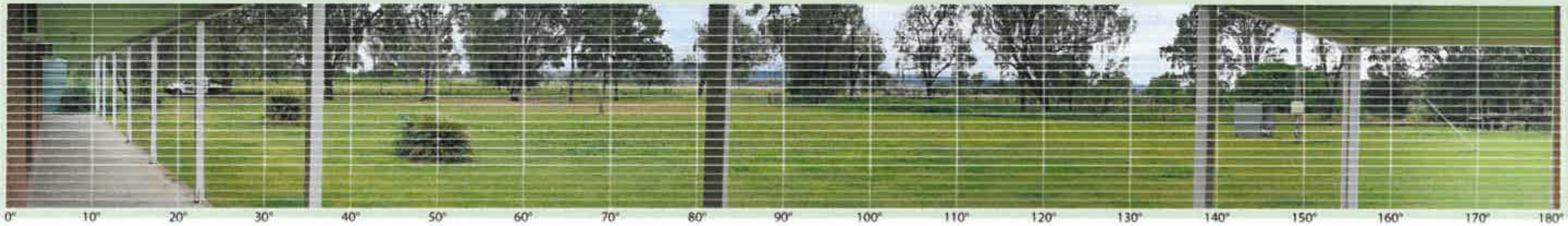
### 4.2.4 Viewpoint 4 (VP4) –


| | | | | | |
|---|---|---|---|---|---|
| Location: | Current view towards Callide SPS site looking North from R5 | | | | |
| Co-ordinates: | 150.5839553°E - 24.3687758°S | Date: | 20/10/2022 | Time: | 10:55 am |
| Orientation: | North | Altitude: | 188 m | Distance to project: | 722 m |
| Camera: | Pentax K-70 50mm<br>Height: 1500 mm | Weather: | Cloudy | Surveyor: | Jacqueline Mallinson (Environmental Scientist MSc BSc) |

*Photo 4.11 Current view from VP4*

*Photo 4.12 Photomontage of view from VP4 with SPS infrastructure*

*Photo 4.13 Magnitude grid tool for VP4 photomontage*




### VP4 Visual Impact Rating

The impact rating for VP4 (R5) as detailed in Table 4.6 is determined using the matrix in Table 2.3 to consider the combination of the Sensitivity rating of the receiver and the Magnitude rating of the development from the receiver. For VP4 the final impact rating is **Low.** This receptor (R5) is within a kilometre of the development footprint but the topography between the receptor and the site is advantageous to the receptor, minimising site visibility. The intermittent vegetation between the site and receptor provides additional visual buffering capacity. The receptor will retain views of the elevated slopes on the other side of the development footprint.

*Table 4.6 Visual Impact Rating VP4*

| Distance to development | Viewpoint Type | Viewer Sensitivity | Scenic Quality Class | Visual Sensitivity rating (pre-mitigation) | Occupied Cells (10° wide 1° high) | Magnitude rating | Visual Impact rating |
|---|---|---|---|---|---|---|---|
| 722 m | Rural dwelling primary viewpoint | Moderate | Moderate | **Moderate** | 8 | **Low** | **Low** |

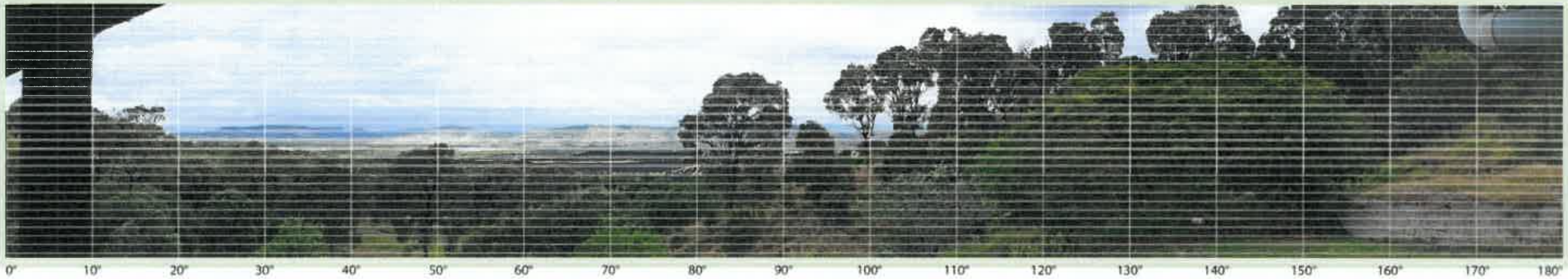
### 4.2.5 Viewpoint 5 (VP5) –


| | | | | | |
|---|---|---|---|---|---|
| Location: | Current view towards Callide SPS site looking South from R6 | | | | |
| Co-ordinates: | 150.5829140E -24.3349874S | Date: | 19/10/2022 | Time: | 4:25 pm |
| Orientation: | South | Altitude: | 282 m | Distance to project: | 794 m |
| Camera: | Pentax K-70 50mm<br>Height: 1500 mm | Weather: | Cloudy | Surveyor: | Jacqueline Mallinson (Environmental Scientist MSc) |

*Photo 4.14 Current view from VP5*

*Photo 4.15 Photomontage of view from VP5 with SPS Infrastructure*

*Photo 4.16 VP5 with magnitude grid*




VP5 Visual Impact Rating

The impact rating for VP5 (R6) as detailed in Table 4.7 is determined using the matrix in Table 2.3 to consider the combination of the Sensitivity rating of the receiver and the Magnitude rating of the development from the receiver. For VP5 the final impact rating is **Moderate** This receptor (R6) is within a kilometre of the development footprint and is elevated over 100 m above portions of the SPS. Whilst the magnitude rating is low, the scenic quality and value associated with the view are high. The topography to the immediate west (the right-hand side of Photos 4.13-4.15) limits the horizontal field of view and the intermittent vegetation provides visual buffering capacity. The receptor will also retain views of the hills on the other side of the development footprint.

*Table 4.7 Visual Impact Rating VP5*

| Distance to development | Viewpoint Type | Viewer Sensitivity | Scenic Quality Class | Visual Sensitivity rating (pre-mitigation) | Occupied Cells (10° wide 1° high) | Magnitude rating | Visual Impact rating |
|---|---|---|---|---|---|---|---|
| 794 m | Rural dwelling primary viewpoint | Moderate | High | **High** | 9 | **Low** | **Moderate** |

### 4.2.6 Viewpoint 6 (VP6) –

| | | | | | | |
|---|---|---|---|---|---|---|
| Location: | Current view towards Callide SPS site looking south from R8 | | | | | |
| Co-ordinates: | 150.5830172°E -24.3336969°S | Date: | 19/10/2022 | Time: | 4:07 pm | |
| Orientation: | South | Altitude: | 283 m | Distance to project: | 943 m | |
| Camera: | Pentax K-70 50mm Height: 1500 mm | Weather: | Cloudy | Surveyor: | Jacqueline Mallinson (Environmental Scientist MSc BSc) | |

*Photo 4.17 Current view from VP6*

The solar farm infrastructure would not be visible from this viewpoint due to both favourable topography and vegetation between the site and the residence, therefore no photomontage has been undertaken for this view. The resident also voiced little concern during a short interaction with Accent personnel during the site visit.

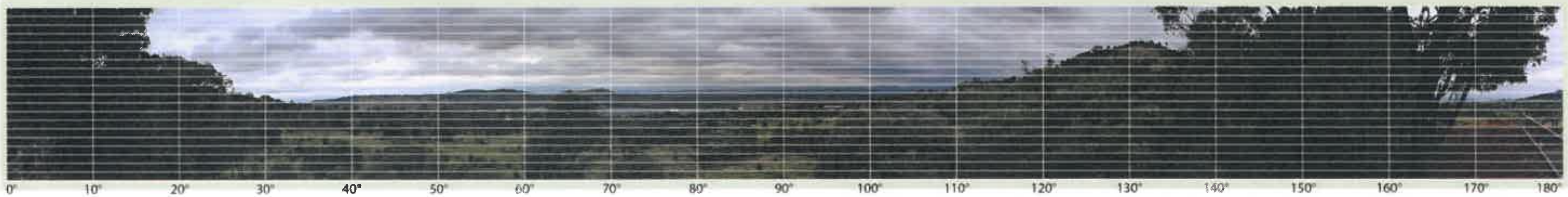
### 4.2.1 Viewpoint 7 (VP7) –


| Location: | Current view towards Callide SPS site looking south from R9 | | | | |
|---|---|---|---|---|---|
| Co-ordinates: | 150.5870270°E -<br>24.3332079°S | Date: | 19/10/2022 | Time: | 4:50 pm |
| Orientation: | South | Altitude: | 282 m | Distance to project: | 1004 m |
| Camera: | Pentax K-70 50mm<br>Height: 1500 mm | Weather: | Cloudy | Surveyor: | Jacqueline Mallinson (Environmental Scientist MSc BSc) |

*Photo 4.18 Current view from VP7*

*Photo 4.19 Photomontage of view from VP7 with SPS infrastructure*

*Photo 4.20 Magnitude grid tool for VP7 photomontage*




### VP7 Visual Impact Rating

The impact rating for VP7 (R8) as detailed in Table 4.8 is determined using the matrix in Table 2.3 to consider the combination of the Sensitivity rating of the receiver and the Magnitude rating of the development from the receiver. For VP7 the final impact rating is **Low**. This receptor (R8) is over a kilometre away from the development footprint but is elevated over 100 m above portions of the SPS. Whilst the magnitude rating is low, the scenic quality and value associated with the view are high. The topography to the immediate west (the right-hand side of Photos 4.13-4.15) limits the horizontal field of view and the extensive intermittent vegetation provides significant buffering capacity. The receptor will also retain views of the hills on the other side of the development footprint.

*Table 4.8 Visual Impact Rating VP7*

| Distance to development | Viewpoint Type | Viewer Sensitivity | Scenic Quality Class | Visual Sensitivity rating (pre-mitigation) | Occupied Cells (10° wide 1° high) | Magnitude rating | Visual Impact rating |
|---|---|---|---|---|---|---|---|
| 1004 m | Rural dwelling primary viewpoint | Moderate | High | **High** | 4-5 | **Very low** | **Low** |

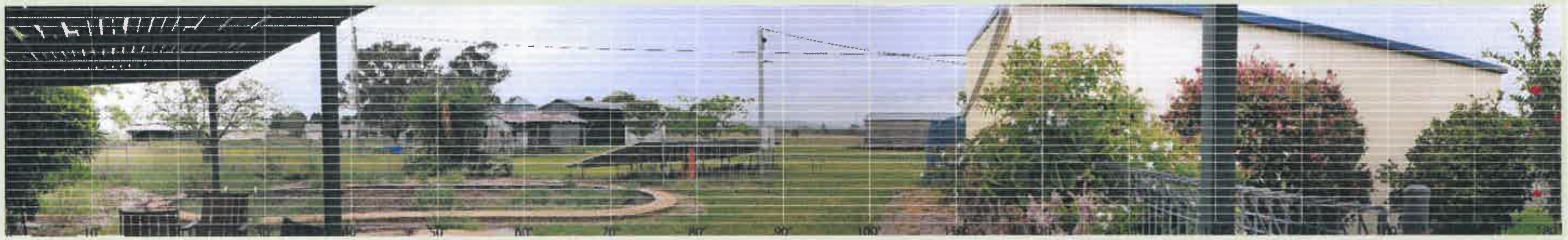
### 4.2.2 Viewpoint 8 (VP8) –


| Location: | Current view towards Callide SPS site looking east from R10 | | | | |
|---|---|---|---|---|---|
| Co-ordinates: | 150.5572422 E, 24.3558955 S | Date: | 20/10/2022 | Time: | 10:00 am |
| Orientation: | East | Altitude: | 188 m | Distance to project: | 1064 m |
| Camera: | Pentax K-70 50mm<br>Height: 1500 mm | Weather: | Cloudy | Surveyor: | Jacqueline Mallinson (Environmental Scientist MSc BSc) |

*Photo 4.21 Current view from VP8*

*Photo 4.22 Photomontage of view from VP8 with SPS infrastructure*

*Photo 4.23 Magnitude grid tool for VP8 photomontage*



**VP8 Visual Impact Rating**

The impact rating for VP8 (R10) as detailed in Table 4.9 is determined using the matrix in Table 2.3 to consider the combination of the Sensitivity rating of the receiver and the Magnitude rating of the development from the receiver. For VP8 the final impact rating is **Very Low**. This receptor (R10) is over a kilometre away from the development footprint and is at roughly the same elevation as the proposed SPS. The large number of out buildings surrounding the property and presence of intermittent vegetation significantly impede views towards the development footprint.

*Table 4.9 Visual Impact Rating VP8*

| Distance to development | Viewpoint Type | Viewer Sensitivity | Scenic Quality Class | Visual Sensitivity rating (pre-mitigation) | Occupied Cells (10° wide 1° high) | Magnitude rating | Visual Impact rating |
|---|---|---|---|---|---|---|---|
| 658 m | Rural dwelling primary viewpoint | Moderate | Low | **Moderate** | 2-4 | **Very Low** | **Very Low** |

### 4.2.3 Viewpoint 9 (VP9) –


| Location: | Current view towards Callide SPS site looking north from R11 | | | | |
|---|---|---|---|---|---|
| Co-ordinates: | 150.5723463E 24.3680922S | Date: | 19/10/2022 | Time: | 4:30 pm |
| Orientation: | North | Altitude: | 185 m | Distance to project: | 1239 m |
| Camera: | Pentax K-70 50mm<br>Height: 1500 mm | Weather: | Cloudy | Surveyor: | Jacqueline Mallinson<br>(Environmental Scientist MSc) |

*Photo 4.24 Current view from VP9*

*Photo 4.25 Photomontage of view from VP9 with SPS infrastructure*

*Photo 4.26 Magnitude grid tool for VP9 photomontage*

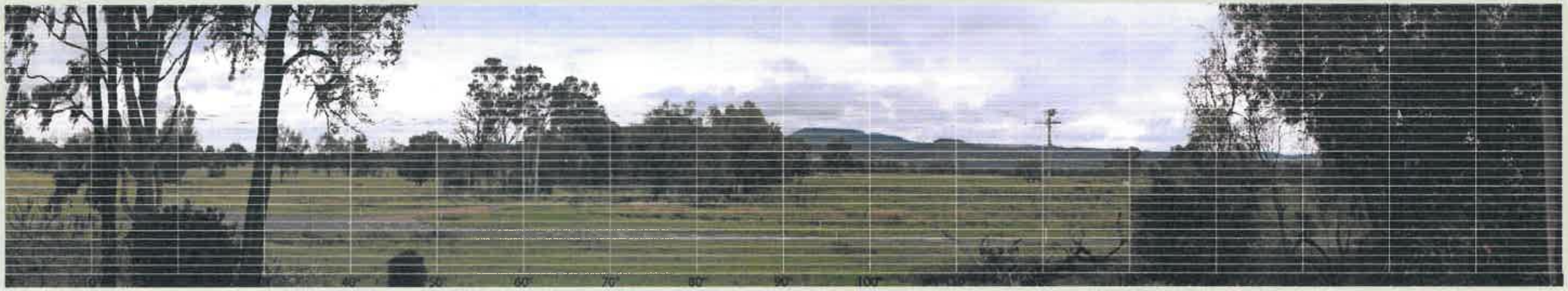
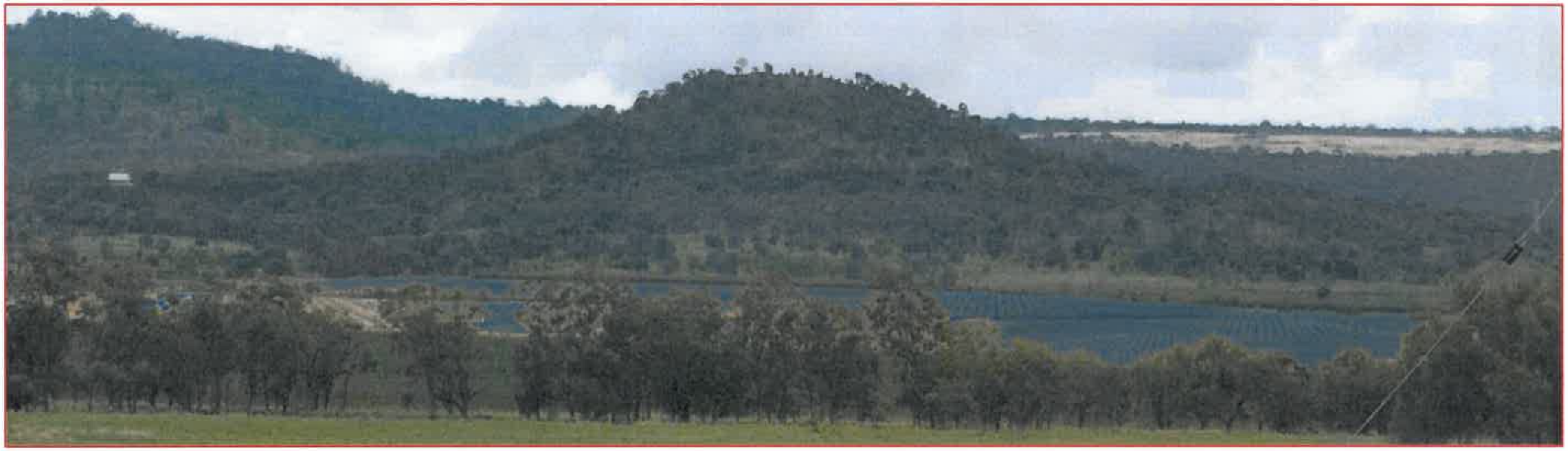



*Photo 4.27 Area of VP9 zoom-in Photo 4.27*

*Photo 4.28 Zoom in on visible panels from VP9*



**VP9 Visual Impact Rating**

The impact rating for VP9 (R11) as detailed in Table 4.10 is determined using the matrix in Table 2.3 to consider the combination of the Sensitivity rating of the receiver and the Magnitude rating of the development from the receiver. For VP9 the final impact rating is **Very Low**. This receptor (R11) is over a kilometre away from the development footprint and is at roughly the same elevation as the proposed SPS (most of which is not visible) with the visible portion of the SPS shown in Figure 4.3 coinciding with the higher elevations within the footprint. The vegetation along Shorts Road and between the development and the receptor have a significant visual absorption capacity. This view is also from a balcony and so is approximately 2 m higher than views that would be experienced by road users along Linkes Road approaching Biloela Callide Road immediately to the west of the R11 property, as such the visual impact on road users along Linkes Road would be anticipated to be very low.

*Table 4.10 Visual Impact Rating VP10*

| Distance to development | Viewpoint Type | Viewer Sensitivity | Scenic Quality Class | Visual Sensitivity rating (pre-mitigation) | Occupied Cells (10° wide 1° high) | Magnitude rating | Visual Impact rating |
|---|---|---|---|---|---|---|---|
| 1239 m | Rural dwelling primary viewpoint | Moderate | Moderate | **Moderate** | 3-4 | **Very Low** | **Very Low** |

## 4.2.4 Viewpoint 10 (VP10) –


| Location: | Current view towards Callide SPS site looking north from R12 | | | | |
|---|---|---|---|---|---|
| **Co-ordinates:** | 150.5883110°E 24.3745967°S | **Date:** | 20/10/2022 | **Time:** | 12:00 pm |
| **Orientation:** | Southeast | **Altitude:** | 957 m | **Distance to project:** | 1310 m |
| **Camera:** | Pentax K-70 50mm<br>Height: 1500 mm | **Weather:** | Cloudy | **Surveyor:** | Jacqueline Mallinson (Environmental Scientist MSc BSc) |

The solar farm infrastructure would not be visible from this viewpoint due to both favourable topography and vegetation between the site and the residence; therefore, no photomontage has been prepared for this view. The resident (who rents the property) also voiced little concern during a short interaction with Accent personnel during the site visit.

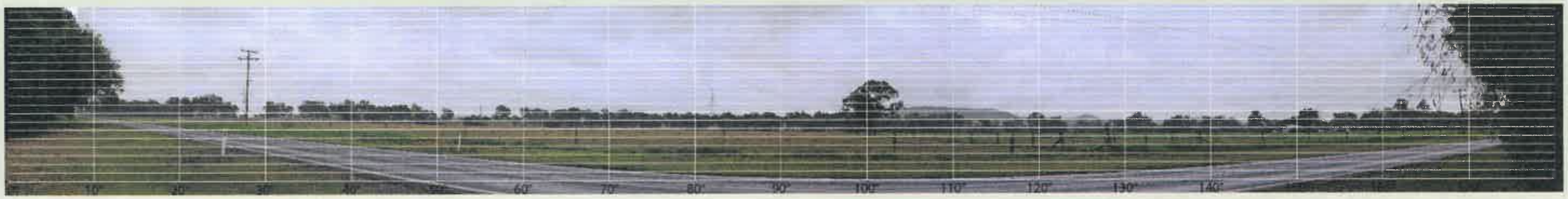
### 4.2.5 Viewpoint 11 (VP11) –


| Location: | Current view towards Callide SPS site looking north from R20 | | | | |
|---|---|---|---|---|---|
| Co-ordinates: | 150.5609156°E<br>24.3626428°S | Date: | 20/10/2022 | Time: | 9:30 am |
| Orientation: | Northeast | Altitude: | 182 m | Distance to project: | 1746 m |
| Camera: | Pentax K-70 50mm<br>Height: 1500 mm | Weather: | Cloudy | Surveyor: | Jacqueline Mallinson (Environmental Scientist MSc BSc) |

Photo 4.29 Current view from VP11

Photo 4.30 Photomontage of view from VP11 with SPS infrastructure

***Photo 4.31 Magnitude grid tool for VP11 photomontage***




**VP11 Visual Impact Rating**

The impact rating for VP11 (R20) as detailed in Table 4.11 is determined using the matrix in Table 2.3 to consider the combination of the Sensitivity rating of the receiver and the Magnitude rating of the development from the receiver. For VP9 the final impact rating is **Very Low**. This receptor (R20) is over a kilometre away from the development footprint and is at roughly the same elevation as the proposed SPS. The vegetation and topography limit the visibility from this receptor.

*Table 4.11 Visual Impact Rating VP11*

| Distance to development | Viewpoint Type | Viewer Sensitivity | Scenic Quality Class | Visual Sensitivity rating (pre-mitigation) | Occupied Cells (10° wide 1° high) | Magnitude rating | Visual Impact rating |
|---|---|---|---|---|---|---|---|
| 1746 m | Rural dwelling primary viewpoint | Moderate | Moderate | **Moderate** | 1 | **Very Low** | **Very Low** |

### 4.2.6 Viewpoint 12 (VP12) –


| | | | | | |
|---|---|---|---|---|---|
| Location: | Current view towards Callide SPS site looking north from the end of the driveway of R42 representing views from R32/R38/R42 | | | | |
| Co-ordinates: | 150.5796615°E<br>24.3795164°S | Date: | 19/10/2022 | Time: | 3:07 pm |
| Orientation: | North | Altitude: | 197 m | Distance to project: | 1946 m |
| Camera: | Pentax K-70 50mm<br>Height: 1500 mm | Weather: | Cloudy | Surveyor: | Jacqueline Mallinson (Environmental Scientist MSc BSc) |

The Solar farm infrastructure would not be visible from this viewpoint due to both favourable topography and vegetation between the site and the residence, therefore no photomontage has been undertaken for this view. The resident (associated with R32/ R38/ R42) agreed the possibility of visibility would be very low a short interaction with Accent personnel during the site visit.

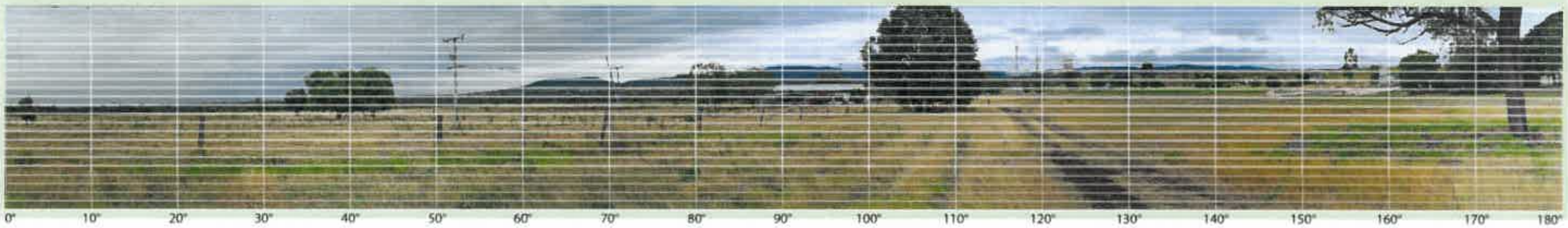
## 4.2.7 Viewpoint 13a (VP13a) –

| | | | | | |
|---|---|---|---|---|---|
| Location: | Current view towards Callide SPS site looking northwest from Cluster of residences along Callide Lake Drive | | | | |
| Co-ordinates: | 150.6112284°E 24.3740948°S | Date: | 19/10/2022 | Time: | 3:30 pm |
| Orientation: | North | Altitude: | 215 m | Distance to project: | 1570 m |
| Camera: | Pentax K-70 50mm<br>Height: 1500 mm | Weather: | Cloudy | Surveyor: | Jacqueline Mallinson (Environmental Scientist MSc BSc) |

*Photo 4.32 Current view from VP13a*

*Photo 4.33 Photomontage of view from VP13a with SPS infrastructure*

*Photo 4.34 Magnitude grid tool for VP13a photomontage*




### VP13a Visual Impact Rating

The impact rating for VP13a (Cluster of residential receptors along Lake Callide Drive) as detailed in Table 4.12 is determined using the matrix in Table 2.3 to consider the combination of the Sensitivity rating of the receiver and the Magnitude rating of the development from the receiver. For VP13a the final impact rating is **Very Low.** This cluster of receptors is over a kilometre away from the development footprint and are roughly the same elevation as the proposed SPS. Callide Creek which runs between the development footprint and the receptors is densely vegetated providing some visual absorption capacity. In addition to these factors most of the properties primary viewpoints are directed west towards Lake Callide away from the proposed development.

*Table 4.12 Visual Impact Rating VP13a*

| Distance to development | Viewpoint Type | Viewer Sensitivity | Scenic Quality Class | Visual Sensitivity rating (pre-mitigation) | Occupied Cells (10° wide 1° high) | Magnitude rating | Visual Impact rating |
|---|---|---|---|---|---|---|---|
| 658 m | Rural dwelling primary viewpoint | Moderate | Moderate | **Moderate** | 2 | **Very Low** | **Very Low** |

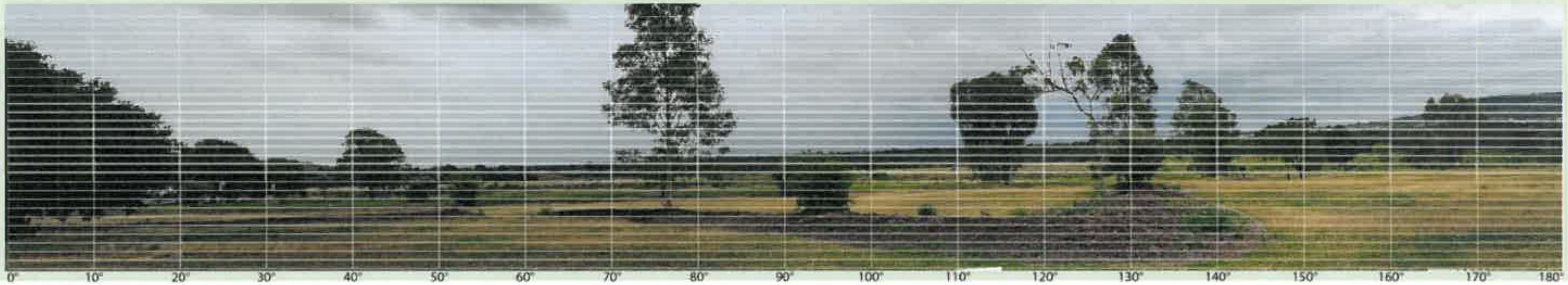
### 4.2.8 Viewpoint 13b (VP13b) –

| | | | | | |
|---|---|---|---|---|---|
| Location: | Current view towards Callide SPS site looking north from Lake Callide Campground | | | | |
| Co-ordinates: | 152.977477 E 29.084213 S | Date: | 19/10/2022 | Time: | 3:40 pm |
| Orientation: | Northwest | Altitude: | 215 m | Distance to project: | 1550 m |
| Camera: | Pentax K-70 50mm<br>Height: 1500 mm | Weather: | Cloudy | Surveyor: | Jacqueline Mallinson<br>(Environmental Scientist MSc) |

*Photo 4.35 Current view from VP13b*

*Photo 4.36 Photomontage of view from VP13b with SPS infrastructure*

*Photo 4.37 Magnitude grid tool for VP13b photomontage*




### VP13a Visual Impact Rating

The impact rating for VP13b (Campsite along Lake Callide Drive) as detailed in Table 4.13 is determined using the matrix in Table 2.3 to consider the combination of the Sensitivity rating of the receiver and the Magnitude rating of the development from the receiver. For VP13b the final impact rating is **Very Low**. This recreational receptor is over a kilometre away from the development footprint. Callide Creek which runs between the development footprint and the receptors is densely vegetated in addition to intermittent roadside vegetation providing significant visual absorption capacity. In addition to these factors the receptors have low visual sensitivity and would be expected to orient themselves towards the key view west towards Lake Callide away from the proposed development as the recreational users as transient receptors.

*Table 4.13 Visual Impact Rating VP13b*

| Distance to development | Viewpoint Type | Viewer Sensitivity | Scenic Quality Class | Visual Sensitivity rating (pre-mitigation) | Occupied Cells (10° wide 1° high) | Magnitude rating | Visual Impact rating |
|---|---|---|---|---|---|---|---|
| 658 m | Recreational location (campsite) | Low | Low | Low | 2 | **Very Low** | **Very Low** |

### 4.2.9 Viewpoint 14 (VP14) –

Due to the large number of panels visible from this viewpoint two larger 90-degree photomontages have been created to demonstrate the impact on road users along Biloela-Callide Road


| Location: | Current view towards Callide SPS site looking north from Biloela-Callide Road | | | | |
|---|---|---|---|---|---|
| Co-ordinates: | 152.977477 E, 29.084213 S | Date: | 20/10/2022 | Time: | 12:07 pm |
| Orientation: | North | Altitude: | 191 m | Distance to project: | 20 m |
| Camera: | Pentax K-70 50mm<br>Height: 1500 mm | Weather: | Cloudy | Surveyor: | Jacqueline Mallinson (Environmental Scientist MSc BSc) |

Photo 4.38 Current view east from VP14

*Photo 4.39 Photomontage of VP14 (east) with panels*

Photo 4.40 Magnitude grid tool for VP14 photomontage (eastern 90 degrees)

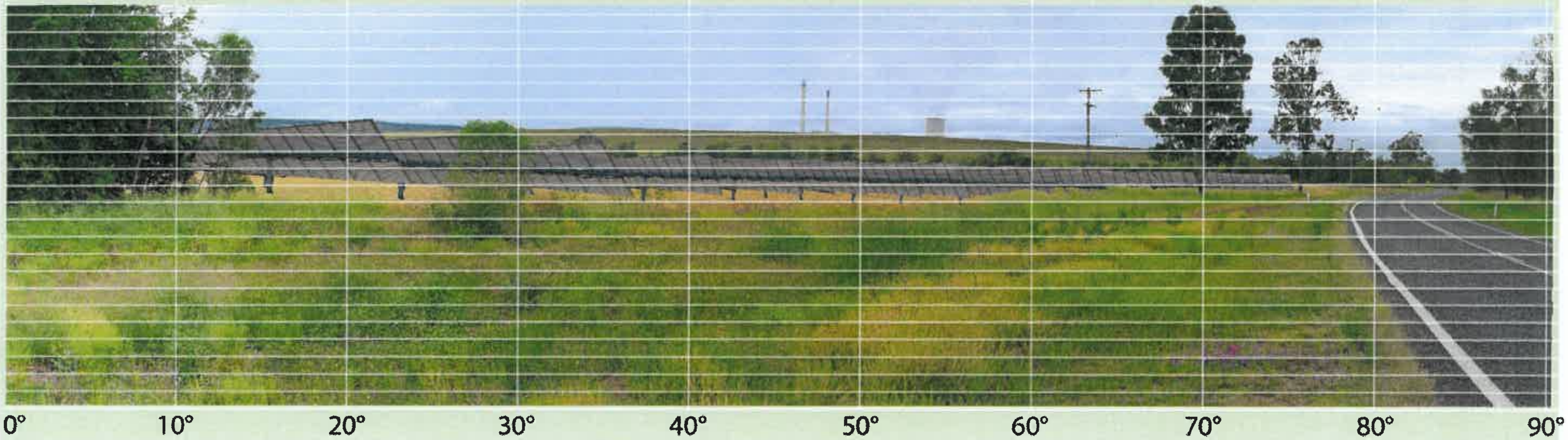
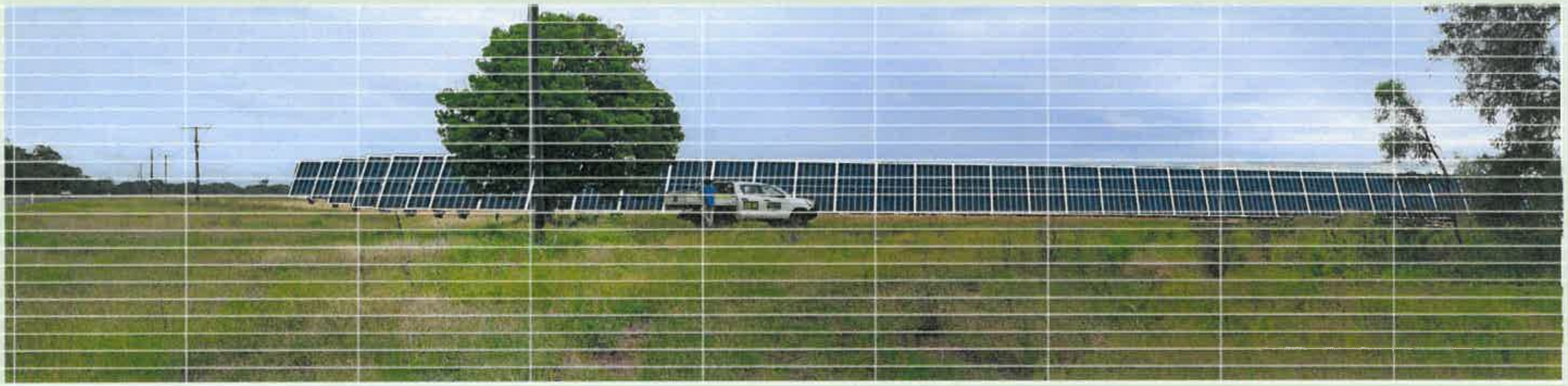


Photo 4.41 Current view from VP14 west

Photo 4.42 Photomontage of VP14 (west) with panels

*Photo 4.43 Magnitude grid tool for VP14 photomontage (western 90 degrees)*




VP14 Visual Impact Rating

The impact rating for VP14 (along Biloela-Callide Road) as detailed in Table 4.14 is determined using the matrix in Table 2.3 to consider the combination of the Sensitivity rating of the receiver and the Magnitude rating of the development from the receiver. For VP14 the final impact rating is **Moderate.** This road receptor is less sensitive than other receptors due to the transient nature of the viewpoint particularly as road users are travelling at up to 100 km/hour. However, at this bend in the road there is particularly high visibility of the SPS panels. The road is adjacent to the property boundary where there is currently minimal vegetation present. Due to the impacts on road users along this section of Biloela-Callide Road mitigation measures should be taken to reduce visual impacts as well as reduce the risk (considered low) of glint and glare impacts on road users.

*Table 4.14 Visual Impact Rating VP14*

| Distance to development | Viewpoint Type | Viewer Sensitivity | Scenic Quality Class | Visual Sensitivity rating (pre-mitigation) | Occupied Cells (10° wide 1° high) | Magnitude rating | Visual Impact rating |
|---|---|---|---|---|---|---|---|
| 40m | Road | Low | Moderate | **Low** | 14 (east), 22 (west) | **Very high** | **Moderate** |

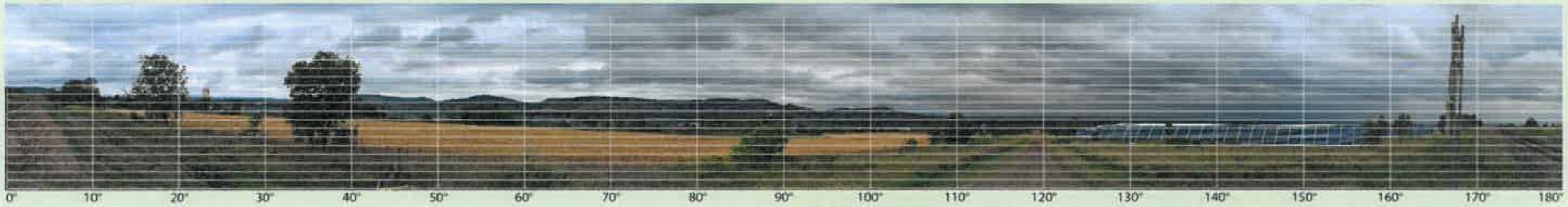
### 4.2.10 Viewpoint 15 (VP15) –


| | | | | | |
|---|---|---|---|---|---|
| Location: | Current view towards Callide SPS site looking north from Lake Callide Campground | | | | |
| Co-ordinates: | 152.977477 E 29.084213 S | Date: | 19/10/2022 | Time: | 3:40 pm |
| Orientation: | Northwest | Altitude: | 215 m | Distance to project: | 1550 m |
| Camera: | Pentax K-70 50mm<br>Height: 1500 mm | Weather: | Cloudy | Surveyor: | Jacqueline Mallinson<br>(Environmental Scientist MSc) |

*Photo 4.44 Current view from VP15*

*Photo 4.45 Photomontage of view from VP15 with SPS infrastructure*

*Photo 4.46 Magnitude grid tool for VP15 photomontage*




### VP15 Visual Impact Rating

The impact rating for VP15 (Shorts Road) as detailed in Table 4.15 is determined using the matrix in Table 2.3 to consider the combination of the Sensitivity rating of the receiver and the Magnitude rating of the development from the receiver. For VP15 the final impact rating is **Low**. This local road receptor is adjacent to the development running through the development footprint. It will also be the location of site access points. Much of the road is currently flanked by vegetation and the primary portions of the road with visibility of the site will be adjacent to the site entrance points (this cannot be avoided as clear lines of site are important for traffic safety entering and leaving the site) and the location of VP15 approaching from the north. This is not a highly trafficked road and primarily serves as access to the small number of residences along Shorts Road (including R4, R6, R8 and R9). The development is also setback from Shorts Road (a minimum of 20 m) on the eastern extent for 780 m of the road's length Callide Creek which runs between the development footprint and the receptors is densely vegetated in addition to intermittent roadside vegetation providing significant visual absorption capacity. In addition to these factors the receptors (transient road users) have low visual sensitivity as it is along a lightly trafficked local road.

*Table 4.15 Visual Impact Rating VP15*

| Distance to development | Viewpoint Type | Viewer Sensitivity | Scenic Quality Class | Visual Sensitivity rating (pre-mitigation) | Occupied Cells (10° wide 1° high) | Magnitude rating | Visual Impact rating |
|---|---|---|---|---|---|---|---|
| 50 m | Local Road | Very Low | Moderate | **Low** | 17 | **Moderate** | **Low** |

## 4.3 Night lighting

During operation, lighting will be provided for security reasons and for staff and contractors utilising the site facilities. External lighting would be restricted to the area where the maintenance shed, permanent site office, and switch yard are located. All external lighting around buildings will be faced downwards and inwards to minimise impacts to neighbouring properties. All external lighting will be compliant with *AS/NZS 4282:2019 Control of the obtrusive effects of outdoor lighting.*

Construction activities at the site would occur from approximately 7 am to 6 pm Monday to Friday and from 8 am to 1 pm on Saturdays (i.e., during daylight hours). However, if lighting is required during construction, it will be directed into the construction areas and positioned to minimise the potential increase in light pollution for adjacent receptors.

The likely visual impacts of project night lighting on surrounding residences, air traffic and road corridors in the public domain are summarised below.

### 4.3.1 Residences

Light spill from the development is expected to be minimal and is unlikely to be visible from the residential sensitive receivers. Given the relatively minor amount of construction and operational lighting required for the project and the proposed management measures outlined above, night lighting is unlikely to pose a significantly adverse impact to any residences.

### 4.3.2 Air traffic

The closest airport to the proposed Solar Farm site is Thangool Aerodrome 14 km south of the site, there are two additional aerodromes within 85 km of the site: Banana Airstrip (48 km southwest) and Gladstone Airport (82 km northeast).

Considering the nature and relatively minor amount of construction and operational lighting required for the project, and given the proposed management measures, it is unlikely that air traffic would be affected by night lighting at the site.

### 4.3.3 Road corridors

Light spill from the development is unlikely to impact surrounding roads users, including Biloela-Callide Road, Shorts Road and Linkes Road, given the proposed light management measures and relatively minor amount of construction and operational lighting required for the project.

## 4.4 Glint and glare

Glint and Glare have been considered separately and in-depth within the Callide SPS Glint and Glare Assessment (Accent 2023) this assessment facilitated by ForgeSolar GlareGauge software and models the potential impact on the following glint and glare receptors:

- observation points (OPs) (residents within 3 km of the development footprint) for Callide 70 Ops were identified and assessed
- route receptors (roads and rail routes within 1 km of the development footprint) for Callide five roads and one rail line were identified ad assessed
- flight paths (within 5 km of the development footprint) for Callide two flight paths associated with Fitzy's airfield were identified and assessed.

No glint or glare impacts were identified for Callide SPS.

The assessment also considers the following qualities to ascertain the proposal's degree of reflective nuisance:

- the design and the mechanical behaviour of the solar panels
- the existing environment.

Glare-based visual nuisance associated with the proposal will be largely influenced by the location and position of the solar panels relative to sensitive visual receivers. Receivers within a closer proximity to the proposal will be exposed to more direct glare effects.

### Solar panel design

The solar panels are designed to track the sun, east-west, along a single axis to maximise energy absorption. The solar panels would remain at a stationary and constant 52-degree angle from sunrise (first light), until approximately 9:00 am when the solar panels will begin to move and follow the path of the sun. Likewise, from approximately 4:30 pm until sunset (last light), the solar panels will remain at a constant -52-degree angle.

Considering that the solar panels will remain at a static 52-degree angle in the early hours of morning and late afternoon, the resulting specular glare is likely to have a negligible influence on sensitive receivers, and any glare would reflect away from ground-based receivers.

Photovoltaic solar panels are specifically designed to maximise the absorption of solar energy for the purpose of converting it to electricity. Good quality panels incorporate reflective glass front surfaces to capture and retain as much as possible of the solar spectrum. Typical panels are designed to reflect only about 2% of incoming sunlight and the glass of a solar panel has less reflectivity than window glass (MDER et al 2015).

The 2010 USA Federal Aviation Administration (FAA) document *Technical Guidance for Evaluating Selected Solar Technologies on Airports* includes a diagram which illustrates the relative reflectance of solar panels compared to other surfaces, as summarised in Table 4.4 (FAA 2010).

The potential for glare associated with non-concentrating photovoltaic systems which do not involve mirrors or lenses is therefore relatively limited. They generally do not create nuisance glare compared with other commonly existing surfaces such as roofs and are less reflective than other naturally occurring elements (Table 4.15).

Within the pastoral, rural context of the project site, grazing landscapes, crops and water share a similar or higher reflective value than photovoltaic solar panels, therefore the proposal would not represent a significant departure from the existing visual environment in terms of glare.

Additional proposed solar farm infrastructure that may potentially cause glare or reflections depending on the sun's angle, include the following (note that this infrastructure would be relatively widely dispersed and unlikely to present a glare or reflectivity hazard to motorists or aircraft):

- steel array mounting structures – array mounting would be steel or aluminium
- temporary site offices, sheds, containerised inverter stations
- high voltage substation
- BESS modules
- perimeter fencing
- permanent staff amenities.

The topography of the site and local area is undulating and there are some nearby opportunities to view the site from a higher position, however this area is highly vegetated which obscures views toward the development footprint. The nearest airfields are Fitzy's airfield approximately 5.25 km northwest of the site and the larger Thangool Aerodrome located 14 km south of the site, Fitzy's Airfield and the associated flight paths have been assessed within the Glint and Glare assessment. When viewed from above, from aircraft or tall buildings, photovoltaic solar panels appear dark grey and do not cause a glare or reflectivity hazard. It is therefore unlikely that air traffic would be affected by solar panel glare as reflected in the no glint or glare impact found within the Glint and Glare assessment.

*Table 4.15 Reflectivity of different materials*

| Material | Approximate percentage of light reflected* |
|---|---|
| Snow | 80 |
| White concrete | 77 |
| Bare aluminium | 74 |
| Vegetation | 50 |
| Bare soil | 30 |
| Wood shingle | 17 |
| Water | 5 |
| Solar panels | 5 |
| Black asphalt | 2 |

* Sourced from FAA (2010)

## 4.5 Visual impact assessment summary

In assessing the visual impacts of the proposed development, the following factors have been considered:

- the potential sensitive receivers in the vicinity of the site
- the type of sensitive receiver
- distance and elevation of sensitive receiver in relation to site
- visibility of site from sensitive receiver
- profile of proposed infrastructure
- the type of materials proposed to be used in construction
- the nature, location and frequency of project-related traffic accessing the site
- lighting required during construction and operation.

In summary 12 residences (see Table 4.2), one cluster of residences (including R14, R15 and 24 other residences adjacent to Lake Callide), one tourist attraction (Lake Callide campsite), and one road (Biloela-Callide Road) were identified as viewpoints requiring detailed assessment.

A summary of the pre-mitigation visual impact assessment for the 15 viewpoints is provided in Table 4.16.

*Table 4.16 Viewpoint visual impact assessment summary*

| Viewpoint/ residence | Sensitivity | Magnitude | Impact rating (pre-mitigation) |
|---|---|---|---|
| **VP1/ R1** | Moderate | High | High |
| **VP2/ R3** | Moderate | Low | Low |
| **VP3/ R4** | High | High | High |
| **VP4/ R5** | Moderate | Low | Low |
| **VP5/ R6** | High | Low | Moderate |
| **VP6/ R8** | Moderate | None (panels not visible) | Negligible (panels not visible) |

| Viewpoint/ residence | Sensitivity | Magnitude | Impact rating (pre-mitigation) |
|---|---|---|---|
| **VP7/ R9** | High | Very Low | Low |
| **VP8/ R10** | Moderate | Very Low | Very Low |
| **VP9/ R11** | Moderate | Very Low | Very Low |
| **VP10/ R12** | Moderate | None (panels not visible) | Negligible (panels not visible) |
| **VP11/ R21** | Moderate | Very Low | Very Low |
| **VP12/ R32** | Moderate | None (panels not visible) | Negligible (panels not visible) |
| **VP13a (cluster of residences)** | Moderate | Very Low | Very Low |
| **VP13b (Lake Callide Campsite)** | Low | Very Low | Very Low |
| **VP14 (Biloela-Callide Road)** | Low | High | Moderate |
| **VP15 (Shorts Road)** | Low | Low | Very Low |

### 4.5.1 Requirements for impact mitigation

The viewpoints that were located on rural residential properties and local roads, the sensitivity of the impacts was largely identified as moderate (rural homesteads) with the exception of VP3 (R4), VP5 (R6), VP6 (R8) and VP7 (R9) which were given a visual sensitivity rating of either high (due to the higher Scenic Quality class of viewpoints from higher elevations), low (classified main roads) or very low (other local roads, i.e. Shorts Road).

The viewpoints with the highest pre-mitigation visual impact rating were VP1 (R1) and VP3 (R4). Moderate impact ratings were also given to VP5 (R6) and VP14 (Biloela-Callide Road).

Due to elevation profiles between both R4 and R6 and the project, mitigation strategies would be ineffective unless planting at receptors. However, planting at the receptor is unlikely to be acceptable to the resident due to the expressed desire to preserve the current panoramic views.

Impacts on R1 and road users along portions of Biloela-Callide Road are considered to require mitigation. It should be noted that the location of VP14 represented the location of greatest visual magnitude along the length of Biloela-Callide Road. The road is adjacent to the SPS footprint for approximately 480 m from the south-eastern extreme of the footprint to R1. Mitigation measures to address impacts on R1 will also address the impacts on Biloela-Callide Road users. It should also be noted that all viewpoints along Biloela-Callide Road are transient as road users are travelling up to 100 km/h.

Mitigation of Low Visual impacts may be considered but are not deemed necessary. These would be the impacts on R3 as demonstrated by VP2, R5 as demonstrated by VP4, and R9 as demonstrated by VP7 (in addition, mitigation would be ineffective due to the elevation profile between R9 and the development footprint).

# 5 VISUAL IMPACT ASSESSMENT MANAGEMENT AND MITIGATION MEASURES

As outlined in Section 4.5.1, specific mitigation measures to reduce the visual impacts are necessary for various portions of the proposed SPS. The key visual impact to mitigate is that experienced by R1. Whilst R4 also demonstrates high visual impacts as a result of the proposed SPS, the elevation profile would lead to ineffective mitigation. In addition to the impacts on residential receptors, the Moderate visual impact upon road users along Biloela-Callide Road would also benefit from mitigation efforts.

Where low impacts are anticipated for R3 and R5, mitigation efforts may also be considered.

There are general recommendations for minimising and managing visual impacts and maintaining the landscape character which are discussed in Section 5.1, below.

## 5.1 General visual impact mitigation and management measures

The following general project objectives aim to maintain the existing landscape character where possible, via strategic and practical measures:

- Adopt integrated rural infrastructure/landscape design that permits the landscape to take precedence over the built form.
- Strengthen the vegetated character of the proposal area and express the rural and bushland nature of landscaping.
- Any urban design features should reflect and be sympathetic (complementary) to the existing historic, cultural and natural character of the area.
- Design lighting so as not to negatively impact on adjacent land uses and should be compliant with Standard AS/NZS 4284:2019 *Control of the obtrusive effects of outdoor lighting* (e.g. no light spill into adjacent rural properties affecting residences).

The following landscape design principles would be applied to the proposal:

- Maximise the retention of existing visual screening opportunities.
- Revegetate areas disturbed by construction work, where possible.
- When revegetating, consider the potential to reflect similar vegetation types found in the area.
- Use materials and colours that reflect the existing urban design character and palette.

Management measures have been proposed in the following sections to ensure that potential impacts are minimised during both construction and operation.

### 5.1.1 Design phase measures

In addition to targeted mitigation efforts which are outlined in Section 5.2, below, the following detailed design measures should be adopted to reduce the visual impact of the project:

- Apply urban design principles and objectives during detailed design phase.
- Investigate colour combinations for infrastructure items to aid visual obscurity.
- Ancillary structures: minimise reflective surfaces with a preferred use of muted colours.

### 5.1.2 Construction phase measures

The following measures will be implemented to minimise visual impacts during construction:

- Demarcation and exclusion fencing will be installed around trees and vegetation to be retained.
- Limiting disturbance and rehabilitating disturbed areas.
- Minimising light spill from the development into adjacent visually sensitive properties by directing construction lighting into the construction areas and ensuring the site is not over-lit. This includes the sensitive placement and specification of lighting to minimise any potential increase in light pollution.
- Temporary hoardings, barriers, traffic management and signage should be removed when no longer required.
- The site to be kept tidy and well maintained, including removal of all rubbish at regular intervals. There should be no storage of materials beyond the construction boundaries.

### 5.1.3 Operation phase measures

The following measures will be taken to minimise visual impacts during the operation phase of the project:

- Restrict external lighting to the area where the maintenance shed, permanent site office, and switch yard are located.
- All external lighting around buildings to be faced downwards and inwards to minimise impacts to neighbouring properties.

### 5.1.4 Decommissioning phase measures

The following measures will be taken to minimise visual impacts during the decommissioning phase of the project:

- A rehabilitation and decommissioning strategy will be implemented to return the site to its pre-existing condition.

## 5.2 Targeted mitigation recommendations

### 5.2.1 Panel and infrastructure placement

Panel layout has not been finalised for Callide SPS. The photomontages represent a worst-case scenario.

In addition to the solar panels, other infrastructure has the potential to have visual impacts; the location of the proposed substation will determine which receivers are impacted. The proposed location along the transmission line which transects the development footprint is a minimum of 1.5 km from any receptor helping to reduce potential visual impacts.

### 5.2.2 Onsite mitigation measures

The need for onsite vegetation treatments, as recommended by Accent, is based on consideration of elevation data, site visit findings, site photography and discussions with sensitive receivers. The proposed treatments are shown in Figure 5.1 and detailed in Table 5.2.

The primary impacts to mitigate are those on R1 and road users along Biloela-Callide Road. Whilst there are high visual impacts anticipated for R4 and R6, due to their topography vegetation screening would be ineffective in mitigating the impacts; planting closer to the receptors R4 and R6 would also not be advised as they have valued views that would be impeded by at-receptor planting. However, this option can be considered if these receptors reconsider their preference.


Screening Vegetation Recommendations
- Priority screening for moderate and high visual impacts
- Potential sensitive receptors

- Callide SPS maximum extent
- Lot boundaries
- Flood map overlay exclusion
- Regulated Vegetation Watercourse buffer
- Electrical easement
- Drainage line exclusions

**AE1206 Callide SPS**
**Figure 5.1: Screening Vegetation Options**

Created: 02/12/2022
Print size: A4
CRS: GDA2020 / MGA zone 56
Additional data sources:
ESRI satellite [accessed 20/10/2022]

ACCENT ENVIRONMENTAL

*Table 5.1 Onsite Screening vegetation options*

| Screening Vegetation option | Mitigating impacts on | Location | Length |
|---|---|---|---|
| **SV1** | R1 and road users along Biloela-Callide Road | Along the closest boundary of Biloela-Callide Road to R1 running east west | 240 m |
| **SV2** | Road users along Biloela-Callide Road | Along the southern boundary of the site from the southeastern extent to the current entrance to the property | 345 m |

For further details on the specifics of vegetation screening refer to the Section 6 Landscape Plan.

## 5.3 Further considerations

### 5.3.1 Consultation

In consideration of the various screening options, consultation with the potentially visually impacted residents (R1, R2 (still unclear if this is an occupied residence), R3, R4, R5, R6, R8, R9, R10) is important. The site visit and initial community consultation undertaken by Edify have enabled Edify to understand the concerns of the residential receptors and records of interactions retained. In general, strong opposition was not experienced during Accent's site visit. Residents who communicated the greatest concerns were R3 and R10 (although the owner of the property which is leased understood his visual impact would likely be low). Continued consultation relating to mitigation is recommended to ensure the best mitigation options for both the receptors and Edify.

# 6 LANDSCAPE PLAN

This Landscape Plan relates to the vegetation screening mitigation discussed in Section 5.2. In developing a landscape plan, the following relevant documents were consulted:

- Australian Institute of Landscape Architects '*Guidance Note for Landscape and Visual Assessment' (AILA 2018)*
- Transport for NSW (TfNSW) *Guideline for landscape character and visual impact assessment* (TfNSW 2020a)
- TfNSW *Beyond the Pavement 2020: Urban design approach and procedures for road and maritime infrastructure planning, design and construction* (*landscape design guideline*) (TfNSW 2020b).

## 6.1 Clearing, species selection and planting locations

### 6.1.1 Clearing and retention of existing vegetation

Edify have identified key vegetation to retain within the development footprint in association with the vegetation buffer zone and drainage lines and flood overlay. As the footprint has been largely cleared for agricultural purposes there would be limited clearing within the paddocks (primarily within Lot 2 RP619032) of a number of shrubs.

### 6.1.2 Species selection and vegetation screening composition

A list of suggested planting species is provided in Attachment 2. The list is comprised of key species native to the Bioregion with particular reference to the broad vegetation groups present within the vicinity of the development footprint.

Some additional recommendations for the composition of vegetation screening are as follows:

- a minimum of two rows of planting
- tree spacing 12 m apart depending on species characteristics
- shrub spacing 2-3 m apart depending on species characteristics
- use a variety of species including trees, shrubs, tufting plants and ground cover
- use planting layouts where the variety of species may be repeated along the length of the subject site, for example repeating a 10 m wide x 25 m long layout of planting area
- plant understorey species in groups of five to seven plants of same species
- use of ground covers and mulch to retain water and minimise erosion
- undertake maintenance including replacement of losses.

To conform with the relevant guidelines and provide adequate visual buffering, Accent suggests a buffer width of 10 m comprised of overstory trees selected from the suggested species list (Attachment 2) spaced approximately 12 m apart with a second row of shrubs or midstorey trees planted 2-3 m apart. A cross section is provided in Figure 6.1 and a transect demonstrating the plant type composition for a standard 25 m section of vegetation screen is shown in Figure 6.2. This transect can be repeated for the length of the buffer, alternating species of each plant type (overstorey/midstorey/understorey) as required. Where planting is close to specific residents, consultation can be undertaken identify the species preferences of the relevant sensitive receivers.

The predicted effect of the visual buffering is illustrated in Photos 6.1 and 6.2.

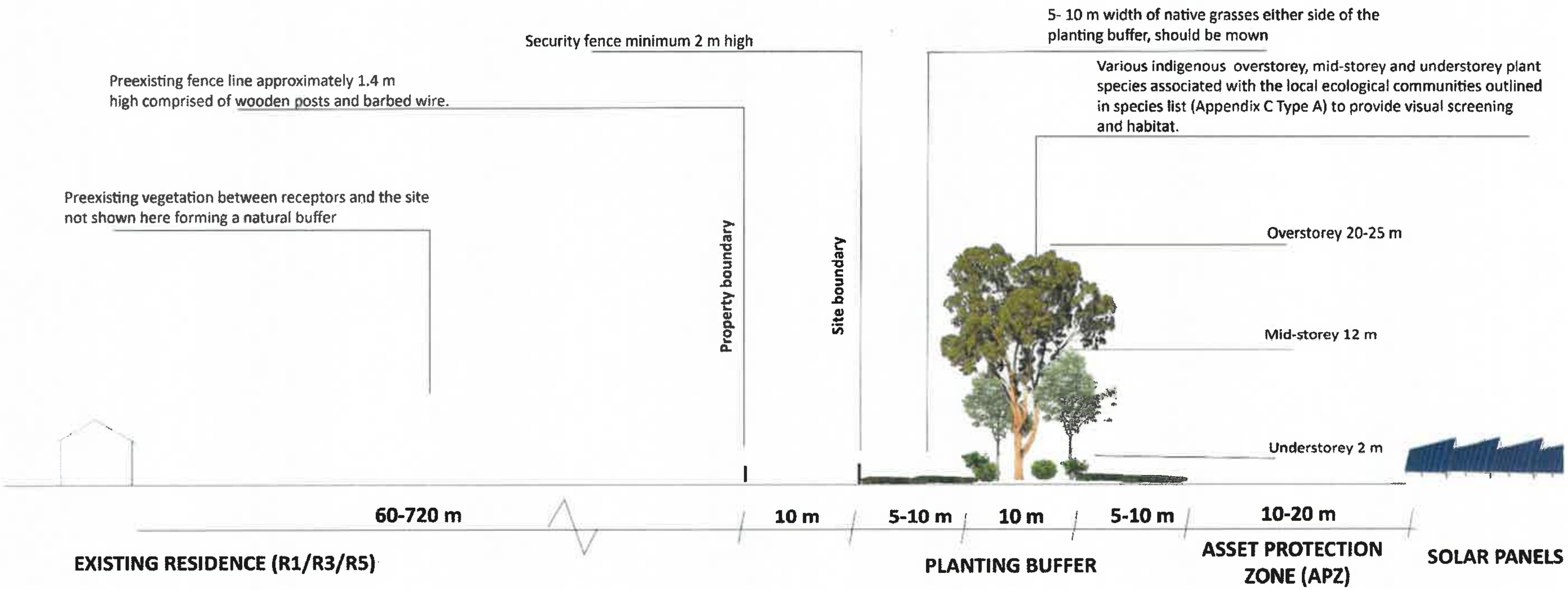
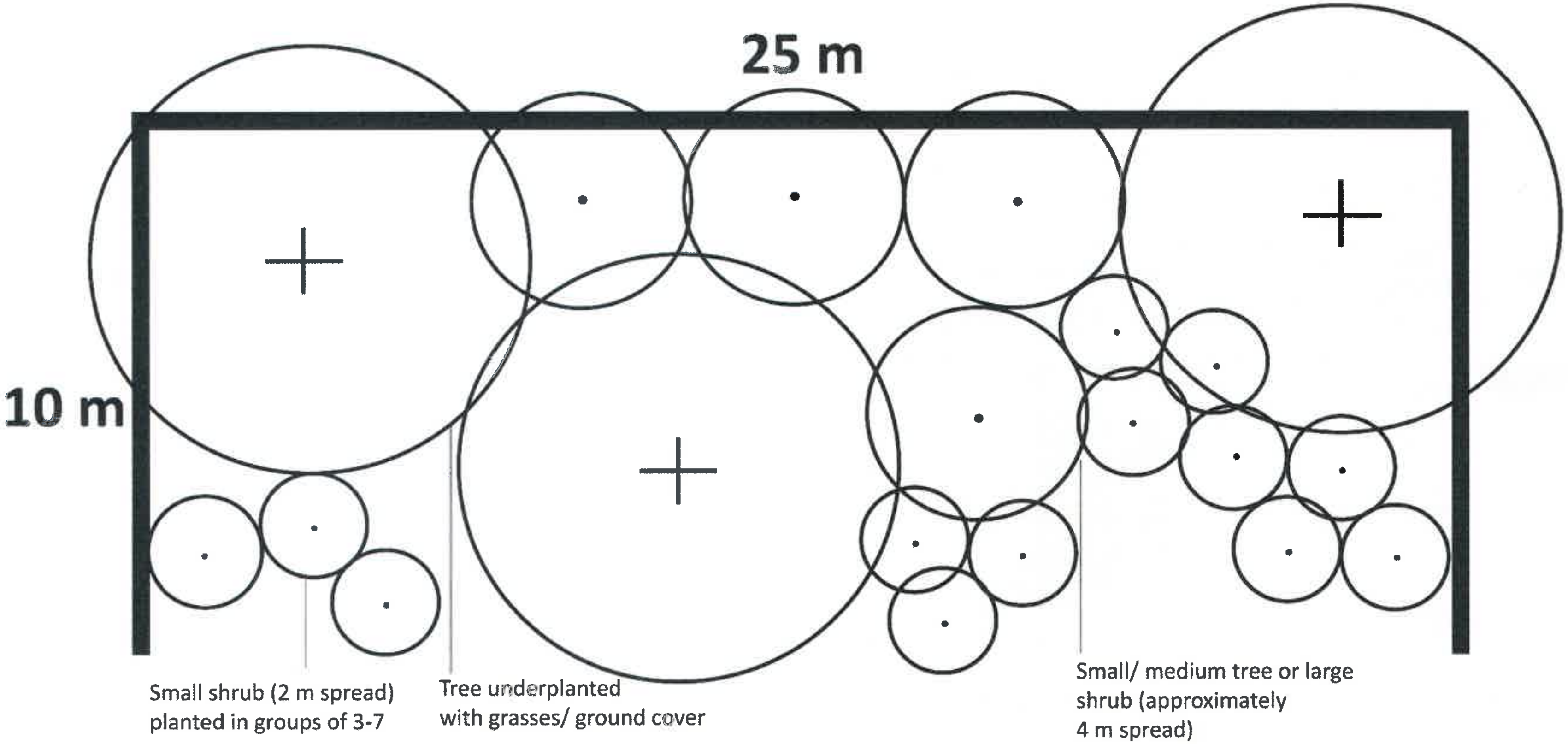



*Figure 6.1 Cross section of vegetation screening for visual impacts on identified residents*




Example of vegetation screening strip 25 m long that could be repeated with various native species nominated from the selected species list (Appendix C). Large tree spacing approximately 12 m, understorey plant 2- 3m spacing in groupings of 5- 7 of the same species to promote success. Minimum of 1 tree per 10 m sq or 10-15 linear ms

*Figure 6.2 Vegetation screening composition strip to be repeated along length of buffers*

*Photo 6.1 Photomontage of VP1 (R1) with SPS infrastructure*

*Photo 6.2 Photomontage of VP1 (R1) with SPS infrastructure and vegetation screening (SV1)*

Photo 6.2 demonstrates the residual impact on R1 following establishment of the SV1 vegetation screening location shown in Figure 5.1. The species demonstrated here are brigalow (*Acacia harpophylla*), Gidgee (*Acacia cambagei*) and wilga (*Geijera parviflora*) which are locally occurring, native species with screening properties. Additional species that could be used for screening are listed in Attachment 2. To assess residual effects following screening the Magnitude grid tool has been applied to the photomontage to provide a visual impact magnitude following mitigation (Photo 6.3). The residual visual impacts are summarised in Table 6.1.

*Photo 6.3 Photomontage of VP1 (R1) with vegetation screening (SV1) with magnitude grid tool*

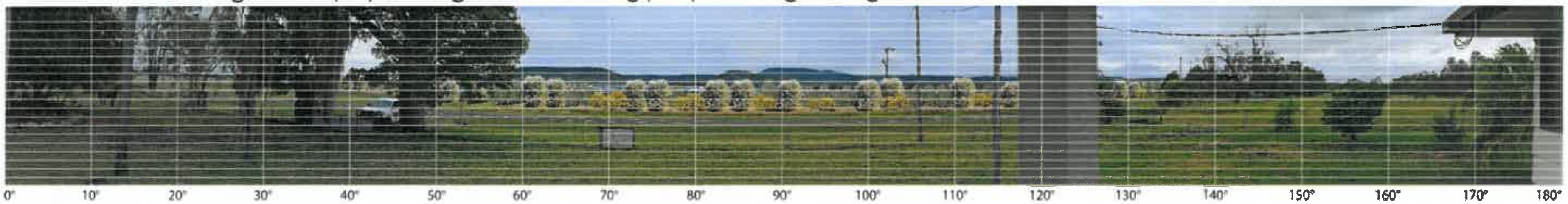


*Table 6.1 Residual visual impact assessment for VP1 (R1) following mitigation measures*

| Distance to development | Viewpoint Type | Viewer Sensitivity | Scenic Quality Class | Visual Sensitivity rating (pre-mitigation) | Occupied Cells (10° wide 1° high) | Magnitude rating | Visual Impact rating |
|---|---|---|---|---|---|---|---|
| 80 m | Rural dwelling primary viewpoint | Moderate | Moderate | **Moderate** | 1-2 | **Ver Low** | **Very Low** |

**R1 visual impact mitigation option**

The SV1 screening option comprises onsite vegetation screening along the closest boundary of Callide SPS to R1, running east west along Biloela-Callide Road for approximately 240 m (see Table 5.1, Figure 5.1 and Photo 6.2). This screening option will also benefit road users along Biloela-Callide Road. It was noted during Accent's site visit that the receptor at R1 does not want overly tall screening vegetation to eliminate his view of the hills on the opposite side of the development footprint, he also expressed a dislike for gum trees.

**Biloela-Callide Road visual impact mitigation option**

The SV2 screening option to mitigate impacts on road users along Biloela-Callide Road (see Table 5.1 and Figure 5.1) would not be a continuous vegetation screen but would comprise strategic planting along the southern boundary of the site from the south-eastern extent to the current entrance to the property (which will not be used as a site entrance by the project).

## 6.2 Planting preparation and plant establishment

### 6.2.1 Planting preparation

**Initial weed spray**

Weeds are to be controlled by spraying with an herbicide 1.5-2 m wide along each row. This will be completed as early as possible so moisture can start accumulating. All herbicides will be applied strictly in accordance with the directions on the product label and the applicable safety data sheet.

The rows may need to be sprayed several times depending on weed growth.

**Pre-watering**

If sufficient rain has not fallen prior to the desired planting dates, the areas should be pre-watered prior to planting.

**Bed preparation**

Planting beds should be prepared by ripping the soil to a minimum depth of 0.5 m. This will allow for greater moisture and root penetration and a reduction in the energy output required for root growth. This will increase the seedling growth rates and will enable greater access to water and nutrients.

The deep ripping of the soil should be followed up with topsoil mounding to ensure thicknesses of topsoil are maximised. This will increase the capacity of the topsoil to retain water and nutrients. At the time of ripping, soil testing at representative locations will be carried out. The soil testing results will be used to inform fertiliser selection.

**Weed and pest management**

Pests and weeds can be brought to site as a result of landscaping activities associated with personnel and/or vehicle movement and materials used for landscaping purposes, including topsoil, mulch, seedlings, seeds and equipment.

Edify will consider implementing a Weed and Pest Management Plan to manage pest and weed impacts during construction and operations phases. This plan would include additional information on the use of herbicides.

### 6.2.2 Planting

When planting, the following will be undertaken:

- as soon as seasonal conditions are conducive and pre-watering has been undertaken (if required), tube stock will be planted out

- native formulated slow-release fertiliser will be applied to each plant at the time of planting. This should provide nutrients for an average of nine months
- all plants will be watered in at the time of planting with at least 2 litres of water per plant
- all plants will be protected with UV-stabilised tree guards to create a microclimate around the immature plant, increasing the growth rate. Protection of new plantings during their first two seasons of growth will be critical to their long-term success rate. Guards will also help protect from climatic extremes, wind, wildlife, pests and potential spray-drift from follow-up weed control measures.

### 6.2.3 Initial maintenance

The first few months after planting are crucial in establishing the planting screens. In those initial months, the following should be considered:

- to properly establish, plants need sufficient and regular watering. Therefore, rainfall should be carefully monitored – see below.
- where less than 50 mm of rain has fallen in that month, manual watering will be required until plants are established.
- daily rainfall totals should be monitored during the first 12 months of planting to ensure sufficient water can be given to the plants to maximise their chances of survival – see the information below on the Biloela-Valbona BOM weather station.
- regular plant nourishment and weeding may also be required. Spraying and/or mulching will be used to control weeds and competition during establishment.
- regular monitoring should be undertaken to assist with plant establishment. This monitoring will be weekly for the first two months or until plants appear to be taking hold. The monitoring frequency can then be reduced to monthly. Once monitoring shows the plants are established, the monitoring can be reduced further to 3-monthly.

Rainfall totals are available for the Biloela-Valbona weather station (BoM 081118), located 13.9 km to the southwest, and can serve as a surrogate for the rainfall at the site. This rainfall data can be accessed from the BoM website.

### 6.2.4 Medium and long-term maintenance

After plants have established, the first three years of growth are important and monitoring over this period should take place to ensure long-term plant survival. This monitoring program, outlined below, should take place quarterly and will include:

- recording of planting survival rates and replacement plantings, if necessary
- plant health, appearance and growth rates
- weed and pest infestation inspections and, if necessary, control spraying
- measuring soil fertility and soil moisture levels and increasing plant nourishment and watering rates, if necessary
- inspection of tree guard integrity and replacement, if necessary.

The landscaping is to be maintained in a tidy manner by the developer (e.g., watering, fertilising, mulching, weeding) at all times to the satisfaction of the Assessment Manager.

### 6.2.5 Plant survival rates, appearance and growth rates

If plant survival rates are less than 90% or gaps of greater than 5 m are noted, dead plants will be replaced.

Plant health will be checked for stress indicators (disease and pest problems) and appearance by an appropriately qualified person. If plants are:

- diseased, or pests are noted, measures should be undertaken to address the conditions
- not appearing to be 'bushy' enough to act as screens, judicious pruning should be undertaken to improve screening properties.

### 6.2.6 Soil properties

Soil properties can change over time and may reduce the soil's fertility. Therefore, soil will be tested at the time of planting, with testing repeated at 12 months and 24 months at the same locations. This will ensure that if any changes occur to soil makeup over the time, that fertiliser, micro-nutrient and soil moisture levels (if required) can be adjusted accordingly. The soil testing will include: soil fertility (nitrogen, phosphorus, potassium and pH) and soil moisture.

# 7 LIMITATIONS

Whilst Accent has endeavoured to provide accurate and reliable photomontages the following limitations should be considered:

During the site visit weather conditions were sub-optimal across the three days in the field. Cloudy conditions may reduce the depth of view and clarity of images.

Whilst a maximum footprint is known and the dimensions and separation distance between panels is correct, the exact placement of panels may vary from the photomontages. However, any reduction in footprint will result in a reduction in the potential for visual impacts.

Accent has used open-source graphics and models to produce the photomontages and illustrate the solar panels based on commonly used industrial scale solar panels and related infrastructure. The exact make and model of solar panels has not been finalised and variations in appearance are expected.

To demonstrate the greatest height of panels, the simulated view is of the panels at maximum tilt (as recommended by DPE (2022) of 52 degrees. The view from any viewpoint will vary throughout the day as the panels' angle of tilt changes to track the path of the sun.

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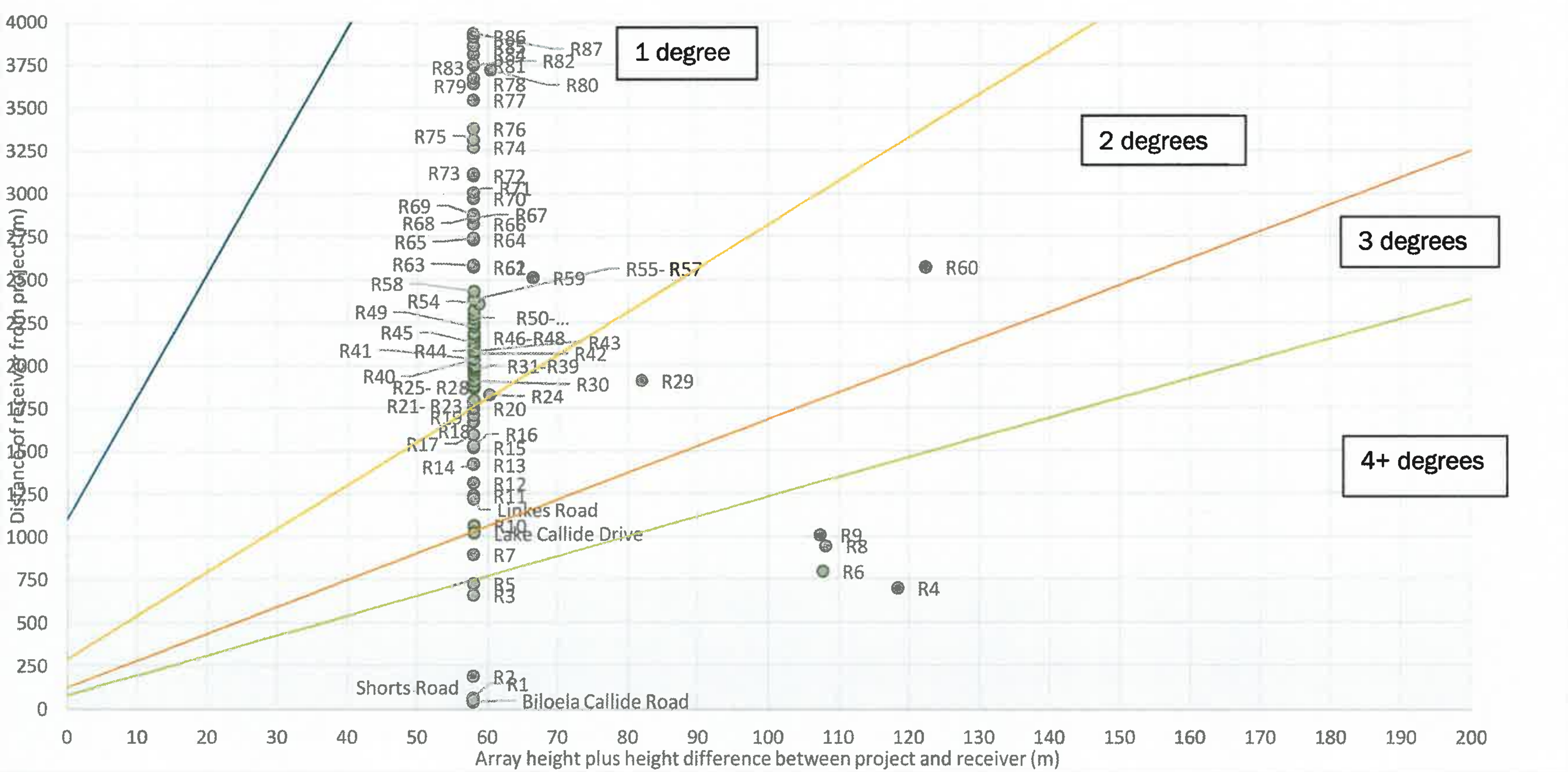
Xie et al (2018). *Learning and Teaching Engineering Design through Modeling and Simulation on a CAD Platform, Computer Applications in Engineering Education, 26(4), pp. 824-840, 2018 (DOI: 10.1002/cae.21920)* Charles Xie, Corey Schimpf, Jie Chao, Saeid Nourian, and Joyce Massicotte,

# Attachment 1 – Preliminary visual assessment calculations



| Receptor/ receptor (within 4 km) | Height of receptor (m) | Distance to project (m) | Height difference between receptor and array (m) | Indicative vertical field of view | Worst-case horizontal field of view | Worst-case horizontal field of view grouping | Assessment required? | Eliminated during viewshed analysis |
|---|---|---|---|---|---|---|---|---|
| R1 | 191 | 60 | 58 | 4 | 145 | 130+ | Assessment required | |
| R2 | 225 | 189 | 58 | 4 | 142 | 130+ | Assessment required | |
| R3 | 189 | 658 | 58 | 4 | 131 | 130+ | Assessment required | |
| R4 | 293 | 698 | 118 | 4 | 120 | 71-130 | Assessment required | |
| R5 | 188 | 723 | 58 | 4 | 178 | 130+ | Assessment required | |
| R6 | 283 | 794 | 108 | 4 | 174 | 130+ | Assessment required | |
| R7 | 182 | 894 | 58 | 3 | 124 | 71-130 | Assessment required | |
| R8 | 283 | 944 | 108 | 4 | 138 | 130+ | Assessment required | |
| R9 | 282 | 1009 | 107 | 4 | 89 | 71-130 | Assessment required | yes |
| R10 | 188 | 1064 | 58 | 2 | 84 | 71-130 | Assessment required | |
| R11 | 185 | 1239 | 58 | 2 | 74 | 71-130 | Assessment required | yes |
| R12 | 191 | 1310 | 58 | 2 | 59 | 51-60 | Assessment required for all viewpoints except road/rail | |
| R13 | 181 | 1418 | 58 | 2 | 58 | 51-60 | Assessment required for all viewpoints except road/rail | |
| R14 | 210 | 1424 | 58 | 2 | 123 | 71-130 | Assessment required | |
| R15 | 215 | 1518 | 58 | 2 | 49 | 41-50 | Assessment required for all viewpoints except road/rail | |
| R16 | 179 | 1528 | 58 | 2 | 98 | 71-130 | Assessment required | |

| Receptor/ receptor (within 4 km) | Height of receptor (m) | Distance to project (m) | Height difference between receptor and array (m) | Indicative vertical field of view | Worst-case horizontal field of view | Worst-case horizontal field of view grouping | Assessment required? | Eliminated during viewshed analysis |
|---|---|---|---|---|---|---|---|---|
| R17 | 217 | 1594 | 58 | 2 | 49 | 41-50 | Assessment required for all viewpoints except road/rail | yes |
| R18 | 223 | 1668 | 58 | 2 | 57 | 51-60 | Assessment required for all viewpoints except road/rail | yes |
| R19 | 226 | 1708 | 58 | 2 | 48 | 41-50 | Assessment required for all viewpoints except road/rail | |
| R20 | 182 | 1747 | 58 | 2 | 48 | 41-50 | Assessment required for all viewpoints except road/rail | |
| R21 | 229 | 1749 | 58 | 2 | 48 | 41-50 | Assessment required for all viewpoints except road/rail | |
| R22 | 222 | 1784 | 58 | 1 | 48.5 | 41-50 | No assessment required | |
| R23 | 232 | 1794 | 58 | 1 | 38 | 31-40 | No assessment required | |
| R24 | 235 | 1830 | 60 | 1 | 38 | 31-40 | No assessment required | |
| R25 | 179 | 1868 | 58 | 1 | 37 | 31-40 | No assessment required | only 4 ref points |
| R26 | 181 | 1874 | 58 | 1 | 38 | 31-40 | No assessment required | |

| Receptor/ receptor (within 4 km) | Height of receptor (m) | Distance to project (m) | Height difference between receptor and array (m) | Indicative vertical field of view | Worst-case horizontal field of view | Worst-case horizontal field of view grouping | Assessment required? | Eliminated during viewshed analysis |
|---|---|---|---|---|---|---|---|---|
| R27 | 185 | 1875 | 58 | 1 | 69 | 61-70 | No assessment required | |
| R28 | 181 | 1882 | 58 | 1 | 77 | 71-130 | Assessment required for all viewpoints except road/rail | yes |
| R29 | 257 | 1909 | 82 | 2 | 38 | 31-40 | Assessment required for all viewpoints except road/rail | |
| R30 | 230 | 1909 | 58 | 1 | 23 | 21-30 | No assessment required | yes |
| R31 | 229 | 1940 | 58 | 1 | 37 | 31-40 | No assessment required | |
| R32 | 183 | 1946 | 58 | 1 | 37 | 31-40 | No assessment required | |
| R33 | 197 | 1968 | 58 | 1 | 76 | 71-130 | Assessment required for all viewpoints except road/rail | |
| R34 | 228 | 1971 | 58 | 1 | 36 | 31-40 | No assessment required | |
| R35 | 184 | 1976 | 58 | 1 | 39 | 31-40 | No assessment required | yes |
| R36 | 179 | 1988 | 58 | 1 | 70 | 61-70 | No assessment required | |
| R37 | 217 | 2000 | 58 | 1 | 32 | 31-40 | No assessment required | yes |

| Receptor/ receptor (within 4 km) | Height of receptor (m) | Distance to project (m) | Height difference between receptor and array (m) | Indicative vertical field of view | Worst-case horizontal field of view | Worst-case horizontal field of view grouping | Assessment required? | Eliminated during viewshed analysis |
|---|---|---|---|---|---|---|---|---|
| R38 | 199 | 2003 | 58 | 1 | 75 | 71-130 | Assessment required for all viewpoints except road/rail | |
| R39 | 230 | 2004 | 58 | 1 | 37 | 31-40 | No assessment required | yes |
| R40 | 229 | 2035 | 58 | 1 | 35 | 31-40 | No assessment required | yes |
| R41 | 201 | 2038 | 58 | 1 | 35 | 31-40 | No assessment required | yes |
| R42 | 232 | 2068 | 58 | 1 | 35 | 31-40 | No assessment required | |
| R43 | 232 | 2082 | 58 | 1 | 35 | 31-40 | No assessment required | |
| R44 | 232 | 2111 | 58 | 1 | 35 | 31-40 | No assessment required | |
| R45 | 231 | 2134 | 58 | 1 | 35 | 31-40 | No assessment required | |
| R46 | 178 | 2161 | 58 | 1 | 68 | 61-70 | No assessment required | |
| R47 | 232 | 2172 | 58 | 1 | 35 | 31-40 | No assessment required | |
| R48 | 230 | 2189 | 58 | 1 | 35 | 31-40 | No assessment required | |
| R49 | 231 | 2227 | 58 | 1 | 35 | 31-40 | No assessment required | |

| Receptor/ receptor (within 4 km) | Height of receptor (m) | Distance to project (m) | Height difference between receptor and array (m) | Indicative vertical field of view | Worst-case horizontal field of view | Worst-case horizontal field of view grouping | Assessment required? | Eliminated during viewshed analysis |
|---|---|---|---|---|---|---|---|---|
| R50 | 232 | 2248 | 58 | 1 | 35 | 31-40 | No assessment required | |
| R51 | 231 | 2271 | 58 | 1 | 35 | 31-40 | No assessment required | |
| R52 | 230 | 2298 | 58 | 1 | 35 | 31-40 | No assessment required | |
| R53 | 198 | 2324 | 58 | 1 | 70 | 61-70 | No assessment required | |
| R54 | 234 | 2359 | 59 | 1 | 33 | 31-40 | No assessment required | |
| R55 | 185 | 2382 | 58 | 1 | 74 | 71-130 | Assessment required for all viewpoints except road/rail | |
| R56 | 178 | 2387 | 58 | 1 | 66 | 61-70 | No assessment required | |
| R57 | 181 | 2388 | 58 | 1 | 40 | 31-40 | No assessment required | |
| R58 | 188 | 2434 | 58 | 1 | 70 | 61-70 | No assessment required | |
| R59 | 241 | 2510 | 66 | 1 | 33 | 31-40 | No assessment required | |
| R60 | 297 | 2571 | 122 | 2 | 30 | 21-30 | No assessment required | |
| R61 | 224 | 2572 | 58 | 1 | 32 | 31-40 | No assessment required | |

| Receptor/ receptor (within 4 km) | Height of receptor (m) | Distance to project (m) | Height difference between receptor and array (m) | Indicative vertical field of view | Worst-case horizontal field of view | Worst-case horizontal field of view grouping | Assessment required? | Eliminated during viewshed analysis |
|---|---|---|---|---|---|---|---|---|
| R62 | 180 | 2573 | 58 | 1 | 63 | 61-70 | No assessment required | |
| R63 | 184 | 2583 | 58 | 1 | 70 | 61-70 | No assessment required | |
| R64 | 179 | 2731 | 58 | 1 | 63 | 61-70 | No assessment required | |
| R65 | 212 | 2739 | 58 | 1 | 24 | 21-30 | No assessment required | |
| R66 | 182 | 2822 | 58 | 1 | 28 | 21-30 | No assessment required | |
| R67 | 183 | 2860 | 58 | 1 | 65 | 61-70 | No assessment required | |
| R68 | 193 | 2865 | 58 | 1 | 62 | 61-70 | No assessment required | |
| R69 | 183 | 2876 | 58 | 1 | 59 | 51-60 | No assessment required | |
| R70 | 180 | 2970 | 58 | 1 | 59 | 51-60 | No assessment required | |
| R71 | 223 | 3004 | 58 | 1 | 22 | 21-30 | No assessment required | |
| R72 | 206 | 3101 | 58 | 1 | 34 | 31-40 | No assessment required | |
| R73 | 179 | 3111 | 58 | 1 | 62 | 61-70 | No assessment required | |
| R74 | 179 | 3269 | 58 | 1 | 60 | 51-60 | No assessment required | |

| Receptor/ receptor (within 4 km) | Height of receptor (m) | Distance to project (m) | Height difference between receptor and array (m) | Indicative vertical field of view | Worst-case horizontal field of view | Worst-case horizontal field of view grouping | Assessment required? | Eliminated during viewshed analysis |
|---|---|---|---|---|---|---|---|---|
| R75 | 177 | 3311 | 58 | 1 | 40 | 31-40 | No assessment required | |
| R76 | 200 | 3376 | 58 | 1 | 56 | 51-60 | No assessment required | |
| R77 | 177 | 3544 | 58 | 1 | 37 | 31-40 | No assessment required | |
| R78 | 192 | 3639 | 58 | 1 | 54 | 51-60 | No assessment required | |
| R79 | 176 | 3671 | 58 | 1 | 43 | 41-50 | No assessment required | |
| R80 | 235 | 3721 | 60 | 1 | 34 | 31-40 | No assessment required | |
| R81 | 182 | 3748 | 58 | 1 | 54 | 51-60 | No assessment required | |
| R82 | 183 | 3748 | 58 | 1 | 54 | 51-60 | No assessment required | |
| R83 | 182 | 3753 | 58 | 1 | 54 | 51-60 | No assessment required | |
| R84 | 176 | 3812 | 58 | 1 | 38 | 31-40 | No assessment required | |
| R85 | 178 | 3860 | 58 | 1 | 39 | 31-40 | No assessment required | |
| R86 | 223 | 3914 | 58 | 1 | 34 | 31-40 | No assessment required | |
| R87 | 177 | 3933 | 58 | 1 | 30 | 21-30 | No assessment required | |

| Receptor/ receptor (within 4 km) | Height of receptor (m) | Distance to project (m) | Height difference between receptor and array (m) | Indicative vertical field of view | Worst-case horizontal field of view | Worst-case horizontal field of view grouping | Assessment required? | Eliminated during viewshed analysis |
|---|---|---|---|---|---|---|---|---|
| R88 | 176 | 4010 | 58 | 1 | 21 | 11-20 | No assessment required | |
| R89 | 251 | 4017 | 76 | 1 | 45 | 41-50 | No assessment required | |
| R90 | 190 | 4037 | 58 | 1 | 51 | 41-50 | No assessment required | |
| R91 | 178 | 4158 | 58 | 1 | 38 | 31-40 | No assessment required | |
| R92 | 178 | 4204 | 58 | 1 | 45 | 41-50 | No assessment required | |
| R93 | 181 | 4290 | 58 | 1 | 42 | 41-50 | No assessment required | |
| R94 | 213 | 4301 | 58 | 1 | 29 | 21-30 | No assessment required | |
| R95 | 232 | 4302 | 58 | 1 | 24 | 21-30 | No assessment required | |
| R96 | 181 | 4310 | 58 | 1 | 46 | 41-50 | No assessment required | |
| R97 | 178 | 4328 | 58 | 1 | 20 | 11-20 | No assessment required | |
| R98 | 179 | 4348 | 58 | 1 | 42 | 41-50 | No assessment required | |
| R99 | 225 | 4412 | 58 | 1 | 25 | 21-30 | No assessment required | |
| R100 | 174 | 4536 | 59 | 1 | 25 | 21-30 | No assessment required | |

| Receptor/ receptor (within 4 km) | Height of receptor (m) | Distance to project (m) | Height difference between receptor and array (m) | Indicative vertical field of view | Worst-case horizontal field of view | Worst-case horizontal field of view grouping | Assessment required? | Eliminated during viewshed analysis |
|---|---|---|---|---|---|---|---|---|
| R101 | 180 | 4540 | 58 | 1 | 44 | 41-50 | No assessment required | |
| R102 | 179 | 4563 | 58 | 1 | 37 | 31-40 | No assessment required | |
| R103 | 182 | 4597 | 58 | 1 | 41 | 31-40 | No assessment required | |
| R104 | 180 | 4624 | 58 | 1 | 42 | 41-50 | No assessment required | |
| R105 | 176 | 4727 | 58 | 1 | 37 | 31-40 | No assessment required | |
| R106 | 173 | 4742 | 60 | 1 | 25 | 21-30 | No assessment required | |
| R107 | 174 | 4885 | 59 | 1 | 18 | 11-20 | No assessment required | |
| R108 | 184 | 4892 | 58 | 1 | 44 | 41-50 | No assessment required | |
| R109 | 175 | 4967 | 58 | 1 | 27 | 21-30 | No assessment required | |
| R110 | 204 | 4981 | 58 | 1 | 37 | 31-40 | No assessment required | |
| Biloela Callide Road | 190 | 40 | 58 | 4 | 180 | 130+ | Assessment required | |
| Linkes Road | 216 | 1220 | 58 | 2 | 105 | 71-130 | Assessment required | |
| Shorts Road | 220 | 50 | 58 | 4 | 180 | 130+ | Assessment required | |

| Receptor/ receptor (within 4 km) | Height of receptor (m) | Distance to project (m) | Height difference between receptor and array (m) | Indicative vertical field of view | Worst-case horizontal field of view | Worst-case horizontal field of view grouping | Assessment required? | Eliminated during viewshed analysis |
|---|---|---|---|---|---|---|---|---|
| Lake Callide Drive | 195 | 1020 | 58 | 3 | 60 | 51-60 | Assessment required | |

# Attachment B – Recommended plant list for screening

| Common name | Botanical name | Height | Minimum spacing | Tree size |
|---|---|---|---|---|
| Queensland blue gum | *Eucalyptus tereticornis* | 50 m | 6 m | Large tree |
| Narrow leaf ironbark | *Eucalyptus crebra* | 35 m | 6 m | Large tree |
| Moreton Bay Ash | *Corymbia tessellaris* | 35 m | 6 m | Large tree |
| Brigalow | *Acacia harpophylla* | 25 m | 6 m | Large tree |
| gidgee | *Acacia cambagei* | 4-15 m | 3-4m | Medium Tree |
| Ironwood | *Acacia excelsa* | 3-15 m | 2-3 m | Medium Tree |
| Broad leaved poplar gum | *Eucaluptus platyphylla* | 20 m | 3-4 m | Medium Tree |
| Poplar box | *Eucalyptus populnea* | 20 m | 2-3m | Medium Tree |
| Silver Leaved ironbark | *Eucalyptus melanophloia* | 20 m | 3-4 m | Medium Tree |
| belah | *Casuarina cristata* | 10-20m | 3-4 m | Medium Tree |
| Leichhardt bean | *Cassia brewsteri* | 10-12 m | 3-4 m | Medium Tree |
| False Sandalwood | *Eremophila mitchellii* | 10 m | 3-4 m | Medium Tree |
| Black tea-tree, river tea-tree or mock olive | *Melaleuca bracteata* | 7 m | 1-2 m | Shrub |
| Weeping Acacia | *Acacia salicina* | 3-13 m | 2-3 m | Shrub |
| Conkerberry | *Carissa lanceolata* | 3 m | 2-3 m | Shrub |
| wilga | *Geijera parviflora* | 2-4 max 10m | 2-3m | Shrub |
| Dark wiregrass | *Aristida calycina* | 2 m | | Grasses/ forbes |
| Black speargrass | *Heteropogon contortus* | 1.5 m | | Grasses/ forbes |
| Spiked Side | *Sida hackettiana* | 1.5 m | | Grasses/ forbes |
| Kangaroo grass | *Themeda triandra* | 1.5 m | | Grasses/ forbes |
| Flannel weed | *Abutilon oxycarpum* | 1.5- 2m | | Grasses/ forbes |
| Barbed Wire Grass | *Cymbopogon refractus* | 1 m | | Grasses/ forbes |
| Velvet hibiscus | *Melhania oblongifolia* | 0.7 m | | Grasses/ forbes |

| Common name | Botanical name | Height | Minimum spacing | Tree size |
|---|---|---|---|---|
| Hairy panic | *Panicum effusum* | 0.7 m | | Grasses/ forbes |
| Winterapple | *Eremophila debilis* | 0.5 m | | Grasses/ forbes |
| Ribbon grass | *Chrysopogon fallax* | 0.3- 1.5 m | | Grasses/ forbes |
| Rhuncho | *Rhynchosia minima* | 0.3- 1.2 m | | Grasses/ forbes |
| Curly Windmill Grass | *Enteropogon acicularis* | 0.25- 1.1 m | | Grasses/ forbes |
| Blue trumpet | *Brunoniella australis* | 0.15 m | | Grasses/ forbes |
| Purple lovegrass | *Eragrostis lacunaria* | 0.12-0.6 m | | Grasses/ forbes |
| Forked fimbry | *Fimbristylis dichotoma* | 0.1- 0.75 m | | Grasses/ forbes |
| Dwarf morning glory | *Evolvulus alsinoides* | 0.05-0.5 m | | Grasses/ forbes |
| Lesser joyweed | *Alternanthera micrantha* | | Grasses/ forbes | |