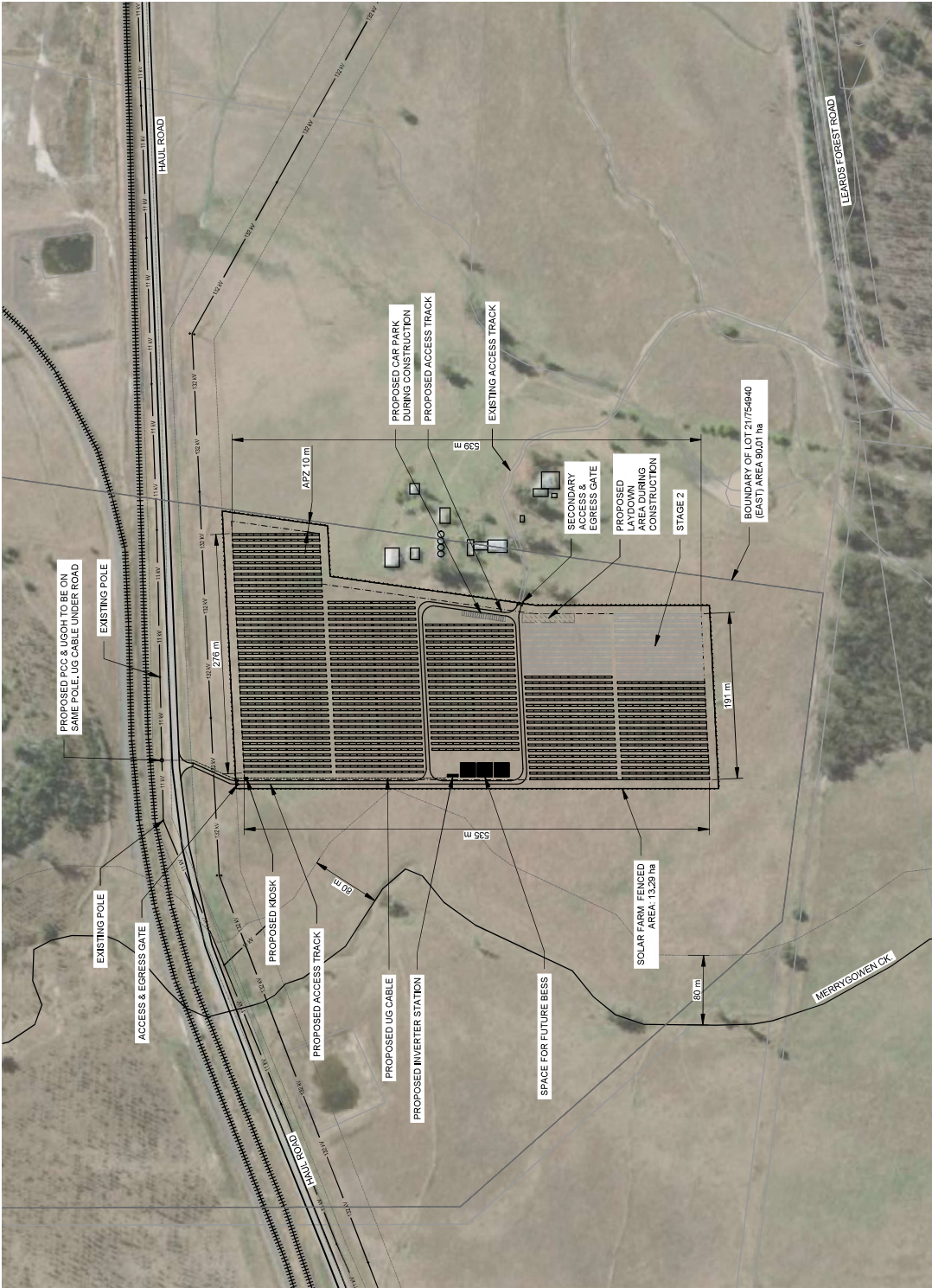
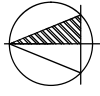




| SITE INFORMATION |                                       |
|------------------|---------------------------------------|
| LOT / DP         | 21/754940                             |
| ADDRESS          | LEARDS FOREST ROAD, BOGGABRI NSW 2382 |
| LGA              | NARRABRI SHIRE COUNCIL                |
| LOT / LONG       | -30.625801 / 150.122058               |
| LOT AREA         | 90.01 ha                              |
| FENCED AREA      | 13.29 ha                              |
| NSP              | TRANSGRID                             |

| PROJECT INFORMATION    |                                          |
|------------------------|------------------------------------------|
| DC CAPACITY            | 6,528 MW (STAGE 1)<br>1,023 MW (STAGE 2) |
| INVERTERS              | 4.95 MW                                  |
| TRACKER SPACING (M-S)  | MIN. 6.0 m                               |
| ARRAY PITCH            | 6.5 m                                    |
| CONNECTION VOLTAGE     | 11 kV                                    |
| CONNECTION FEEDER      | TRANSGRID                                |
| CONNECTION SUBSTATION  | TRANSGRID                                |
| SECURITY FENCE SETBACK | MIN. 3 m FROM OPTION BOUNDARY            |
| ARRAY SETBACK          | MIN. 10 m FROM SECURITY FENCE            |
| ACCESS PATH WIDTH      | 4 m                                      |

1

GENERAL ARRANGEMENT PLAN

SCALE: 1:5000

| NO. | STAGE                               | OWN | CHD | APPR | DATE | NOTES      |
|-----|-------------------------------------|-----|-----|------|------|------------|
| 1   | 30% DESIGN                          | ISC | MJB | ISC  | LF   | 15/08/2023 |
| 2   | SITE FOOTPRINT OPTIMISED            | ISC | MJB | ISC  | LF   | 28/08/2023 |
| 3   | VANADIUM REDOX FLOW BATTERIES ADDED | ISC | MJB | ISC  | ISC  | 04/10/2023 |
| 4   | ---                                 | --- | --- | ---  | ---  | ---        |
| 5   | ---                                 | --- | --- | ---  | ---  | ---        |
| 6   | ---                                 | --- | --- | ---  | ---  | ---        |



RENEWABLES

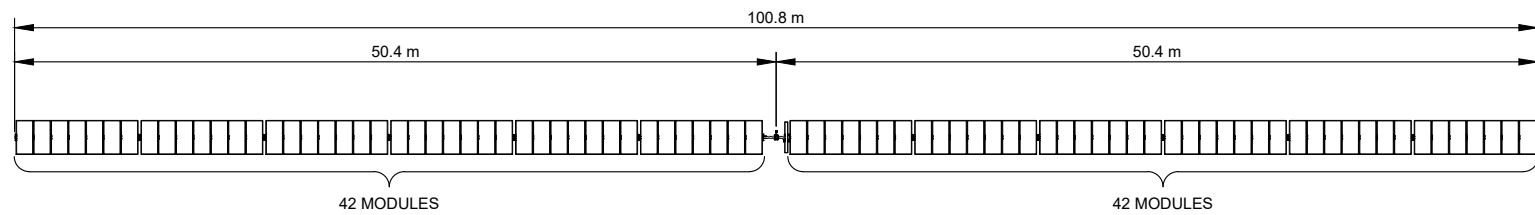
PO Box 6717  
NARRABRI NSW 2382  
AUSTRALIA  
Tel: 02 6337 3511  
info@itp.com.au

| GENERAL ARRANGEMENT PLAN |                                           |
|--------------------------|-------------------------------------------|
| PROJECT                  | BOGGABRI SOLAR FARM                       |
| CLIENT                   | IDEMITSU RENEWABLE DEVELOPMENTS AUSTRALIA |
| ADDRESS                  | LEARDS FOREST ROAD<br>BOGGABRI NSW 2382   |
| DWG NO.                  | 23043-G-2100                              |

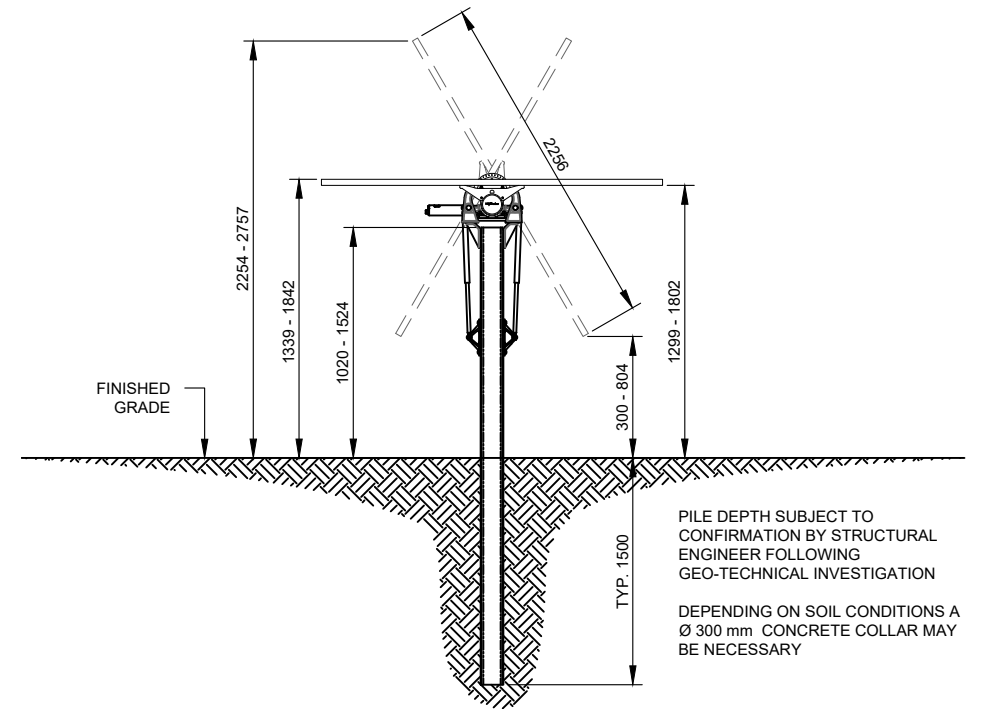
|                                                                                                                                              |                                                                                                                                              |
|----------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------|
| DO NOT SCALE                                                                                                                                 | DO NOT SCALE                                                                                                                                 |
| THIS DOCUMENT MAY ONLY BE USED BY CLIENTS OF ITP FOR THE PURPOSES OF THE PROJECT. EXPRESS PERMISSION FROM ITP IS REQUIRED FOR ANY OTHER USE. | THIS DOCUMENT MAY ONLY BE USED BY CLIENTS OF ITP FOR THE PURPOSES OF THE PROJECT. EXPRESS PERMISSION FROM ITP IS REQUIRED FOR ANY OTHER USE. |
| SCALE                                                                                                                                        | AS NOTED                                                                                                                                     |
| SHEET NO.                                                                                                                                    | A3                                                                                                                                           |
| DATE                                                                                                                                         | 28/08/23                                                                                                                                     |
| REV. NO.                                                                                                                                     | 3                                                                                                                                            |



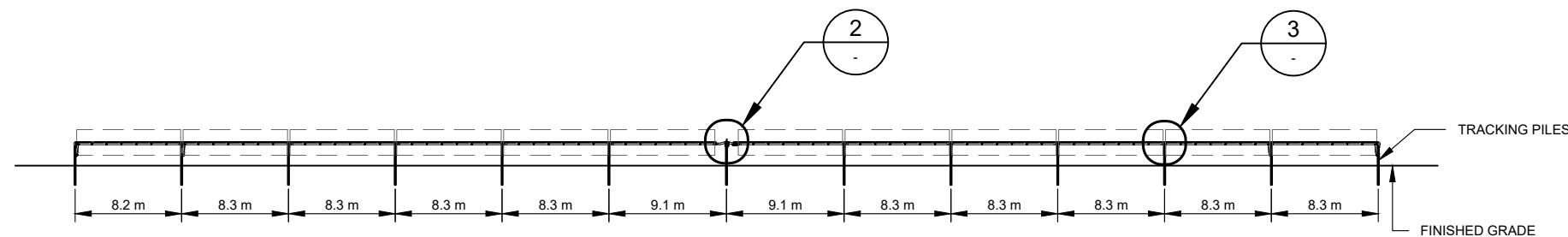




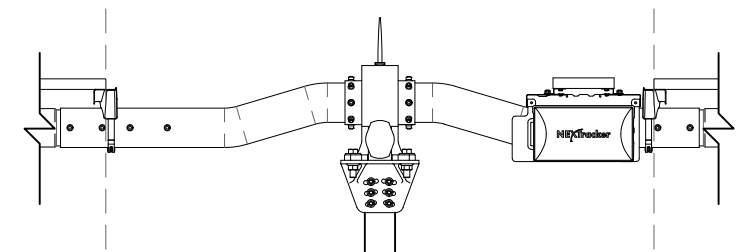
**1** TYPICAL ARRAY PLAN - 84 MODULE TRACKER  
SCALE: 1:500



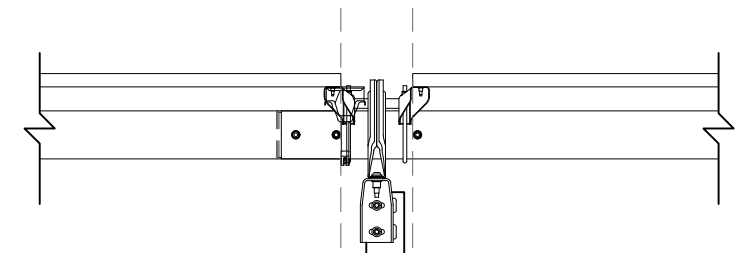
**B** TYPICAL ARRAY END ELEVATION  
SCALE: 1:50



**A** TYPICAL ARRAY ELEVATION - 84 MODULE TRACKER  
SCALE: 1:500



**2** SELF POWERED CONTROLLER DETAIL  
SCALE: NTS

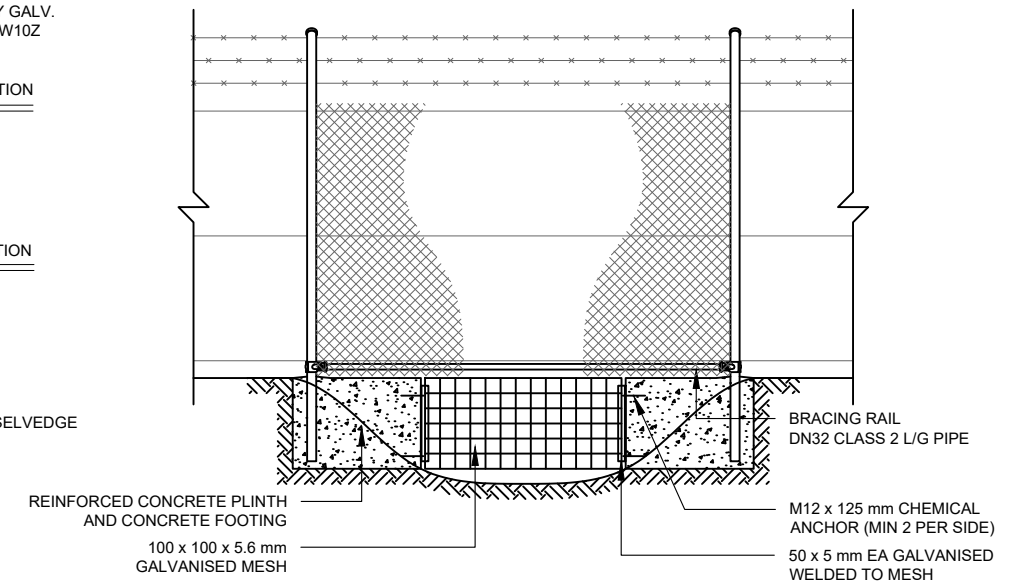
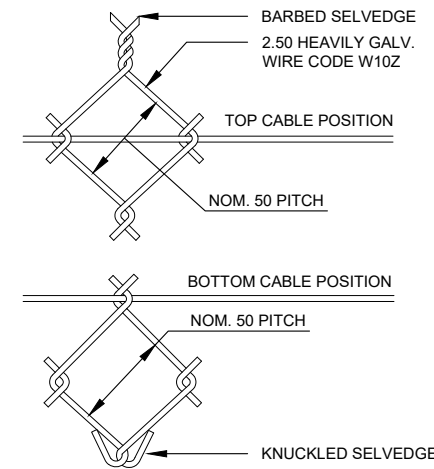
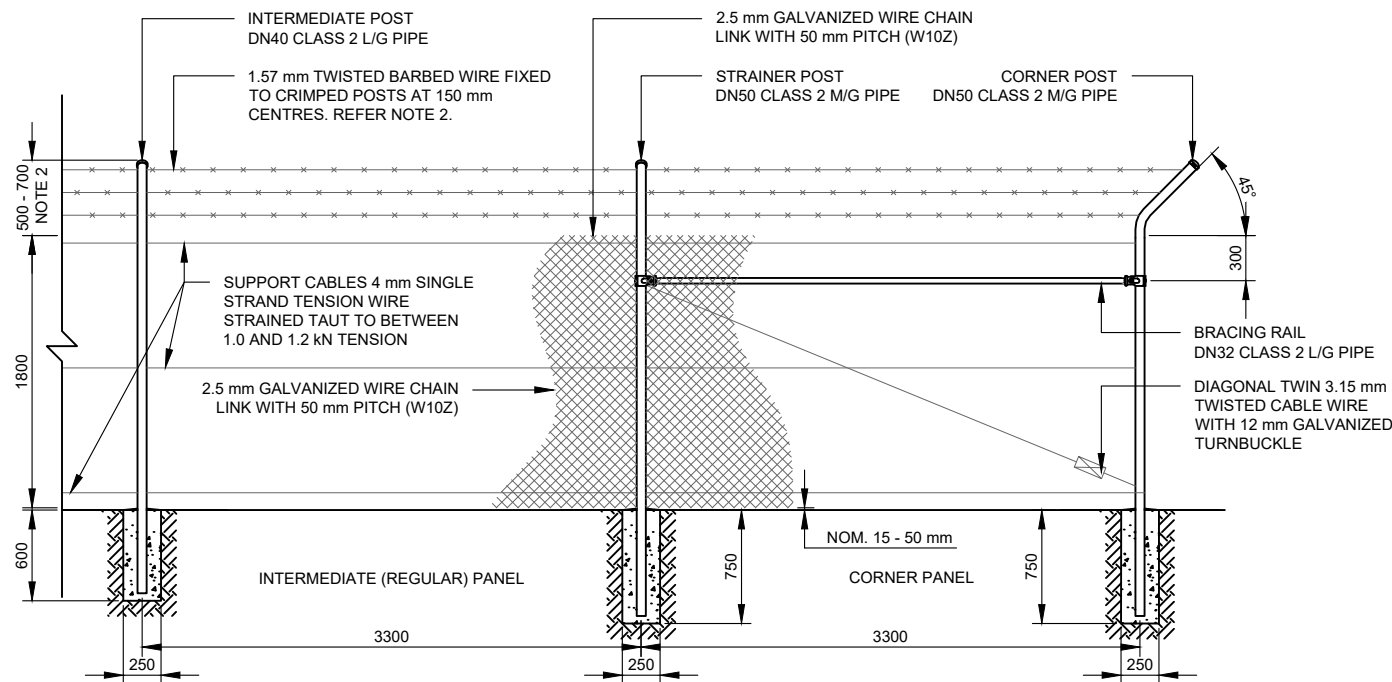


**3** DAMPER DETAIL  
SCALE: NTS

DRAFT FOR TENDER

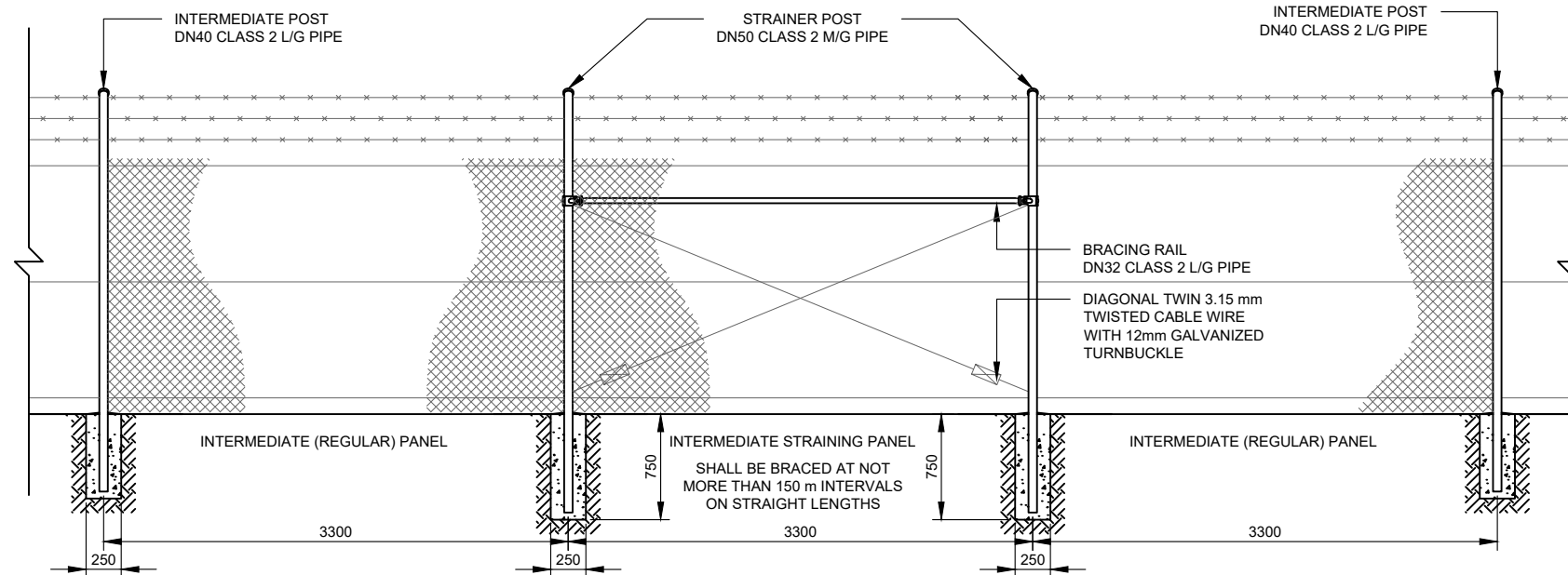
|     |                  |     |     |      |      |            |                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                              |                                                                                                          |              |                       |                                                                                       |            |          |
|-----|------------------|-----|-----|------|------|------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------|--------------|-----------------------|---------------------------------------------------------------------------------------|------------|----------|
| NO. | STAGE            | DSN | DWN | CHKD | APPR | DATE       | <div>NOTES</div> <div>1. DRAFT TENDER PACKAGE IS BASED ON 30% DESIGN AND MAY BE UPDATED BASED ON CHANGES DURING DETAILED DESIGN PHASE.</div> <div>2. TRACKER AND MODULE DIMENSIONS ARE INDICATIVE AND SUBJECT TO CHANGE BY THE MANUFACTURER WITHOUT NOTICE.</div> | <div><div>info@itpau.com.au<br/>itpau.com.au<br/>+61 2 6257 3511</div><div>PO Box 6217<br/>O'Connor, ACT 2602<br/>AUSTRALIA</div></div> | DSN   ISC   DWN   MJB                                                                                    |              | DRG TITLE             |                                                                                       |            |          |
| 1   | DRAFT FOR TENDER | ISC | MJB | ISC  | MOR  | 05/01/2024 |                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                              | CHKD   ISC   APPR   MOR                                                                                  |              | ARRAY FRAMING DETAILS |                                                                                       |            |          |
| 2   |                  |     |     |      |      |            |                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                              | DO NOT SCALE                                                                                             |              | ----                  |                                                                                       |            |          |
| 3   |                  |     |     |      |      |            |                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                              | ALL MEASUREMENTS IN mm UNLESS OTHERWISE STATED.                                                          |              | PROJECT               | BOGGABRI SOLAR FARM                                                                   | SCALE      | AS NOTED |
| 4   |                  |     |     |      |      |            |                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                              | THIS DOCUMENT MAY ONLY BE USED BY CLIENTS OF ITP OR THOSE WHO HAVE RECEIVED EXPRESS PERMISSION FROM ITP. |              | CLIENT ADDRESS        | IDEMITSU RENEWABLE DEVELOPMENTS AUSTRALIA<br>LEARDS FOREST ROAD<br>BOGGABRI, NSW 2382 | SHEET SIZE | A3       |
| 5   |                  |     |     |      |      |            |                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                              | THE USE OF THIS DRAWING SHALL NOT EXTEND BEYOND THE PURPOSE FOR WHICH IT WAS ORIGINALLY PREPARED.        |              |                       |                                                                                       | ORIG. DATE | 5/9/22   |
| 6   |                  |     |     |      |      |            |                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                              |                                                                                                          |              |                       |                                                                                       | REV. DATE  | 3/1/24   |
|     |                  |     |     |      |      |            |                                                                                                                                                                                                                                                                   | DRG NO.                                                                                                                                                                                                                      |                                                                                                          | 23043-M-2300 |                       | REV NO.                                                                               |            | 1        |



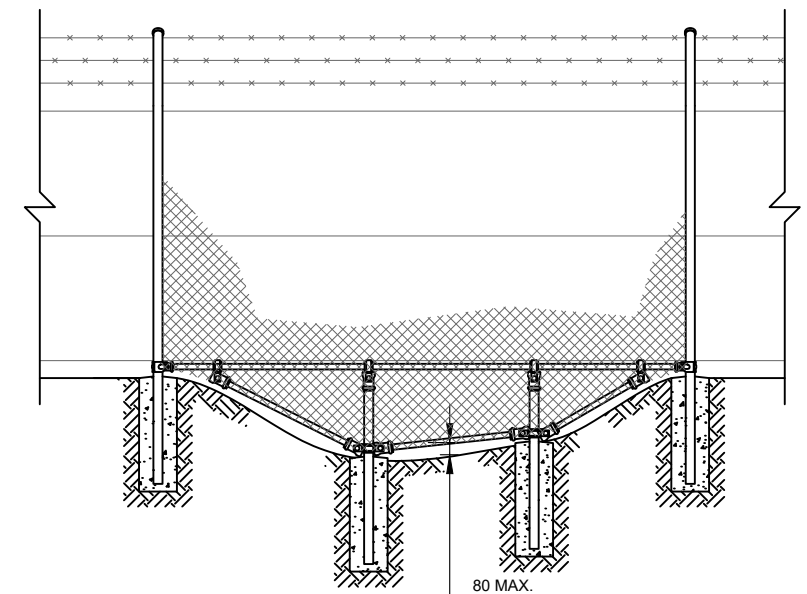


1 TYPICAL FENCE SECTION  
SCALE: 1:50

3 TYPICAL STORMWATER CROSSING  
SCALE: 1:50

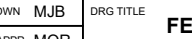


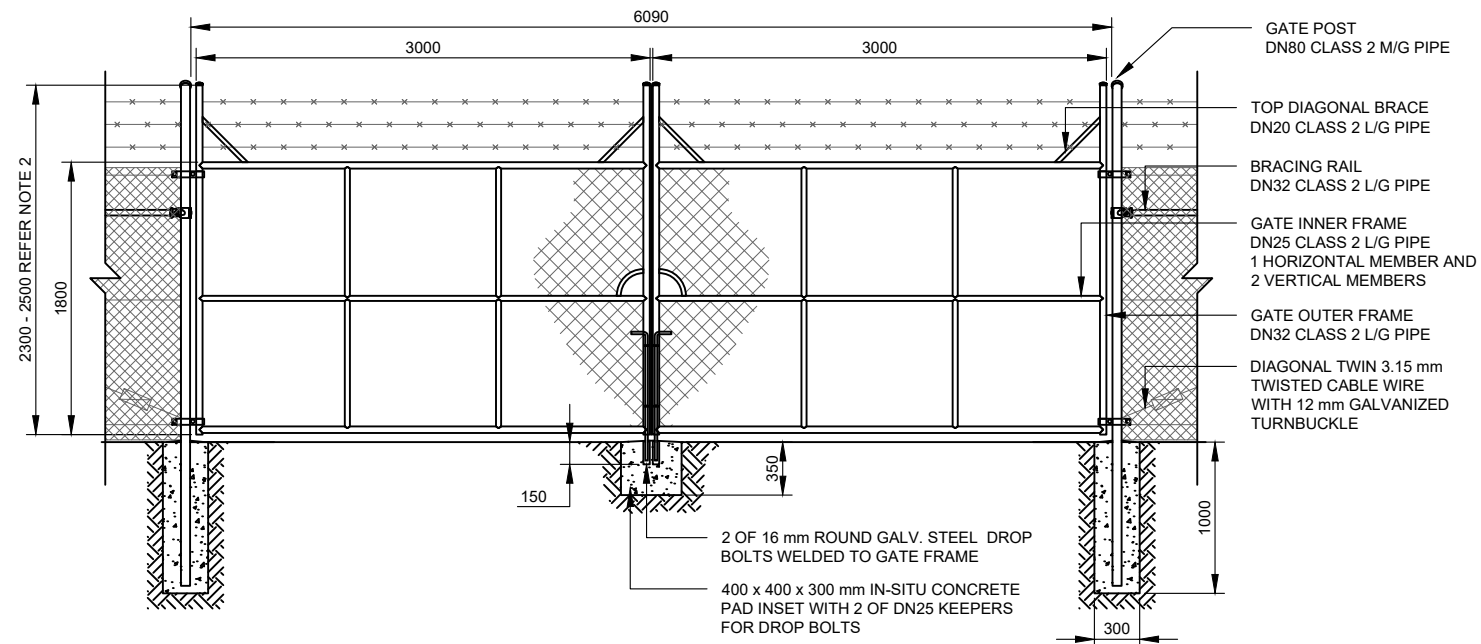
2 INTERMEDIATE STRAINING PANEL FENCE SECTION  
SCALE: 1:50



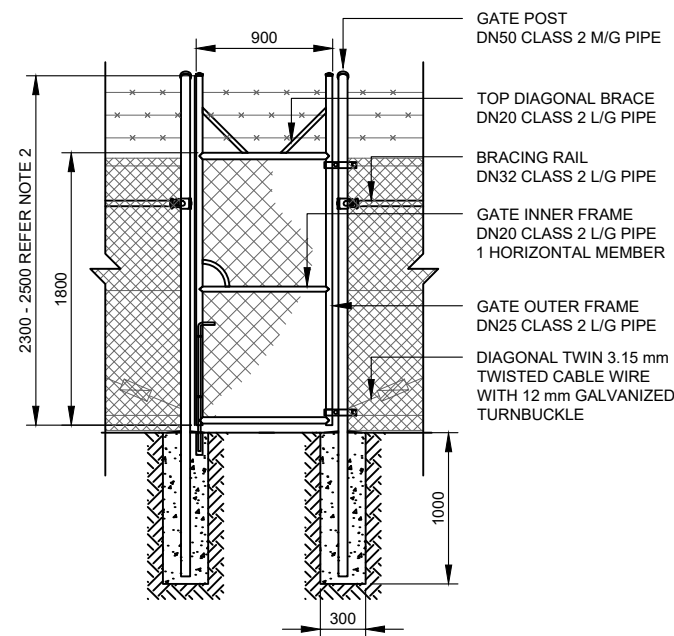
4 TYPICAL GULLY CROSSING  
SCALE: 1:50

DRAFT FOR TENDER

|     |                  |     |     |      |      |            |                                                                                                                  |                                                                                                                                                                                                                      |                                                                                                          |     |      |     |                 |                                                                                       |         |            |            |          |
|-----|------------------|-----|-----|------|------|------------|------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------|-----|------|-----|-----------------|---------------------------------------------------------------------------------------|---------|------------|------------|----------|
| NO. | STAGE            | DSN | DWN | CHKD | APPR | DATE       | NOTES                                                                                                            | <div><p>info@itpau.com.au<br/>itpau.com.au<br/>+61 2 6257 3511</p><p>PO Box 6217<br/>O'Connor, ACT 2602<br/>AUSTRALIA</p></div> | DSN                                                                                                      | ISC | DWN  | MJB | DRG TITLE       |                                                                                       |         |            |            |          |
| 1   | DRAFT FOR TENDER | ISC | MJB | ISC  | MOR  | 05/01/2024 | 1. DRAFT TENDER PACKAGE IS BASED ON 30% DESIGN AND MAY BE UPDATED BASED ON CHANGES DURING DETAILED DESIGN PHASE. |                                                                                                                                                                                                                      | CHKD                                                                                                     | ISC | APPR | MOR | FENCING DETAILS |                                                                                       |         |            |            |          |
| 2   |                  |     |     |      |      |            | 2. FENCE AND GATES TO BE DESIGNED AND CONSTRUCTED TO AS 1725 (PART 1) AND AS2067 (2016).                         |                                                                                                                                                                                                                      | DO NOT SCALE                                                                                             |     |      |     | ----            |                                                                                       |         |            |            |          |
| 3   |                  |     |     |      |      |            | 3. THREE ROWS OF BARBED WIRE FOR 2.3 m FENCE, FOUR ROWS OF BARBED WIRE FOR 2.5 m FENCE.                          |                                                                                                                                                                                                                      | ALL MEASUREMENTS IN mm UNLESS OTHERWISE STATED.                                                          |     |      |     | PROJECT         | BOGGABRI SOLAR FARM                                                                   |         |            | SCALE      | AS NOTED |
| 4   |                  |     |     |      |      |            | 4. ALL CONCRETE FOOTINGS MOUNDED TO PREVENT WATER POOLING AROUND STEEL PILES.                                    |                                                                                                                                                                                                                      | THIS DOCUMENT MAY ONLY BE USED BY CLIENTS OF ITP OR THOSE WHO HAVE RECEIVED EXPRESS PERMISSION FROM ITP. |     |      |     | CLIENT ADDRESS  | IDEMITSU RENEWABLE DEVELOPMENTS AUSTRALIA<br>LEARDS FOREST ROAD<br>BOGGABRI, NSW 2382 |         |            | SHEET SIZE | A3       |
| 5   |                  |     |     |      |      |            |                                                                                                                  |                                                                                                                                                                                                                      | THE USE OF THIS DRAWING SHALL NOT EXTEND BEYOND THE PURPOSE FOR WHICH IT WAS ORIGINALLY PREPARED.        |     |      |     |                 |                                                                                       |         | ORIG. DATE | 9/8/22     |          |
| 6   |                  |     |     |      |      |            |                                                                                                                  |                                                                                                                                                                                                                      |                                                                                                          |     |      |     | DRG NO.         | 23043-C-5300                                                                          |         |            | REV. DATE  | 3/1/24   |
|     |                  |     |     |      |      |            |                                                                                                                  |                                                                                                                                                                                                                      |                                                                                                          |     |      |     |                 |                                                                                       | REV NO. | 1          |            |          |



**1 DOUBLE LEAF 6 METRE GATE SECTION**  
SCALE: 1:50



**2 SINGLE LEAF GATE SECTION**  
SCALE: 1:50

**DRAFT FOR TENDER**

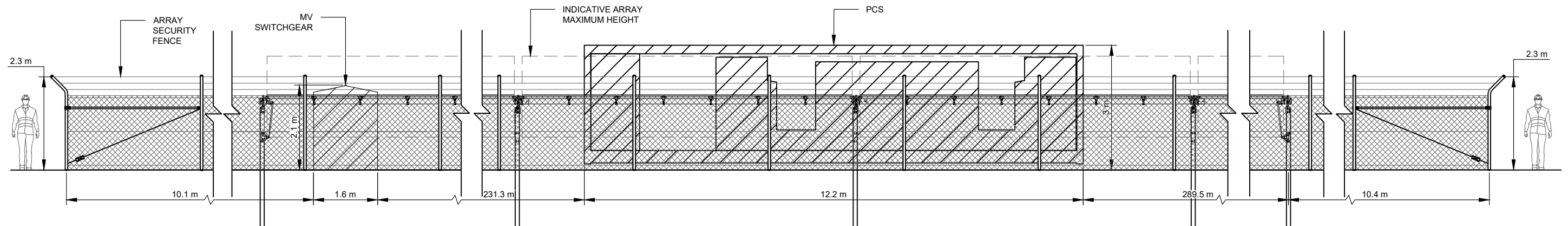
| NO. | STAGE            | DSN | DWN | CHKD | APPR | DATE       | NOTES                                                                                                                                                                                                                                                                                                                                                                                                       |  |  |  | GATE DETAILS                                                                                                                                                                                                                                                                                        |                                                                                       |            |          |
|-----|------------------|-----|-----|------|------|------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|------------|----------|
| 1   | DRAFT FOR TENDER | ISC | MJB | ISC  | MOR  | 05/01/2024 | <p>1. DRAFT TENDER PACKAGE IS BASED ON 30% DESIGN AND MAY BE UPDATED BASED ON CHANGES DURING DETAILED DESIGN PHASE.</p> <p>2. FENCE AND GATES TO BE DESIGNED AND CONSTRUCTED TO AS 1725 (PART 1) AND AS2067 (2016).</p> <p>3. THREE ROWS OF BARBED WIRE FOR 2.3 m FENCE, FOUR ROWS OF BARBED WIRE FOR 2.5 m FENCE.</p> <p>4. ALL CONCRETE FOOTINGS MOUNDED TO PREVENT WATER POOLING AROUND STEEL PILES.</p> |  |  |  | <p>DO NOT SCALE</p> <p>ALL MEASUREMENTS IN mm UNLESS OTHERWISE STATED.</p> <p>THIS DOCUMENT MAY ONLY BE USED BY CLIENTS OF ITP OR THOSE WHO HAVE RECEIVED EXPRESS PERMISSION FROM ITP.</p> <p>THE USE OF THIS DRAWING SHALL NOT EXTEND BEYOND THE PURPOSE FOR WHICH IT WAS ORIGINALLY PREPARED.</p> |                                                                                       |            |          |
| 2   |                  |     |     |      |      |            |                                                                                                                                                                                                                                                                                                                                                                                                             |  |  |  | PROJECT                                                                                                                                                                                                                                                                                             | BOGGABRI SOLAR FARM                                                                   | SCALE      | AS NOTED |
| 3   |                  |     |     |      |      |            |                                                                                                                                                                                                                                                                                                                                                                                                             |  |  |  | CLIENT ADDRESS                                                                                                                                                                                                                                                                                      | IDEMITSU RENEWABLE DEVELOPMENTS AUSTRALIA<br>LEARDS FOREST ROAD<br>BOGGABRI, NSW 2382 | SHEET SIZE | A3       |
| 4   |                  |     |     |      |      |            |                                                                                                                                                                                                                                                                                                                                                                                                             |  |  |  |                                                                                                                                                                                                                                                                                                     |                                                                                       | ORIG. DATE | 9/8/22   |
| 5   |                  |     |     |      |      |            |                                                                                                                                                                                                                                                                                                                                                                                                             |  |  |  |                                                                                                                                                                                                                                                                                                     |                                                                                       | REV. DATE  | 5/1/24   |
| 6   |                  |     |     |      |      |            |                                                                                                                                                                                                                                                                                                                                                                                                             |  |  |  | DRG NO.                                                                                                                                                                                                                                                                                             | 23043-C-5310                                                                          | REV NO.    | 1        |



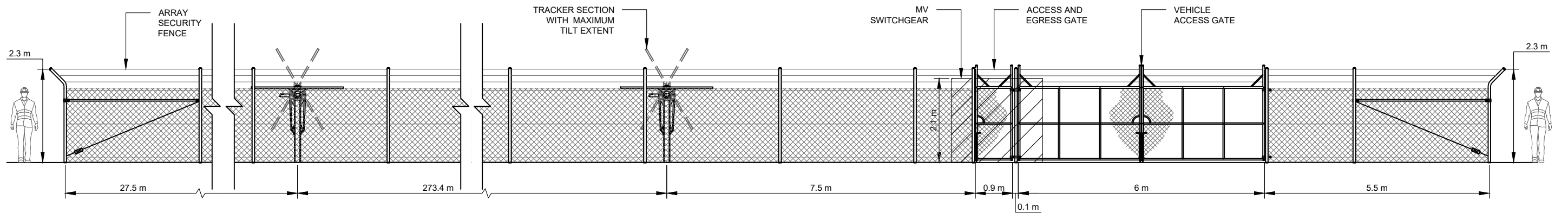
**RENEWABLES**

info@itpau.com.au  
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+61 2 6257 3511

PO Box 6217  
O'Connor, ACT 2602  
AUSTRALIA



**A** ELEVATION A  
G-2100 SCALE: 1:100

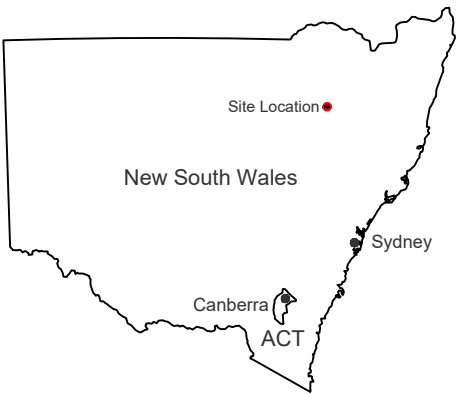


**B** ELEVATION B  
G-2100 SCALE: 1:100

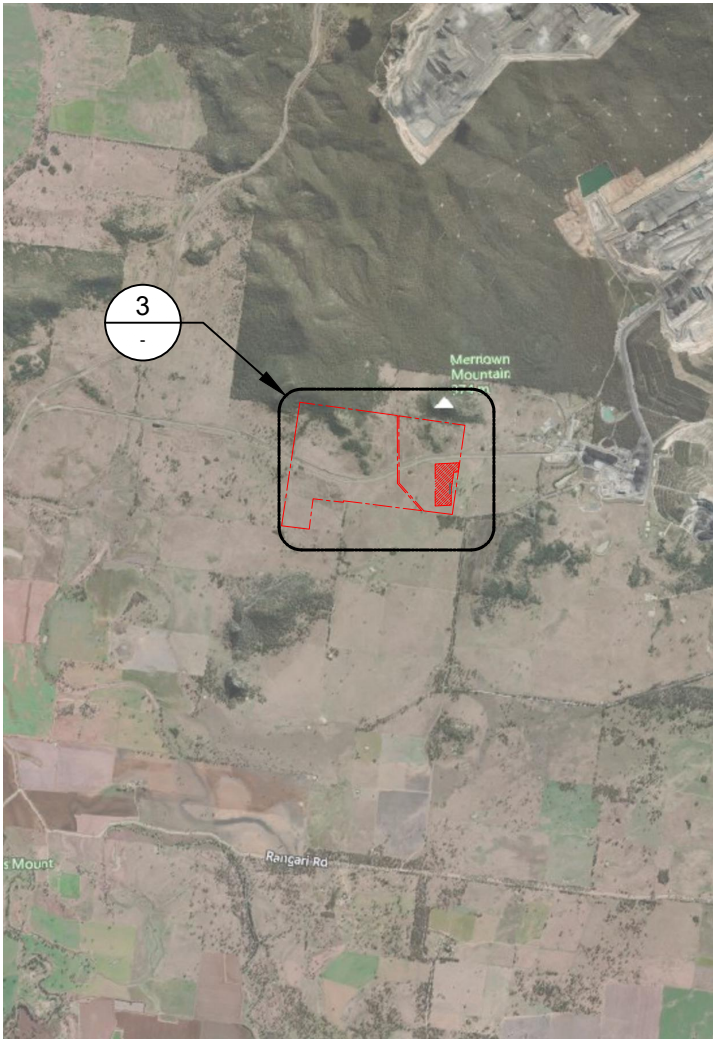
DRAFT FOR TENDER

| NO. | STAGE | DSN | DWN | CHKD | APPR | DATE | NOTES                                                                                                             | <div><div></div><div>RENEWABLES</div><div><div>info@itpau.com.au<br/>itpau.com.au<br/>+61 2 6257 3511</div><div>PO Box 6217<br/>O'Connor, ACT 2602<br/>AUSTRALIA</div></div></div> | <div>DSNISC</div>                                                                                   | <div>DWNMJB</div> | DRG TITLE |  |         |            |          |
|-----|-------|-----|-----|------|------|------|-------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|-------------------|-----------|--|---------|------------|----------|
|     |       |     |     |      |      |      | <div>CHKDISC</div>                                                                                                |                                                                                                                                                                                                                                                                         | <div>APPRMOR</div>                                                                                  | SITE ELEVATIONS   |           |  |         |            |          |
|     |       |     |     |      |      |      | DO NOT SCALE                                                                                                      |                                                                                                                                                                                                                                                                         |                                                                                                     | ----              |           |  |         |            |          |
|     |       |     |     |      |      |      | ALL MEASUREMENTS IN mm<br>UNLESS OTHERWISE STATED.                                                                |                                                                                                                                                                                                                                                                         | PROJECTBOGGABRI SOLAR FARM                                                                          |                   |           |  |         | SCALE      | AS NOTED |
|     |       |     |     |      |      |      | THIS DOCUMENT MAY ONLY BE<br>USED BY CLIENTS OF ITP OR<br>THOSE WHO HAVE RECEIVED<br>EXPRESS PERMISSION FROM ITP. |                                                                                                                                                                                                                                                                         | CLIENT ADDRESSIDEMITSU RENEWABLE DEVELOPMENTS AUSTRALIA<br>LEARDS FOREST ROAD<br>BOGGABRI, NSW 2382 |                   |           |  |         | SHEET SIZE | A3       |
|     |       |     |     |      |      |      | THE USE OF THIS DRAWING<br>SHALL NOT EXTEND BEYOND THE<br>PURPOSE FOR WHICH IT WAS<br>ORIGINALLY PREPARED.        |                                                                                                                                                                                                                                                                         | DRG NO.23043-G-2200                                                                                 |                   |           |  |         | ORIG. DATE | 2/12/20  |
|     |       |     |     |      |      |      |                                                                                                                   |                                                                                                                                                                                                                                                                         |                                                                                                     |                   |           |  |         | REV. DATE  | 3/1/24   |
|     |       |     |     |      |      |      |                                                                                                                   |                                                                                                                                                                                                                                                                         |                                                                                                     |                   |           |  | REV NO. | 1          |          |





1 STATE MAP  
SCALE: NTS



2 LOCATION PLAN  
SCALE: NTS



3 SITE PLAN  
SCALE: 1:10000

DEVELOPMENT APPLICATION

| NO. | STAGE                            | DSN  | DWN  | CHKD | APPR | DATE       |
|-----|----------------------------------|------|------|------|------|------------|
| 1   | 30% DESIGN                       | ISC  | MJB  | ISC  | ISC  | 15/08/2023 |
| 2   | OH WIRES ADDED                   | ISC  | MJB  | ISC  | LF   | 28/08/2023 |
| 3   | SECURITY FENCE FOOTPRINT UPDATED | ISC  | MJB  | ISC  | ISC  | 04/10/2023 |
| 4   | DRAFT FOR TENDER                 | ISC  | MJB  | ISC  | MOR  | 05/01/2024 |
| 5   | DEVELOPMENT APPLICATION          | ISC  | MJB  | ISC  | ISC  | 13/03/2024 |
| 6   | ----                             | ---- | ---- | ---- | ---- | ----       |

NOTES

1. DRAFT TENDER PACKAGE IS BASED ON 30% DESIGN AND MAY BE UPDATED BASED ON CHANGES DURING DETAILED DESIGN PHASE.



| DSN                                                                                                      | ISC | DWN  | MJB | DRG TITLE                                                                                      |
|----------------------------------------------------------------------------------------------------------|-----|------|-----|------------------------------------------------------------------------------------------------|
| CHKD                                                                                                     | ISC | APPR | ISC | LOCATION PLAN                                                                                  |
| DO NOT SCALE                                                                                             |     |      |     | ----                                                                                           |
| ALL MEASUREMENTS IN mm UNLESS OTHERWISE STATED.                                                          |     |      |     | PROJECT BOGGABRI SOLAR FARM                                                                    |
| THIS DOCUMENT MAY ONLY BE USED BY CLIENTS OF ITP OR THOSE WHO HAVE RECEIVED EXPRESS PERMISSION FROM ITP. |     |      |     | CLIENT ADDRESS IDEMITSU RENEWABLE DEVELOPMENTS AUSTRALIA LEARDS FOREST ROAD BOGGABRI, NSW 2382 |
| THE USE OF THIS DRAWING SHALL NOT EXTEND BEYOND THE PURPOSE FOR WHICH IT WAS ORIGINALLY PREPARED.        |     |      |     | DRG NO. 23043-G-0400                                                                           |
|                                                                                                          |     |      |     | SCALE AS NOTED                                                                                 |
|                                                                                                          |     |      |     | SHEET SIZE A3                                                                                  |
|                                                                                                          |     |      |     | ORIG. DATE 2/8/23                                                                              |
|                                                                                                          |     |      |     | REV. DATE 13/3/24                                                                              |
|                                                                                                          |     |      |     | REV NO. 5                                                                                      |

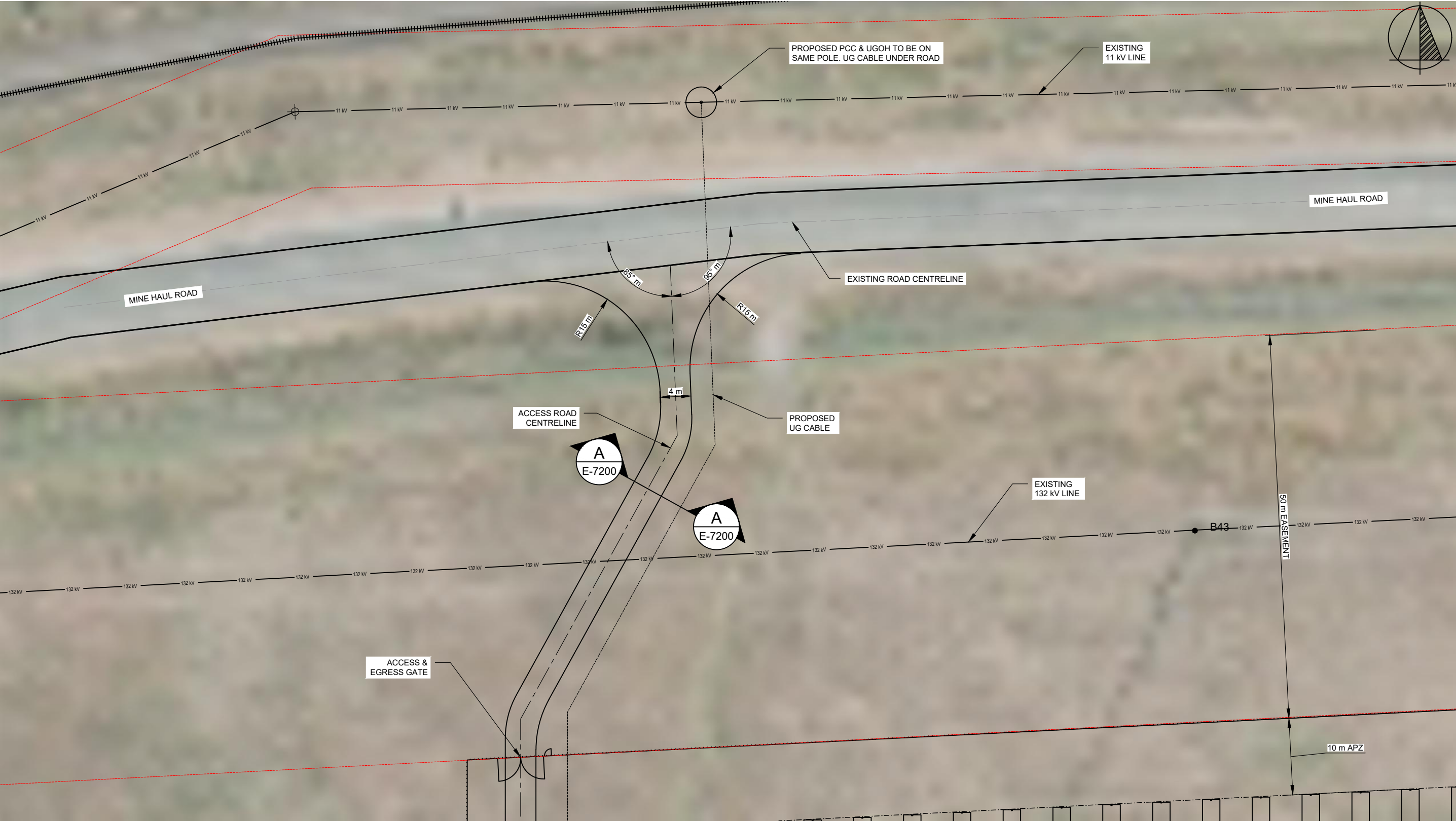




**1 EASEMENT DETAIL PLAN**  
SCALE: 1:1000

60% DESIGN

| NO. | STAGE      | DSN  | DWN  | CHKD | APPR | DATE       | NOTES | <div><div><div><div>itp</div></div><div>RENEWABLES</div></div><div><div>info@itpau.com.au<br/>itpau.com.au<br/>+61 2 6257 3511</div><div>PO Box 6217<br/>O'Connor, ACT 2602<br/>AUSTRALIA</div></div></div> | <div><div><div>DSNISC</div><div>DWNMJB</div></div><div><div>CHKDISC</div><div>APPRMOR</div></div></div> <div>DO NOT SCALE</div> | DRG TITLE                                       |  | DRG NO.          |  |
|-----|------------|------|------|------|------|------------|-------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------|--|------------------|--|
|     |            |      |      |      |      |            |       |                                                                                                                                                                                                             |                                                                                                                                 | EASEMENT DETAIL PLAN                            |  | 23043-G-2120     |  |
| 1   | 60% DESIGN | ISC  | MJB  | ISC  | MOR  | 02/04/2024 |       |                                                                                                                                                                                                             |                                                                                                                                 | PROJECTBOGGABRI SOLAR FARM                      |  | SCALEAS NOTED    |  |
| 2   | ----       | ---- | ---- | ---- | ---- | ----       |       |                                                                                                                                                                                                             |                                                                                                                                 | CLIENTIDEMITSU RENEWABLE DEVELOPMENTS AUSTRALIA |  | SHEET SIZEA3     |  |
| 3   | ----       | ---- | ---- | ---- | ---- | ----       |       |                                                                                                                                                                                                             |                                                                                                                                 | ADDRESSLEARDS FOREST ROAD<br>BOGGABRI, NSW 2382 |  | ORIG. DATE2/8/23 |  |
| 4   | ----       | ---- | ---- | ---- | ---- | ----       |       |                                                                                                                                                                                                             |                                                                                                                                 |                                                 |  | REV. DATE2/4/24  |  |
| 5   | ----       | ---- | ---- | ---- | ---- | ----       |       |                                                                                                                                                                                                             |                                                                                                                                 |                                                 |  |                  |  |
| 6   | ----       | ---- | ---- | ---- | ---- | ----       |       |                                                                                                                                                                                                             |                                                                                                                                 |                                                 |  | REV NO.1         |  |



1  
-

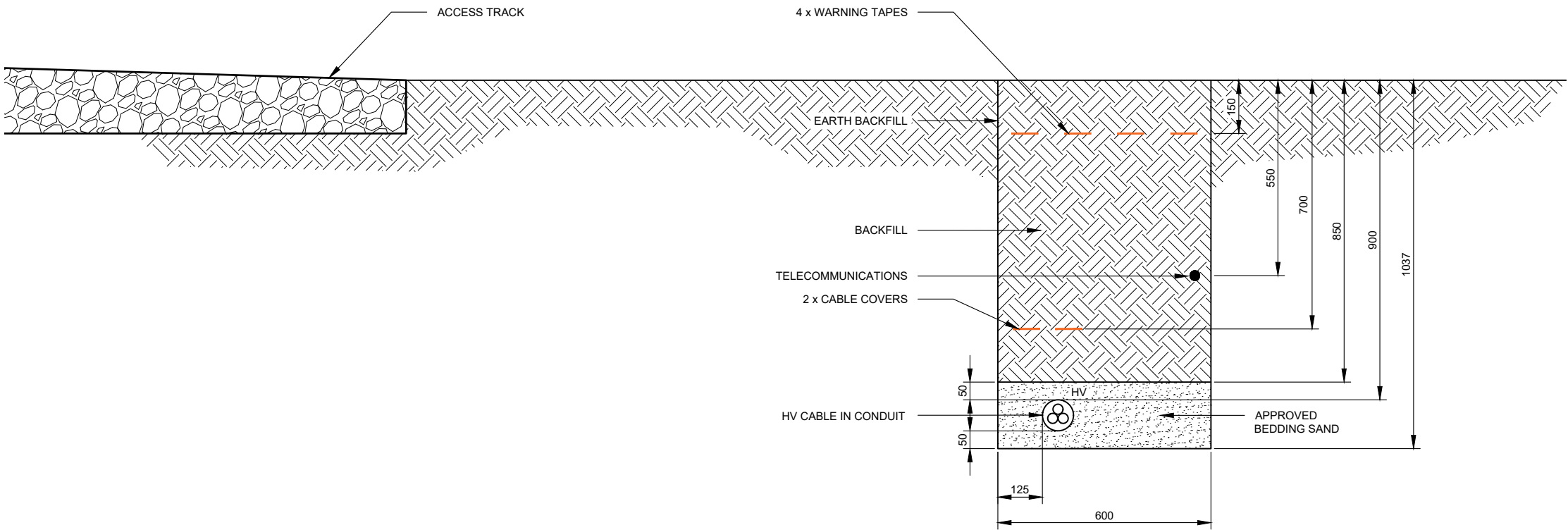
ACCESS ROAD CROSSING EASEMENT PLAN

SCALE: 1:500

60% DESIGN

|              |  |              |      |      |      |                   |       |                                                                                                                                                                                                                              |                                                                                                          |              |                |                                                                                       |            |          |
|--------------|--|--------------|------|------|------|-------------------|-------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------|--------------|----------------|---------------------------------------------------------------------------------------|------------|----------|
| NO. STAGE    |  | DSN          | DWN  | CHKD | APPR | DATE              | NOTES | <div><div>info@itpau.com.au<br/>itpau.com.au<br/>+61 2 6257 3511</div><div>PO Box 6217<br/>O'Connor, ACT 2602<br/>AUSTRALIA</div></div> | DSN ISC DWN MJB                                                                                          |              | DRG TITLE      | ACCESS ROAD CROSSING PLAN                                                             |            |          |
|              |  |              |      |      |      | CHKD ISC APPR MOR |       |                                                                                                                                                                                                                              |                                                                                                          |              |                |                                                                                       |            |          |
|              |  | DO NOT SCALE |      |      |      |                   |       |                                                                                                                                                                                                                              |                                                                                                          |              |                |                                                                                       |            |          |
| 1 60% DESIGN |  | ISC          | MJB  | ISC  | MOR  | 02/04/2024        |       |                                                                                                                                                                                                                              | ALL MEASUREMENTS IN mm UNLESS OTHERWISE STATED.                                                          |              | PROJECT        | BOGGABRI SOLAR FARM                                                                   | SCALE      | AS NOTED |
| 2 ----       |  | ----         | ---- | ---- | ---- | ----              |       |                                                                                                                                                                                                                              | THIS DOCUMENT MAY ONLY BE USED BY CLIENTS OF ITP OR THOSE WHO HAVE RECEIVED EXPRESS PERMISSION FROM ITP. |              | CLIENT ADDRESS | IDEMITSU RENEWABLE DEVELOPMENTS AUSTRALIA<br>LEARDS FOREST ROAD<br>BOGGABRI, NSW 2382 | SHEET SIZE | A3       |
| 3 ----       |  | ----         | ---- | ---- | ---- | ----              |       |                                                                                                                                                                                                                              |                                                                                                          |              |                |                                                                                       | ORIG. DATE | 2/8/23   |
| 4 ----       |  | ----         | ---- | ---- | ---- | ----              |       |                                                                                                                                                                                                                              |                                                                                                          |              |                |                                                                                       | REV. DATE  | 2/4/24   |
| 5 ----       |  | ----         | ---- | ---- | ---- | ----              |       |                                                                                                                                                                                                                              | DRG NO.                                                                                                  | 23043-G-2130 | REV NO.        | 1                                                                                     |            |          |
| 6 ----       |  | ----         | ---- | ---- | ---- | ----              |       |                                                                                                                                                                                                                              |                                                                                                          |              |                |                                                                                       |            |          |





**A** TRENCH SECTION A  
G-2130 SCALE: 1:15

60% DESIGN

|              |  |            |  |      |  |     |  |      |  |      |  |            |  |       |  |                                                                                                                                                                                                                                                                         |  |         |  |                                                    |  |         |  |                                           |  |            |  |                             |  |
|--------------|--|------------|--|------|--|-----|--|------|--|------|--|------------|--|-------|--|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|---------|--|----------------------------------------------------|--|---------|--|-------------------------------------------|--|------------|--|-----------------------------|--|
| NO.          |  | STAGE      |  | DSN  |  | DWN |  | CHKD |  | APPR |  | DATE       |  | NOTES |  | <div><div><div>RENEWABLES</div><div><div>info@itpau.com.au<br/>itpau.com.au<br/>+61 2 6257 3511</div><div>PO Box 6217<br/>O'Connor, ACT 2602<br/>AUSTRALIA</div></div></div></div> |  | DSN     |  | ISC                                                |  | DWN     |  | MJB                                       |  | DRG TITLE  |  | UNDERGROUND TRENCH SECTIONS |  |
| CHKD         |  | ISC        |  | APPR |  | MOR |  |      |  |      |  |            |  |       |  |                                                                                                                                                                                                                                                                         |  |         |  |                                                    |  |         |  |                                           |  |            |  |                             |  |
| DO NOT SCALE |  |            |  |      |  |     |  |      |  |      |  |            |  |       |  |                                                                                                                                                                                                                                                                         |  |         |  |                                                    |  |         |  |                                           |  |            |  |                             |  |
| 1            |  | 60% DESIGN |  | ISC  |  | MJB |  | ISC  |  | MOR  |  | 02/04/2024 |  |       |  |                                                                                                                                                                                                                                                                         |  |         |  | ALL MEASUREMENTS IN mm<br>UNLESS OTHERWISE STATED. |  | PROJECT |  | BOGGABRI SOLAR FARM                       |  | SCALE      |  | AS NOTED                    |  |
| 2            |  |            |  |      |  |     |  |      |  |      |  |            |  |       |  |                                                                                                                                                                                                                                                                         |  |         |  |                                                    |  | CLIENT  |  | IDEMITSU RENEWABLE DEVELOPMENTS AUSTRALIA |  | SHEET SIZE |  | A3                          |  |
| 3            |  |            |  |      |  |     |  |      |  |      |  |            |  |       |  |                                                                                                                                                                                                                                                                         |  |         |  |                                                    |  | ADDRESS |  | LEARDS FOREST ROAD<br>BOGGABRI, NSW 2382  |  | ORIG. DATE |  | 22/6/22                     |  |
| 4            |  |            |  |      |  |     |  |      |  |      |  |            |  |       |  |                                                                                                                                                                                                                                                                         |  |         |  |                                                    |  |         |  |                                           |  | REV. DATE  |  | 2/4/24                      |  |
| 5            |  |            |  |      |  |     |  |      |  |      |  |            |  |       |  |                                                                                                                                                                                                                                                                         |  |         |  |                                                    |  |         |  |                                           |  |            |  |                             |  |
| 6            |  |            |  |      |  |     |  |      |  |      |  |            |  |       |  |                                                                                                                                                                                                                                                                         |  | DRG NO. |  | 23043-E-7200                                       |  | REV NO. |  | 1                                         |  |            |  |                             |  |



View north across the Project Area.

## **ABORIGINAL CULTURAL HERITAGE ASSESSMENT REPORT**

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### **MERRIOWN SOLAR FARM**

NARRABRI SHIRE LOCAL GOVERNMENT AREA

MARCH 2024

Report prepared by  
OzArk Environment & Heritage  
for Idemitsu Renewable Developments Australia



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Heritage NSW



## ABORIGINAL CULTURAL HERITAGE ASSESSMENT REPORT COVER SHEET

|                                              |                                                                                                                                                                                                                                                                                                                                  |
|----------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Report Title                                 | Aboriginal Cultural Heritage Assessment Report: Merriown Solar Farm                                                                                                                                                                                                                                                              |
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| Address of Subject Area                      | Address: 333 Leards Forest Road, Boggabri<br>Title Reference: Lot 21 DP754940<br>Local Government Area: Narrabri Shire Local Government Area                                                                                                                                                                                     |
| Report prepared for                          | Company Name: Idemitsu Renewable Developments Australia Pty Ltd<br>Contact Person: Shaun Vagne<br>Project Development Engineer - Renewables<br>Email: shaun.vagne@idemitsu.com.au                                                                                                                                                |
| Date of Report                               | March 2024                                                                                                                                                                                                                                                                                                                       |
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Ben Churcher, OzArk Environment & Heritage Principal Archaeologist



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|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                     |                                                                                                                                                                                                                                  |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Proponent                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Idemitsu Renewable Developments Australia Pty Ltd                   |                                                                                                                                                                                                                                  |
| Client                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                     |                                                                                                                                                                                                                                  |
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| Clients\Idemitsu Australia\Merriown solar farm ACHAR and test ex Sept 23\Report                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 4145                                                                |                                                                                                                                                                                                                                  |
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### **Acknowledgement**

OzArk acknowledge the traditional custodians of the area on which this assessment took place and pay respect to their beliefs, cultural heritage, and continuing connection with the land. We also acknowledge and pay respect to the post-contact experiences of Aboriginal people with attachment to the area and to the Elders, past and present, as the next generation of role models and vessels for memories, traditions, culture and hopes of local Aboriginal people.

## ABBREVIATIONS AND GLOSSARY

|                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ACHAR            | Aboriginal Cultural Heritage Assessment Report. As set out in the <i>Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales</i> , all developments where harm to Aboriginal objects is likely must be assessed in an ACHAR.                                                                                                                                                                                    |
| ACHCRs           | <i>Aboriginal Cultural Heritage Consultation Requirements for Proponents</i> . Guidelines for conducting Aboriginal community consultation for developments where harm to Aboriginal objects is likely.                                                                                                                                                                                                                                            |
| AHIMS            | Aboriginal Heritage Information Management System. Administered by the DCCEEW, AHIMS is the central register of all Aboriginal sites within NSW.                                                                                                                                                                                                                                                                                                   |
| AHIP             | Aboriginal Heritage Impact Permit. Issued by Heritage NSW to allow harm to Aboriginal objects.                                                                                                                                                                                                                                                                                                                                                     |
| Assemblage       | All artefacts recorded at a location. In this report, assemblage refers to stone artefacts as this was the only artefact class recorded.                                                                                                                                                                                                                                                                                                           |
| Code of Practice | <i>Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales</i> under Part 6 NPW Act. Issued by the former NSW Department of Environment, Climate Change and Water (DECCW, now DCCEEW) in 2010, the Code of Practice is a set of guidelines that allows limited test excavation without the need to apply for an AHIP. The test excavation program for this assessment was conducted under the Code of Practice. |
| DCCEEW           | NSW Department of Climate Change, Energy, the Environment and Water. DCCEEW contains the Environment and Heritage Group which, in turn, contains Heritage NSW.                                                                                                                                                                                                                                                                                     |
| Debitage         | The termdebitage refers to all the waste material produced during lithic reduction and the production of stone tools. This report usesdebitage to describe the small flakes and chips produced purely as a by-product of knapping.                                                                                                                                                                                                                 |
| DPE              | Former Department of Planning and Environment. The functions of DPE are now carried out by DCCEEW and DPHI.                                                                                                                                                                                                                                                                                                                                        |
| DPHI             | NSW Department of Planning, Housing and Infrastructure. DPHI contains the Planning agency.                                                                                                                                                                                                                                                                                                                                                         |
| GSE              | Ground surface exposure. A measure of factors that may reveal surface artefacts such as erosion scalds.                                                                                                                                                                                                                                                                                                                                            |

|              |                                                                                                                                                                                 |
|--------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| GSV          | Ground surface visibility. A measure of factors that may obscure the detection of surface artefacts such as leaf litter.                                                        |
| Heritage NSW | Government department tasked with ensuring compliance with the NPW Act. Heritage NSW is advised by the Aboriginal Cultural Heritage Advisory Committee (ACHAC).                 |
| NPW Act      | <i>National Parks and Wildlife Act 1974</i> . Primary legislation governing Aboriginal cultural heritage within NSW.                                                            |
| PAD          | Potential archaeological deposit. Indicates that a particular location has potential to contain subsurface archaeological deposits, although no Aboriginal objects are visible. |
| RAP          | Registered Aboriginal Party. An individual or group who have indicated through the ACHCR process that they wish to be consulted regarding the project.                          |



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## EXECUTIVE SUMMARY

---

OzArk Environment & Heritage (OzArk) has been engaged by Idemitsu Renewable Developments Australia Pty Ltd (the proponent) to complete an *Aboriginal Cultural Heritage Assessment Report* (ACHAR) of 333 Leards Forest Road, Boggabri which has the potential to be impacted by Merriown Solar Farm (the Project). The Project is located approximately 40 kilometres (km) north of Gunnedah and 10 km northeast of the township of Boggabri, in the Narrabri Shire Local Government Area.

This ACHAR is to inform an application for an Aboriginal Heritage Impact Permit (AHIP). Further detailed information for the AHIP application is presented in **Section 11**.

RPS Group (RPS) was initially engaged to prepare the ACHAR for the Project, previously known as the Boggabri Solar Farm, prior to a consultancy changeover from RPS to OzArk.

RPS conducted a field survey over a 27-hectare (ha) area (the Survey Area) for the Project on 26 July 2023 accompanied by four representatives from Registered Aboriginal Parties (RAPs). Five Aboriginal sites were recorded with two of the sites being in the Project Area (20-4-1120 [Merriown 1] and 20-4-1119 [Merriown 2]; a low-density artefact scatter of two artefacts and an isolated find respectively). Following the survey, RPS recommended that investigation in the form of subsurface archaeological test excavation be carried out to establish the nature and extent of any Aboriginal objects and/or deposits that are/may be present within the Project Area. OzArk was engaged to undertake the test excavation program and to prepare the ACHAR.

The test excavation program took place over four days from 28 November to 1 December 2023. There were six RAPs in attendance on each day of excavation, except for the first day, on which there were three. Across the 11 transects investigated, 59 test units (TUs) were excavated totalling an area of 14.75 square metres (m<sup>2</sup>). The total assemblage consists of 21 artefacts, giving an average artefact density of 1.5 artefacts per linear square metre. The greatest number of artefacts recorded at any one TU were five artefacts located in Transect 9 TU2. Because of the results of the test excavation, three additional sites, Merriown 6 to Merriown 8, have been recorded in the Project Area. These sites are subsurface manifestations only and have been partially harmed by the test excavation program (with artefacts being removed from the Project Area).

An assessment of likely harm from the Project concluded that surface artefact sites 20-4-1120 (Merriown 1) and 20-4-1119 (Merriown 2), situated close to the northern boundary, will be harmed by the development. Salvage collection of surface artefacts by the Aboriginal community is recommended for these sites.

Merriown 6 to Merriown 8 recorded because of the test excavation are also within the Project Area and will be harmed by the Project. These sites do not have a surface manifestation and no

further archaeological investigation is required given the low subsurface artefact density at these sites.

The proponent has redesigned the Project Area to avoid impact to Merriown 3, Merriown 4, and Merriown 5 situated close to the eastern boundary. It is recommended that these sites be temporarily demarcated using hi-vis fencing along the eastern boundary of the Project Area prior to construction. Likewise, temporary hi-vis fencing should be installed on the western boundary of the Project Area prior to construction to avoid ground disturbance in the sensitive archaeological landform surrounding Merrygowen Creek.

Recommendations concerning Aboriginal cultural values within the Project Area are as follows:

1. An AHIP to permit impact to 20-4-1120 (Merriown 1), 20-4-1119 (Merriown 2), 20-4-1121 (Merriown 6), 20-4-1122 (Merriown 7), and 20-4-1123 (Merriown 8) will be required to be sought from Heritage NSW.
2. To ensure 20-4-1117 (Merriown 3), 20-4-1116 (Merriown 4), and 20-4-1118 (Merriown 5) will not be harmed during construction of the Project, temporary hi-vis fencing should be erected along the eastern boundary of the Project Area prior to construction commencing. A no-go zone should be established extending 20 metres to the east of this fence.
3. Temporary hi-vis fencing should also be erected along the western boundary of the Project Area to ensure that the archaeologically sensitive landforms surrounding Merrygowen Creek are not harmed during construction. This area should not be driven on by construction vehicles or used to stockpile materials without further investigation.
4. If the AHIP is approved, the proponent will organize a salvage collection with a qualified archaeologist and the Aboriginal community to locate any remaining surface artefacts at 20-4-1120 (Merriown 1) and 20-4-1119 (Merriown 2) and to collect any visible artefacts.
5. Any artefacts salvaged during the community collection or recorded during the test excavation program will be securely stored at Boggabri Coal Mine along with other artefacts from the mine. All artefacts will be managed as per Section 4.4.5 of the Boggabri Coal Part 3A Cultural Heritage Management Plan (2016).
6. All land-disturbing activities must be confined to within the Project Area. Should the parameters of the proposed work extend beyond this, then further archaeological assessment may be required.
7. No archaeological testing has taken place outside of the Project Area. Should landforms near but outside of the current Project Area be proposed for ground disturbance in the future, further archaeological testing may be required.
8. Work crews should undergo cultural heritage induction to ensure they recognise Aboriginal artefacts and are aware of the legislative protection of Aboriginal objects under

the *National Parks and Wildlife Act 1974* and the contents of the Unanticipated Finds Protocol (**Appendix 4**).

9. Should human skeletal material be encountered, all work will cease in the area and the procedures in the Unanticipated Skeletal Remains Protocol (**Appendix 5**) must be followed.



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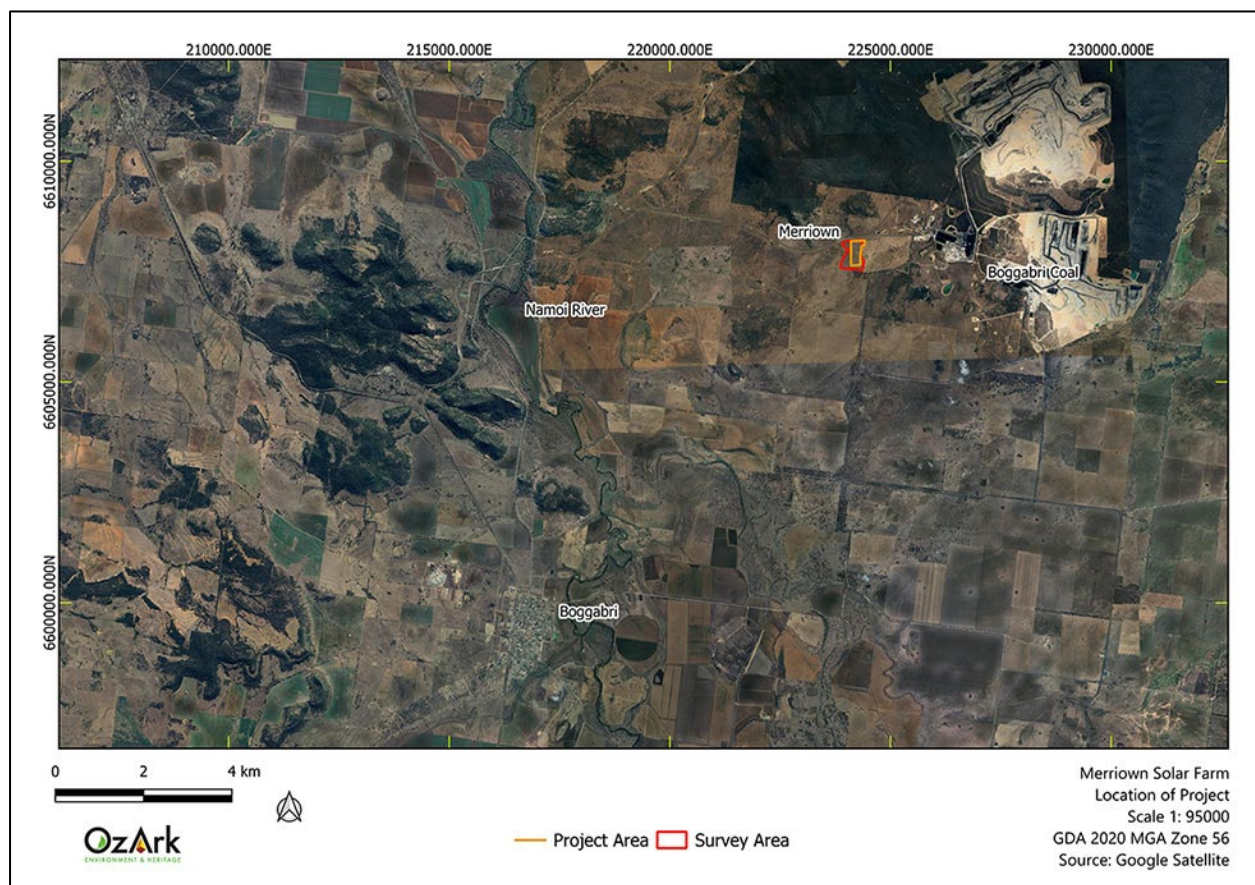
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# 1 INTRODUCTION

## 1.1 DESCRIPTION OF THE PROPOSAL

OzArk Environment & Heritage (OzArk) has been engaged by Idemitsu Renewable Developments Australia Pty Ltd (the proponent) to complete an *Aboriginal Cultural Heritage Assessment Report* (ACHAR) of 333 Leards Forest Road, Boggabri which has the potential to be impacted by Merriown Solar Farm (the Project). The Project is located approximately 40 kilometres (km) north of Gunnedah and 10 km northeast of the township of Boggabri, in the Narrabri Shire Local Government Area (LGA) (**Figure 1-1**).

**Figure 1-1: Map showing the location of the Project.**



## 1.2 BACKGROUND

RPS Group (RPS) was initially engaged to prepare the ACHAR for the Project, previously known as Boggabri Solar Farm, prior to a consultancy changeover from RPS to OzArk.

RPS conducted a field survey over a 27-hectare (ha) area (the Survey Area) for the Project on 26 July 2023, which was accompanied by four representatives from Registered Aboriginal Parties (RAPs). Recommendation was made by RPS that investigation in the form of subsurface archaeological test excavation be carried out to establish the nature and extent of any Aboriginal objects and/or deposits that are/may be present within the Project Area.





## **1.4 PROJECT AND SURVEY AREAS**

The Survey Area consists of 27 ha and is the area surveyed by RPS in 2023.

The Project Area describes the area within which construction works and associated infrastructural zones (e.g. laydown area) will be located. This encompasses approximately 13 ha of land.

A 1 ha portion of the Project Area to the northeast is outside the Survey Area surveyed by RPS. As this area was not surveyed, it was investigated via the test excavation program.

The area to the north of the Project Area where site access is required is part of the Boggabri Mine Project Approval Area and 50 m either side of the haul road has already been surveyed and is included in the Boggabri Mine Cultural Heritage Management Plan curtilage. Because of this, the area did not require further assessment for the Project.

Figure 1-3: Survey and Project Areas.



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## 2 THE ABORIGINAL CULTURAL HERITAGE ASSESSMENT

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### 2.1 RELEVANT LEGISLATION

Cultural heritage is managed by several state and national Acts. Baseline principles for the conservation of heritage places and relics can be found in the *Burra Charter* (Burra Charter 2013). The *Burra Charter* has become the standard of best practice in the conservation of heritage places in Australia, and heritage organisations and local government authorities have incorporated the inherent principles and logic into guidelines and other conservation planning documents. The *Burra Charter* generally advocates a cautious approach to changing places of heritage significance. This conservative notion embodies the basic premise behind legislation designed to protect our heritage, which operates primarily at a state level.

Several Acts of parliament provide for the protection of heritage at various levels of government.

#### 2.1.1 Commonwealth legislation

##### 2.1.1.1 *Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)*

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), administered by the Commonwealth Department of Climate Change, Energy, the Environment and Water, provides a framework to protect nationally significant flora, fauna, ecological communities, and heritage places. The EPBC Act establishes both a National Heritage List and Commonwealth Heritage List of protected places. These lists may include Aboriginal cultural sites or sites in which Aboriginal people have interests. The assessment and permitting processes of the EPBC Act are triggered when a proposed activity or development could potentially have an impact on one of the matters of national environment significance listed by the Act. Ministerial approval is required under the EPBC Act for proposals involving significant impacts to national/commonwealth heritage places.

##### 2.1.1.2 *Aboriginal and Torres Strait Islander Heritage Protection Act 1984*

The *Aboriginal and Torres Strait Islander Heritage Protection Act 1984* is aimed at the protection from injury and desecration of areas and objects that are of significance to Aboriginal Australians. This legislation has usually been invoked in emergency and conflicted situations.

#### Applicability to the Project

It is noted there are no Commonwealth or National heritage listed places within the Project Area, and as such, the heritage provisions of the EPBC Act and other Commonwealth Acts do not apply.

## **2.1.2 State legislation**

### **2.1.2.1 *Environmental Planning and Assessment Act 1979***

The *Environmental Planning and Assessment Act 1979* (EP&A Act) established requirements relating to land use and planning. The main parts of the EP&A Act that relate to development assessment and approval are Part 4 (development assessment) and Part 5 (environmental assessment). The Minister responsible for the Act is the Minister for Planning and Public Spaces.

The EP&A Act currently provides the primary legislative basis for planning and environmental assessment in NSW. The objects of the EP&A Act include encouragement of:

- The proper management, development, and conservation of natural resources
- The provision and coordination of the orderly and economic use and development of land
- Protection of the environment, including the protection and conservation of native animals and plants, including threatened species, populations and ecological communities, and their habitats
- Ecologically sustainable development.

The objects also provide for increased opportunity for public involvement and participation in environmental planning and assessment.

The EP&A Act includes provisions to ensure that the potential environmental impacts of a development or activity are rigorously assessed and considered in the decision-making process.

The framework governing environmental and heritage assessment in NSW is contained within the following parts of the EP&A Act:

- Part 4: Local government development assessments, including heritage. May include schedules of heritage items.

#### **Applicability to the Project**

The Project will be assessed under Part 4 of the EP&A Act.

### **2.1.2.2 *National Parks and Wildlife Act 1974***

The *National Parks and Wildlife Act 1974* (NPW Act) provides for the protection of Aboriginal objects (sites, objects, and cultural material) and Aboriginal places. Under the Act (Part 6), an Aboriginal object is defined as: any deposit, object, or material evidence (not being a handicraft for sale) relating to Aboriginal habitation of the area that comprises NSW, being habitation both prior to and concurrent with the occupation of that area by persons of European extraction and includes Aboriginal remains.



An Aboriginal place is defined under the NPW Act as an area which has been declared by the Minister administering the Act as a place of special significance for Aboriginal culture. It may or may not contain physical Aboriginal objects.

It is an offence under Section 86 of the NPW Act to 'harm or desecrate an object the person knows is an Aboriginal object'. It is also a strict liability offence to 'harm an Aboriginal object' or to 'harm or desecrate an Aboriginal place', whether knowingly or unknowingly. Section 87 of the Act provides a series of defences against the offences listed in Section 86, such as:

- The harm was authorised by and conducted in accordance with the requirements of an *Aboriginal Heritage Impact Permit* (AHIP) under Section 90 of the Act
- The defendant exercised 'due diligence' to determine whether the action would harm an Aboriginal object
- The harm to the Aboriginal object occurred during the undertaking of a 'low impact activity' (as defined in the regulations).

Under Section 89A of the Act, it is a requirement to notify the Secretary of the NSW Department of Climate Change, Energy, the Environment and Water (DCCEEW) of the location of an Aboriginal object. Identified Aboriginal items and sites are registered on Aboriginal Heritage Information Management System (AHIMS) that is administered by Heritage NSW.

#### Applicability to the Project

Any Aboriginal sites within the Project Area are afforded legislative protection under the NPW Act.

The Secretary of DCCEEW will be notified of the location of an Aboriginal object recorded by sending the relevant details to the AHIMS register.

## **2.2 ASSESSMENT APPROACH**

The archaeological assessment followed the *Code of Practice for the Investigation of Aboriginal Objects in New South Wales* (Code of Practice; DECCW 2010a).

The Aboriginal cultural heritage assessment followed the *Guide to investigating, assessing and reporting on Aboriginal cultural heritage in NSW* (the Guide; OEH 2011) and the *Aboriginal cultural heritage consultation requirements for proponents* (ACHCRs) (DECCW 2010b).

## **2.3 PURPOSE AND OBJECTIVES**

The purpose of this study is to identify and assess heritage constraints relevant to the proposed works.

The study will apply the Code of Practice, the Guide, and the ACHCRs in the completion of the Aboriginal cultural heritage assessment to meet the following objectives:

**Objective One:** Undertake background research on the Project Area to formulate a predictive model for site location within the Project Area

**Objective Two:** Identify and record Aboriginal cultural heritage values within the survey areas. This includes intangible cultural values, Aboriginal objects, and any landforms likely to contain further archaeological deposits

**Objective Three:** To assess the significance of any recorded Aboriginal cultural values, Aboriginal objects, or sites in consultation with RAPs

**Objective Four:** Assess the likely impacts of the proposed work to Aboriginal cultural heritage values and provide management recommendations.

## 2.4 REPORT COMPLIANCE WITH THE CODE OF PRACTICE

The Code of Practice establishes requirements that should be followed by all archaeological investigations where harm to Aboriginal objects may be possible. **Table 2-1** tabulates the compliance of this report with the requirements established by the Code of Practice.

**Table 2-1: Report compliance with the Code of Practice.**

| Code of Practice Requirement | Context of the Requirement                                                                            | Concordance in this report                                                |
|------------------------------|-------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------|
| Requirement 1a               | Review previous archaeological work                                                                   | <b>Section 5</b>                                                          |
| Requirement 1b               | Review AHIMS searches                                                                                 | <b>Section 5.3.1</b>                                                      |
| Requirement 2                | Review the landscape context                                                                          | <b>Section 4</b>                                                          |
| Requirement 3                | Summarise and discuss the local and regional character of Aboriginal land use and its material traces | <b>Section 5</b>                                                          |
| Requirement 4a               | Develop predictive model                                                                              | <b>Section 5.4</b>                                                        |
| Requirement 4b               | Present predictive model results                                                                      | <b>Section 5.4.3</b>                                                      |
| Requirement 5a               | Archaeological survey sampling strategy                                                               | <b>Section 6.1</b>                                                        |
| Requirement 5b               | Archaeological survey requirements                                                                    | This requirement was fulfilled during the undertaking of the survey.      |
| Requirement 5c               | Archaeological survey units                                                                           | <b>Section 6.3</b>                                                        |
| Requirement 6                | Site definition                                                                                       | <b>Section 6.4</b>                                                        |
| Requirement 7a               | Site recording information to be recorded                                                             | All sites were recorded in accordance with this requirement.              |
| Requirement 7b               | Site recording: scales for photography                                                                | All artefact photographs employed a centimetre scale bar.                 |
| Requirement 8a               | Geospatial information                                                                                | All artefact locations were logged using a non-differential handheld GPS. |
| Requirement 8b               | Datum and grid coordinates                                                                            | All coordinates are provided in GDA Zone 56.                              |
| Requirement 9                | Record survey coverage data                                                                           | <b>Sections 6.1 and 6.3</b>                                               |
| Requirement 10               | Analyse survey coverage                                                                               | <b>Section 6.3</b>                                                        |
| Requirement 11               | Archaeological Report content and format                                                              | This report adheres to this requirement.                                  |
| Requirement 12               | Records                                                                                               | OzArk undertakes to maintain all survey records for at least five years.  |
| Requirement 13a              | Notifying Heritage NSW of breaches                                                                    | Not applicable                                                            |

| Code of Practice Requirement | Context of the Requirement                                                      | Concordance in this report                                                                                                                                                                                        |
|------------------------------|---------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Requirement 13b              | Providing Heritage NSW with information                                         | Not applicable                                                                                                                                                                                                    |
| Requirement 14               | Test excavation which is not excluded from the definition of harm               | The test excavation did not take place in any of the landforms identified in Requirement 14.                                                                                                                      |
| Requirement 15a              | Consultation regarding test excavation                                          | Consultation has included the ACHCRs, see <b>Section 3</b> .                                                                                                                                                      |
| Requirement 15b              | Developing a test excavation sampling strategy                                  | A test excavation methodology was produced ( <b>Appendix 3</b> ) and issued to RAPs for their information.                                                                                                        |
| Requirement 15c              | Providing Heritage NSW with notification of the test excavation                 | Heritage NSW was provided with a copy of the test excavation methodology via the heritage mailbox on 15 November 2023.                                                                                            |
| Requirement 16a              | Test excavation that can be carried out in accordance with the Code of Practice | The test excavation program complied with this requirement; see <b>Section 7</b> and <b>Appendix 3</b> .                                                                                                          |
| Requirement 16b              | Objects recovered during test excavations                                       | The test excavation methodology established that any artefacts recovered from the excavations would be housed at the OzArk office (145 Wingewarra Street, Dubbo NSW) before being returned to Boggabri Coal Mine. |
| Requirement 17               | When to stop test excavations                                                   | The methodology of the test excavation adhered to this requirement; see <b>Section 7.6</b> .                                                                                                                      |
| Requirement 18–20            | Artefact recording                                                              | The procedures for artefact recording were adhered to during the investigation.                                                                                                                                   |

## 2.5 DATE OF ARCHAEOLOGICAL ASSESSMENT

The field survey was undertaken by RPS on the 26 July 2023, which was accompanied by four RAPs.

The test excavation component of this assessment was undertaken by OzArk from the 28 November to 1 December 2023, which was accompanied by six RAPs, except for the first day when there were three RAPs only.

## 2.6 RPS AND OZARK INVOLVEMENT

### 2.6.1 Field survey

The RPS fieldwork survey was undertaken by:

- Fieldwork Director: Sarah van der Linde, RPS Senior Heritage Consultant
- Archaeologist: Dr. Gary Marriner, RPS Senior Heritage Consultant.

The OzArk test excavation was undertaken by:

- Fieldwork Director: Ben Churcher, OzArk Principal Archaeologist, BA, Hons, University of Queensland, Dip Ed. University of Sydney
- Archaeologist: Imogen Crome, BA Science (Biological Anthropology), BA (Archaeology), Australian National University

- Archaeologist: Jordan Henshaw, BA (Ancient History) Macquarie University.

### **2.6.2 Reporting**

The reporting component of the heritage assessment was undertaken by:

- Report author: Dr. Bernadette Drabsch, Heritage Consultant, BA Ancient History, Hons (Natural History Illustration, PhD Design/Archaeology, University of Newcastle
- Contributor: Tenae Robertson, Archaeologist, BA Archaeological Practices, Australian National University
- Reviewer: Ben Churcher.



### 3 ABORIGINAL COMMUNITY CONSULTATION

#### 3.1 INTRODUCTION TO CULTURAL VALUES

*No matter who you are, we all have culture. Each person's culture is important; it's part of what makes us who we are.*

[australianstogether.org.au](http://australianstogether.org.au)

Many Aboriginal people in Australia have a unique view of the world that's distinct from the mainstream. Land, family, law, ceremony, and language are five key interconnected elements of Aboriginal culture. For example, families are connected to the land through the kinship system, and this connection to land comes with specific roles and responsibilities which are enshrined in the law and observed through ceremony. In this way, the five elements combine to create a way of seeing and being in the world that is distinctly Aboriginal.

Aboriginal and Torres Strait Islander peoples are connected to Country through lines of descent (paternal and maternal), as well as clan and language groups. Territory is defined by spiritual as well as physical links. Landforms have deep meaning, recorded in art, stories, songs, and dance. Songlines or Dreaming Tracks as well as kinship structures link Aboriginal peoples to the territories of other groups. In the past, these links were also used for trade.

Living on this land for more than 50,000 years, Aboriginal and Torres Strait Islanders established effective ways to use and sustain resources. One important aspect is the right of certain people to control the use of resources in a particular area, as well as cultural and spiritual values like totemism that were fundamental in resource management. There was a wide range of traditional methods for gathering food including fish traps, subsistence agriculture, hunting and harvesting a wide range of natural fruits and vegetables. Some groups of people would stay in one place, while others moved around the land according to the seasons, to ensure sustainable and rich food supplies, and to fulfil their spiritual and cultural obligations.

In much of eastern Australia, Aboriginal communities live their lives like most Australians. However, in certain crucial areas, particularly associated with family, leadership roles and caring for Country, Aboriginal lore continues, even in the most urbanised communities.

#### 3.2 ABORIGINAL COMMUNITY CONSULTATION

A major aim of this assessment is to identify any cultural values within the landscape in which the Project is located so that those values can be recognised and incorporated into the Project's management recommendations.

The Aboriginal cultural heritage assessment of the proposal has followed the ACHCRs (DECCW 2010b). A log and copies of correspondence with Aboriginal community stakeholders is presented in **Appendix 1 Figure 1**.

The ACHCRs include four main stages, and these will be detailed in the following sections.

### **3.2.1 ACHCRs Stage 1**

The aim of Stage 1 is to identify the RAPs who wish to be consulted about the Project.

An advertisement was placed in the *North West Courier Newspaper* on 16 May 2023 to solicit expressions of interest (**Appendix 1 Figure 2**).

A letter seeking information from various agencies was sent on 16 March 2023 (**Appendix 1 Figure 3**). These agencies were: Office of the Registrar, *Aboriginal Land Rights Act 1983*; Heritage NSW; National Native Title Tribunal; National Native Title Services Corporation Ltd (NTSCORP); Red Chief Local Aboriginal Land Council (LALC), Narrabri LALC, Tamworth LALC, Narrabri Shire Council, and the North West Local Land Services. Replies from government agencies are provided in **Appendix 1 Figure 4**.

Letters were sent to individuals and groups whose contact details had been provided by the government agencies (**Appendix 1 Figure 5**).

By the closing date for registration concerning this project, 23 groups or individuals registered to be consulted as RAPs:

- AGA Services
- AT Gomilaroi Cultural Consultancy
- Brian Draper
- Cindy and Gloria Foley
- Cucatua Culture Consultants
- Didge Ngunawal Clan
- Edgerton Kwiembal AC
- Girragirra Murun Aboriginal Corporation
- Gomeroi Murri Ganuurr Yuurray Wadi Palinka
- Gomeroi Namoi
- Gomery Cultural Consultants
- Jeremy Duncan
- Konanggo Aboriginal Cultural Heritage Services
- Michael Long
- RAW Cultural Healing

- Red Chief LALC
- Stakeholder 1 (requested name to be withheld)
- Stakeholder 2 (requested name to be withheld)
- Thomas Dahlstrom
- Troy Silver
- Vicky Hannah Gomeroi Duncan
- Wallanbah Aboriginal Site Conveyancing
- Wingarra Wilay Aboriginal Corporation.

### 3.2.2 ACHCRs Stage 2

The aim of Stage 2 is to provide information about the project to the RAPs.

Detailed project information was provided in the assessment methodology that was issued to all RAPs for their consideration on 5 June 2023 (**Appendix 1 Figure 6**).

### 3.2.3 ACHCRs Stage 3

The aim of Stage 3 is to acquire information regarding Aboriginal cultural values associated with the Project through RAP consultation and field work.

To inform the RAPs of the assessment, an assessment methodology was issued to all RAPs for their consideration on 5 June 2023 (**Appendix 1 Figure 6**). This document provided the archaeological context of the Project Area, a description of the proposed survey, and asked whether there were any cultural values that should be considered in the assessment.

RAPs were provided the stipulated 28 days in which to review and comment on the assessment methodology as per Stage 3 of the ACHCRs. The closing date for comment was 3 July 2023.

Responses were received from Didge Ngunawal Clan, Jeremy Duncan, and Stakeholder 1. All groups advised that they supported the methodology without providing any further details.

The field survey as per Stage 3 of the ACHCRs was undertaken with the assistance of RAP representatives on 26 July 2023.

**Table 3-1** provides a log of the RAPs and their representatives who participated in fieldwork.

**Table 3-1: Aboriginal community involvement in the fieldwork.**

| Individual/group                          | Name           | Day of participation |
|-------------------------------------------|----------------|----------------------|
| Brian Draper                              | Tyan Silver    | 26/7/2023            |
| Gomeroi Murri Ganuurr Yuuray Wadi Palinka | Gary Griffiths | 26/7/2023            |
| Cindy Foley                               | Cindy Foley    | 26/7/2023            |
| Gomeroi Namoi                             | Steve Talbott  | 26/7/2023            |

On 17 October 2023, all RAPs were informed that OzArk was undertaking the remainder of the assessment having replaced RPS (**Appendix 1 Figure 7**).

As part of the Stage 3 investigations, OzArk issued a test excavation methodology (**Appendix 3**) to all RAPs on 27 October 2023 with a closing period for comments of 24 November 2023. During this time, Didge Ngunawal Clan, Stakeholder 2, Konanggo Aboriginal Cultural Heritage Services, Jeremy Duncan, and AGA Services all replied that they supported the test excavation methodology without providing any further details.

### 3.2.4 ACHCRs Stage 4

Stage 4 involves the production of a draft ACHAR that is issued to all RAPs for their consideration. The ACHAR will document the results of the assessment, outline opportunities for the conservation of Aboriginal cultural values, and suggest recommendations for the management of Aboriginal objects should impacts to these objects be unavoidable.

The draft ACHAR was issued to all RAPs on 2 February 2024 with a closing date for comment of 1 March 2024 (**Appendix 1 Figure 8**).

During this time, AT Gomilaroi Cultural Consultancy, Cindy and Gloria Foley, and Didge Ngunawal Clan replied. AT Gomilaroi Cultural Consultancy's comments were about engagement in the test excavation program, and Cindy and Gloria Foley and Didge Ngunawal Clan replied that they had no issues with the draft ACHAR without providing any further details. The correspondence is presented in **Appendix 1 Figure 8** and none of the responses necessitated changes to the draft ACHAR.

## 3.3 CULTURAL VALUES IDENTIFIED THROUGHOUT THE ACHCR PROCESS

No specific cultural values were identified by the RAPs regarding the Project Area, however, the strong cultural values of Aboriginal communities towards landscapes and cultural heritage sites are recognised.

No further details regarding the RAP's cultural values of the Project Area were obtained from the Stage 4 ACHAR review.



## 4 LANDSCAPE CONTEXT

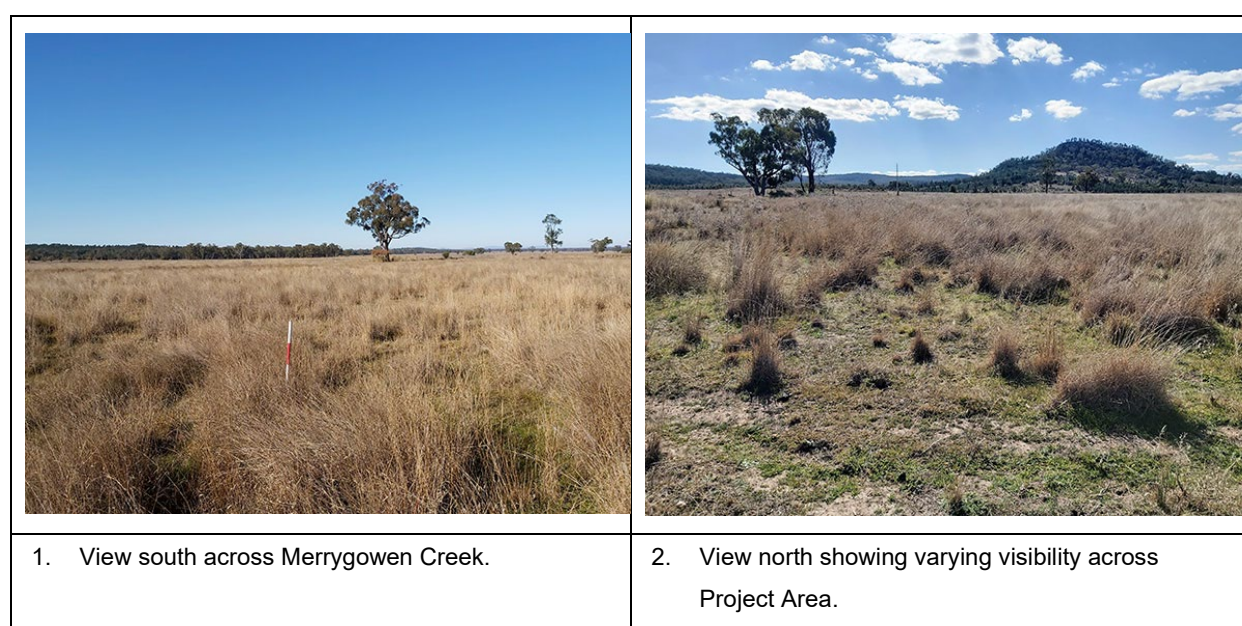
An understanding of the environmental context of a Project Area is requisite in any Aboriginal archaeological investigation (DECCW 2010a). It is a particularly important consideration in the development and implementation of survey strategies for the detection of archaeological sites. In addition, natural geomorphic processes of erosion and/or deposition, as well as human-activated landscape processes, influence the degree to which the remains of material culture are retained in the landscape as archaeological sites; and the degree to which they are preserved, revealed and/or conserved in present environmental settings.

### 4.1 TOPOGRAPHY

The Project Area is located within the long footslopes south of Merriown Mountain, in the central north of the Liverpool Plains subregion. The Project Area landform consists of a very gently inclined slope with very little topographic variation. The Project Area generally overlooks what may have been a swampy area to the east.

As the Project Area is without varying topographical features, it was not divided into different survey units. **Figure 4-1** provides representative images of the topography of the Project Area.

**Figure 4-1: Topography of the Project Area.**



### 4.2 GEOLOGY AND SOILS

Soil analysis has important ramifications for archaeological research through the potential impact of different soils on human activity (such as agricultural exploitation) and the impact of the soils on archaeological evidence (such as post-depositional movement).

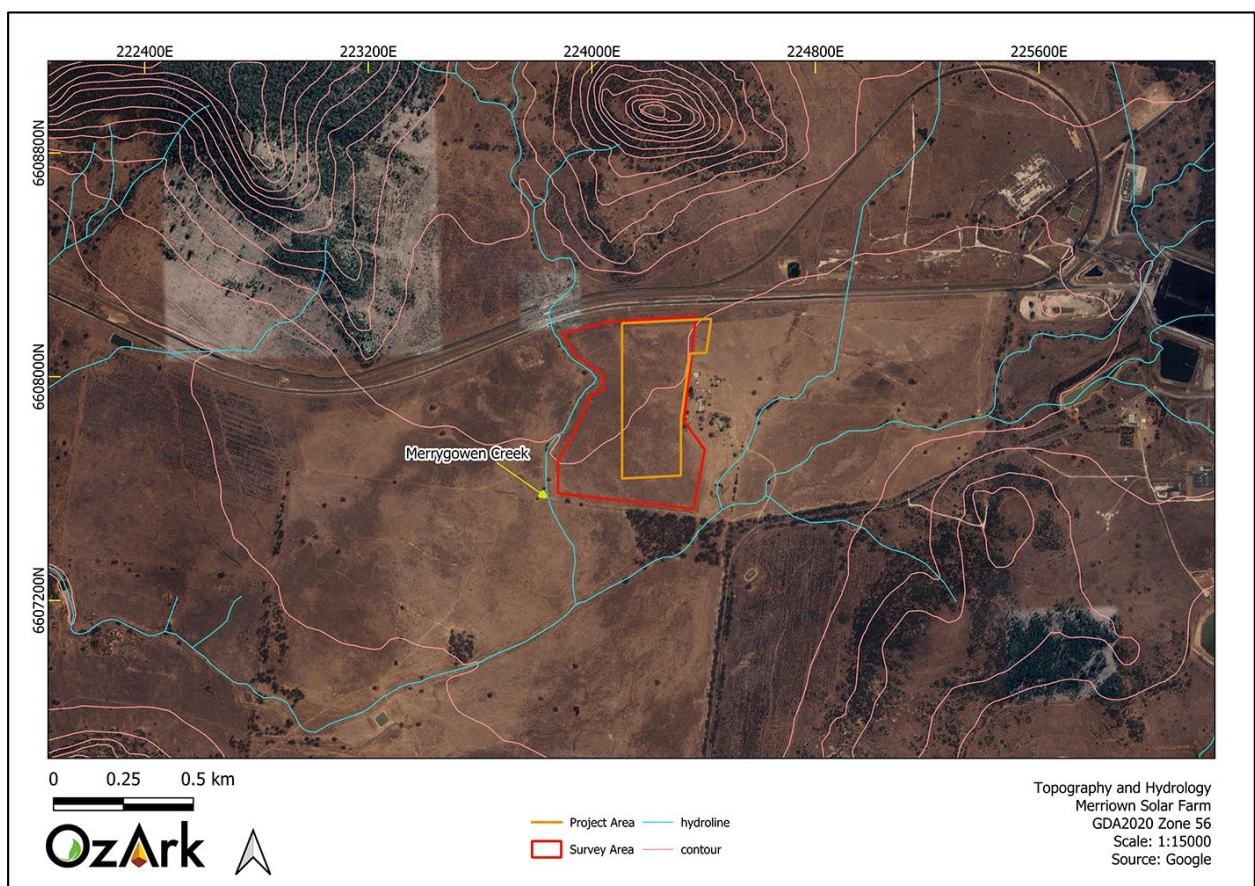
The Project Area landscape is defined by a mixture of deep, heavy clay alluvium from andesites and dacites, with lighter texture alluvium from rhyolitic material. It is located within the velyama

soil landscape (vey), described as deep to very deep, moderately well-drained to imperfectly drained Brown Sodosols on courser-grained parent materials, with very deep to giant, poorly drained brown and grey clays on slopes with mixed parent materials, and deep to giant, poorly drained grey clays occurring on terminal footslopes (NSW Office of Environment and Heritage 2011).

### 4.3 HYDROLOGY

The Project Area is located adjacent to Merrygowen Creek, which is a second order stream with intermittent flow, likely following rain events only (**Figure 4-2**). However, the Namoi River, located around 7 km west of the Project Area, would have been a reliable fresh water source for Aboriginal people. A wealth of resources would have been available within the floodplain and associated water sources in proximity to the Namoi River, however, resources would have been sparser in association with the smaller local waterways and these would not have supported long-term occupation.

**Figure 4-2. Topography and hydrology of Project Area.**



### 4.4 VEGETATION

The landscape of the Project Area is characterised by woodland and grassland species. Woodland species on duplex soils include *Callitris glaucophylla* (white cypress pine), *Allocasuarina leuhmannii* (bull oak), *Eucalyptus melliodora* (yellow box), *E. albens* (white box), *E.*

*pilligaensis* (pilliga box), *E. populnea* (bimble box), *Geijera parviflora* (wilga), *Notelaea microcarpa* (native olive), *Beyeria viscosa* (sticky wallaby-bush), *Carissa ovata* (currant bush) and *Cassine australis* (red olive plum). Groundcover species include *Austrostipa verticillata* (slender bamboo grass), *Dicanthium sericeum* (Queensland bluegrass), *Cymbopogon refractus* (barbed wire grass) and *Aristida ramosa* (wire grass) (NSW Office of Environment and Heritage 2011).

Whereas heavy soils tend to be dominated by *Casuarina cristata* (belah), *Eucalyptus microcarpa* (western grey box), *Alectryon oleifolius* (rosewood), *Eremophila mitchellii* (budda), *Acacia pendula* (myall), and *Geijera parviflora* (wilga) separated by grasslands. Grassland species include *Dicanthium sericeum* (Queensland bluegrass), *Austrostipa aristiglumis* (plains grass), *Aristida leptopoda* (white wiregrass), *Oxalis perennans* (sorrel), *Chloris truncata* (windmill grass) and *Sclerolaena muricata* (copper burr) (NSW Office of Environment and Heritage 2011).

The landscape of the Project Area is characterised by woodland and grassland species. The large array of resource plant species available in the area indicates that the region could have supported a rich variety of fauna species which Aboriginal people may have used for sustenance, tools, and clothing. In the past, these vegetation communities would likely have supported a range of fauna, reptile, and bird species (National Parks and Wildlife Service NSW 2003).

#### 4.5 LAND USE HISTORY AND EXISTING LEVELS OF DISTURBANCE

The Project Area has been extensively cleared and is classified as grazing land, with modified grazing pastures (OEH NSW Landuse 2013). There are no remaining mature trees, the soil is likely to have been frequently disturbed, and the vegetation present is dominated by pasture species. Other disturbances within the Project Area include grazing and the construction of farm infrastructure, such as access tracks and fencing.

#### 4.6 CONCLUSION

The review of the environmental factors associated with the study area allows the following conclusions to be drawn in terms past Aboriginal occupation:

- Topography and hydrology: the flat to gently sloping landform which dominates the Project Area would have been hospitable to Aboriginal people. Proximity to Merrygowen Creek, located approximately 80 m west of the Project Area, being an intermittent watercourse, may have encouraged transitory Aboriginal occupation of the landscape. The permanent water supply of the Namoi River, located approximately 7 km west of the Project Area, would have provided a more reliable fresh water source. There are no topographic features within the Project Area that would have attracted occupation.
- Geology and soils: landforms which typically comprise outcropping rock, i.e. hills, are not present within the Project Area, and therefore sources of stone procurement for tool manufacture is unlikely to be present. Soils present on the gentle slopes are likely to have been affected by water erosion and are poor draining. The erosional qualities of the soils present will have had an effect on the likelihood for *in situ* archaeological



deposits being present. Furthermore, the widespread and comprehensive use of most of the Project Area for grazing would have further promoted soil loss and ground churning.

- Vegetation: the Project Area would have once supported an open woodland which would have provided some resources for Aboriginal subsistence in the past. However, resources likely to have supported a large population of people would have been present closer to the banks of more permanent water sources including the Namoi River. The broad-scale vegetation clearance which has taken place across the Project Area for agricultural purposes removes the likelihood that culturally modified trees will be recorded.
- Land use: ground surface disturbances such as vegetation clearance related to grazing exist throughout the study area. These activities may have displaced Aboriginal objects and are likely to have reduced the potential for subsurface archaeological material. However, disturbance at a given location does not necessarily mean that there will be no cultural material present, as often a disturbed context will reveal objects which may have previously been subsurface. As noted above, initial vegetation clearing would also have removed the likelihood of culturally modified trees remaining.



## 5 ARCHAEOLOGICAL CONTEXT

### 5.1 ETHNO-HISTORIC SOURCES OF REGIONAL ABORIGINAL CULTURE

The Project Area is situated within the traditional territory of people belonging to the Kamilaroi (also spelt Gomeroi, Gamilaraay) linguistic group. According to Tindale (1974), the Kamilaroi range at the time of British arrival was thought to extend to Walgett in New South Wales to Nindigully in Queensland and included areas such as Moree, Mungindi, Mogil Mogil, Narrabri, Pilliga, Gunnedah, Bingara, Tamworth, Quirindi, Bundella, Barraba, Gwabegar, and Come-by-Chance on the headwater of the Hunter River. O'Rourke (1997:159) noted that social organisation amongst the Kamilaroi was based on a complex system of kinship involving two moieties, the Dhibay ('dilb l') and Gubadhin ('kupathin').

O'Rourke estimated that there may have been up to 10,000 Kamilaroi speakers pre-contact with an additional unquantified number of dialectical sub-groups (1997:126). O'Rourke noted that the smallest residential unit within the Kamilaroi society was the 'hearth-group' which consisted of up to ten people, typically a man, his wife (or wives) and their dependent children. Larger residential groupings of 40–60 individuals, termed 'bands', were formed through the regular though temporary gathering of several 'hearth-groups'. Annual seasonal aggregations of 'bands' resulted in 'communities' of 200 or more people (O'Rourke 1997:130). These communities are estimated to have occupied territories of more than 2,500 km<sup>2</sup>. The presence of up to eight communities at irregular ceremonial events such as Bora (buurra) assemblies has also been noted (O'Rourke 1997:130).

The Kamilaroi people appear to have spent summers along rivers exploiting a range of terrestrial, avian, and aquatic food resources and winters spent in the areas away from rivers hunting and/or trapping predominantly terrestrial game. Hunting and gathering 'gear' amongst the Kamilaroi is reported to have included wooden spears, boomerangs, digging sticks, nets, stone fishhooks, fibre-based fishing line, ground stone axes, and a variety of supplementary chipped stone tools (AECOM 2010:24).

O'Rourke (1997:148) hypothesised that '*summer villages with semi-permanent huts were [likely] a common feature of Aboriginal life on the plains of New South Wales*'. Observations by the early British explorers provide some support to this claim. In 1825 Cunningham recorded that he observed 14 huts with bark floors and conical roofs scattered through thick woodland to the west of Cocks Creek near Boggabri. Some of the huts were apparently large enough to accommodate up to six people and appeared to have been designed to resist months of inclement weather. Similarly, in 1839, Major Mitchell described the huts in a 'native village' to the south of Moree near the Gwydir River in a similar fashion. He notes that '*each hut was semi-circular, or circular, the roof conical, and from side a flat roof stood forward like a portico, supported by two sticks... The*

*interior of each looked clean, and to us, passing in the rain, gave some idea, not only of shelter, but even of comfort and happiness' (Mitchell 1839:76–77).*

The ethno-historic account from George 'the Barber' Clarke, an escaped convict from the Hunter Valley, provides important information about everyday life with the Kamilaroi. After reaching the area around Boggabri in 1825, Clarke was befriended by a local group of Kamilaroi people and adopted their language, dress, and customs, before settling at a lagoon east of Boggabri and directly south of the Project Area. In his notes, Clarke refers to *taurai*, the traditional hunting and food gathering grounds of each group as having distinct boundaries.

Major Mitchell refers to Clarke as '*The Bushranger*' and used his carefully recorded account as the basis for his 1831 expedition. Having located 'Barber's Lagoon' Mitchell noted that the stockyard (home to Clarke's stolen cattle) was intact as well as a number of *gunyahs* (bark huts), indicating substantial encampment. He described the vegetation elsewhere along the flood plain as being rather thickly wooded with a broad-leaved eucalyptus (probably bimple box) and *Acacia pendula*. The banks of the river were said to have '*lofty blue gum-trees (river red gum) and excellent grass*' and, according to his sketch of Tangulda peak, the lower slopes were well forested in what appear to be casuarina, Callitris and eucalypts – probably box (ARAS 2007:21).

Mitchell was in the vicinity of Leard State Forest during December 1831 and commented on the extensive smoke and fire in the area, indicating that this period of the year was likely a time of fire stick farming. While he encountered frequent evidence of the local Aboriginal population's existence, such as footprints and evidence of stone axes (*mogo*), he didn't interact with any of them, apart from one elderly lady whom he startled (Mitchell 1839:49). Towards the junction of Maules Creek and the Namoi River (approximately 15 km northwest of the Project Area) he encountered a small band of approximately 30 people that were chopping trees with iron tomahawks. As Mitchell was one of the first British person to explore this area, the presence of iron axes suggests links through trade networks with neighbouring tribes with existing links to British settlements (AECOM 2010:26).

Settlement around the villages of Gunnedah and Boggabri (the name is derived from the Kamilaroi word '*Bukki-bri*' meaning place of many creeks) proceeded from the 1830s with several large sheep and cattle pastoral runs being established through the Australian Agricultural Company. By the 1850s, local Aboriginal people were employed as stock keepers and shepherds and a number of conflicts were reported between settlers and Aboriginal people near Manilla on the Namoi River (ARAS 2005:13).

## 5.2 REGIONAL ARCHAEOLOGICAL CONTEXT

### Thompson 1981

A survey was conducted between Boggabri and Gunnedah (approximately 20–70 km from the Survey Area). During the survey, 29 sites and 11 isolated finds were recorded. Site types included artefact scatters, axe grinding grooves, scarred trees, and a single mythological site. A close spatial association between sites and water sources was evident.

### Haglund 1983

A survey was conducted at the Maules Creek Coal Mine (approximately 13 km from the Project Area). A total of 13 sites were identified and these included six artefact scatters and seven isolated finds. Retouched flakes, cores, and flakes were the most common artefact types. It was noted that recorded sites should not be regarded as separate occurrences, but as part of a general scatter of stone artefacts on and in most flat and/or gently sloping surfaces in the vicinity of temporary water sources. Lack of sites about the 340 m contour interpreted as a product of generally unfavourable environmental conditions for occupation, including a lack of surface water and the prevalence of steep, stony surfaces.

### Balme 1986

A survey of the Pilliga sand region and the Pilliga State Forests (approximately 30 km from the Project Area) was conducted in 1986. The study found that open campsites were the dominant site type, typically identified on erosion surfaces in valleys, alongside streamlines. Most sites were between 20–50 artefacts. Quartz was the dominant raw material type. Silcrete, quartzite, jasper, fine-grained volcanic, and chert were also used. It was concluded that the lack of variety of alternative resources, such as permanent waterholes, may explain why there is little evidence of intensive Aboriginal occupation in the Pilliga Forests.

### Dallas 1986

A survey of the rail loop and coal haul route for the Maules Creek Coal mine (approximately 13 km from the Project Area) was conducted in 1986. The survey identified four sites along or adjacent to the haul route and no sites were identified on the rail loop. Three of the sites were open artefact scatters, numbering 2, 11, and 14 artefacts. Artefact material included quartz, mudstone, siltstone, agate, volcanic, chalcedony, and silcrete. The fourth site was a rock shelter with one identified stone artefact on the floor of the shelter and three artefacts between the shelter and the creek.

### Roberts 1991

A survey was conducted through the Pilliga Forests (approximately 30 km from the Project Area). As a result, 89 sites were identified, including 24 open campsites, 62 scarred trees, and three rock shelters. It was noted that quartz was the dominant raw material type. It was also noted that

poor ground surface visibility away from water sources prohibits an effective assessment of the relationship between water sources and the extent of Aboriginal activities in the forest. Roberts proposed that Aboriginal people may have utilised the forest's creeks as 'corridors' for movement and suggested that the distribution of scarred trees likely reflects post-contact European land practices.

#### NSW National Parks and Wildlife Service (Purcell 2002)

A large-scale regional survey of the Brigalow Belt South Bioregion (within which the Project Area lies) was conducted by Philip Purcell in 2002. A total of 1940 sites were identified. Of these, 311 sites were identified in the Liverpool Plains, 303 in the Pilliga Outwash, and 609 in the Pilliga Forests. Sites frequently occurred in the Alluvial Group, where 668 sites were identified in total, likely due to the association of the group with water features. The most prolific site types were open camp sites and isolated finds. 90% of the sites recorded were located within 200–300 m of water.

#### RW Corkery & Co, 2005a & b

Two surveys were conducted in East Boggabri (approximately 15 km from the Project Area) by Corkery & Co during 2005. During the first survey, four Aboriginal sites were identified, including a possible scarred tree, two low density artefact scatters, and one isolated find of a basalt hatchet head made from a river cobble. The second survey identified four Aboriginal sites comprising of chipped stone artefact scatters with artefact totals ranging from 5 to 20.

## 5.3 LOCAL ARCHAEOLOGICAL CONTEXT

### 5.3.1 Desktop database searches conducted

A desktop search was conducted on the following databases to identify any previously recorded heritage within the Project Area. The results of this search are summarised in **Table 5-1** and presented in detail in **Appendix 2**.

**Table 5-1: Aboriginal cultural heritage: desktop-database search results.**

| Name of Database Searched           | Date of Search                                                                 | Type of Search                        | Comment                                                                                                                                                       |
|-------------------------------------|--------------------------------------------------------------------------------|---------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Commonwealth Heritage Listings      | 16/3/2023                                                                      | Narrabri Shire LGA                    | No places listed on either the National or Commonwealth heritage lists are located within the Project Area                                                    |
| National Native Title Claims Search | 16/3/2023                                                                      | NSW                                   | The Native Title Application (NSD37/2019) (Gomerioi Applicant) applies to the Project Area.                                                                   |
| AHIMS                               | <ul style="list-style-type: none"> <li>24/01/2023</li> <li>4/3/2024</li> </ul> | 8 x 4 km centred on the Project Area. | <ul style="list-style-type: none"> <li>2023: 77 sites were within the search parameters.</li> <li>2024: 87 sites were within the search parameters</li> </ul> |
| Local Environmental Plan (LEP)      | 16/3/2023                                                                      | Narrabri Shire LEP of 2012            | None of the Aboriginal places noted occur near the Project Area.                                                                                              |



As per **Table 5-1**, it is noted that the Project Area includes land currently subject to Native Title Claim (*Tribunal File No. NC2011/006, Federal Court File No. NSD37/2019, Application Name, Gomeroi People*).

A search of the AHIMS database returned 77 records for Aboriginal heritage sites within the designated search area, with no sites located in the Project Area. Several sites are located close to the Project Area, the closest being AHIMS 20-4-0229, an artefact scatter located on the western side of Merrygowen Creek. **Figure 5-1** shows the location of the AHIMS sites that have been recorded near the Project Area.

The most common site type identified in the search area are artefact sites (n=63), followed by Modified Tree (Carved or Scarred) (n=9), with grinding grooves (n=1), hearth (n=1), and potential archaeological deposit (PAD) (n=1) also present (refer to **Table 5-2**). One site is restricted, with no information available, and there is one combined Artefact and Aboriginal Resource & Gathering and Aboriginal Ceremony & Dreaming within the search parameters.

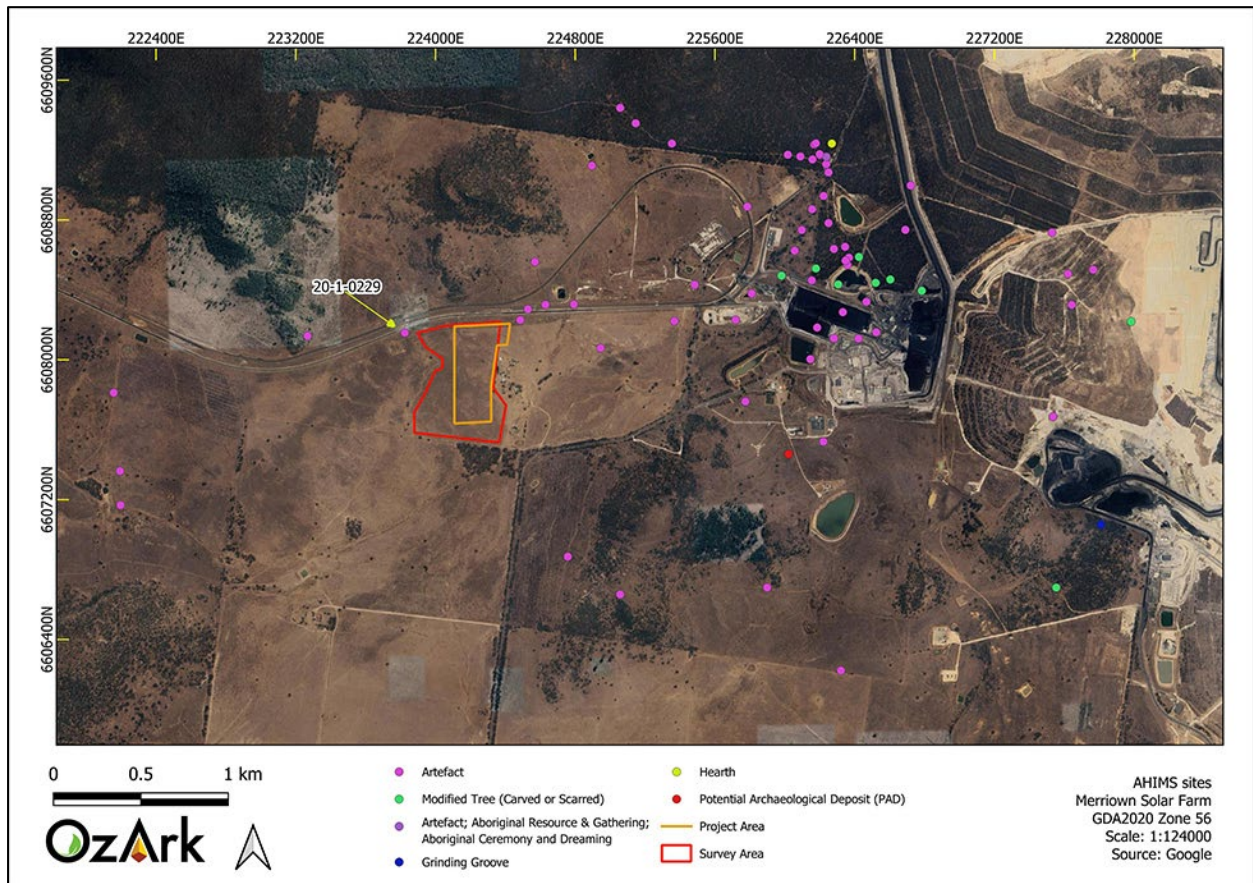
**Table 5-2: Site types and frequencies of AHIMS sites near the Project Area (2023 search area).**

| Site Type                                                                    | Number    | % Frequency |
|------------------------------------------------------------------------------|-----------|-------------|
| Artefact                                                                     | 63        | 82          |
| Modified Tree (scarred or carved)                                            | 9         | 13          |
| Grinding Groove                                                              | 1         | 1           |
| Hearth                                                                       | 1         | 1           |
| Potential Archaeological Deposit (PAD)                                       | 1         | 1           |
| Restricted Site                                                              | 1         | 1           |
| Artefact: Aboriginal Resource & Gathering;<br>Aboriginal Ceremony & Dreaming | 1         | 1           |
| <b>Total</b>                                                                 | <b>77</b> | <b>100</b>  |

On 5 March 2024, a renewed AHIMS search was undertaken over the identical search area to the 2023 search area. The renewed search area records 87 sites. The additional 10 sites recorded between the 2023 and 2024 searches comprise:

- The eight sites recorded as part of the assessment for the proposal (Merriown 1 to Merriown 8)
- 20-4-1110 (Merriown IF1) recorded by OzArk for another project 1.1 km north of the Project Area
- 20-4-1109 (Nagero IF1) recorded by OzArk for another project 370 m east of the Project Area

As no additional sites have been recorded within of close to the Project Area, the results of the desktop searches do not change.

**Figure 5-1: Location of previously recorded sites in relation to the Project Area (2023 search).**

### 5.3.2 Previous studies in or near the Project Area

#### ARAS 2005 & 2007

In 2004 Giles Hamm undertook an assessment of Aboriginal heritage values within the then proposed Boggabri Coal Mine focussing on the Leard State Forest (1 km north of the Project Area) and adjacent Nagero Wetlands. Overall, the investigation identified 61 Aboriginal cultural heritage sites (30 artefact scatters, 26 isolated artefacts, and five scarred trees).

Hamm returned in 2006 to complete artefact salvage and subsurface investigations, including geotechnical analysis. Test excavations at two sites, BC 35 and BC 41, recovered 179 and 30 stone artefacts respectively. The raw material distribution at both sites was dominated by rhyolitic tuff, followed by silcrete and chalcedony at BC 35, and quartz at BC 41. Subsurface artefacts discovered using grader scrapes across more general areas in the Leard Forest and Nagero Creek catchment produced the same or similar raw material distributions.

Geotechnical analysis was conducted at select locations including an area, named Section 4, placed at the southern edge of Leard Forest at a distance of roughly 1–2 km from the Project Area and in matching landforms i.e. flat floodplain traversed by distributary channels with agricultural disturbances. Hamm (ARAS 2007:28) noted that the only location where Aboriginal

artefacts were found in this section was on a distinct terrace landform above the bed of a modern terrace.

In the final report, Hamm (ARAS 2007:31–32) made several conclusions to describe the pattern of archaeological site distribution in the landforms studied, he determined that:

*Aboriginal people undoubtedly visited but rarely occupied the high sandstone and conglomerate ridges but sites are found there because the soils are shallow and ground cover is low. The intermediate zone in the landscape between the stony ridges and the top of the alluvial fans, where there is considerable fluctuation in the water availability and resource richness, is perhaps the area most often occupied. Much of the mine site and the sedimentation pond lie in this environment. It is also where the strongest development of texture contrast soils occurs, and all of the usual archaeological constraints associated with the biomantles of these soils will apply to any site. In short these are:*

- *Open sites are unlikely to be stratified in a chronologically useful sense*
- *Artefacts will be confined to the biomantle*
- *Artefacts will have been subject to surface dispersion, limited down-slope movement, and differential burial or exposure by bioturbation agents and they will contribute to a stone layer between the A and B-horizon where artefacts of all ages accumulate*
- *Despite the taphonomic processes affecting artefact distribution in the soil some site use patterns, such as knapping floors, may survive in plan form but with an extended vertical distribution of their components and possible mixing with artefacts from other events*
- *Because artefactual burial is an ongoing process, surface visibility will be poor except where material has been exposed by erosion*
- *The only means of dating any sites in this landscape will be by recognition of cultural sequences of artefacts, or from the recovery of intact 'hearths' or burials. All other dates, especially those based on detrital charcoal, and including those based on thermo-luminescence, will be spurious because artefacts can move through soil material of any age.*

#### Insite Heritage 2010

Angela Besant conducted a field survey in the southern portion of the Boggabri Coal Mine in 2009, which included approximately 9 ha in the southern part of the Project Area. The survey identified 77 Aboriginal cultural heritage sites, of which 29 were isolated finds, 34 open artefact scatters, and 14 scarred trees. Two patches of grinding grooves on sandstone bedrock in Leard State Forest were also identified during a subsequent survey, although they were considered relatively poor examples of their site type (Insite 2010:73). None of the recorded sites were located within the Project or Survey Area boundaries. As a result of the survey, the potential for

subsurface artefacts in the Leard State Forest was assessed by Besant to be high, and it is possible that expansive sites could be located on the lower and upper slopes within the forest. The sites in the Leard State Forest were assessed by Besant as being of high scientific significance at a local level, as they are relatively rare in their regional context.

#### Kayandel 2011

In 2011, an additional 14 Aboriginal cultural heritage sites were recorded on Boggabri Coal Mine land during the Tarrawonga Cultural Heritage Assessment. The recorded artefact materials were comprised of quartzite, chalcedony, silt stone, volcanic, and fine-grained silicious. Most artefacts recorded were small. It was suggested that this provides potential evidence for flaking technology evolution, i.e. the production of geometric microliths (Kayandel 2011:57).

#### Insite Heritage 2015

In 2015 Insite Heritage were commissioned to prepare an Aboriginal Cultural Heritage assessment for the Boggabri Coal Mine Modification 5. Six Aboriginal cultural heritage sites were identified across the four areas surveyed.

- Item 1: Roma Bore Hole and Pipeline: one open site (eight artefacts) in a disturbed context was located and an area of PAD identified
- Items 2 & 3: Cooboobindi Bore Hole, Pipeline, Power Line & Access: five artefacts located on access road and two artefacts located within a ploughed field
- Item 4: Victoria Park auxiliary infrastructure: one scatter of seven artefacts over an area of 50 x 50 m located on the pipeline route on disturbed ground
- Item 5: Bellevue Pipeline: artefact scatter of 100 objects over a 50 x 50 m area on ground heavily disturbed by ploughing
- Item 6: Bellevue pipeline – low density artefact scatter and three isolated finds on an unformed road and adjacent paddock.

#### UQ Culture & Heritage, 2017

Sneddon & Whincop prepared an Aboriginal Heritage Conservation Strategy for Maules Creek Coal Mine, Tarrawonga Coal Project, Boggabri Coal Mine, and related Biodiversity Offset Areas. It was noted that a total of 67 Aboriginal cultural heritage sites are the subject of the Boggabri Cultural Heritage Management Plan (CHMP) (Idemitsu 2013). Of those, 21 Aboriginal Heritage Information Management System (AHIMS) sites had been salvaged, and two AHIMS sites were partially salvaged in 2013. A total of nine AHIMS sites and one partial site remained to be salvaged at that date and 32 whole and two partial AHIMS sites were to be retained.

## **5.4 PREDICTIVE MODEL FOR SITE LOCATION**

Across Australia, numerous archaeological studies in widely varying environmental zones and contexts have demonstrated a high correlation between the permanence of a water source and



the permanence and/or complexity of Aboriginal occupation. Site location is also affected by the availability of and/or accessibility to a range of other natural resources including plant and animal foods, stone and ochre resources and rock shelters, as well as by their general proximity to other sites/places of cultural/mythological significance. Consequently, sites tend to be found along permanent and ephemeral water sources, along access or trade routes, or in areas that have good flora/fauna resources and appropriate shelter.

In formulating a predictive model for Aboriginal archaeological site location within any landscape it is also necessary to consider post-depositional influences on Aboriginal material culture. In all but the best preservation conditions very little of the organic material culture remains of ancestral Aboriginal communities survives to the present. Generally, it is the more durable materials such as stone artefacts, stone hearths, shells, and some bones that remain preserved in the current landscape. Even these, however, may not be found in their original depositional context since these may be subject to either (a) the effects of wind and water erosion/transport, both over short- and long-time scales, or (b) the historical impacts associated with the introduction of European farming practices including grazing and cropping, land degradation, and farm related infrastructure. Scarred trees, due to their nature, may survive for up to several hundred years but rarely beyond.

#### 5.4.1 Site types in the region of the Project Area

The site types listed in **Table 5-3** are present in the region of the Project Area. The likelihood of these sites being present in the study area is discussed in **Section 5.4.3**.

**Table 5-3: Site types recorded in the region of the Project Area.**

| Site type                 | Site description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|---------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Isolated finds            | May be indicative of random loss or deliberate discard of a single artefact, the remnant of a now dispersed and disturbed artefact scatter, or an otherwise obscured or subsurface artefact scatter. They may occur anywhere within the landscape but are more likely to occur in topographies where open artefact scatters typically occur.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Open artefact scatters    | Artefact scatters are defined as two or more artefacts, not located within a rock shelter, and located no more than 50 m away from any other constituent artefact. This site type may occur almost anywhere that Aboriginal people have travelled and may be associated with hunting and gathering activities, short- or long-term camps, and the manufacture and maintenance of stone tools. Artefact scatters typically consist of surface scatters or sub-surface distributions of flaked stone discarded during the manufacture of tools but may also include other artefactual rock types such as hearth and anvil stones. Less commonly, artefact scatters may include archaeological stratigraphic features such as hearths and artefact concentrations which relate to activity areas. Artefact density can vary considerably between and across individual sites. Small ground exposures revealing low density scatters may be indicative of a background scatter rather than a spatially or temporally distinct artefact assemblage. These sites are classed as 'open', that is, occurring on the land surface unprotected by rock overhangs, and are sometimes referred to as 'open camp sites'.<br><br>Artefact scatters are most likely to occur on level or low gradient contexts, along the crests of ridgelines and spurs, and elevated areas fringing watercourses or wetlands. Larger sites may be expected in association with permanent water sources.<br><br>Topographies which afford effective through-access across, and relative to, the surrounding landscape, such as the open basal valley slopes and the valleys of creeks, will tend to contain more and larger sites, mostly camp sites evidenced by open artefact scatters. |
| Culturally modified trees | Aboriginal scarred trees contain evidence of the removal of bark (and sometimes wood) in the past by Aboriginal people, in the form of a scar. Bark was removed from trees for a wide range of reasons. It was a raw material used in the manufacture of various tools, vessels, and commodities such as string, water containers, roofing for shelters, shields and canoes. Bark was also removed because of gathering food, such as collecting wood boring grubs or creating footholds to climb a                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |

| Site type             | Site description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|-----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                       | tree for possum hunting. Due to the multiplicity of uses and the continuous process of occlusion (or healing) following removal, it is difficult to accurately determine the intended purpose for any example of bark removal. Scarred trees may occur anywhere old growth trees survive. The identification of scars as Aboriginal cultural heritage items can be problematical because some forms of natural trauma and European bark extraction create similar scars. Many remaining scarred trees probably date to the historic period when bark was removed by Aboriginal people for both their own purposes and for roofing on early European houses. Consequently, the distinction between European and Aboriginal scarred trees may not be clear. |
| Grinding grooves      | Grinding grooves are the remnants of ground edge hatchet manufacture and sometimes from food preparation. The site is most likely to occur on flat outcrops of coarse-grained sandstone in the vicinity of water sources, however, grinding grooves have also been recorded on fine-grained granite and quartzite outcrops.                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Hearths/ovens         | Features used by Aboriginal people for the preparation of food and would generally be in the vicinity of available resources, such as water sources to procure fish and shellfish, and on elevated ground to avoid impact from environmental threats.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Bora/Ceremonial sites | Places which have ceremonial or spiritual connections. Ceremonial sites may comprise of natural landscapes or have archaeological material. Bora sites are ceremonial sites which consist of a cleared area and earthen rings.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |

#### 5.4.2 Landform modelling of archaeological potential

The large number of archaeological studies undertaken within the vicinity of the Project Area provides information to obtain a sound understanding of the nature and distribution of archaeological sites within the area. The primary factor appearing to determine the location of Aboriginal campsites is the proximity of permanent water. Results of regional studies suggests a high correlation between the size of a water source and the permanence and/or complexity of the area's Aboriginal occupation.

The archaeological investigations surrounding the Project Area as summarised above indicate that:

- Open sites consisting of stone artefact scatters, modified trees, and isolated stone artefacts are the most common site types in the region
- Aboriginal people may have utilised the creeks as 'corridors' for movement
- The intermediate zone in the landscape between the stony ridges and the top of the alluvial fans, where there is considerable fluctuation in the water availability and resource richness, is perhaps the area most often occupied
- Artefact material includes quartz, mudstone, siltstone, agate, volcanic, chalcedony, and silcrete.

#### 5.4.3 Conclusion

Based on knowledge of the environmental contexts of the Project Area and a desktop review of the archaeological record, the following predictions are made concerning the probability of landforms within the Project Area containing Aboriginal objects (**Table 5-4**), and what types of sites may be present within the Project Area (**Table 5-5**).

**Table 5-4: Likelihood of landforms within the Project Area to contain Aboriginal objects.**

| Survey Unit | Landform type           | Likelihood to contain Aboriginal objects                                                                                                                                                                                                                                         |
|-------------|-------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1           | Flat plain/gentle slope | Flat plains/gentle slopes are an overall stable environment. While such landforms did not provide impediments to movement, they would predominantly have been attractive to repeated occupation only if they were near to permanent water or some other resource, such as stone. |

**Table 5-5: Likelihood of certain site types being present in the Project Area.**

| Site type                 | Likelihood of being present in the Project Area                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|---------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Isolated finds            | As isolated finds can occur anywhere, particularly within disturbed contexts, it is predicted that this site type could be recorded within the Project Area.                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Open artefact scatters    | Stone artefact distributions of variable artefact densities are the most common Aboriginal object found within the region. The Project Area is within a relatively flat landform associated with an ephemeral watercourse which has a low–moderate archaeological potential. As the Project Area is distant to larger, more permanent watercourses, should artefact scatters be recorded they will likely be small and not have great site complexity. Furthermore, due to agricultural and other disturbances, the sites will likely have been dispersed, and may now only exist as isolated finds. |
| Culturally modified trees | Due to the total clearance of trees from within the Project Area, this site type is not predicted to be recorded. It is also noted that this site type is very rare at a regional level.                                                                                                                                                                                                                                                                                                                                                                                                             |
| Hearths/ovens             | This site type is considered possible in areas where A-Horizon soils are relatively undisturbed. However, given the high levels of disturbance across the Project Area the likelihood of identifying this site type <i>in situ</i> is significantly reduced.                                                                                                                                                                                                                                                                                                                                         |
| Bora/Ceremonial sites     | This site type does not necessarily follow landform predictability and are, overall, a rare site type with a low likelihood of being present and remaining extant. These sites are generally identified through consultation with the RAPs.                                                                                                                                                                                                                                                                                                                                                          |

## 5.5 RESEARCH QUESTIONS

Several research questions can meaningfully be applied to the investigation of the Survey Area.

These research questions include:

- What resources were available to the Aboriginal people using the land within the Survey Area (food, stone, and water) and what resources were transported to the area?
- How do the raw materials recorded within the Survey Area compare to those in recorded in the surrounding region?
- Establish how the findings within the Survey Area (if any) accord with the regional archaeological context examined in **Section 5.4**.

## 6 RESULTS OF ABORIGINAL ARCHAEOLOGICAL ASSESSMENT

### 6.1 SAMPLING STRATEGY AND FIELD METHODS

The field survey was conducted as one survey unit and covered the Project Area, targeting the creek line and areas of good visibility and exposure. Standard archaeological field survey and recording methods were employed in this study (Burke & Smith 2004).

The archaeological field survey was undertaken on 26 July 2023 and was conducted by Sarah van der Linde (RPS Senior Heritage Consultant) and Dr Gary Marriner (RPS Senior Heritage Consultant) together with RAP representatives listed in **Table 3-1**. The Survey Area was able to be fully accessed by pedestrian transects.

The archaeological field survey was conducted in accordance with the methodology issued to RAPs for review on 5 June 2023 and the *Code of Practice for Archaeological investigation of Aboriginal Objects in New South Wales* (DECCW 2010a), including:

- Conducted on foot (pedestrian) in transects, with participants spaced 2–5 m apart
- Targeted sensitive landforms (i.e. creek line) and areas of visibility and good ground surface exposure
- Inspection of all mature trees, caves, rock shelters, where present
- Survey units mapped and recorded in accordance with landforms outlined in the sample strategy, Project Area boundaries, disturbance area boundaries, changes in survey conditions (such as visibility or ground surface exposure) and/or other relevant considerations
- Mapping of survey undertaken on the basis of GPS recorded data and with reference to aerial and topographic information
- All identified sites recorded and photographed, including site locations recorded with GPS
- Artefacts recorded in an appropriate manner, including length, width, thickness as well as artefact type and raw material, where applicable.

### 6.2 PROJECT CONSTRAINTS

The entire Project Area was accessible to the survey team. The only constraint was the vegetation comprising grasses and weeds that limited ground surface visibility as seen on **Figure 6-2**.

### 6.3 EFFECTIVE SURVEY COVERAGE

Two of the key factors influencing the effectiveness of archaeological survey are ground surface exposure (GSE) and ground surface visibility (GSV). These factors are quantified to ensure that the survey data provides adequate evidence for the evaluation of the archaeological materials



across the landscape. For the purposes of the current assessment, these terms are used in accordance with the definitions provided in the Code of Practice.

GSV is defined as:

*... the amount of bare ground (or visibility) on the exposures which might reveal artefacts or other archaeological materials. It is important to note that visibility, on its own, is not a reliable indicator of the detectability of buried archaeological material. Things like vegetation, plant or leaf litter, loose sand, stone ground or introduced materials will affect the visibility. Put another way, visibility refers to 'what conceals' (DECCW 2010:39).*

GSE is defined as:

*... different to visibility because it estimates the area with a likelihood of revealing buried artefacts or deposits rather than just being an observation of the amount of bare ground. It is the percentage of land for which erosion and exposure was sufficient to reveal archaeological evidence on the surface of the ground. Put another way, exposure refers to 'what reveals' (DECCW 2010:37).*

**Table 6-1** calculates the effective survey coverage within the Survey Area. In general, **Table 6-1** presents an approximation of the amount of ground surface able to be seen at any location within the landform unit.

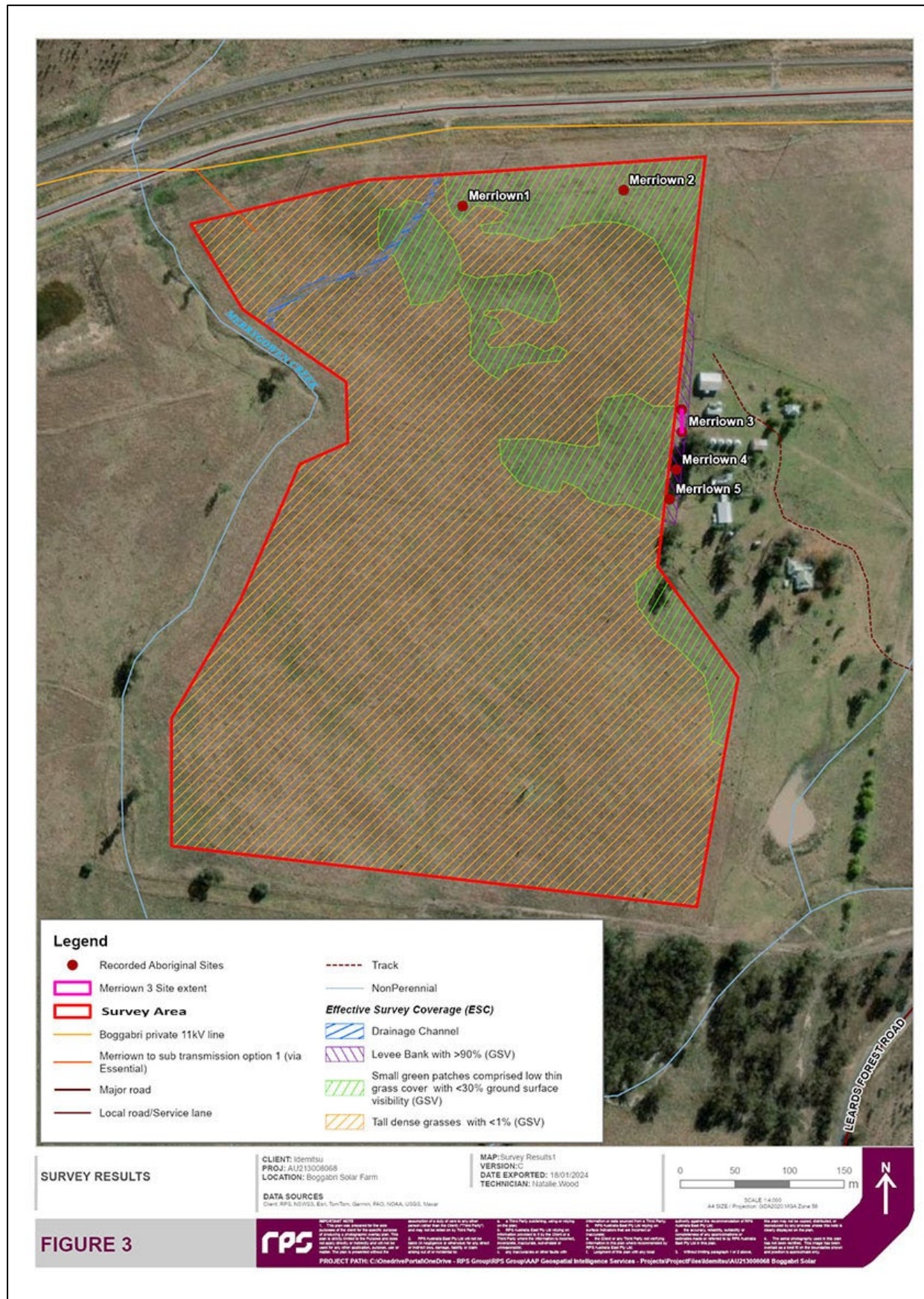
The Survey Area is characterised as a large open plain, currently used for stock grazing. Generally, the Survey Area had poor visibility (c. 1%) due to the presence of thick grasses. Areas of low ground surface visibility (c. 3%) were identified in low lying areas containing low, thin grass. Areas of exposure with good ground surface visibility (>80%) were evident along the eastern flank of the Survey Area where a levee bank had been created. The levee bank was approximately 400–500 millimetres (mm) high and appeared to have been pushed up from the Survey Area. Minor disturbance from wild pigs was evident across the site.

The three landscape zones identified by RPS in the field are shown on **Figure 6-1**.

**Table 6-1: Effective survey coverage within the Survey Area.**

| Landform              | Survey Unit Area (sq m) | Visibility % | Exposure % | Effective Coverage Area (sq m) | Effective Coverage % |
|-----------------------|-------------------------|--------------|------------|--------------------------------|----------------------|
| Plain                 | 228125                  | <1           | <5         | 114                            | 0.05                 |
| Plain                 | 39571                   | <30          | <10        | 1187                           | 3                    |
| Modified (levee bank) | 2041                    | >90          | 90         | 1653                           | 81                   |
| <b>Total</b>          | <b>269,738</b>          | <b>-</b>     | <b>-</b>   | <b>2954</b>                    | <b>1.1</b>           |

Figure 6-1: Landscape zones identified during the survey.



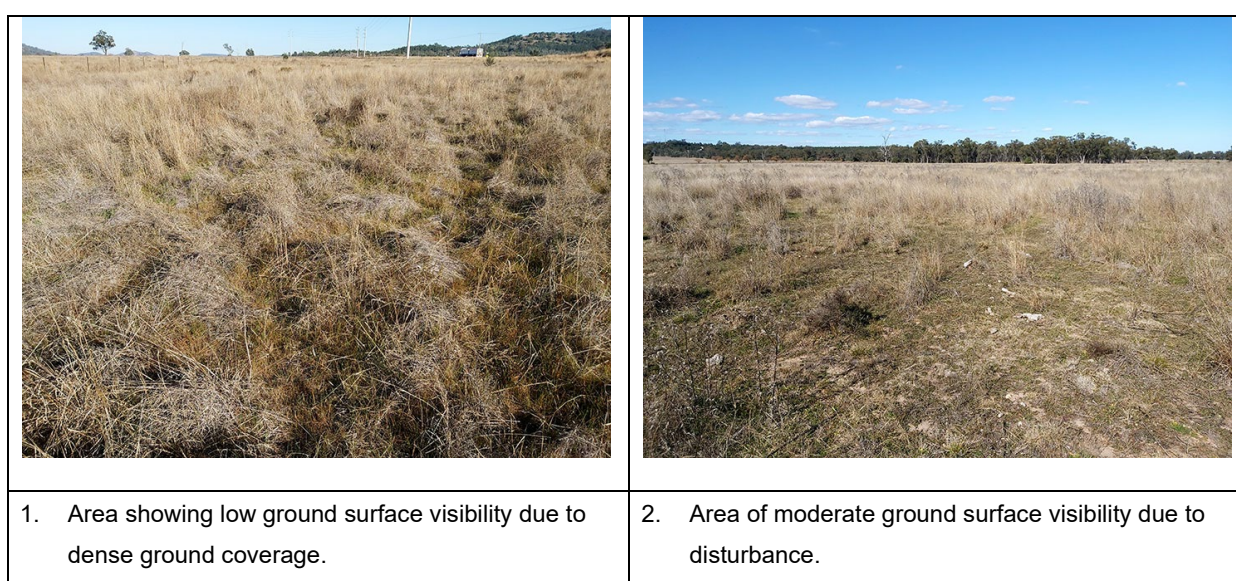


**Table 6-2** demonstrates that although the survey efficacy was low at five per cent, artefacts were recorded; but often in association with disturbances where exposures were present. The low incidence of artefact recordings is considered more associated with the low archaeological potential of the Survey Area than the low effective survey coverage.

**Table 6-2: Effective survey coverage and incidences of site recording.**

| Landform                | Landform area (sq m) | Area Effectively Surveyed (sq m) | % of Landform Effectively Surveyed | Number of Sites | Number of Artefacts or Features |
|-------------------------|----------------------|----------------------------------|------------------------------------|-----------------|---------------------------------|
| Flat plain gentle slope | 269,738              | 2954                             | 1.1                                | 5               | 12 artefacts                    |

**Figure 6-2: Examples of ground surface visibility.**



## 6.4 ABORIGINAL SITES RECORDED

**Table 6-3** summarises the Aboriginal cultural heritage sites recorded during the survey of the Survey Area. Further details on each site follows (**Table 6-3**) and their location is shown on **Figure 6-3**.

**Table 6-3: Aboriginal cultural heritage sites recorded during the survey.**

| AHIMS ID  | Site name  | Site type         | Coordinates (GDA Zone 56 East) | Coordinates (GDA Zone 56) North | Survey Unit |
|-----------|------------|-------------------|--------------------------------|---------------------------------|-------------|
| 20-4-1120 | Merriown 1 | Isolated artefact | 224147.7                       | 6608168                         | 1           |
| 20-4-1119 | Merriown 2 | Isolated artefact | 224294                         | 6608183                         | 1           |
| 20-4-1117 | Merriown 3 | Isolated artefact | 224348                         | 6607972                         | 1           |
| 20-4-1116 | Merriown 4 | Artefact scatter  | 224343                         | 6607927                         | 1           |
| 20-4-1118 | Merriown 5 | Isolated artefact | 224337                         | 6607900                         | 1           |



Figure 6-3: Sites recorded during the survey.





**20-4-1120 (Merriown 1)****Site type:** Artefact scatter**GPS coordinates:** 224147E 6608168N, GDA 94, Zone 56**Location of site:** 27 m south of the northern boundary, 254 m east of the western boundary (Figure 6-3).**Description of site:** The site comprises two surface artefacts manufactured from chalcedony identified in an area of low ground surface visibility near the northern property boundary (Table 6-4 and Figure 6-4). The site extent is 22 x 12 m.**Table 6-4: Merriown 1. Artefact attributes.**

| Artefact type | Raw material | Artefact integrity | Stage of reduction | Size (LxWxD) mm |
|---------------|--------------|--------------------|--------------------|-----------------|
| Flake         | Chalcedony   | Complete           | Tertiary           | 11x9x4          |
| Flaked piece  | Quartz       | Broken             | Tertiary           | 8x8x5           |

**Figure 6-4: Merriown 1. View of site and recorded artefacts.**

|                                                                                     |                                                                                      |
|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|
|   |   |
| 1. Merriown 1 location.                                                             | 2. View northeast, Merriown 1.                                                       |
|  |  |
| 3. Artefact #1, Merriown 1.                                                         | 4. Artefact #2, Merriown 1.                                                          |



**20-4-1119 (Merriown 2)**

**Site type:** Isolated artefact

**GPS coordinates:** 224294E 6608183N, GDA 94, Zone 56

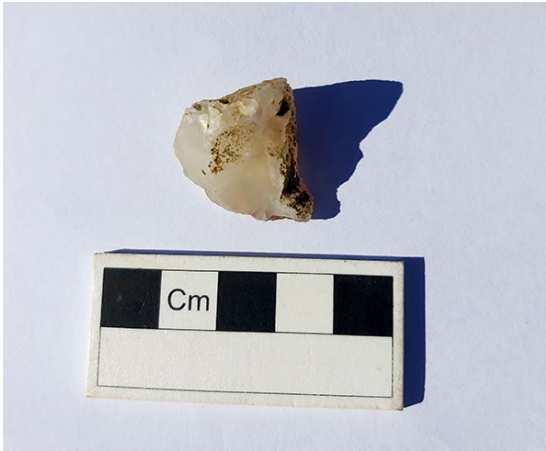
**Location of site:** The site is located 31 m south of the northern boundary and 403 m east of the western boundary (**Figure 6-3**).

**Description of site:** Single isolated artefact comprising a core fragment manufactured from chalcedony identified within an area of exposure on the plain (**Table 6-5** and **Figure 6-5**). The site extent is 5 x 5 m.

**Table 6-5: Merriown 2. Artefact attributes.**

| Artefact type | Raw material | Artefact integrity | Stage of reduction | Size (LxWxD) mm |
|---------------|--------------|--------------------|--------------------|-----------------|
| Core          | Quartz       | Broken             | Secondary          | 26x22x15        |

**Figure 6-5: Merriown 2. View of site and recorded artefact.**

|                                                                                     |                                                                                     |
|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
|   |  |
| <p>1. Merriown 2 location.</p>                                                      | <p>2. View east, Merriown 2.</p>                                                    |
|  |                                                                                     |
| <p>3. Artefact #3, Merriown 2.</p>                                                  |                                                                                     |

**20-4-1117 (Merriown 3)****Site type:** Artefact scatter**GPS coordinates:** 224348E 6607972N, GDA 94, Zone 56**Location of site:** The site is located along the eastern boundary, 246 m south of the northern boundary (**Figure 6-3**).**Description of site:** Artefact scatter comprising five artefacts identified along an approximate 19 m length of a recent levee bank along with eastern fence line. Artefacts comprise mudstone and chalcedony flakes (**Table 6-6** and **Figure 6-6**). The site extent is 20 x 8 m.**Table 6-6: Merriown 3. Artefact attributes.**

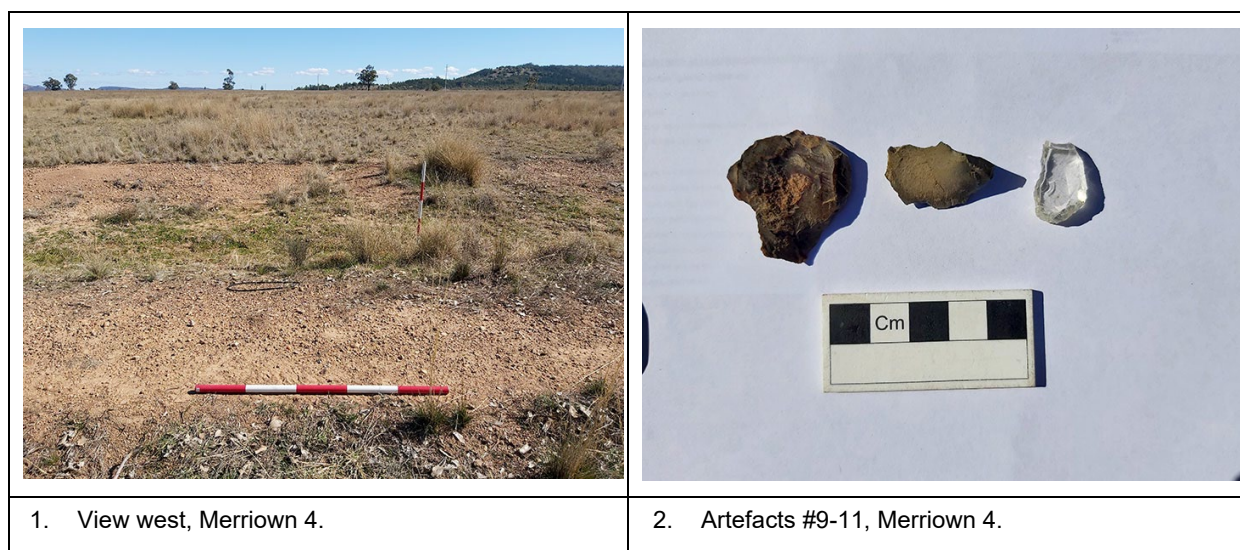
| Artefact type  | Raw material     | Artefact integrity | Stage of reduction | Size (LxWxD) mm |
|----------------|------------------|--------------------|--------------------|-----------------|
| Proximal flake | Mudstone         | Broken             | Tertiary           |                 |
| Flake          | Mudstone         | Broken             | Secondary          | 27x17x7         |
| Flaked piece   | Chalcedony       | Broken             | Tertiary           |                 |
| Flake          | Amber chalcedony | Broken             | Tertiary           | 18x15x7         |
| Flake          | Mudstone         | Broken             | Tertiary           | 9x7x3           |

**Figure 6-6: Merriown 3. View of site and recorded artefacts.**

|                                                                                     |                                                                                      |
|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|
|  |  |
| 1. View south along levee bank showing location of Merriown 3.                      | 2. View south across Merriown 3 showing height of levee bank.                        |
|  |                                                                                      |
| 3. Artefacts #4-9, Merriown 3.                                                      |                                                                                      |

**20-4-1116 (Merriown 4)****Site type:** Artefact scatter**GPS coordinates:** 224343E 6607927N, GDA 94, Zone 56**Location of site:** The site is located along the eastern boundary, 293 m south of the northern boundary (Figure 6-3).**Description of site:** Artefact scatter comprising two artefacts manufactured on mudstone and silcrete and one possible glass artefact identified on the upcast soil of the eastern levee bank (Table 6-7 and Figure 6-7). The site extent is 18 x 9 m.**Table 6-7: Merriown 4. Artefact attributes.**

| Artefact type    | Raw material | Artefact integrity | Stage of reduction | Size (LxWxD) mm |
|------------------|--------------|--------------------|--------------------|-----------------|
| Flake            | Silcrete     | Broken             | Tertiary           | 31x33x11        |
| Flake            | Mudstone     | Broken             | Tertiary           | 20x27x10        |
| Possible scraper | Glass        | Broken             |                    | 21x13x5         |

**Figure 6-7: Merriown 4. View of site and recorded artefacts.**

1. View west, Merriown 4.

2. Artefacts #9-11, Merriown 4.



**20-4-1118 (Merriown 5)****Site type:** Isolated artefact**GPS coordinates:** 224337E 6607900N, GDA 94, Zone 56**Location of site:** The site is located along the eastern boundary, 317 m south of the northern boundary (Figure 6-3).**Description of site:** Isolated artefact comprising a silcrete medial flake identified in area of exposure on western levee bank (Table 6-8 and Figure 6-8). The site extent is 5 x 5 m.**Table 6-8: Merriown 5. Artefact attributes.**

| Artefact type | Raw material | Artefact integrity | Stage of reduction | Size (LxWxD) mm |
|---------------|--------------|--------------------|--------------------|-----------------|
| Medial flake  | Silcrete     | Broken             | Tertiary           | 18x13x3         |

**Figure 6-8: Merriown 5. View of site and recorded artefacts.**

1. View west, Merriown 5.

2. Artefacts #12, Merriown 5.

**6.5 SUMMARY OF SURVEY RESULTS****6.5.1 Discussion**

Five Aboriginal sites were identified as a result of the field survey, comprising three isolated artefacts and two low-density artefact scatters. Two artefact occurrences (Merriown 1 and Merriown 2) were identified on the plain in areas of low ground surface visibility along the northern boundary of the Project Area. Three Aboriginal sites (Merriown 3, Merriown 4, and Merriown 5) were identified along the exposed levee bank just beyond the eastern boundary of the Project Area.

There were no mature trees in the Survey Area.

The presence of surface artefacts in the Survey Area and the proximity to Merrygowen Creek indicate that further Aboriginal objects may be present subsurface. The identification of artefacts on the levee bank, likely pushed up from the Survey Area, is also strongly indicative of subsurface



cultural material being present. It was therefore recommended that the investigation progress to subsurface testing to determine the full nature of Aboriginal cultural heritage in the Project Area.

### 6.5.2 Responses to the research questions

In **Section 5.5** several research questions were advanced to guide the investigation of the Survey Area. Following the survey, responses to these research questions are set out below.

- What resources were available to the Aboriginal people using the land within the Survey Area (food, stone, and water) and what resources were transported to the area?
  - No specific food resource locations were noted, and water resources were limited to the ephemeral Merrygowen Creek. At the time of the survey there was no water in the creek. No outcropping rock materials were identified within the Survey Area. Therefore, the implication is that all the raw material used in the manufacturing of the artefacts at Merriown 1 to Merriown 5 were transported into the area.
- How do the raw materials recorded within the Survey Area compare to those in recorded in the surrounding region?
  - All artefacts found at Merriown 1 to Merriown 5 were manufactured from chalcedony, quartz, mudstone, and silcrete, with the exception of one manufactured out of glass. These materials are recorded as being a relatively common in the region for manufacturing stone tools (Dallas 1986 and Kayandel 2011).
- Establish how the findings within the Survey Area (if any) accord with the regional archaeological context examined in **Section 5.5**.
  - The findings of the Survey Area accord with the regional archaeological context. Previous assessments indicated that flats and gentle slopes distant from reliable water which dominate the Project Area have lower archaeological potential compared to footslopes and spurs in the surrounding area or landforms immediately adjacent to reliable water. The recording of Merriown 1 to Merriown 5, consisting of isolated finds and open artefact scatters with low density situated within general proximity to an ephemeral stream, is consistent with the findings of Purcell (NPWS 2002).

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## 7 TEST EXCAVATION PROGRAM

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### 7.1 BACKGROUND TO THE TEST EXCAVATION PROGRAM

Further investigation in the form of subsurface archaeological test excavation was recommended by RPS because of the field survey findings. This was proposed to establish the extent, nature, and significance of any Aboriginal objects and/or deposits that are/may be present within the Project Area. Subsurface test excavation will also assist in determining any cultural heritage constraints that were not possible through the survey carried out by RPS due to low visibility.

The test excavation program took place over four days on 28 November to 1 December 2023. Notice of test excavation was sent to Heritage NSW on 15 November 2023.

### 7.2 EXCAVATION METHODOLOGY

#### 7.2.1 Purpose of the test excavation program

The purpose of the test excavation program is to understand more completely the nature of the subsurface material across the Project Area. Data obtained from the test excavation program will inform the mitigation and management options in this ACHAR.

The aims are therefore to:

1. Establish the extent and nature of the subsurface archaeological deposits
2. Use the data gained from the test excavation program to better evaluate the archaeological significance and potential of the location
3. Develop, in consultation with the RAPs and the proponent, an informed strategy for the management of impacts to any Aboriginal cultural heritage likely to be impacted by the proposal.

#### 7.2.2 Rationale of the test excavation program

The test excavation methodology is provided as **Appendix 3**. This document sets out the predictive model used to design the test excavation program.

While any test excavation program is limited in the level of research objectives it can achieve due to the restricted nature of the excavations, the test excavations attempted to answer the following research questions:

- How does the artefactual material and stratigraphy identified at the site compare to other archaeological excavations undertaken in the local area and the region?
- Is there evidence providing insight into the tasks Aboriginal people were undertaking?

- What are the cultural values of the deposit? How does the local Aboriginal community understand the value of the deposit?

### 7.3 SAMPLING METHODOLOGY FOR THE TEXT EXCAVATION PROGRAM

The excavation program was undertaken by archaeologists and representatives of RAPs in compliance with the requirements outlined in the Code of Practice.

#### 7.3.1 Test excavation methodology

Fourteen linear transects were selected across the Project Area (**Figure 7-1**). This number included three transects (TR8, TR11, and TR14) which were placed outside of the Project Area but within the Survey Area. These transects were to investigate landforms where future expansion may happen but will not be impacted by the current Project.

Each transect was arranged as a linear 100 m transect containing six test units (TU) spaced 20 m apart. Thus, a total of 84 TUs measuring 0.5 x 0.5 m each were proposed.

The full test excavation methodology was issued to all RAPs on 27 October 2023 setting out the nature and location of the test excavation program (**Appendix 3**). At the end of the 28 day review period, Didge Ngunawal Clan, Stakeholder 2, Konanggo Aboriginal Cultural Heritage Services, Jeremy Duncan, and AGA Services all replied that they supported the test excavation methodology without providing any further details.

#### 7.3.2 Undertaking the test excavation

The entirety of the Project Area is located within a flat plain landform with a very slight slope down to the east and south. The landscape of the excavation area is shown on **Figure 7-2**.

The test excavation methodology was followed where possible, however, when the landscape within the Project Area was assessed in person, it was decided that more effective results could be achieved by modifying Transect 6 to place it nearer to the ephemeral Merrygowen Creek. Transect 6 was therefore moved approximately 25 m west and the TUs were spaced 10 m apart as this was suspected to be a more archaeologically sensitive landform.

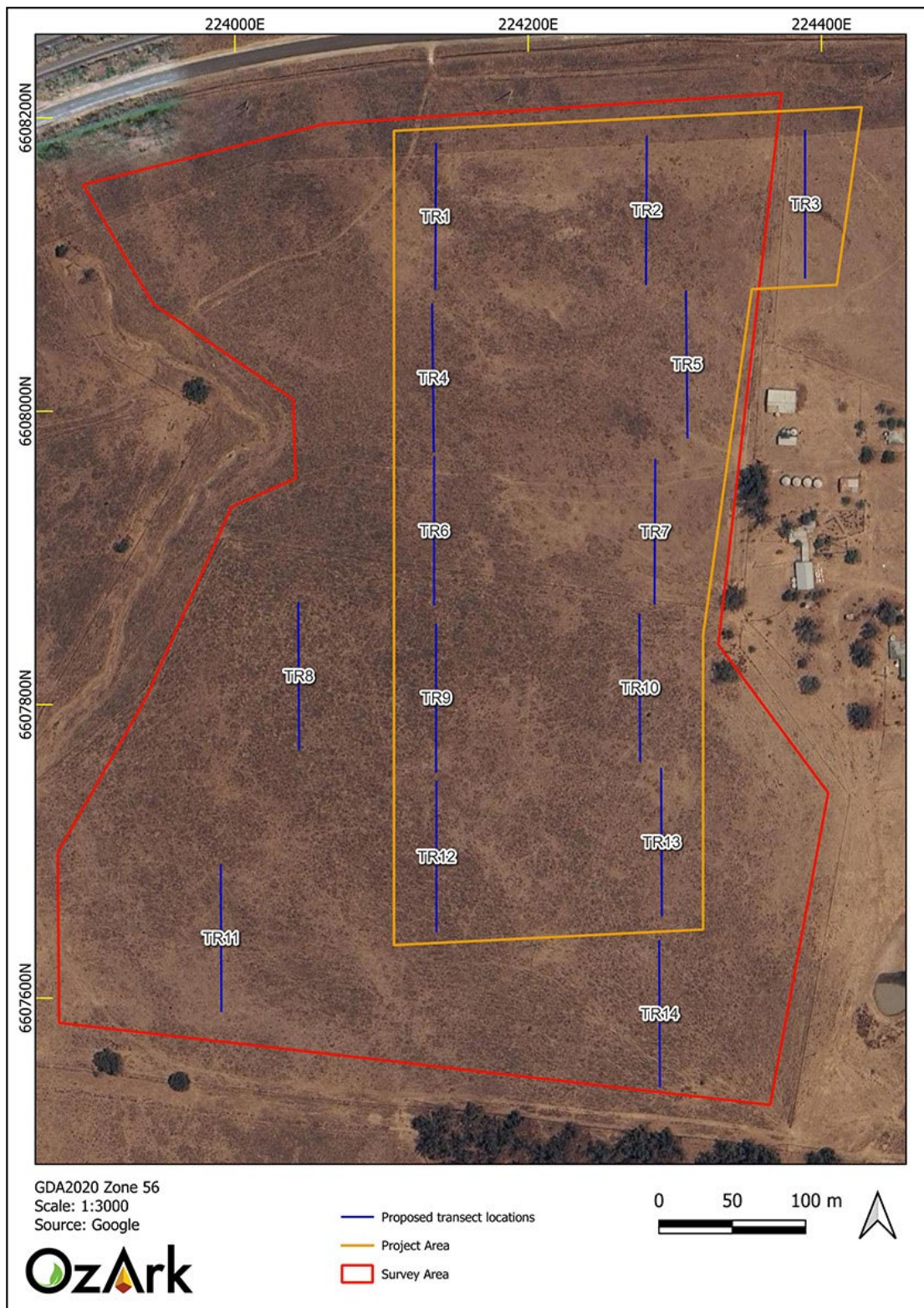
Transects 8, 11, and 14 were not subject to test excavation as wet weather slowed the program and because excavation of these transects were for future, rather than current, investigations.

The excavations were conducted by hand, using hand tools only. The initial spits at each transect were five centimetres (cm) deep until it was deemed that 10 cm spits were suitable for excavation. Excavated materials were dry sieved through a 5 mm sieve, except wet sieving was used in the southern transects where clay content was high and wet weather created difficult sieving conditions.

Artefacts recovered from the sieved materials were bagged and labelled with the transect, square, and spit information for later analysis. Standard excavation recording forms were completed for each TU, which detailed the date, site recorder, spit number, excavation depth, and description of the soil profile.

TR3 was placed to examine the 1 ha area of land that was not surveyed by the RPS survey.

**Figure 7-1: The proposed transect locations in the methodology.**





**Figure 7-2: Views of the test excavation area.**

## 7.4 THE ARTEFACT CATALOGUE

### 7.4.1 Analysis terminology

The abbreviations shown in **Table 7-1** have been used in the catalogue of the artefact assemblage from the test excavation program.

**Table 7-1: Abbreviations used in the artefact catalogue.**

| Artefact Analysis Abbreviations |                                                                                          |                                                                                                                         |
|---------------------------------|------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------|
| Artefact Type                   |                                                                                          |                                                                                                                         |
| F                               | flake                                                                                    | An unmodified artefact that is broader than it is long                                                                  |
| B                               | blade                                                                                    | An unmodified artefact that is longer than it is broad (normally twice as long as it is broad). Parallel dorsal ridges  |
| S                               | shatter                                                                                  | Shatter does not refer solely to heat shatter but also chips of raw material clearly the result of the knapping process |
| Raw Material                    |                                                                                          |                                                                                                                         |
| MS                              | mudstone                                                                                 |                                                                                                                         |
| S                               | silcrete                                                                                 |                                                                                                                         |
| Q                               | quartz                                                                                   |                                                                                                                         |
| V                               | volcanics (other)                                                                        |                                                                                                                         |
| PW                              | petrified wood                                                                           |                                                                                                                         |
| Integrity                       |                                                                                          |                                                                                                                         |
| C                               | complete                                                                                 |                                                                                                                         |
| PF                              | proximal fragment                                                                        | i.e. the distal is missing                                                                                              |
| DF                              | distal fragment                                                                          | i.e. the proximal is missing                                                                                            |
| LB                              | longitudinal break                                                                       | Broken down through the platform                                                                                        |
| MB                              | medial break                                                                             | Broken across the angle of strike                                                                                       |
| Reduction                       |                                                                                          |                                                                                                                         |
| 1                               | Primary: greater than c. 50% cortex, dorsal surface entirely cortex                      |                                                                                                                         |
| 2                               | Secondary: displaying cortex but either incomplete on dorsal surface or less than c. 50% |                                                                                                                         |
| 3                               | Tertiary: no cortex                                                                      |                                                                                                                         |

| Size          |                                                                                                  |                                                                                                                               |
|---------------|--------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|
| Size range 1  |                                                                                                  | 0.5–10 mm                                                                                                                     |
| Size range 2  |                                                                                                  | 10–20 mm                                                                                                                      |
| Size range 3  |                                                                                                  | 20–50 mm                                                                                                                      |
| Size range 4  |                                                                                                  | 50–100 mm                                                                                                                     |
| Size range 5  |                                                                                                  | Over 100 mm                                                                                                                   |
| Rotation      |                                                                                                  |                                                                                                                               |
| P             | Previous flakes have been removed in a parallel (direct or opposed) orientation to the flake     |                                                                                                                               |
| R             | Previous flakes have been removed in a non-parallel (direct or opposed) orientation to the flake |                                                                                                                               |
| N             | Not discernible                                                                                  |                                                                                                                               |
| Platform type |                                                                                                  |                                                                                                                               |
| S             | Simple                                                                                           | Platform commonly struck from a previous flake removal presenting as an unfaceted surface                                     |
| P             | Point                                                                                            | Denotes a single point of contact often as a result of in-direct percussion                                                   |
| C             | Cortex                                                                                           | Platform displaying cortex on part of the platform                                                                            |
| CR            | Crushed                                                                                          | A platform that is crushed, often obscuring the original form of the platform                                                 |
| F             | Flaked                                                                                           | A platform displaying faceting                                                                                                |
| Platform size |                                                                                                  |                                                                                                                               |
| 1             |                                                                                                  | Point                                                                                                                         |
| 2             |                                                                                                  | Very small: up to 3 mm                                                                                                        |
| 3             |                                                                                                  | Small: up to 5 mm                                                                                                             |
| 4             |                                                                                                  | Moderate: up to 10 mm                                                                                                         |
| 5             |                                                                                                  | Large: over 10 mm                                                                                                             |
| Termination   |                                                                                                  |                                                                                                                               |
| F             | Feather                                                                                          | Termination has a smooth distal without steps or steep angles                                                                 |
| SH            | Step/Hinge                                                                                       | Termination that has steps or 'breaks' at the distal: often associated with flakes removed from an almost exhausted core      |
| P             | Plunge                                                                                           | Flakes that have a marked curvature denoting a flake removed for core rejuvenation purposes                                   |
| Cores         |                                                                                                  |                                                                                                                               |
| U             | unidirectional                                                                                   | Core with a single platform and flakes removed with the same orientation                                                      |
| B             | bidirectional                                                                                    | Core with two platforms, often opposed platforms but also where flakes are removed in two orientations from a single platform |
| M             | multidirectional                                                                                 | Multiple platforms                                                                                                            |
| Core features |                                                                                                  |                                                                                                                               |
| B             | bladelet core                                                                                    | Parallel ridge scars on the core                                                                                              |
| R             | reduced/globular                                                                                 | Exhausted cores, normally small, globular, multidirectional cores but also reduced bladelet cores                             |
| O             | 'opportunistic'                                                                                  | A core where two or three flakes have been removed in an opportunistic way to test a cobble. Majority of core is un-flaked    |
| F             | fragment                                                                                         | A broken or shattered core                                                                                                    |
| Retouch       |                                                                                                  |                                                                                                                               |
| proximal      | Retouch is confined primarily to the proximal end (i.e. platform has been removed)               |                                                                                                                               |
| distal        | Retouch is confined primarily to the distal end (i.e. platform is intact)                        |                                                                                                                               |
| margin        | Retouch is confined primarily to one or both margins                                             |                                                                                                                               |
| steep         | Retouch is closer to ninety degrees (i.e. vertical retouch)                                      |                                                                                                                               |
| semi-steep    | Retouch is closer to forty-five degrees (i.e. sloping retouch)                                   |                                                                                                                               |
| fine          | Very fine nibbling                                                                               |                                                                                                                               |

|           |                                                                                  |
|-----------|----------------------------------------------------------------------------------|
| invasive  | Retouching where retouch extends into the body of the artefact (regular retouch) |
| unifacial | Retouch is on one side of an artefact only                                       |
| bifacial  | Retouch is on both ventral and dorsal surfaces                                   |

A discussion on why these attributes were analysed follows.

### **Artefact type**

Description: Possible artefact types include flakes, blades, retouched flakes/blades, cores, scrapers, shatter/fragments and other (hammerstones, grindstones, ground-edge hatchets) although not all may be present at any one site.

Issues: Classing artefacts, generally, does not usually entail significant problems. A minority of artefacts are difficult to define such as ambiguities between recognising flaked pieces (flakes subsequently used as a core to source further flakes), and between cores and scrapers.

Uses: This category will be used to assess differences in provisioning strategies (e.g. core provisioning as opposed to flake provisioning), differences in site function/use (e.g. presence/absence of grindstones), and the taphonomic effects of past land use on the site (are more broken artefacts part of the assemblage?).

### **Raw Material**

Description: A largely self-explanatory attribute, raw materials expected to be present include silcrete, mudstone, quartz, and volcanics.

Issues: This category often has problems for analysts without a geological background. Even then, without breaking an artefact, the true nature of the stone will sometimes remain uncertain. By far the most common stones utilised for artefact manufacture in the Project Area are silcrete, mudstone, and quartz; all of which come in a variety of colours. Sometimes a single artefact will have been struck from a cobble displaying two distinct colours. While heat treatment has been put forward to explain this colour variation; particularly from yellow to red in silcrete (Moore 2000), examples from the study lack a lustre that would suggest that heat treatment has caused this colour change. Other stone types such as chalcedony, agate, volcanics etc. also occur.

Uses: Raw material is an important attribute, which may broadly indicate the place of origin of an artefact. The dominance of one raw material or another may also be used to group or differentiate sites. Raw material is also frequently used in concert with attributes in the creation of analytic units for more in-depth inter and intra site comparisons.

### **Artefact Breakage**

Description: At a basic level, flakes break in three different ways. Two are transverse (at 90 degrees to the direction of percussion) – proximal and distal; one is longitudinal (along the plane of percussion).

**Issues:** It is occasionally difficult to be certain of the breakage on an artefact. In most cases, however, the kind of breakage can be ascertained.

**Use:** It is important to differentiate broken from complete flakes for the purposes of analysis, as the two are not comparable regarding several measures. The amount of artefact breakage in an assemblage also indicates the degree of fragmentation to which the assemblage has been subject. In highly fragmented assemblages, the actual number of artefacts represented may be significantly exaggerated. Quantifying breakage allows a more accurate approximation of artefact numbers to be made.

## **Dimensions<sup>1</sup>**

**Description:** Percussive dimensions measure the maximum length of the flake in the direction of force application from the point that force was applied. In this regard it relates to the length of core face that was removed during the manufacture of the artefact.

**Issues:** There is some uncertainty as to what these attributes are measuring in terms of the flake manufacturing process.

**Use:** Flake dimensions are expected to correlate with differences in the provisioning and reduction strategies at different places. For example, the reduction of cores at a site will produce many moderate to small flakes and some larger flakes. As a result, a histogram of flake length will show a relatively consistent increase in number of flakes from large to small. Contrastingly, when most flakes are the result of retouching or maintenance tasks on other flakes, most of the flakes remaining should be very small, with comparably few large to moderate flakes. However, it may be the case that a few moderate to large flakes will be discarded at the site as they are exhausted through excessive/heavy retouch or simply thrown away prior to a reprovisioning event. In such a case, a histogram of artefact size should show bimodality regarding length (a small peak in the moderate range and a large peak in the small range).

## **Reduction**

**Description:** This category refers to the level of reduction evident on an artefact, assessed by the amount of cortex remaining on the artefact. Cortex refers to the 'skin' of a rock: the surface that has been weathered to a different texture and colour by exposure to the elements over a long period of time. The amount of cortex as a percentage of surface area will be measured on all artefacts (in relation to flakes, cortex can only occur on the dorsal and platform surfaces). The

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<sup>1</sup> From experience OzArk does not routinely weigh artefacts as this information has been found to closely correlate either to artefact size or the raw material from which the flake has been struck. Thus, smaller artefacts are lighter than larger artefacts when made from the same material and artefacts made from denser stone (such as volcanics) are heavier than comparably sized artefacts from lighter (less-dense) stones such as mudstone. In practice, the category cataloguing the maximum size of the artefact is analogous with the artefact's weight.



nature of cortex—its shape and texture—will vary depending on where the raw material was sourced. This measurement will help determine if an artefact is at a primary, secondary, or tertiary level of reduction.

**Issues:** This is a relatively unambiguous descriptive category.

**Use:** When a natural cobble is first selected it will usually be covered in cortex. Therefore, the first artefacts produced from it will have a complete coverage of cortex on the dorsal side (primary reduction). As the cobble is increasingly reduced the amount of cortex on each artefact will rapidly decrease (secondary reduction) until it ceases to be present on artefacts (tertiary reduction). Because of this trend, it should be possible to determine how early in the reduction sequence the artefact was produced. If large numbers of artefacts or a high proportion of the artefacts of a raw material retain cortex it may indicate that the site is near the source. Differences between the proportions of artefacts retaining cortex between different raw material indicates relative differences in distance to source. This does not necessarily mean distance in terms of measurable distance across the landscape; it may also reflect length of time since leaving the source. For example, the last campsite when a group is returning to the source of the raw material may be very close to the source in terms of distance, but distant in terms of time elapsed since the group left the source. If artefacts with cortex are occurring in sites a long distance from the place of origin of the natural cobble, then it is likely that cobbles were being transferred to the site when still only slightly reduced. This would imply an attempt to maximise the amount of stone being provisioned with the weight of transported material being a relatively minor concern.

## **Rotation**

**Description:** Describes whether a flake was struck from a core that was rarely rotated (a unidirectional or bidirectional core), or from a core that has been rotated frequently (a multidirectional core).

**Issues:** There is little ambiguity in assessing this category. If the orientation of previous flakes was unclear, this category is left blank.

**Use:** An examination of the direction in which previous flake scars on an artefact's dorsal surface have been removed, along with the orientation in which the flake itself was removed from its core, will give evidence about the core from which the flake was struck. This enables a greater sample pool to determine the types of cores used in the Project Area even if the original core may not have been recorded in the investigation.

## **Platform Surface**

**Description:** Platform surface will be recorded as one of the following: simple, point, cortical, crushed or flaked.

**Issues:** This is a largely unambiguous descriptive attribute.

Use: The surface of a platform provides information about the history of the core prior to the detachment of the flake, and about methods employed to control the flaking process. ‘Point’ platforms often imply the use of an intermediary punch (or in-direct percussion) to remove a flake; while ‘simple’ platforms are often indicative of free-hand percussion. Crushing on the platform surface can imply a bipolar reduction technique where the core is first rested on an anvil prior to the flake being detached. Platforms displaying flaking have been linked to the systematic production of ‘blades’. Patterns in the spatial distribution of these attributes may be used to infer differences in reduction strategies.

### **Platform Size**

Description: Platform size will be recorded as fulfilling one of a series of size ranges.

Issues: This is a largely unambiguous descriptive attribute.

Use: Like the platform surface, platform size is illustrative in determining the type of reduction technique used to detach a flake. The smaller (finer) the platform size implies a greater likelihood that it was detached by in-direct percussion rather than direct percussion which often results in a larger platform size.

### **Termination**

Description: Termination refers to the way in which force leaves a core during the detachment of a flake. Every complete flake has a termination. There are patterns in the forms that terminations will take, with the three major categories (those to be used here) being feather, hinge/step and plunging (outrepasse).

Issues: This is a largely unambiguous descriptive attribute although care needs to be taken to distinguish terminations on a previous flake scar from hinge/step terminations or breakages.

Use: Different terminations have different implications both for flake and core morphology. A flake with a feather termination (in which force exits the core at a low or gradual angle) will have a continuous sharp edge around the periphery beneath the platform. This has advantages in terms of the amount of the flake edge that can be used for cutting and makes the flake more amenable to subsequent retouching or resharpening activities. Detaching flakes with feather terminations also has minimal impact on the effective platform angle of the core, and so platform angle thresholds are reached relatively slowly while feather terminating flakes continue to be produced.

Hinge and step terminating flakes have none of these advantages. They result in edges that are amenable neither to cutting nor to retouching. Furthermore, hinge and step terminations lead to rapidly increasing effective platform angles, leading to a requirement for core rejuvenation and core exhaustion. For these reasons, such terminations are considered undesirable or *aberrant*. The number of aberrant flake terminations is expected to increase towards the end of a core’s use-life, as reduction in core size and increase in core platform angle make it increasingly difficult

to detach feather terminating flakes. In areas where aberrantly terminating flakes are relatively common it may be inferred that core potential was more thoroughly exploited. From this it may in turn be inferred that the pressure to realize core potential (e.g. a strategy of heavy raw material conservation) was greater. Increased mobility/emphasis on portability is one possible explanation of such a pattern.

Plunging or outrepasse flakes have the opposite effect on core morphology to step and hinge flakes, in that they remove the entire core face and part of the core bottom. As a result, such flakes may be used to rejuvenate cores in which core angles have become high, but which still retain useable potential (e.g. are still quite large). The presence of outrepasse flakes may be taken to indicate core rejuvenation and the requirement to increase core use-life.

#### **7.4.2 Research considerations**

Stone artefacts are probably the most resilient physical evidence of Aboriginal occupation in Australia and for many parts of the country form the most abundant archaeological evidence of Aboriginal occupation. Stone artefacts are important because they are tangible evidence of Aboriginal use of an area and can potentially contain information about lithic activities, the organisation of stone technologies, and potentially information about larger-scale issues of settlement organisation across regions and even social change over time.

The kinds of information which can be obtained from stone artefacts may vary considerably, depending in part on:

- The numbers of artefacts which can be examined and recorded: generally, the larger the number of artefacts the more reliable will be statistical statements about them
- The presence of other assemblages with which the artefacts can be compared
- The condition of sites in which they occur: generally undisturbed sites have more information potential than disturbed sites, depending on the scale at which research is carried out
- The theory which underlies the artefact recording and analysis.

##### **7.4.2.1 Statistically useful sample sizes**

A large enough number of artefacts need to be recorded so that analyses can be based on statistically sound data (Leonard and Jones 1989). The numbers of artefacts which are needed in a sample will depend on how common or rare certain kinds of artefacts are. If a summary of most common raw material types is required, then a random sample of 20 or 30 artefacts might suffice. On the other hand, if no backed artefacts were found, and this type normally makes up 1% of an assemblage, then several hundred artefacts would need to be recorded to indicate whether or not backed artefacts are present on a site or in a certain landscape setting. Ideally,

sample sizes should be large enough to be able to carry out statistical tests of significance (Clegg 1990).

#### **7.4.2.2 Condition**

As a rule, artefacts from undisturbed sites may be able to provide more information than artefacts from disturbed sites. On sites in good physical condition it may be possible to identify artefacts relating to individual lithic activities, such as knapping floors (Hiscock & Mitchell 1993). It may be possible to refit or conjoin artefacts and analyse the evidence from those activities (White 1999). On very heavily disturbed sites the artefacts themselves may be very broken, making it harder to analyse them.

#### **7.4.2.3 Theory and recording**

Stone artefacts can be recorded and analysed in different ways to give different kinds of information about different topics. The variables that are recorded and the interpretations which are made will depend in part on the theory which underlies the analysis. If someone wants to know what stone tools were used for, then artefacts should be examined under a microscope for use-wear and residues. If someone wants to know how stone was flaked and tools were made, then a technological analysis may record data on stone flaking such as patterns of scarring on cores or flakes. If someone wants to know about how stone materials were obtained (procured), transported and discarded then recording might focus on stone raw materials; information about raw material types and where they occur naturally in the landscape will be critical, and raw material type and size of artefacts may be recorded.

Consulting projects may seek to provide a basic description of an assemblage, recording just a few variables to give information about general topics. The present analysis records provenance information (where each artefact was found) and nine other variables, with some additional information for modified artefacts and cores. This level of recording should not be regarded as a definitive record of the assemblage. If artefacts are kept in a safe place they can be reanalysed in the future to provide new information and address new questions.

### **7.5 TEST EXCAVATION RESULTS**

#### **7.5.1 Preamble**

Eleven transects of TUs (0.5 x 0.5 m) were excavated over four days by OzArk Archaeologists Imogen Crome and Jordan Henshaw. OzArk Principal Archaeologist, Ben Churcher, was the Excavation Director. There were six RAPs in attendance on each day of excavation, except for the first day, on which there were three.

Across the 11 transects investigated, 59 TUs were excavated totalling an area of 14.75 square metres (m<sup>2</sup>).



## 7.5.2 Description of excavation areas

### 7.5.2.1 Stratigraphy

**Figure 7-3** provides a sample of photographs of the soil profile at all transects.

**Table 7-2** provides individual descriptions of the excavation squares from each of the excavated TUs. The general soil sequence was a layer of loamy humic topsoil (A1 Horizon) which transitioned into a brown clay loam (A2 Horizon). In some areas, the A1 Horizon was very thin or negligible, with the A2 Horizon presenting near to or at the surface. The clay loam continued in areas up to 20 cm in depth in the north of the Project Area and 30 cm in the south, before transitioning into a compact clay base (B Horizon). In other areas of excavation, this basal clay was present within 15 cm. Additionally, gravels, where present, tended to increase with depth and clay content.

**Figure 7-3** provides a sample of photographs of the soil profile at all transects.

**Table 7-2: Test Units and soil profile descriptions.**

| Transect & Square | GDA2020 Zone 56 East | GDA2020 Zone 56 North | Description                                                                                                                                                                                                                                        |
|-------------------|----------------------|-----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Transect 1 TU1    | 224137               | 6608176               | Excavated in 5 cm spits. It was deemed that the remaining TUs in the Area could be excavated in 10 cm spits.<br>Layer A: 0–15cm. Mid-dark brown clay loam.<br>Layer B: 15–20 cm. Reddish brown clay.                                               |
| Transect 1 TU2    | 224137               | 6608152               | Excavated in 10 cm spits.<br>Layer A: 0–12 cm. Dark brown loam with gravels.<br>Layer B: 12–20 cm. Reddish brown clay loam with gravels and stones.<br>Layer C: 20cm. Reddish brown clay.                                                          |
| Transect 1 TU3    | 224136               | 6608130               | Excavated in 10 cm spits.<br>Layer A: 0–4 cm. Mid brown loam with few inclusions.<br>Layer B: 4–15 cm. Mid brown, gravelly loam.<br>Layer C: 15–20 cm. Reddish brown clay.                                                                         |
| Transect 1 TU4    | 224136               | 6608107               | Excavated in 10 cm spits.<br>Layer A: 0–15 cm. Dark brown clay loam.<br>Layer B: 15–20 cm. Compact, reddish brown clay                                                                                                                             |
| Transect 1 TU5    | 224137               | 6608086               | Excavated in 10 cm spits.<br>Layer A: 0–15 cm. Dark brown clay loam.<br>Layer B: 15–20 cm. Reddish brown clay.                                                                                                                                     |
| Transect 2 TU1    | 224280               | 6608179               | Excavated in 5 cm spits. It was deemed that the remaining TUs in the Area could be excavated in 10 cm spits.<br>Layer A: 0–3cm. Dark brown, humic loam.<br>Layer B: 3–12 cm. Dark brown clay loam.<br>Layer C: 12–20 cm. Compact, dark brown clay. |
| Transect 2 TU2    | 224279               | 6608163               | Excavated in 10 cm spits.<br>Layer A: 0–8 cm. Dark brown loam.<br>Layer B: 8–18 cm. Dark brown clay loam with gravels.<br>Layer C: 18–20 cm. Dark clay.                                                                                            |
| Transect 2 TU3    | 224278               | 6608141               | Excavated in 10 cm spits.<br>Layer A: 0–12 cm. Dark brown loam.<br>Layer B: 12–22 cm. Dark brown loam with gravels.<br>Layer C: 22cm. Reddish brown clay.                                                                                          |

| Transect & Square | GDA2020 Zone 56 East | GDA2020 Zone 56 North | Description                                                                                                                                                                                                                                                     |
|-------------------|----------------------|-----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Transect 2 TU4    | 224278               | 6608121               | Excavated in 10 cm spits.<br>Layer A: 0–10 cm. Mid brown loam.<br>Layer B: 10–20 cm. Cream clay.                                                                                                                                                                |
| Transect 2 TU5    | 224279               | 6608101               | Excavated in 10 cm spits.<br>Layer A: 0–22 cm. Mid brown, gravelly clay loam.<br>Layer B: 22 cm. Cream clay.                                                                                                                                                    |
| Transect 3 TU1    | 224380               | 6608183               | Excavated in 5 cm spits. It was deemed that the remaining TUs in the Area could be excavated in 10 cm spits.<br>Layer A: 0–14cm. Mid brown clay loam.<br>Layer B: 14–20 cm. Pale brown clay.                                                                    |
| Transect 3 TU2    | 224378               | 6608165               | Excavated in 10 cm spits.<br>Layer A: 0–11 cm. Mid brown, gritty clay loam.<br>Layer B: 11–20 cm. Pale brown clay.                                                                                                                                              |
| Transect 3 TU3    | 224376               | 6608143               | Excavated in 10 cm spits.<br>Layer A: 0–10 cm. Mid brown clay loam.<br>Layer B: 10–12 cm. Light brown, gritty clay loam.<br>Layer C: 12–20 cm. Pale brown clay.                                                                                                 |
| Transect 3 TU4    | 224376               | 6608122               | Excavated in 10 cm spits.<br>Layer A: 0–10 cm. Mid brown clay loam.<br>Layer B: 10–20 cm. Pale brown clay.                                                                                                                                                      |
| Transect 3 TU5    | 224373               | 6608103               | Excavated in 10 cm spits.<br>Layer A: 0–10 cm. Mid brown clay loam.<br>Layer B: 10–20 cm. Pale brown clay.                                                                                                                                                      |
| Transect 3 TU6    | 224372               | 6608081               | Excavated in 10 cm spits.<br>Layer A: 0–10 cm. Mid brown clay loam.<br>Layer B: 10–20 cm. Pale brown clay.                                                                                                                                                      |
| Transect 4 TU1    | 224134               | 6608061               | Excavated in 5 cm spits. It was deemed that the remaining TUs in the Area could be excavated in 10 cm spits.<br>Layer A: 0–8cm. Mid brown loam with some gravels.<br>Layer B: 8–20 cm. Mid brown clay loam with gravels.<br>Layer C: 20 cm. Reddish brown clay. |
| Transect 4 TU2    | 224130               | 6608046               | Excavated in 10 cm spits.<br>Layer A: 0–13 cm. Mid brown loam with some gravels.<br>Layer B: 13–20 cm. Light brown clay loam with gravels and stones.<br>Layer C: 20 cm. Cream clay.                                                                            |
| Transect 4 TU3    | 224126               | 6608030               | Excavated in 10 cm spits.<br>Layer A: 0–10 cm. Mid brown loam with some gravels.<br>Layer B: 10–20 cm. Dark brown clay loam with gravels and stones.                                                                                                            |
| Transect 4 TU4    | 224124               | 6608010               | Excavated in 10 cm spits.<br>Layer A: 0–20 cm. Mid brown loam with few inclusions.<br>Layer B: 20 cm. Reddish brown clay.                                                                                                                                       |
| Transect 4 TU5    | 224120               | 6607993               | Excavated in 10 cm spits.<br>Layer A: 0–8 cm. Mid brown loam.<br>Layer B: 8–25 cm. Mid brown clay loam.<br>Layer C: 25 cm. Dark brown clay.                                                                                                                     |
| Transect 5 TU1    | 224313               | 6608084               | Excavated in 5 cm spits. It was deemed that the remaining TUs in the Area could be excavated in 10 cm spits.<br>Layer A: 0–12cm. Mid brown loam with gravels.<br>Layer B: 12–20 cm. Cream clay.                                                                 |

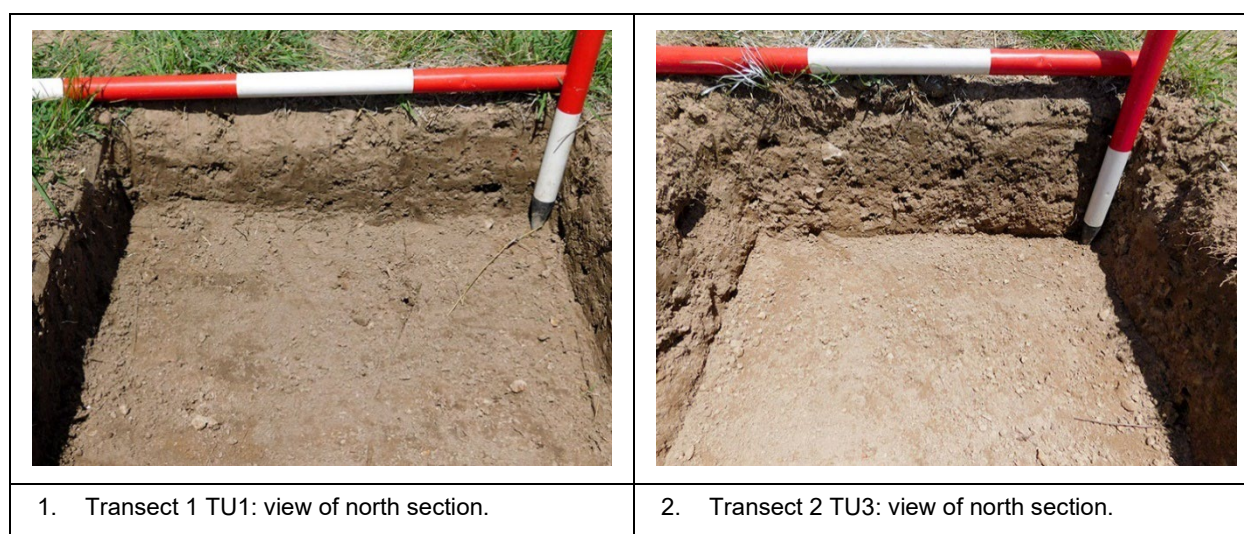
| Transect & Square | GDA2020 Zone 56 East | GDA2020 Zone 56 North | Description                                                                                                                                                                                                                                                        |
|-------------------|----------------------|-----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Transect 5 TU2    | 224312               | 6608064               | Excavated in 10 cm spits.<br>Layer A: 0–5 cm. Dark brown loam.<br>Layer B: 5–12 cm. Dark brown loam with gravels.<br>Layer C: 12–16 cm. Pale brown clay loam.<br>Layer D: 16–20 cm. Cream clay.                                                                    |
| Transect 5 TU3    | 224310               | 6608041               | Excavated in 10 cm spits.<br>Layer A: 0–11 cm. Dark brown loam with few inclusions.<br>Layer B: 11–20 cm. Mid brown loam with gravels.<br>Layer C: 20 cm. Cream clay with gravels.                                                                                 |
| Transect 5 TU4    | 224311               | 6608016               | Excavated in 10 cm spits.<br>Layer A: 0–10 cm. Mid brown loam.<br>Layer B: 10–19 cm. Mid brown loam with gravels.<br>Layer C: 19–20 cm. Pale brown clay loam with gravels.<br>Layer D: 20 cm. Cream clay.                                                          |
| Transect 5 TU5    | 224306               | 6607993               | Excavated in 10 cm spits.<br>Layer A: 0–18 cm. Dark brown loam with gravels.<br>Layer B: 18–20 cm. Mid brown loam with stones.<br>Layer C: 20 cm. Cream clay.                                                                                                      |
| Transect 6 TU1    | 224119               | 6607981               | Excavated in 5 cm spits. It was deemed that the remaining TUs in the Area could be excavated in 10 cm spits.<br>Layer A: 0–10cm. Mid brown loam.<br>Layer B: 10–14 cm. Mid brown clay loam.<br>Layer C: 14–20 cm. Pale brown clay.                                 |
| Transect 6 TU2    | 224116               | 6607971               | Excavated in 10 cm spits.<br>Layer A: 0–18 cm. Mid brown clay loam.<br>Layer B: 18–20 cm. Pale brown clay.                                                                                                                                                         |
| Transect 6 TU3    | 224114               | 6607958               | Excavated in 10 cm spits.<br>Layer A: 0–10 cm. Mid brown clay loam.<br>Layer B: 10–20 cm. Pale brown clay.                                                                                                                                                         |
| Transect 6 TU4    | 224112               | 6607946               | Excavated in 10 cm spits.<br>Layer A: 0–10 cm. Mid brown clay loam.<br>Layer B: 10–20 cm. Pale brown clay.                                                                                                                                                         |
| Transect 6 TU5    | 224110               | 6607935               | Excavated in 10 cm spits.<br>Layer A: 0–10 cm. Mid brown clay loam.<br>Layer B: 10–20 cm. Pale brown clay.                                                                                                                                                         |
| Transect 6 TU6    | 224109               | 6607924               | Excavated in 10 cm spits.<br>Layer A: 0–14 cm. Mid brown clay loam.<br>Layer B: 14–20 cm. Pale brown clay.                                                                                                                                                         |
| Transect 7 TU1    | 224288               | 6607966               | Excavated in 5 cm spits. It was deemed that the remaining TUs in the Area could be excavated in 10 cm spits.<br>Layer A: 0–13cm. Reddish brown loam.<br>Layer B: 10–14 cm. Reddish brown loam with gravels.<br>Layer C: 14–20 cm. Reddish brown clay with gravels. |
| Transect 7 TU2    | 224285               | 6607947               | Excavated in 10 cm spits.<br>Layer A: 0–10 cm. Reddish brown loam with gravels and stones.<br>Layer B: 10–20 cm. Reddish brown clay.                                                                                                                               |
| Transect 7 TU3    | 224280               | 6607927               | Excavated in 10 cm spits.<br>Layer A: 0–8 cm. Reddish brown gritty loam.<br>Layer B: 8–20 cm. Reddish brown loam with gravels.<br>Layer C: 20 cm. Reddish-cream clay.                                                                                              |

| Transect & Square | GDA2020 Zone 56 East | GDA2020 Zone 56 North | Description                                                                                                                                                                                                                                       |
|-------------------|----------------------|-----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Transect 7 TU4    | 224279               | 6607906               | Excavated in 10 cm spits.<br>Layer A: 0–8 cm. Reddish brown loam.<br>Layer B: 8–16 cm. Reddish brown loam with gravels and stones.<br>Layer C: 16–20 cm. Reddish-cream clay with gravels.                                                         |
| Transect 7 TU5    | 224280               | 6607888               | Excavated in 10 cm spits.<br>Layer A: 0–6 cm. Reddish brown loam.<br>Layer B: 6–20 cm. Reddish brown loam with gravels and stones.<br>Layer C: 20 cm. Reddish-cream clay.                                                                         |
| Transect 9 TU1    | 224135               | 6607852               | Excavated in 5 cm spits. It was deemed that the remaining TUs in the Area could be excavated in 10 cm spits.<br>Layer A: 0–11cm. Dark brown clay loam.<br>Layer B: 11–26 cm. Light brown sandy loam with gritty inclusions.                       |
| Transect 9 TU2    | 224136               | 6607833               | Excavated in 10 cm spits.<br>Layer A: 0–30 cm. Brown, gritty clay loam with stones.                                                                                                                                                               |
| Transect 9 TU3    | 224136               | 6607813               | Excavated in 10 cm spits.<br>Layer A: 0–8 cm. Brown clay loam.<br>Layer B: 8–18 cm. Light brown sandy loam with high stoney inclusions.<br>Layer C: 18–27 cm. Brown gravelly sandy loam with high stoney inclusions.                              |
| Transect 9 TU4    | 224137               | 6607794               | Excavated in 10 cm spits.<br>Layer A: 0–12 cm. Dark brown clay loam.<br>Layer B: 12–19 cm. Brown gritty clay loam.<br>Layer C: 19–30 cm. Very dark brown-black clay.                                                                              |
| Transect 9 TU5    | 224138               | 6607774               | Excavated in 10 cm spits.<br>Layer A: 0–10 cm. Dark brown clay loam.<br>Layer B: 10–21 cm. Grey-light grey sandy loam.<br>Layer C: 21–29 cm. Dark brown clay loam.                                                                                |
| Transect 9 TU6    | 224137               | 6607755               | Excavated in 10 cm spits.<br>Layer A: 0–10 cm. Dark brown clay loam.<br>Layer B: 10–20 cm. Grey-light grey sandy loam.<br>Layer C: 20–30 cm. Dark brown clay loam.                                                                                |
| Transect 10 TU1   | 224276               | 6607858               | Excavated in 5 cm spits. It was deemed that the remaining TUs in the Area could be excavated in 10 cm spits.<br>Layer A: 0–15cm. Compact, dark brown clay loam.<br>Layer B: 15–33 cm. Dark brown, gravelly clay loam with high stoney inclusions. |
| Transect 10 TU2   | 224273               | 6607836               | Excavated in 10 cm spits.<br>Layer A: 0–5 cm. Compact, dark brown silty clay.<br>Layer B: 5–15 cm. Compact, dark brown, gravelly silt with high stoney inclusions.                                                                                |
| Transect 10 TU3   | 224273               | 6607815               | Excavated in 10 cm spits.<br>Layer A: 0–13 cm. Compact dark brown clay loam.<br>Layer B: 13–20 cm. Compact yellow-brown silty clay.<br>Layer C: 20–25 cm. Brown, gravelly clay                                                                    |
| Transect 10 TU4   | 224272               | 6607797               | Excavated in 10 cm spits.<br>Layer A: 0–10 cm. Compact dark brown silty clay, humic.<br>Layer B: 10–20 cm. Light brown clay with minor gravel inclusions and reduced silt content.                                                                |
| Transect 10 TU5   | 224274               | 6607780               | Excavated in 10 cm spits.<br>Layer A: 0–23 cm. Compact dark brown silty clay.                                                                                                                                                                     |



| Transect & Square | GDA2020 Zone 56 East | GDA2020 Zone 56 North | Description                                                                                                                                                                                                                                 |
|-------------------|----------------------|-----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Transect 10 TU6   | 224272               | 6607762               | Excavated in 10 cm spits.<br>Layer A: 0–38 cm. Compact dark brown clay.                                                                                                                                                                     |
| Transect 12 TU1   | 224138               | 6607748               | Excavated in 5 cm spits. It was deemed that the remaining TUs in the Area could be excavated in 10 cm spits.<br>Layer A: 0–17 cm. Dark brown gritty clay loam.<br>Layer B: 17–20 cm. Dark brown clay loam with common inclusions            |
| Transect 12 TU2   | 224138               | 6607725               | Excavated in 10 cm spits.<br>Layer A: 0–20 cm. Dark brown clay loam.                                                                                                                                                                        |
| Transect 12 TU3   | 224137               | 6607704               | Excavated in 10 cm spits.<br>Layer A: 0–20 cm. Dark brown clay loam with few inclusions.                                                                                                                                                    |
| Transect 12 TU4   | 224137               | 6607685               | Excavated in 10 cm spits.<br>Layer A: 0–30 cm. Dark brown clay loam with few inclusions.                                                                                                                                                    |
| Transect 12 TU5   | 224137               | 6607665               | Excavated in 10 cm spits.<br>Layer A: 0–14 cm. Dark brown clay loam.<br>Layer B: 14–20 cm. Brown gritty clay loam.<br>Layer C: 20–30 cm. Dark brown clay loam.                                                                              |
| Transect 13 TU1   | 224294               | 6607754               | Excavated in 5 cm spits. It was deemed that the remaining TUs in the Area could be excavated in 10 cm spits.<br>Layer A: 0–20 cm. Dark brown clay loam.<br>Layer B: 20–30 cm. Light brown gravelly, sandy loam with high stoney inclusions. |
| Transect 13 TU2   | 224291               | 6607733               | Excavated in 10 cm spits.<br>Layer A: 0–20 cm. Dark brown clay loam with few inclusions.                                                                                                                                                    |
| Transect 13 TU3   | 224288               | 6607714               | Excavated in 10 cm spits.<br>Layer A: 0–22 cm. Brown clay loam with few inclusions.<br>Layer B: 22–30 cm. Brown clay loam with common inclusions.                                                                                           |
| Transect 13 TU4   | 224286               | 6607692               | Excavated in 10 cm spits.<br>Layer A: 0–18 cm. Dark brown clay loam.<br>Layer B: 18–20 cm. Dark brown clay.                                                                                                                                 |
| Transect 13 TU5   | 224288               | 6607675               | Excavated in 10 cm spits.<br>Layer A: 0–15 cm. Brown clay loam.<br>Layer B: 18–20 cm. Dark brown clay.                                                                                                                                      |

Figure 7-3: Example images of TU stratigraphy.





|                                                                                     |                                                                                      |
|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|
|    |    |
| 1. Transect 3 TU3: view of north section.                                           | 2. Transect 4 TU5: view of north section.                                            |
|   |   |
| 3. Transect 5 TU3: view of north section                                            | 4. Transect 6 TU: view of north section                                              |
|  |  |
| 5. Transect 7 TU5: view of north section                                            | 6. Transect 9 TU1: view of north section                                             |



|                                                                                    |                                                                                    |
|------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|
|   |  |
| 7. Transect 10 TU4: view of north section                                          | 8. Transect 12 TU5: view of north section                                          |
|  | 9. Transect 13 TU4: view of north section                                          |

### 7.5.2.2 *Artefact distribution*

Twenty-one artefacts were recorded during the test excavation program. The full artefact catalogue is presented in **Table 7-3**. For consistency, analysis was conducted with the 10 cm spit size as standard.

The horizontal distribution of artefacts, which refers to the location of an artefact's recorded position across the transects and landscape, is heavily weighted to the south of the Project Area with Transects 9 and 13 yielding the highest number of artefacts. In contrast, only two artefacts were recovered from the northern-most transects.

The vertical distribution of artefacts is the relative depth of an artefact's position recorded in 10 cm increments called 'spits'. The highest proportion of artefacts (61%, n=13) were recorded in spit 2 (10–20 cm below ground surface). The remaining artefacts (39%, n=8) were recorded in spit 1. No artefacts were recorded below 20 cm. This suggests that the artefacts are concentrated near what today we regard as the 'surface'; although the pre-1788 A Horizon has been lost along with the exact relationship between artefacts and their original depositional depth.

### **7.5.2.3     *Artefact types***

The most frequent artefact type recorded from the excavation were unmodified flakes (81%, n=17). The remaining artefacts were comprised of angular shatter (or debitage [the byproduct of the knapping process], 15%, n=3), and a single blade (an artefact that is more than twice as long as it is wide).

In general the artefact types recorded in the excavation were small and fragmentary. No larger artefacts and no artefacts with retouch were recorded. In addition, no tool types such as cores and scrapers were recorded indicating that the artefacts within the assemblage are better described as 'debitage', or 'shatter', rather than a formal tool type.

### **7.5.2.4     *Raw materials***

The two dominant raw materials present in the artefact assemblage are mudstone (43%, n=9) and silcrete (28.5%, n=6). Three flakes were manufactured from volcanic material, and another from petrified wood. Additionally, one flake and one piece of shatter were manufactured from quartz.

### **7.5.2.5     *Artefact size***

The assemblage is wholly comprised of artefacts in the Size 1 (n=4), Size 2 (n=10) and Size 3 (n=7) categories. Therefore, the artefacts within the assemblage range 0.5–50mm in size with most in the 10–20 mm category. This indicates that the assemblage is relatively small in size.

### **7.5.2.6     *Reduction stage***

Of the 21 artefacts, 17 (81%) are at the tertiary stage of reduction. Following this, three artefacts (14%) are at a secondary stage of reduction, and one (5%) is at the primary stage of reduction. The high proportion of artefacts at a tertiary stage of reduction indicates that artefacts were produced elsewhere and brought into the Project Area, or that artefacts were produced locally from cores reduced elsewhere.

### **7.5.2.7     *Integrity***

Thirteen artefacts (62%) are complete, while the various types of broken flakes make up 38% (n=8) of the assemblage.

### **7.5.2.8     *Rotation***

Nine artefacts from the assemblage (43%) displayed parallel previous flake scars indicating they were removed from unidirectional or bidirectional cores. Six artefacts (28.5%) displayed rotated previous flake scars indicating they were removed from multidirectional cores. One artefact did not display any previous flake scars, and the rotation of five artefacts could not be discerned.



### 7.5.2.9 Platform type

One artefact displayed a simple platform, one displayed a cortical flake scar, and another a single flake scar platform. The platform types of ten artefacts could not be discerned. Eight artefacts did not have a platform preserved.

### 7.5.2.10 Platform size

Platform sizes in the assemblage include: Size 1 (less than 2 mm, n=5); Size 2 (2–5 mm, n=6); Size 3 (5–10 mm, n=1); and Size 4 (10–20 mm, n=1). Eight artefacts did not have a platform preserved.

### 7.5.2.11 Termination

Seventeen artefacts in the assemblage (81%) have feather terminations. Of the remaining artefacts, one does not preserve the distal end, and three are shatter which are not analysed for termination.

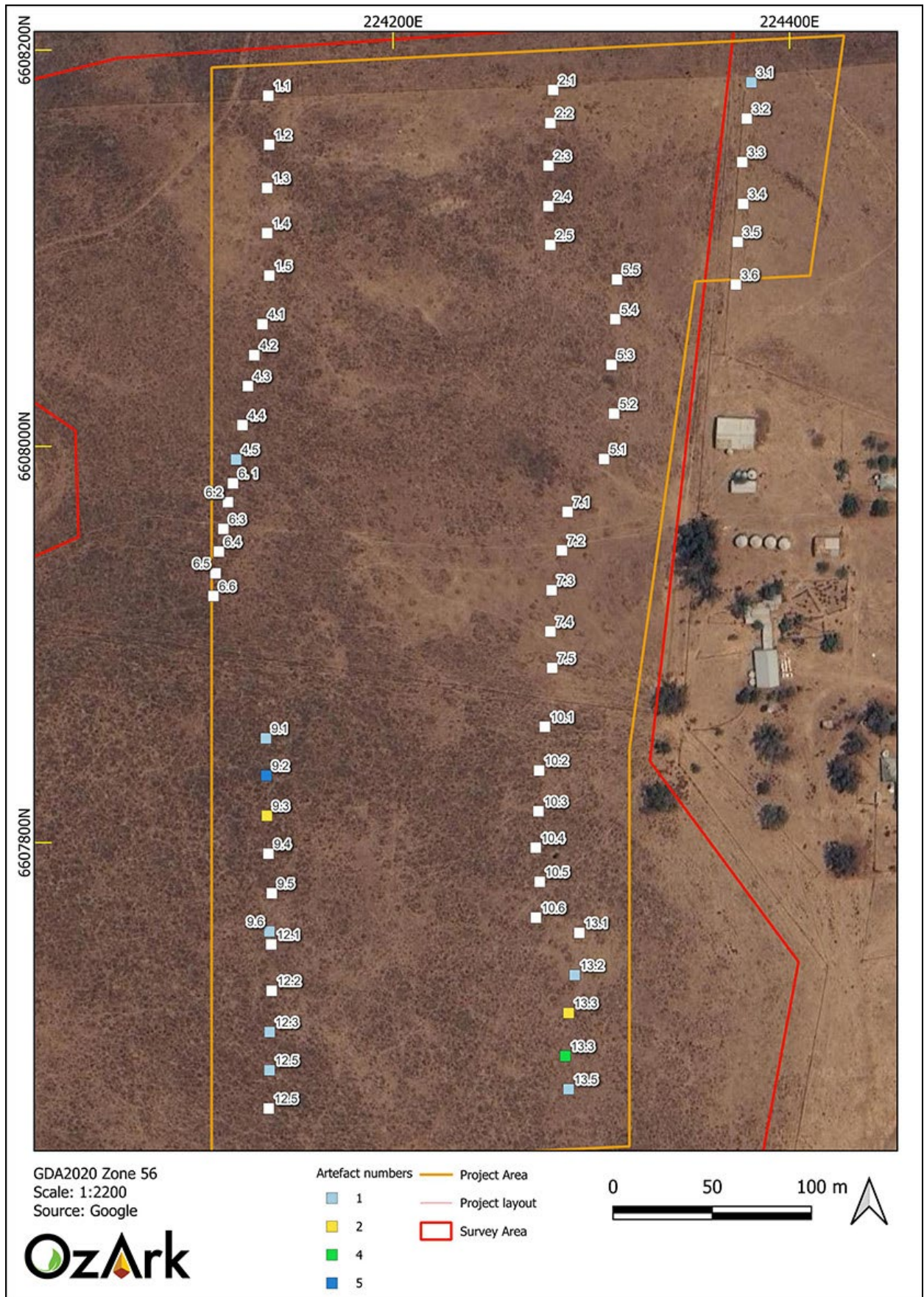
### 7.5.2.12 Artefact assemblage catalogue

**Table 7-3** presents the artefact catalogue, organised by Transect, TU, and Spit.

**Figure 7-4** shows the spatial distribution of artefacts across the Project Area. This shows that the greatest concentration of artefacts is in the southern-most area, which is on a slight downward slope from the northern section. On **Figure 7-4**, the TU designation reads, for example, 5.3. This equates to Transect 5 TU3.

**Figure 7-5** provides sample images of the assemblage.

Figure 7-4: Aerial showing the spatial distribution of recorded artefacts.



**Table 7-3: Artefact Catalogue**

| Transect | Square | Spit | Artefact type | Raw material | Integrity | Size class | Reduction | Rotation | Platform type | Platform size | Termination type |
|----------|--------|------|---------------|--------------|-----------|------------|-----------|----------|---------------|---------------|------------------|
| 3        | 1      | 2    | F             | PW           | P         | 2          | T         | P        | N/A           | 1             | N/A              |
| 4        | 5      | 1    | F             | S            | C         | 1          | P         | N/A      | N/A           | 1             | F                |
| 9        | 1      | 2    | F             | S            | C         | 3          | T         | R        | N/A           | 2             | F                |
| 9        | 2      | 1    | EF            | M            | C         | 3          | T         | P        | S             | 2             | F                |
| 9        | 2      | 1    | F             | M            | D         | 2          | T         | P        | N/A           | N/A           | F                |
| 9        | 2      | 1    | F             | S            | D         | 2          | T         | P        | N/A           | N/A           | F                |
| 9        | 2      | 1    | F             | Q            | D         | 1          | T         | R        | N/A           | N/A           | F                |
| 9        | 2      | 1    | S             | Q            | C         | 2          | S         | N/A      | N/A           | N/A           | N/A              |
| 9        | 3      | 2    | F             | V            | C         | 3          | T         | R        | N/A           | 3             | F                |
| 9        | 3      | 2    | S             | M            | C         | 2          | T         | N/A      | N/A           | N/A           | N/A              |
| 9        | 6      | 1    | F             | M            | C         | 1          | T         | N/A      | N/A           | 2             | F                |
| 12       | 3      | 2    | F             | M            | D         | 1          | T         | N        | N/A           | N/A           | F                |
| 12       | 4      | 2    | F             | V            | C         | 3          | T         | P        | N/A           | 2             | F                |
| 13       | 2      | 2    | F             | M            | C         | 3          | S         | R        | SFS           | 4             | F                |
| 13       | 3      | 1    | F             | M            | L         | 2          | T         | P        | N/A           | 1             | F                |
| 13       | 3      | 2    | F             | M            | L         | 2          | T         | P        | N/A           | 1             | F                |
| 13       | 4      | 2    | F             | S            | C         | 2          | T         | R        | N/A           | 1             | F                |
| 13       | 4      | 2    | S             | S            | C         | 3          | S         | N/A      | N/A           | N/A           | N/A              |
| 13       | 4      | 2    | F             | M            | D         | 1          | T         | P        | N/A           | N/A           | F                |
| 13       | 4      | 2    | F             | S            | C         | 2          | T         | P        | N/A           | 2             | F                |
| 13       | 5      | 2    | F             | V            | C         | 2          | T         | R        | C             | 2             | F                |



**Figure 7-5: Sample images of artefact assemblage.**

1. From left to right: Two silcrete flakes, silcrete shatter, and distal mudstone flake fragment, Transect 13 TU4 Spit 2.



2. Mudstone blade, Transect 9 TU2 Spit 1



3. Distal mudstone flake fragment, Transect 9 TU2 Spit 1.



4. Volcanic flake (left) and mudstone shatter (right), Transect 9 TU3 Spit 2.



5. Mudstone flake, Transect 13 TU2 Spit 2.



|                                                                                    |                                                                                     |
|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
|   |   |
| 6. Mudstone flake, Transect 9 TU6 Spit 1.                                          | 7. Volcanic flake, Transect 13 TU5 Spit 2.                                          |
|  |  |
| 8. Silcrete flake, Transect 4 TU 5 Spit 1                                          | 9. Petrified wood proximal flake fragment, Transect 3 TU1 Spit 2.                   |

## 7.6 DISCUSSION OF THE TEST EXCAVATION PROGRAM

### 7.6.1 Test excavation summary

Twenty-one artefacts were recorded in the assemblage which is a relatively low density considering 14.75 m<sup>2</sup> were excavated. This gives an average artefact density of 1.5 artefacts per linear square metre. The greatest number of artefacts found in any one TU were five artefacts located in Transect 9 TU2 (**Figure 7-4**).

The recorded artefacts within the assemblage are largely concentrated in the southern section of the Project Area, excluding two artefacts recorded in Transects 3 and 4 to the north. The TUs with the highest concentration of artefacts are located approximately 200 m from the nearest ephemeral waterway.

The higher frequency of artefacts in the south of the Project Area demonstrates that the deeper A Horizon found in this area is more conducive to the retention of artefacts. In contrast, the northern portion saw a higher clay content within the A Horizon and with the B Horizon occurring nearer to the surface. This indicates a loss of the former A Horizon soils and, potentially, any artefacts contained within it.

The artefact assemblage predominately consists of unmodified flakes made from mudstone and silcrete raw materials, with lower quantities of quartz, volcanics, and petrified wood also present. Although quartz artefacts are often recorded in higher frequencies in the area surrounding the Project Area, this is still largely consistent with studies in the region.

The range of artefacts indicates that the assemblage is the product of the general accumulation of artefacts that occurs in most landforms in the region where water and fertile soil was readily available. The artefacts at the Project Area are not originating from a foci, such as a campsite, but are rather representative of lost or discarded artefacts that are present after millennia of occupation. Additionally, given the small size of the artefacts, the artefacts may have been also moved to (and out of) the area by water wash.

### **7.6.2 Research considerations**

**Section 7.4.2** provides some research considerations that need to be applied to any excavation.

#### **7.6.2.1 Sample size**

The artefact assemblage recovered during this excavation program is a relatively small sample size of 21 artefacts. This equates to approximately 1.5 artefacts per linear square metre from the 14.75 m<sup>2</sup> excavated. This is a low artefact density and the data has a limited ability to inform on Aboriginal occupation and activity within the Project Area.

#### **7.6.2.2 Condition**

The excavated soil profiles within the Project Area indicate that the former A Horizon soils have been stripped by erosion since British settlement. The loss of the A Horizon will have significantly skewed the assemblage data as this layer is archaeologically significant, preserving not only depositional stratigraphy, which may be dateable, but also the location of the artefacts themselves.

#### **7.6.2.3 Theory and recording**

As indicated in **Section 7.4.2.3**, the nature of test excavation means that, in most cases, only limited theories can be tested and that a basic level of artefact recording is justifiable. Given the low artefact density recorded, this observation is supported and the level of recording undertaken for this report is assessed as adequate.

## **7.7 SITES RECORDED DURING THE TEST EXCAVATION PROGRAM**

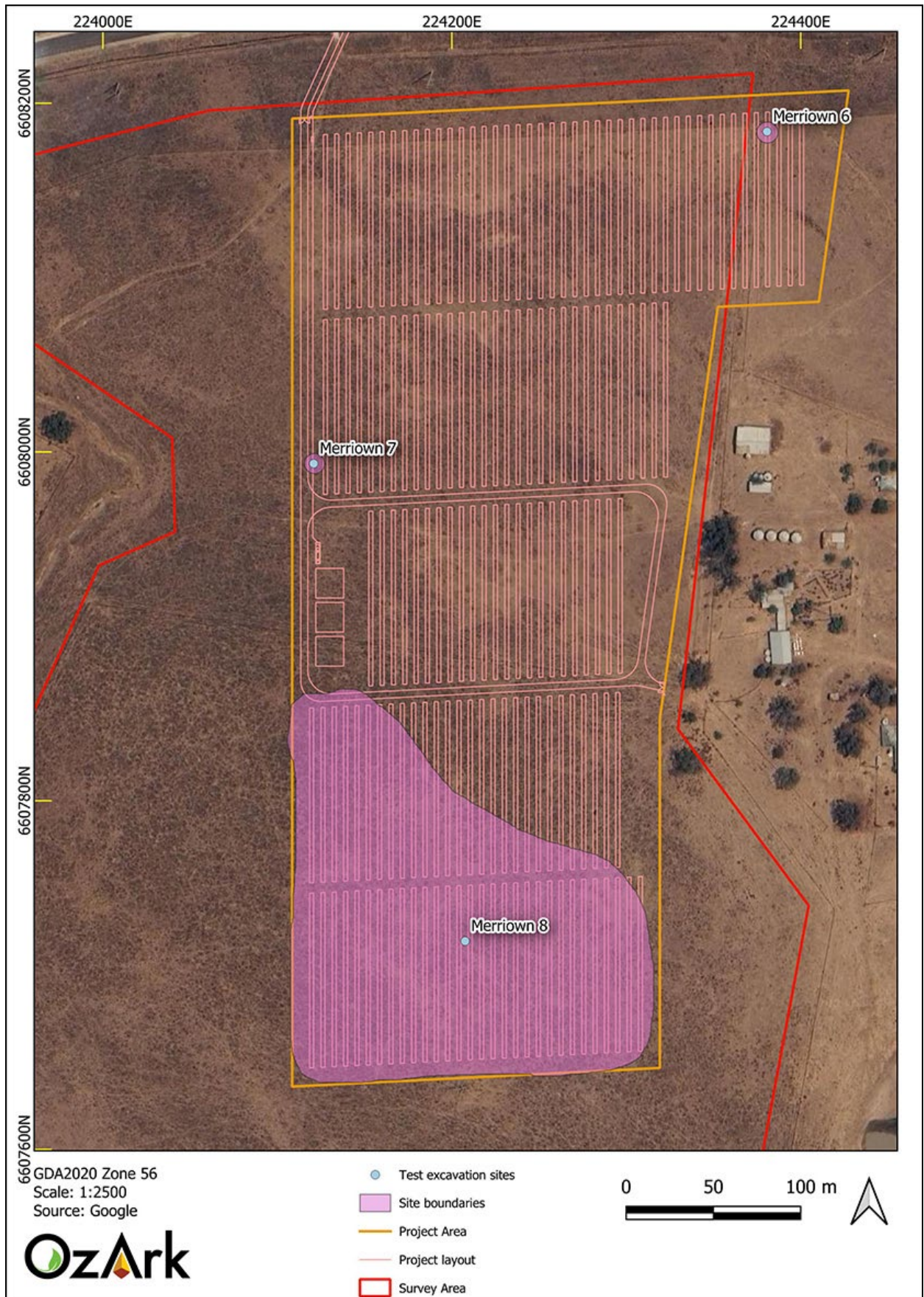
As the test excavation program recorded subsurface artefacts at several locations, an additional three sites will be recorded with the AHIMS registry. Once recorded, an Aboriginal Site Impact Recording Form will be submitted to list the sites as partially destroyed because of the test excavation activity.

The three sites recorded because of the test excavation program are (**Figure 7-6**):

- **20-4-1121 (Merriown 6)**: a 10 m buffer around Transect 3 TU1 where one artefact was recorded. This site has low potential for further subsurface artefacts and no further archaeological investigation is warranted.
- **20-4-1122 (Merriown 7)**: a 10 m around Transect 4 TU5 where one artefact was recorded. This site has low potential for further subsurface artefacts and no further archaeological investigation is warranted.
- **20-4-1123 (Merriown 8)**: a buffer enclosing the area around Transects 9, 12, and 13 where 19 artefacts were recorded. While there is the possibility of further artefacts in this landform, the low density of artefacts does not warrant further archaeological investigation.



Figure 7-6: Sites recorded during the test excavation program.





## 8 SIGNIFICANCE ASSESSMENT

### 8.1 INTRODUCTION TO SIGNIFICANCE ASSESSMENT

#### 8.1.1 Identifying cultural significance

The concept of cultural significance is used in Australian heritage practice and legislation to encompass all the cultural values and meanings that might be recognised in a place. The *Burra Charter*'s definition of cultural significance is broad and encompasses places that are significant to Indigenous cultures (Burra Charter 2013).

The *Burra Charter* definition of 'place' is also broad and encompasses Indigenous places of cultural significance. 'Place' includes locations that embody spiritual value (such as Dreaming places, sacred landscapes, and stone arrangements), social and historical value (such as massacre sites), as well as scientific value (such as archaeological sites). In fact, one place may be all these things or may embody all these values at the same time.

In some cases, the find-spot of a single artefact may constitute a 'place'. Equally, a suite of related locations may together comprise a single 'place', such as the many individual elements that make up a Songline. These more complex places are sometimes called a cultural landscape or cultural route.

The Guide (OEH 2011: 8–9) notes that cultural significance is comprised of an assessment of social values, scientific values, aesthetic values, and historic values. These values are described below.

##### 8.1.1.1 Social or cultural value

Social or cultural value refers to the spiritual, traditional, historical, or contemporary associations and attachments the place or area has for Aboriginal people. Social or cultural value is how people express their connection with a place and the meaning that place has for them.

Places of social or cultural value have associations with contemporary community identity. These places can have associations with tragic or warmly remembered experiences, periods, or events. Communities can experience a sense of loss should a place of social or cultural value be damaged or destroyed.

There is not always consensus about a place's social or cultural value. Because people experience places and events differently, expressions of social or cultural value do vary and, in some instances, will be in direct conflict. When identifying values, it is not necessary to agree with or acknowledge the validity of each other's values, but it is necessary to document the range of values identified.

Social or cultural value can only be identified through consultation with Aboriginal people. This could involve a range of methodologies, such as cultural mapping, oral histories, archival

documentation, and specific information provided by Aboriginal people specifically for the investigation.

Cultural value involves both traditional links with specific areas, as well as an overall concern by Aboriginal people for their sites generally and the continued protection of these. This type of value may not be in accord with interpretations made by the archaeologist: a site may have low archaeological value but high social value, or vice versa.

#### **8.1.1.2     *Scientific (archaeological) value***

This refers to the importance of a landscape, area, place or object because of its rarity, representativeness, and the extent to which it may contribute to further understanding and information (Burra Charter 2013).

Assessing a site in this context involves placing it into a broader regional framework, as well as assessing the site's individual merits in view of current archaeological discourse. This type of value relates to the ability of a site to answer current research questions and is also based on a site's condition (integrity), content and representativeness.

The overriding aim of cultural heritage management is to preserve a representative sample of the archaeological resource. This will ensure that future research within the discipline can be based on a valid sample of the past. Establishing whether a site can contribute to current research also involves defining 'research potential'. Questions regularly asked when determining significance are: can this site contribute information that no other site can? Is this site representative of other sites in the region?

Information about scientific values will be gathered through any archaeological investigation undertaken. Archaeological investigations must be carried out according to Heritage NSW's Code of Practice (DECCW 2010).

Often scientific values are informed by social values that allow a contemporary understanding of the archaeological data to be understood.

#### **8.1.1.3     *Aesthetic value***

This refers to the sensory, scenic, architectural, and creative aspects of the place. It is often closely linked with the social values. It may consider form, scale, colour, texture and material of the fabric or landscape, and the smell and sounds associated with the place and its use (Burra Charter 2013).

#### **8.1.1.4     *Historic value***

Historic value refers to the associations of a place with a historically important person, event, phase, or activity in an Aboriginal community. Historic places do not always have physical

evidence of their historical importance (such as structures, planted vegetation or landscape modifications). They may have 'shared' historic values with other (non-Aboriginal) communities.

Places of post-contact Aboriginal history have generally been poorly recognised in investigations of Aboriginal heritage. Consequently, the Aboriginal involvement and contribution to important regional historical themes is often missing from accepted historical narratives. This means it is often necessary to collect oral histories along with archival or documentary research to gain enough understanding of historic values.

## 8.2 ASSESSED SIGNIFICANCE OF THE RECORDED SITES

**Table 8-1** presents a summary of the significance assessment of Aboriginal cultural heritage sites recorded during this assessment. Further details of each of the assessment criteria are provided below.

### Social or Cultural Value

The social and cultural value of Aboriginal sites is generally determined through consultation with Aboriginal people. Generally, the Aboriginal community regard all sites as having high cultural significance. This is due to all sites, even displaced artefact sites, being able to provide a connection to their ancestors, as well as being a tangible reminder of the past Aboriginal occupation of the area.

A copy of the draft ACHAR was distributed to all RAPs for review on 2 February 2024 with a 28-day review period closing 1 March 2024. No further details regarding the RAP's cultural values of the Project Area or the recorded sites were obtained from the Stage 4 ACHAR review.

As such, all recorded sites have been assessed as having high cultural values as this opinion is often expressed by the Aboriginal community who hold that all tangible traces of their culture have a high social value.

### Archaeological/Scientific Value

The archaeological/scientific significance of the Merriown sites is assessed as low. They are assessed as low/moderate based on the following values:

- Sites tend to represent displaced artefacts in secondary contexts
- Low density of artefacts
- Common artefact types and materials in the region.

Further, these sites have low scientific values because they have little or no research potential and a very limited ability to inform researchers about the nature and extent of Aboriginal occupation in the area.

### Aesthetic Value

The Merriown sites have been assessed as having low aesthetic value. The sites do not have significant aesthetic value as the integrity of the sensory landscape has been altered in historic and modern times. Additionally, the artefacts themselves are not remarkable and are located within secondary contexts.

### Historic Value

The Merriown sites do not have any association with important persons, places, or events. Therefore, the sites have no historic value.

**Table 8-1: Aboriginal cultural heritage: significance assessment.**

| AHIMS ID  | Site Name  | Social or Cultural Value | Archaeological / Scientific Value | Aesthetic Value | Historic Value |
|-----------|------------|--------------------------|-----------------------------------|-----------------|----------------|
| 20-4-1120 | Merriown 1 | High                     | Low                               | Low             | Low            |
| 20-4-1119 | Merriown 2 | High                     | Low                               | Low             | Low            |
| 20-4-1117 | Merriown 3 | High                     | Low                               | Low             | Low            |
| 20-4-1116 | Merriown 4 | High                     | Low                               | Low             | Low            |
| 20-4-1118 | Merriown 5 | High                     | Low                               | Low             | Low            |
| 20-4-1121 | Merriown 6 | High                     | Low                               | Low             | Low            |
| 20-4-1122 | Merriown 7 | High                     | Low                               | Low             | Low            |
| 20-4-1123 | Merriown 8 | High                     | Low                               | Low             | Low            |

#### **8.2.1 Statement of significance**

The intangible Aboriginal cultural values across the wider district relate to a number of important places and themes associated with non-archaeological cultural values. These places mainly relate to spiritual and ceremonial connections across the broader landscape that may encompass areas of culturally significant geographical features.

There may be places with intangible cultural significance within the Project Area, although no specific locations have so far been identified by the Aboriginal community.

The scientific value of the recorded sites within the Project Area (Merriown 1 to Merriown 8) are considered to have low potential to provide further information on the traditional Aboriginal use of the Boggabri region. The Project Area as a whole also has a very low scientific value as it is confined to areas away from optimal occupation locations such as along reliable water sources or landforms which provide shelter.

Apart from the general understanding of the aesthetic qualities of the Project Area, there are no known places with identified aesthetic values.



## 9 ASSESSING HARM

### 9.1 AVOIDING AND MINIMISING HARM

#### 9.1.1 Conserving significant Aboriginal cultural heritage

An object of the NPW Act is the '*conservation of objects places and features... of cultural value within the landscape, including... places, objects and features of significance to Aboriginal people*' (s.2A(1(b)(i)).

As heritage professionals, OzArk, strives for good conservation outcomes. In particular, OzArk is primarily concerned with the conservation and protection of Aboriginal cultural heritage that is of significance to Aboriginal people.

Two primary objectives when managing harm to an Aboriginal object are:

- Impacts to significant Aboriginal objects and places should always be avoided wherever possible
- Where impacts to Aboriginal objects and places cannot be avoided, proposals should be amended to reduce the extent and severity of impacts to significant Aboriginal objects and places using reasonable and feasible measures.

#### 9.1.2 Opportunities to conserve Aboriginal cultural heritage values

As a result of the current assessment, eight previously unrecorded Aboriginal sites have been recorded. Of these, Merriown 3, Merriown 4, and Merriown 5 are located on the eastern boundary of the Project Area and the proponent has redesigned the Project Area to ensure that these three sites are not harmed by the Project.

### 9.2 LIKELY IMPACTS TO ABORIGINAL HERITAGE FROM THE PROJECT

**Table 9-1** presents a summary of potential harm to Aboriginal cultural heritage associated with the Project. The sites that may be harmed by the Project are shown on **Figure 9-1**.

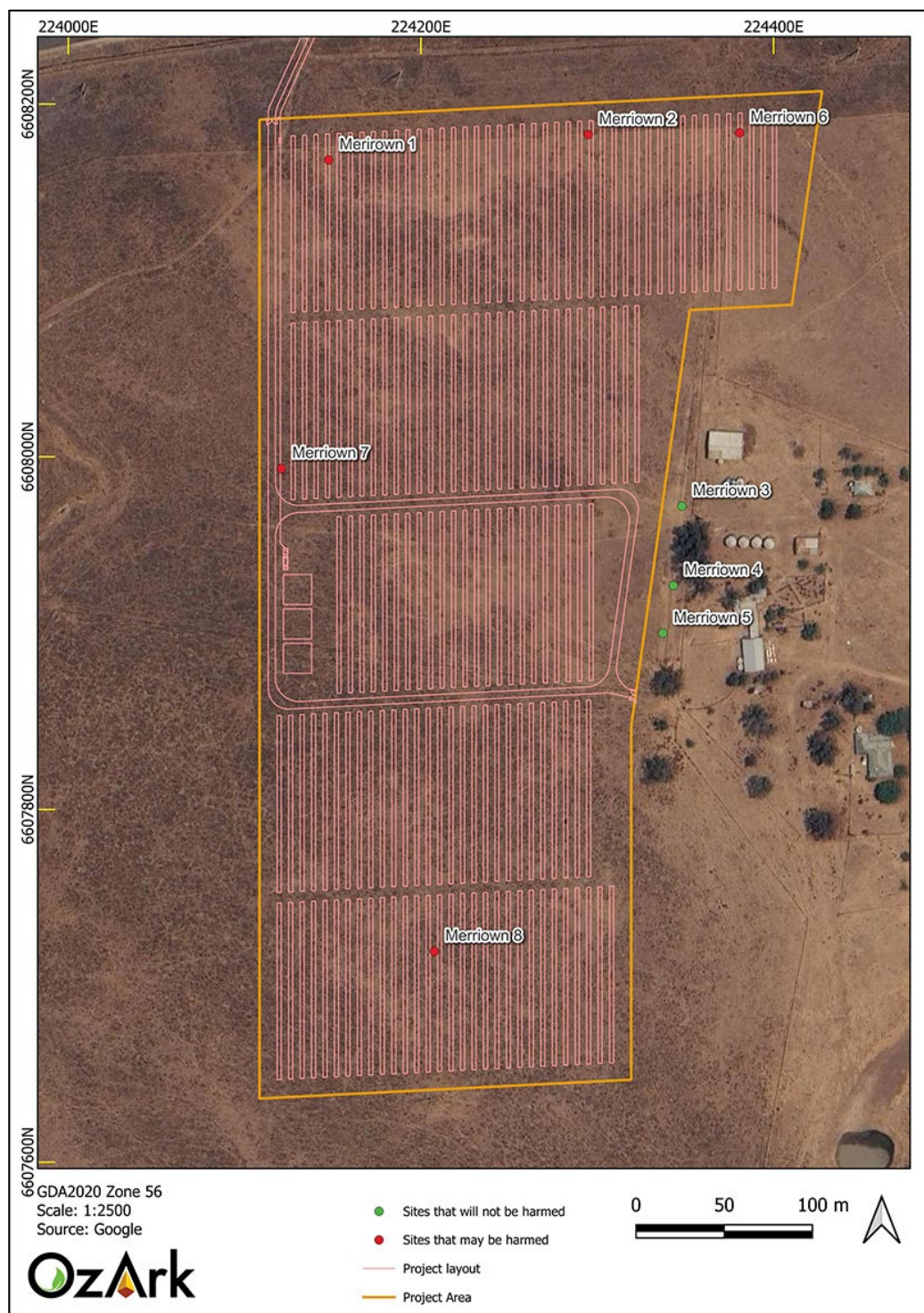
Two surface sites, 20-4-1120 (Merriown 1) and 20-4-1119 (Merriown 2), an isolated find and a low-density artefact scatter respectively, are situated on the northern boundary and these will be harmed by the Project. The three sites located through test excavation, 20-4-1121 (Merriown 6), 20-4-1122 (Merriown 7), and 20-4-1123 (Merriown 8), will be impacted by the Project. These sites display a low artefact density, a low conservation value, and have been partially harmed by the test excavation.

**Table 9-1: Aboriginal cultural heritage: impact assessment.**

| AHIMS ID  | Site Name  | Type of Harm<br>(Direct/Indirect / None) | Degree of Harm<br>(Total/Partial / None) | Consequence of Harm<br>(Total/Partial/No Loss of Value) |
|-----------|------------|------------------------------------------|------------------------------------------|---------------------------------------------------------|
| 20-4-1120 | Merriown 1 | Direct                                   | Total                                    | Loss of Value                                           |
| 20-4-1119 | Merriown 2 | Direct                                   | Total                                    | Loss of Value                                           |

| AHIMS ID  | Site Name  | Type of Harm<br>(Direct/Indirect / None) | Degree of Harm<br>(Total/Partial / None) | Consequence of Harm<br>(Total/Partial/No Loss of Value) |
|-----------|------------|------------------------------------------|------------------------------------------|---------------------------------------------------------|
| 20-4-1117 | Merriown 3 | None                                     | None                                     | No loss of Value                                        |
| 20-4-1116 | Merriown 4 | None                                     | None                                     | No loss of Value                                        |
| 20-4-1118 | Merriown 5 | None                                     | None                                     | No loss of Value                                        |
| 20-4-1121 | Merriown 6 | Direct                                   | Total                                    | Loss of Value                                           |
| 20-4-1122 | Merriown 7 | Direct                                   | Total                                    | Loss of Value                                           |
| 20-4-1123 | Merriown 8 | Direct                                   | Total                                    | Loss of Value                                           |

**Figure 9-1: Location of sites in relation to proposed impacts.**



### 9.3 ECOLOGICALLY SUSTAINABLE DEVELOPMENT PRINCIPLES

Ecologically sustainable development principles (ESD) (defined in s.6 of the *Protection of the Environment Administration Act 1991*) requires the integration of economic and environmental considerations (including cultural heritage) in the decision-making process. Regarding Aboriginal cultural heritage, ESD can be achieved by applying the principle of intergenerational equity and the precautionary principle.

#### 9.3.1 Intergenerational equity

Intergenerational equity is the principle whereby the present generation should ensure the health, diversity, and productivity of the environment for the benefit of future generations.

In terms of Aboriginal heritage, intergenerational equity can be considered in terms of the cumulative impacts to Aboriginal objects and places in a region. If few Aboriginal objects and places remain in a region (for example, because of impacts under previous permits), fewer opportunities remain for future generations of Aboriginal people to enjoy the cultural benefits of those Aboriginal objects and places.

Information about the integrity, rarity or representativeness of the Aboriginal objects and places proposed to be impacted, and how they illustrate the occupation and use of land by Aboriginal people across the region, will be relevant to the consideration of intergenerational equity and the understanding of the cumulative impacts of the Project.

Where there is uncertainty, the precautionary principle should also be followed.

#### 9.3.2 The precautionary principle

The precautionary principle states that if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing cost-effective measures to prevent environmental degradation.

In relation to Aboriginal cultural heritage values, the precautionary principle should be applied if:

- The proposal involves a risk of serious or irreversible damage to Aboriginal objects or places or to the value of those objects or places
- There is uncertainty about the Aboriginal cultural heritage values or scientific or archaeological values, including in relation to the integrity, rarity or representativeness of the Aboriginal objects or places proposed to be impacted.

#### 9.3.3 Principle of Integration

The Plan of Implementation of the World Summit on Sustainable Development held in Johannesburg, 2002, noted the need to “*promote the integration of the three components of sustainable development- economic development, social development and environmental protection- as interdependent and mutually reinforcing pillars*”.

The principle of integration ensures mutual respect and reciprocity between economic and environmental considerations:

- Environmental considerations are to be integrated into economic and other development plans, programs, and projects
- Development needs are to be considered in applying environmental objectives.

#### 9.3.4 Applicability to the Project

There is a very low impact to Aboriginal cultural heritage values as a small number of Aboriginal sites will be harmed, and no intangible heritage values have been identified within the Project Area. The results of the surface survey and test excavation indicate that significant Aboriginal cultural heritage values will not be harmed within the Project Area.

**Table 9-2** examines the application of ESD principles to the Project.

**Table 9-2: Application of ESD principles to the Project.**

| ESD principle                          | Response                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|----------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Avoiding and minimising harm           | <b>Section 10</b> sets out mechanisms by which to avoid and minimise harm.                                                                                                                                                                                                                                                                                                                                                                                                         |
| The integration principle              | The Project presents a strong case for the broader environmental benefits arising from environmentally responsible development. The environmental consequences of the Project have been carefully assessed.                                                                                                                                                                                                                                                                        |
| The precautionary principle            | The Aboriginal cultural heritage investigation has followed the precautionary principle though undertaking a robust Aboriginal cultural heritage assessment to ensure that harm to Aboriginal objects and values is minimised. The survey adopted a precautionary principle when it came to describing and assessing landforms within the Survey area and the test excavation program was undertaken to provide certainty that significant subsurface deposits will not be harmed. |
| The intergenerational equity principle | It is assessed that the Project will not harm significant Aboriginal cultural heritage values and that there will be a manageable diminution of intergenerational equity should the sites recorded here be harmed.                                                                                                                                                                                                                                                                 |



## 10 MANAGEMENT OF ABORIGINAL CULTURAL HERITAGE SITES

### 10.1 GENERAL MANAGEMENT PRINCIPLES

Appropriate management of cultural heritage items is primarily determined based on their assessed significance as well as the likely impacts of the Project. **Section 8.2** and **Section 9.2** describe, respectively, the significance / potential of the recorded sites and the likely impacts of the Project. The following management options are general principles, in terms of best practice and desired outcomes, rather than mitigation measures against individual site disturbance.

- Avoid impact by altering the Project to avoid impact to a recorded Aboriginal site. If this can be done, then a suitable curtilage around the site must be provided to ensure its protection both during the short-term construction phase of development and in the long-term use of the area. If plans are altered, care must be taken to ensure that impacts do not occur to areas not previously assessed.
- If impact is unavoidable then approval to disturb sites under the authority of an AHIP must be sought from Heritage NSW. Whether the AHIP is consented will depend on many factors including the site's assessed significance. This ACHAR will be required to accompany the AHIP application and normally the management recommendations contained in the ACHAR become conditions of the AHIP. As the Aboriginal community have been provided the opportunity to view the draft ACHAR, the ACHAR must make it clear that an AHIP application will be sought so that the Aboriginal community can assess the management recommendations with this knowledge. The AHIP conditions will often stipulate that the Aboriginal community should be involved in any salvage activities and will dictate what the fate of any salvaged Aboriginal objects will be.

### 10.2 MANAGEMENT AND MITIGATION OF RECORDED ABORIGINAL SITES

To ensure 20-4-1117 (Merriown 3), 20-4-1116 (Merriown 4), and 20-4-1118 (Merriown 5) will not be harmed during construction of the Project, temporary hi-vis fencing should be erected along the eastern boundary of the Project Area prior to construction commencing. A no-go zone should be established extending 20 metres to the east of this fence.

Temporary hi-vis fencing should also be erected along the western boundary of the Project Area to ensure that the archaeologically sensitive landforms surrounding Merrygowen Creek are not harmed during construction. This area should not be driven on by construction vehicles or used to stockpile materials without further investigation.

20-4-1120 (Merriown 1) and 20-4-1119 (Merriown 2) located in the northern portion of the Project Area, will be harmed by the Project. It is therefore recommended that the Aboriginal community should be involved in salvage activities to record and collect any surface objects within or near the recorded sites prior to construction.

20-4-1121 (Merriown 6), 20-4-1121 (Merriown 7), and 20-4-1123 (Merriown 8) have been disturbed by excavation procedures and are assessed to have low conservation value. No further assessment or conservation measures are required at these sites. Ground disturbance may proceed in these areas under an unanticipated finds protocol (**Appendix 4**).

Any artefacts salvaged during the community collection or recorded during the test excavation program will be securely stored at Boggabri Coal Mine along with other artefacts from the mine. All artefacts will be managed as per Section 4.4.5 of the Boggabri Coal Part 3A Cultural Heritage Management Plan (2016).

## 11 AHIP APPLICATION DETAILS

### 11.1 AHIP DETAILS

#### 11.1.1 Background

- The AHIP application will be in relation to the proposed construction of a solar farm at 333 Leards Forest Road, Boggabri. The AHIP Area has potential to be impacted by the construction and operation of the facility
- No previous AHIPs have been issued over the Project Area and the proponent is seeking a whole of project AHIP
- Survey of the Project Area was completed by RPS in 2023 according to the Code of Practice and with the assistance of RAPs
- Test excavations were undertaken as RPS determined that the area had potential to contain subsurface Aboriginal objects
- Five sites including an isolated find, a low-density artefact scatter of two artefacts, and three subsurface sites recorded because of the test excavation are located within the impact footprint of the proposed works are likely to be harmed (20-4-1120 [Merriown 1], 20-4-1119 [Merriown 2], 20-4-1121 [Merriown 6], 20-4-1122 [Merriown 7], and 20-4-1123 [Merriown 8])
- Three sites recorded during the survey are being avoided by the Project through a project design (20-4-1117 [Merriown 3], 0-4-1116 [Merriown 4], and 0-4-1118 [Merriown 5])
- A community collection will take place at 20-4-1120 (Merriown 1) and 20-4-1119 (Merriown 2). As 20-4-1121 (Merriown 6), 20-4-1122 (Merriown 7), and 20-4-1123 (Merriown 8) are low-density subsurface sites without surface manifestations, no further management is required before they are harmed
- The Aboriginal objects will be temporarily stored at the Boggabri Coal Mine office to be curated with other artefacts from the mine.

#### 11.1.2 Proposed work

The applicant is Idemitsu Renewable Developments Australia Pty Ltd, Level 9/175 Eagle Street, Brisbane QLD 4000 (07 3222 5600).

The construction the Merriown Solar Farm will broadly include the following:

- Preparatory and ancillary works, including geotechnical investigations, installing erosion and sediment controls, clearing, and trimming of vegetation and establishing a temporary site compound and stockpiling/laydown areas
- Constructing site access
- Constructing a solar farm including the installation of solar panels, substation, and service roads

- Operation of the solar farm including maintenance of the grounds and any required repairs (potentially subsurface)
- Site restoration and rehabilitation to restore disturbed areas as close to their pre-works condition as possible and ensure a stable finished landform.

The proposed works will follow the design and details provided in the approved Development Application.

### 11.1.3 Proposed term

The proposed term of the AHIP will cover 20 years from a proposed start date of May 2024 to May 2044.

### 11.1.4 AHIP Area

The AHIP Area will include the 13 ha Project Area assessed as part of this ACHAR (henceforth 'the AHIP Area'). All ground disturbing impacts associated with the Project will be contained within the AHIP Area.

**Figure 11-1** shows the AHIP area and coordinates demarcating the AHIP Area are detailed in **Table 11-1**.

**Table 11-1: AHIP area boundary points (GDA2020 Zone 56).**

| Boundary ID | GDA East | GDA North | Boundary ID | GDA East | GDA North |
|-------------|----------|-----------|-------------|----------|-----------|
| 1           | 224427   | 6608207   | 5           | 224319   | 6607646   |
| 2           | 224410   | 6608086   | 6           | 224108   | 6607636   |
| 3           | 224352   | 6608083   | 7           | 224108   | 6608191   |
| 4           | 224319   | 6607847   |             |          |           |



Figure 11-1: The AHIP Area and boundary points.



### 11.1.5 Cadastral details

**Table 11-2** details the cadastral information specific to the AHIP area.

**Table 11-2: Cadastral details for the AHIP area.**

| Information requirement | Details                                    |
|-------------------------|--------------------------------------------|
| Street Address          | 333 Leards Forest Road, Boggabri, NSW 2382 |
| Lot(s) / DP             | Lot 21 DP754940                            |
| LGA                     | Narrabri Local Government Area             |
| Land zone               | RU1 Primary Production                     |
| Parish                  | Leard                                      |
| County                  | Nandewar                                   |

### 11.1.6 Descriptions of ‘harm’

#### 11.1.6.1 *Subsurface excavation*

No subsurface archaeological excavations are proposed.

#### 11.1.6.2 *Community collection*

The community collection includes the following known Aboriginal objects, as identified on AHIMS (**Table 11-3**, **Figure 11-2**).

**Table 11-3: Aboriginal objects subject to community collection.**

| AHIMS ID  | Site Name  | Type of Harm<br>(Direct/Indirect / None) | Degree of Harm<br>(Total/Partial / None) | Consequence of Harm<br>(Total/Partial/No Loss of Value) |
|-----------|------------|------------------------------------------|------------------------------------------|---------------------------------------------------------|
| 20-4-1120 | Merriown 1 | Direct                                   | Total                                    | Loss of Value                                           |
| 20-4-1119 | Merriown 2 | Direct                                   | Total                                    | Loss of Value                                           |

#### 11.1.6.3 *Other actions(s) causing harm*

At three sites recorded during test excavations, there is a low probability of further subsurface artefacts (**Table 11-4**). No further assessment or conservation measures are required at these sites. Ground disturbance may proceed in these areas under an unanticipated finds protocol (**Section 11.2**, **Figure 11-2**).

**Table 11-4: Aboriginal objects where no further investigation is required.**

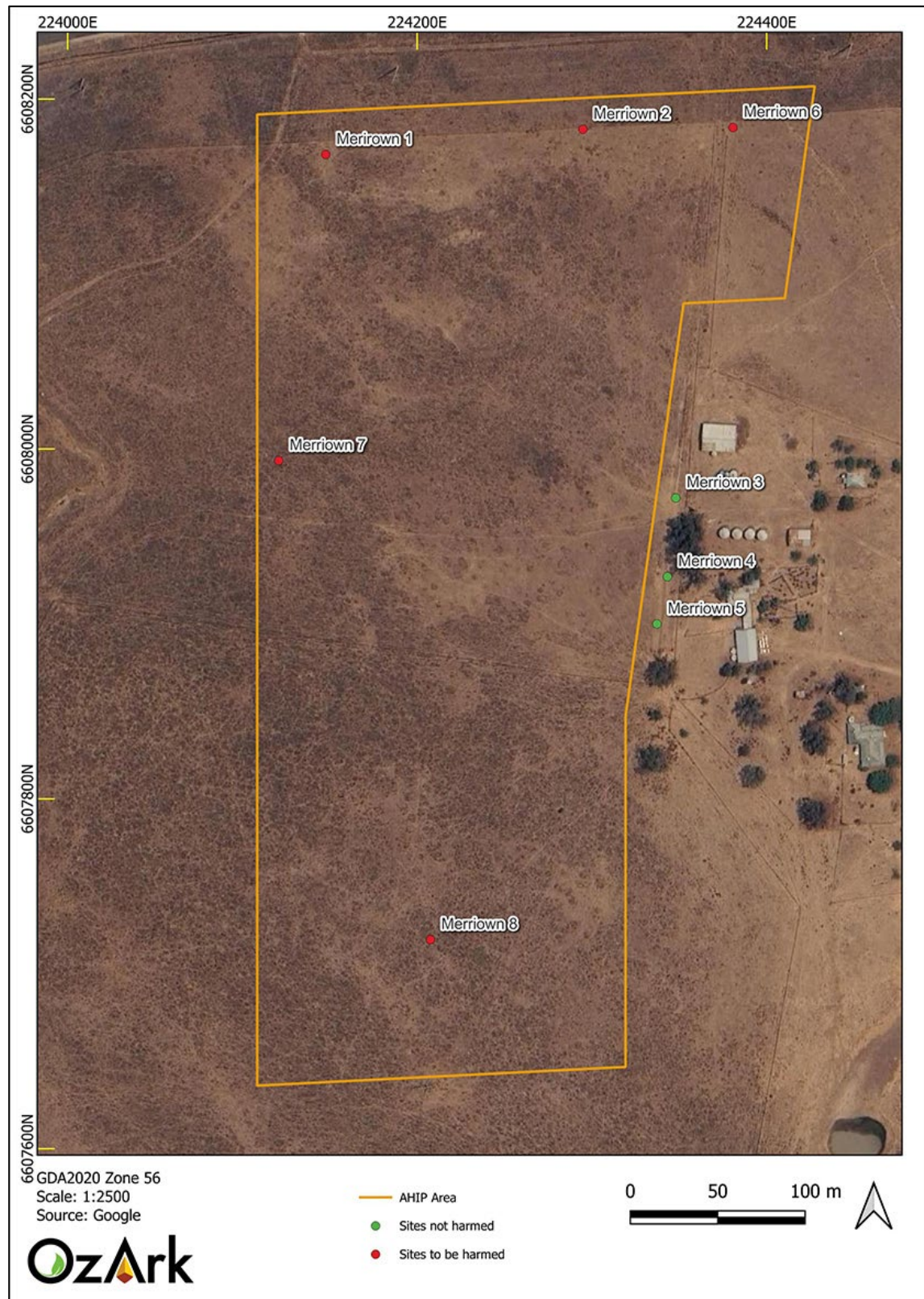
| AHIMS ID  | Site Name  | Type of Harm<br>(Direct/Indirect / None) | Degree of Harm<br>(Total/Partial / None) | Consequence of Harm<br>(Total/Partial/No Loss of Value) |
|-----------|------------|------------------------------------------|------------------------------------------|---------------------------------------------------------|
| 20-4-1121 | Merriown 6 | Direct                                   | Total                                    | Loss of Value                                           |
| 20-4-1122 | Merriown 7 | Direct                                   | Total                                    | Loss of Value                                           |
| 20-4-1123 | Merriown 8 | Direct                                   | Total                                    | Loss of Value                                           |



#### 11.1.6.4 Harm to certain Aboriginal objects through the proposed works

The harm to certain Aboriginal objects through the proposed works would apply to any stone artefacts not identified during the survey inside the AHIP Area. Accidental impact to these stone artefacts from the proposal would be authorised by the AHIP.

**Figure 11-2: Sites associated with the AHIP application.**



## 11.2 HERITAGE CONTINGENCY PROTOCOLS FOR UNANTICIPATED FINDS

If unexpected Aboriginal features, such as a large number of stone artefacts or skeletal material, are encountered within the AHIP Area that are not identified in this ACHAR, work must stop immediately, and the area be cordoned off with hi-vis fencing. The AHIP holder must be notified of the situation as soon as possible and the following protocol followed.

1. If any Aboriginal object is discovered and/or harmed in, or under the land, while undertaking the proposed development activities (excluding human skeletal remains), the proponent must:
  - a. Not further harm the object
  - b. Immediately cease all work at the particular location
  - c. Secure the area to avoid further harm to the Aboriginal object
  - d. Notify a suitably qualified archaeologist and the RAPs registered for the proposal
  - e. With the assistance of the archaeologist and the RAPs, salvage the object under the terms of the AHIP by recording and collecting the artefact
  - f. Salvaged artefacts will be managed as per Section 4.4.5 of the Boggabri Coal Part 3A Cultural Heritage Management Plan (2016)
  - g. A brief addendum to this report should be written to record the find and a site card submitted to AHIMS.
2. If Aboriginal burials are unexpectedly encountered during the activity, work must stop immediately, the area secured to prevent unauthorised access and NSW Police and Heritage NSW contacted. It should be noted that an AHIP, should it be granted, will not allow harm to human skeletal material and that further investigation, as set out below, will be required.
  - a. In the event of human skeletal material being uncovered, the proponent must cooperate with the appropriate authorities and relevant Aboriginal community representatives to facilitate:
    - i. The recording and assessment of the find(s)
    - ii. The fulfilment of any legal constraints arising from the find(s), including complying with Heritage NSW directions
    - iii. The development and implementation of appropriate management strategies, including consultation with stakeholders and the assessment of the significance of the find(s).
  - b. Recommencement of work in the area of the find(s) can only occur in accordance with any consequential legal requirements and after gaining written approval from HNSW (at a minimum with a variation to the AHIP).

Further details regarding the discovery of human skeletal material are provided in **Appendix 5**.



## 12 RECOMMENDATIONS

Under Section 89A of the NPW Act it is mandatory that all newly recorded Aboriginal sites be registered with AHIMS. As a professional in the field of cultural heritage management it is the responsibility of OzArk to ensure this process is undertaken.

To this end it is noted that eight Aboriginal sites were recorded during the assessment.

The following recommendations are made based on these impacts and with regard to:

- Legal requirements under the terms of the NPW Act whereby it is illegal to damage, deface or destroy an Aboriginal place or object without an approved AHIP.
- The findings of the current investigations undertaken within the Project Area
- The interests of the Aboriginal community.

Recommendations concerning Aboriginal cultural values within the Project Area are as follows:

1. An AHIP to permit impact to 20-4-1120 (Merriown 1), 20-4-1119 (Merriown 2), 20-4-1121 (Merriown 6), 20-4-1122 (Merriown 7), and 20-4-1123 (Merriown 8) will be required to be sought from Heritage NSW.
2. To ensure 20-4-1117 (Merriown 3), 20-4-1116 (Merriown 4), and 20-4-1118 (Merriown 5) will not be harmed during construction of the Project, temporary hi-vis fencing should be erected along the eastern boundary of the Project Area prior to construction commencing. A no-go zone should be established extending 20 metres to the east of this fence.
3. Temporary hi-vis fencing should also be erected along the western boundary of the Project Area to ensure that the archaeologically sensitive landforms surrounding Merrygowen Creek are not harmed during construction. This area should not be driven on by construction vehicles or used to stockpile materials without further investigation.
4. If the AHIP is approved, the proponent will organize a salvage collection with a qualified archaeologist and the Aboriginal community to locate any remaining surface artefacts at 20-4-1120 (Merriown 1) and 20-4-1119 (Merriown 2) and to collect any visible artefacts.
5. Any artefacts salvaged during the community collection or recorded during the test excavation program will be securely stored at Boggabri Coal Mine along with other artefacts from the mine. All artefacts will be managed as per Section 4.4.5 of the Boggabri Coal Part 3A Cultural Heritage Management Plan (2016).
6. All land-disturbing activities must be confined to within the Project Area. Should the parameters of the proposed work extend beyond this, then further archaeological assessment may be required.

7. No archaeological testing has taken place outside of the Project Area. Should landforms near but outside of the current Project Area be proposed for ground disturbance in the future, further archaeological testing may be required.
8. Work crews should undergo cultural heritage induction to ensure they recognise Aboriginal artefacts and are aware of the legislative protection of Aboriginal objects under the NPW Act and the contents of the Unanticipated Finds Protocol (**Appendix 4**).
9. Should human skeletal material be encountered, all work will cease in the area and the procedures in the Unanticipated Skeletal Remains Protocol (**Appendix 5**) must be followed.

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## APPENDIX 1: ABORIGINAL COMMUNITY CORRESPONDENCE

**Appendix 1 Figure 1: Aboriginal Community Consultation Log.**

| Aboriginal Consultation Log |                                                                       |                                                                                             |                  |                                                                                                                                                                                                                                                                                                           |
|-----------------------------|-----------------------------------------------------------------------|---------------------------------------------------------------------------------------------|------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Date                        | Organisation                                                          | Comment                                                                                     | Method           | Response                                                                                                                                                                                                                                                                                                  |
| <b>RPS consultation</b>     |                                                                       |                                                                                             |                  |                                                                                                                                                                                                                                                                                                           |
| 16/03/2023                  | Government organisation letters requesting Aboriginal interest groups | Expect responses by 6 April 2023                                                            | Letter via email | Expect Responses by 06/04/2023                                                                                                                                                                                                                                                                            |
| 16/03/2023                  | The Native Title Tribunal                                             | Expect responses by 6 April 2023                                                            | Email            | Provided response with reference to NC2011/006 Gomeroi People application                                                                                                                                                                                                                                 |
| 16/03/2023                  | North West Local Land Services                                        | Expect responses by 6 April 2023                                                            | Email            | Requested contact with Tamworth LALC                                                                                                                                                                                                                                                                      |
| 23/03/2023                  | Native Title Services Corporation                                     | Expect responses by 6 April 2023                                                            | Email            | Please register the Applicant for the Gomeroi People native title determination application (NSD37/2019) ('Gomeroi Applicant') in relation to the Idemitsu Boggabri Solar Farm ACHA. Please direct any further updates addressed to the Gomeroi Applicant to myself and Helen Orr (copied to this email). |
| 29/03/2023                  | HNSW response for interested Aboriginal parties                       | Expect responses by 6 April 2023                                                            | Email            | Provided Aboriginal Stakeholder List                                                                                                                                                                                                                                                                      |
| 11/04/2023                  | Narrabri LGA                                                          | Expect responses by 6 April 2023                                                            | Email            | Requested contact with Red Chief LALC; provided x2 cultural heritage studies for the Narrabri area                                                                                                                                                                                                        |
| 16/03/2023                  | Red Chief Local Aboriginal Land Council (LALC)                        | Expect responses by 6 April 2023                                                            | Email            | Red Chief Local Aboriginal Land Council is currently under Administration. Please make all enquiries to:<br>Tim Gumbleton<br>M: 0418 919 882<br>E: tim.gumbleton@rsm.com.au<br>RSM Australian Partners                                                                                                    |
| 24/03/2023                  | Office of the Registrar, Aboriginal Land Rights Act                   | Brendan Smith Requested contact with Red Chief LALC and Narrabri LALC                       | Email/letter     | Requested contact with Red Chief LALC and Narrabri LALC                                                                                                                                                                                                                                                   |
| 23/05/2023                  | Narrabri Local Aboriginal Land Council (LALC)                         | Expect responses by 31 May 2023                                                             | Email/letter     |                                                                                                                                                                                                                                                                                                           |
| 23/05/2023                  | Tamworth Local Aboriginal Land Council (LALC)                         | Lakeisha Hile requested that Red Chief LALC be contacted at officeadmin@redchiefalac.com.au | Email/letter     | Requested that Red Chief LALC be contacted at officeadmin@redchiefalac.com.au                                                                                                                                                                                                                             |
| 17/05/2023                  | EOI request sent to x71 registered RAPs                               | Expect responses by 31 May 2023                                                             | Letter via email | Expect responses by 31 May 2023                                                                                                                                                                                                                                                                           |
| 16/05/2023                  | Job Advert Placed in NW Courier newspaper                             | Expect responses by 31 May 2023                                                             | Newspaper        | Expect responses by 31 May 2023                                                                                                                                                                                                                                                                           |

| Aboriginal Consultation Log |                                                |                                                        |        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|-----------------------------|------------------------------------------------|--------------------------------------------------------|--------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Date                        | Organisation                                   | Comment                                                | Method | Response                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| 17/05/2023                  | AT Gomilaroi Cultural Consultancy              | Aaron Talbott Registered for the project               | Email  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| 17/05/2023                  | Jeremy Duncan                                  | Jeremy Duncan Registered for the project               | Email  | Registered Interest - Jeremy Duncan as an individual                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| 17/05/2023                  | Vicky Duncan                                   | Vicky Duncan Registered for the project                | Email  | Registered Interest - Vicky Duncan as a as a Gomeroi ippi yabba traditional owner                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| 17/05/2023                  | Edgerton Kwiembal AC                           | Liza Talbot Registered for the project                 | Email  | Registered Interest - Edgerton Kwiembal AC                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| 17/05/2023                  | Individual                                     | Brian Draper Registered for the project                | Email  | Registered Interest - Brian Draper                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| 17/05/2023                  | Troy Silver                                    | Troy Silver Registered for the project                 | Email  | Registered Interest - Troy Silver - holds cultural knowledge on within the area and experience with culture and heritage surveys                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| 17/05/2023                  | Stakeholder 1                                  | Tyan Silver Registered for the project                 | Email  | Registered interest - Tyan Silver - holds cultural knowledge on within the area and experience with culture and heritage surveys                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| 17/05/2023                  | Konanggo Aboriginal Cultural Heritage Services | Robert Young Registered for the project                | Email  | Registered interest - Robert Young - Kamilaroi Traditional Owner Descendant.<br>I have cultural links and cultural knowledge to this Country through my Grandmother Betty Tighe and Dulcie Young, my Grandfather Thomas Nean, my Mother Pamela Tighe Young and my Father Robert Nean Young. My Mob-family is from and connected to Kamilaroi/Gamilaraay Country and I would like to participate to conduct the Aboriginal Cultural Heritage Assessment of the Proposed Boggabri Solar Farm with cultural knowledge relevant to determining the significance of Aboriginal object(s)/and or sites in the vicinity of the study area. I have knowledge of Country and understanding and provide support to Country and heritage is protected. I strongly want to be involved in this application and proposal. |
| 17/05/2023                  | Didge Ngunawal Clan (DNC)                      | Lilly Carroll and Paul Boyd Registered for the project | Email  | Registered interest - DNC                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| 17/05/2023                  | Michael Long                                   | Michael Long Registered for the project                | Email  | Registered interest - Michael Long (17 Albion Street Gunnedah) - to be involved in both consulting and cultural heritage work                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| 17/05/2023                  | Thomas Dahlstrom                               | Thomas Dahlstrom Registered for the project            | Email  | Registered interest - Thomas Dahlstrom                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| 18/05/2023                  | Gomery Cultural Consultants                    | David Horton Registered for the project                | Email  | Registered interest - Gomery Cultural Consultants - for Aboriginal Community consultation and would like to be considered to participate in any associated field work                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| 19/05/2023                  | Girragirra Murun Aboriginal Corp               | Diana Astin Registered for the project                 | Email  | Registered interest - Girragirra Murun Aboriginal Corp                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| 21/05/2023                  | Wallanbah Aboriginal Sites Conveyancing        | Kelvin Boney Registered for the project                | Email  | Registered interest - Kelvin Boney - traditional Gomeroi Mursi and highly skilled within Gomeroi landscape                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| 22/05/2023                  | Wingarra Wilay AC                              | Raymond Moon Registered for the project                | Email  | Registered Interest - Wingarra Wilay AC                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |

| Aboriginal Consultation Log |                                             |                                                                                                    |        |                                                                                                                                                    |
|-----------------------------|---------------------------------------------|----------------------------------------------------------------------------------------------------|--------|----------------------------------------------------------------------------------------------------------------------------------------------------|
| Date                        | Organisation                                | Comment                                                                                            | Method | Response                                                                                                                                           |
| 22/05/2023                  | Raw Cultural Healing                        | Raymond Weatherall Registered for the project                                                      | Email  | Registered Interest - Raw Cultural Healing                                                                                                         |
| 22/05/2023                  | Gomerioi Murri Ganuurr Yuuray Wadi Palinka  | Greg Griffiths registered for the project                                                          | Email  | Registered Interest - Greg Griffiths                                                                                                               |
| 24/05/2023                  | AGA Services                                | Ashley Sampson Registered for the project                                                          | Email  | Registered Interest - AGA Services expressing an interest as this area falls within our traditional country boundaries.                            |
| 24/05/2023                  | Cacatua Culture Consultants                 | George Sampson Registered for the project                                                          | Email  | Registered Interest - Cacatua expressed an interest in this project as the area is part of my traditional country and carry an importance to us.   |
| 25/05/2023                  | Gomerioi Namoi                              | Steve Talbott Registered for the project                                                           | Phone  | Registered interest - Steve Talbott                                                                                                                |
| 25/05/2023                  | Red Chief LALC                              | Tim Gumbleton, Brenda Porter Registered for the project                                            | Email  | Registered Interest - Red Chief LALC via Tim Gumbleton and Brenda Porter (Tim - Tim.Gumbleton@rsm.com.au, Brenda - officeadmin@redchiefalc.com.au) |
| 26/05/2023                  | Lorraine Towney                             | Letter returned to sender via the post                                                             | Letter | Letter returned to sender via the post                                                                                                             |
| 31/05/2023                  | Stakeholder 2                               | Marilyn Carroll-Johnson Registered for the project                                                 | Email  | Registered Interest - Corroboree Aboriginal Corporation                                                                                            |
| 1/06/2023                   | Advisement to DPE and LALC for RAP list     | Notification to DPE/HNSW and LALC with list of EOIs received from RAPs                             | Email  | Notification to DPE/HNSW and LALC with list of EOIs received from RAPs                                                                             |
| 5/06/2023                   | Methodology letter sent to RAP list         | Methodology letter sent to RAP list                                                                | Email  |                                                                                                                                                    |
| 9/06/2023                   | Jeremy Duncan                               | Jeremy Duncan <i>"I'm happy with the methodology"</i>                                              | Email  | <i>"I'm happy with the methodology"</i>                                                                                                            |
| 15/06/2023                  | Cindy Foley                                 | Cindy Foley Late Registration for the project                                                      | Phone  | Late Registered Interest - Cindy Foley and Gloria Foley                                                                                            |
| 15/06/2023                  | Advisement to DPE and LALC for late RAP EOI | Advisement to DPE and LALC for late RAP EOI                                                        | Email  | Notification to DPE/HNSW and LALC for late EOIs received from Cindy and Gloria Foley                                                               |
| 16/06/2023                  | Christine Archbold                          | Christine Archbold Letter returned to sender - not delivered                                       | Letter | Letter returned to sender - not delivered                                                                                                          |
| OzArk consultation          |                                             |                                                                                                    |        |                                                                                                                                                    |
| 17.10.23                    | AT Gomilaroi Cultural Consultancy           | Catherine Burrowes (CB) (OzArk emailed OzArk introduction letter advising an update of the project | Email  |                                                                                                                                                    |
| 17.10.23                    | Jeremy Duncan                               | CB emailed OzArk introduction letter advising an update of the project                             | Email  |                                                                                                                                                    |
| 17.10.23                    | Vicky Hannah Gomerioi Duncan                | CB emailed OzArk introduction letter advising an update of the project                             | Email  |                                                                                                                                                    |
| 17.10.23                    | Edgerton Kwiembal AC                        | CB emailed OzArk introduction letter                                                               | Email  |                                                                                                                                                    |

| Aboriginal Consultation Log |                                                |                                                                        |        |          |
|-----------------------------|------------------------------------------------|------------------------------------------------------------------------|--------|----------|
| Date                        | Organisation                                   | Comment                                                                | Method | Response |
|                             |                                                | advising an update of the project                                      |        |          |
| 17.10.23                    | Brian Draper                                   | CB emailed OzArk introduction letter advising an update of the project | Email  |          |
| 17.10.23                    | Troy Silver                                    | CB emailed OzArk introduction letter advising an update of the project | Email  |          |
| 17.10.23                    | Stakeholder 1                                  | CB emailed OzArk introduction letter advising an update of the project | Email  |          |
| 17.10.23                    | Konanggo Aboriginal Cultural Heritage Services | CB emailed OzArk introduction letter advising an update of the project | Email  |          |
| 17.10.23                    | Didge Ngunawal Clan (DNC)                      | CB emailed OzArk introduction letter advising an update of the project | Email  |          |
| 17.10.23                    | Michael Long                                   | CB emailed OzArk introduction letter advising an update of the project | Email  |          |
| 17.10.23                    | Thomas Dahlstrom                               | CB emailed OzArk introduction letter advising an update of the project | Email  |          |
| 17.10.23                    | Gomery Cultural Consultants                    | CB emailed OzArk introduction letter advising an update of the project | Email  |          |
| 17.10.23                    | Girragirra Murun Aboriginal Corporation        | CB emailed OzArk introduction letter advising an update of the project | Email  |          |
| 17.10.23                    | Wallanbah Aboriginal Site Conveyancing         | CB emailed OzArk introduction letter advising an update of the project | Email  |          |
| 17.10.23                    | Wingarra Wilay Aboriginal Corporation          | CB emailed OzArk introduction letter advising an update of the project | Email  |          |
| 17.10.23                    | RAW Cultural Healing                           | CB emailed OzArk introduction letter advising an update of the project | Email  |          |
| 17.10.23                    | Gomeroi Murri Ganuurr Yuuray Wadi Palinka      | CB emailed OzArk introduction letter advising an update of the project | Email  |          |
| 17.10.23                    | AGA Services                                   | CB emailed OzArk introduction letter advising an update of the project | Email  |          |
| 17.10.23                    | Cucatua Culture Consultants                    | CB emailed OzArk introduction letter advising an update of the project | Email  |          |



| Aboriginal Consultation Log |                                        |                                                                        |        |          |
|-----------------------------|----------------------------------------|------------------------------------------------------------------------|--------|----------|
| Date                        | Organisation                           | Comment                                                                | Method | Response |
| 17.10.23                    | Gomeroi Namoi                          | CB emailed OzArk introduction letter advising an update of the project | Email  |          |
| 17.10.23                    | Red Chief LALC                         | CB emailed OzArk introduction letter advising an update of the project | Email  |          |
| 17.10.23                    | Stakeholder 2                          | CB emailed OzArk introduction letter advising an update of the project | Email  |          |
| 17.10.23                    | Cindy and Gloria Foley                 | CB emailed OzArk introduction letter advising an update of the project | Email  |          |
| 18.10.23                    | Wallanbah Aboriginal Site Conveyancing | CB received call to discuss project                                    | Email  |          |
| 18.10.23                    | Gomeroi Namoi                          | CB received email discussing concern re the project                    | Email  |          |
| 18.10.23                    | Red Chief LALC                         | CB received email acknowledging OzArk with the project                 | Email  |          |
| 18.10.23                    | Cindy and Gloria Foley                 | CB received email acknowledging OzArk with the project                 | Email  |          |
| 18.10.23                    | Didge Ngunawal Clan (DNC)              | CB received email acknowledging OzArk with the project                 | Email  |          |
| 20.10.23                    | Wallanbah Aboriginal Site Conveyancing | CB sent email in response to call 18.10.23                             | Email  |          |
| 23.10.23                    | Gomeroi Namoi                          | CB emailed response to email from 18.10.23                             | Email  |          |
| 24.10.23                    | Wallanbah Aboriginal Site Conveyancing | CB received email - with thanks for reply                              | Email  |          |
| 24.10.23                    | Gomery Cultural Consultants            | CB received email acknowledging OzArk with the project                 | Email  |          |
| 24.10.23                    | Gomery Cultural Consultants            | CB replied with thanks                                                 | Email  |          |
| 27.10.23                    | AT Gomilaroi Cultural Consultancy      | CB Emailed Methodology & Letter - closing date 24.11.23                | Email  |          |
| 27.10.23                    | Jeremy Duncan                          | CB Emailed Methodology & Letter - closing date 24.11.23                | Email  |          |
| 27.10.23                    | Vicky Hannah Gomeroi Duncan            | CB Emailed Methodology & Letter - closing date 24.11.23                | Email  |          |
| 27.10.23                    | Edgerton Kwiembal AC                   | CB Emailed Methodology & Letter - closing date 24.11.23                | Email  |          |
| 27.10.23                    | Brian Draper                           | CB Emailed Methodology & Letter - closing date 24.11.23                | Email  |          |

| Aboriginal Consultation Log |                                                |                                                         |        |          |
|-----------------------------|------------------------------------------------|---------------------------------------------------------|--------|----------|
| Date                        | Organisation                                   | Comment                                                 | Method | Response |
| 27.10.23                    | Troy Silver                                    | CB Emailed Methodology & Letter - closing date 24.11.23 | Email  |          |
| 27.10.23                    | Stakeholder 1                                  | CB Emailed Methodology & Letter - closing date 24.11.23 | Email  |          |
| 27.10.23                    | Konanggo Aboriginal Cultural Heritage Services | CB Emailed Methodology & Letter - closing date 24.11.23 | Email  |          |
| 27.10.23                    | Didge Ngunawal Clan (DNC)                      | CB Emailed Methodology & Letter - closing date 24.11.23 | Email  |          |
| 27.10.23                    | Michael Long                                   | CB Emailed Methodology & Letter - closing date 24.11.23 | Email  |          |
| 27.10.23                    | Thomas Dahlstrom                               | CB Emailed Methodology & Letter - closing date 24.11.23 | Email  |          |
| 27.10.23                    | Gomery Cultural Consultants                    | CB Emailed Methodology & Letter - closing date 24.11.23 | Email  |          |
| 27.10.23                    | Girragirra Murun Aboriginal Corporation        | CB Emailed Methodology & Letter - closing date 24.11.23 | Email  |          |
| 27.10.23                    | Wallanbah Aboriginal Site Conveyancing         | CB Emailed Methodology & Letter - closing date 24.11.23 | Email  |          |
| 27.10.23                    | Wingarra Wilay Aboriginal Corporation          | CB Emailed Methodology & Letter - closing date 24.11.23 | Email  |          |
| 27.10.23                    | RAW Cultural Healing                           | CB Emailed Methodology & Letter - closing date 24.11.23 | Email  |          |
| 27.10.23                    | Gomerioi Murri Ganuurr Yuurray Wadi Palinka    | CB Emailed Methodology & Letter - closing date 24.11.23 | Email  |          |
| 27.10.23                    | AGA Services                                   | CB Emailed Methodology & Letter - closing date 24.11.23 | Email  |          |
| 27.10.23                    | Cucatua Culture Consultants                    | CB Emailed Methodology & Letter - closing date 24.11.23 | Email  |          |
| 27.10.23                    | Gomerioi Namoi                                 | CB Emailed Methodology & Letter - closing date 24.11.23 | Email  |          |
| 27.10.23                    | Red Chief LALC                                 | CB Emailed Methodology & Letter - closing date 24.11.23 | Email  |          |
| 27.10.23                    | Stakeholder 2                                  | CB Emailed Methodology & Letter - closing date 24.11.23 | Email  |          |
| 27.10.23                    | Cindy and Gloria Foley                         | CB Emailed Methodology & Letter - closing date 24.11.23 | Email  |          |

| Aboriginal Consultation Log |                                                |                                                                                                                                                                         |        |          |
|-----------------------------|------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|----------|
| Date                        | Organisation                                   | Comment                                                                                                                                                                 | Method | Response |
| 27.10.23                    | Didge Ngunawal Clan (DNC)                      | CB received response on methodology - <i>DNC is happy with what you have proposed and hope to help you guys out there!</i>                                              | Email  |          |
| 30.10.23                    | Didge Ngunawal Clan (DNC)                      | CB replied with thanks                                                                                                                                                  | Email  |          |
| 28.10.23                    | Stakeholder 2                                  | CB received response on methodology - We agree with test excavations methodology                                                                                        | Email  |          |
| 30.10.23                    | Stakeholder 2                                  | CB replied with thanks                                                                                                                                                  | Email  |          |
| 30.10.23                    | Stakeholder 1                                  | CB received call confirming involvement with the project - CB confirmed                                                                                                 | Email  |          |
| 6.11.23                     | Konanggo Aboriginal Cultural Heritage Services | CB received response on methodology - <i>KACHS has review the methodology and endorse the processes</i>                                                                 | Email  |          |
| 6.11.23                     | Konanggo Aboriginal Cultural Heritage Services | CB replied with thanks                                                                                                                                                  | Email  |          |
| 8.11.23                     | Jeremy Duncan                                  | CB received response on methodology - <i>I'm happy with the methodology</i>                                                                                             | Email  |          |
| 8.11.23                     | Jeremy Duncan                                  | CB replied with thanks                                                                                                                                                  | Email  |          |
| 8.11.23                     | AGA Services                                   | CB received response on methodology - <i>AGA Services, after all information was discussed all present at the meeting were in support of the Merriown Farm project.</i> | Email  |          |
| 8.11.23                     | AGA Services                                   | CB replied with thanks                                                                                                                                                  | Email  |          |
| 15.11.23                    | Heritage NSW                                   | BC sends test excavation methodology as per Requirement 15c of the Code of Practice                                                                                     | Email  |          |
| 2.2.24                      | AT Gomilaroi Cultural Consultancy              | CB Emailed Stage 4 ACHAR & Letter - closing date 1.3.24                                                                                                                 | Email  |          |
| 2.2.24                      | Jeremy Duncan                                  | CB Emailed Stage 4 ACHAR & Letter - closing date 1.3.24                                                                                                                 | Email  |          |
| 2.2.24                      | Vicky Hannah Gomerai Duncan                    | CB Emailed Stage 4 ACHAR & Letter - closing date 1.3.24                                                                                                                 | Email  |          |
| 2.2.24                      | Edgerton Kwiemba AC                            | CB Emailed Stage 4 ACHAR & Letter - closing date 1.3.24                                                                                                                 | Email  |          |

| Aboriginal Consultation Log |                                                |                                                         |        |          |
|-----------------------------|------------------------------------------------|---------------------------------------------------------|--------|----------|
| Date                        | Organisation                                   | Comment                                                 | Method | Response |
| 2.2.24                      | Brian Draper                                   | CB Emailed Stage 4 ACHAR & Letter - closing date 1.3.24 | Email  |          |
| 2.2.24                      | Troy Silver                                    | CB Emailed Stage 4 ACHAR & Letter - closing date 1.3.24 | Email  |          |
| 2.2.24                      | Stakeholder 1                                  | CB Emailed Stage 4 ACHAR & Letter - closing date 1.3.24 | Email  |          |
| 2.2.24                      | Konanggo Aboriginal Cultural Heritage Services | CB Emailed Stage 4 ACHAR & Letter - closing date 1.3.24 | Email  |          |
| 2.2.24                      | Didge Ngunawal Clan (DNC)                      | CB Emailed Stage 4 ACHAR & Letter - closing date 1.3.24 | Email  |          |
| 2.2.24                      | Michael Long                                   | CB Emailed Stage 4 ACHAR & Letter - closing date 1.3.24 | Email  |          |
| 2.2.24                      | Thomas Dahlstrom                               | CB Emailed Stage 4 ACHAR & Letter - closing date 1.3.24 | Email  |          |
| 2.2.24                      | Gomery Cultural Consultants                    | CB Emailed Stage 4 ACHAR & Letter - closing date 1.3.24 | Email  |          |
| 2.2.24                      | Girragirra Murun Aboriginal Corporation        | CB Emailed Stage 4 ACHAR & Letter - closing date 1.3.24 | Email  |          |
| 2.2.24                      | Wallanbah Aboriginal Site Conveyancing         | CB Emailed Stage 4 ACHAR & Letter - closing date 1.3.24 | Email  |          |
| 2.2.24                      | Wingarra Wilay Aboriginal Corporation          | CB Emailed Stage 4 ACHAR & Letter - closing date 1.3.24 | Email  |          |
| 2.2.24                      | RAW Cultural Healing                           | CB Emailed Stage 4 ACHAR & Letter - closing date 1.3.24 | Email  |          |
| 2.2.24                      | Gomeroi Murri Ganuurr Yuuray Wadi Palinka      | CB Emailed Stage 4 ACHAR & Letter - closing date 1.3.24 | Email  |          |
| 2.2.24                      | AGA Services                                   | CB Emailed Stage 4 ACHAR & Letter - closing date 1.3.24 | Email  |          |
| 2.2.24                      | Cucatus Culture Consultants                    | CB Emailed Stage 4 ACHAR & Letter - closing date 1.3.24 | Email  |          |
| 2.2.24                      | Gomeroi Namoi                                  | CB Emailed Stage 4 ACHAR & Letter - closing date 1.3.24 | Email  |          |
| 2.2.24                      | Red Chief LALC                                 | CB Emailed Stage 4 ACHAR & Letter - closing date 1.3.24 | Email  |          |
| 2.2.24                      | Stakeholder 2                                  | CB Emailed Stage 4 ACHAR & Letter - closing date 1.3.24 | Email  |          |



| Aboriginal Consultation Log |                                   |                                                                                                                                                      |        |                                                       |
|-----------------------------|-----------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|--------|-------------------------------------------------------|
| Date                        | Organisation                      | Comment                                                                                                                                              | Method | Response                                              |
| 2.2.24                      | Cindy and Gloria Foley            | CB Emailed Stage 4 ACHAR & Letter - closing date 1.3.24                                                                                              | Email  |                                                       |
| 2.2.24                      | AT Gomilaroi Cultural Consultancy | CB received response to ACHAR - Aaron not happy he was not included in the fieldwork - details in folder                                             | Email  | RAP response reproduced in <b>Appendix 1 Figure 8</b> |
| 2.2.24                      | Cindy and Gloria Foley            | CB received response to ACHAR - Agee with ACHAR - details in folder                                                                                  | Email  | RAP response reproduced in <b>Appendix 1 Figure 8</b> |
| 2.2.24                      | Cindy and Gloria Foley            | CB replied with thanks                                                                                                                               | Email  |                                                       |
| 2.2.24                      | Didge Ngunawal Clan (DNC)         | CB received response to ACHAR. Agree with ACHAR - details in folder                                                                                  | Email  | RAP response reproduced in <b>Appendix 1 Figure 8</b> |
| 5.2.24                      | Didge Ngunawal Clan               | CB replied with thanks                                                                                                                               | Email  |                                                       |
| 6.2.24                      | AT Gomilaroi Cultural Consultancy | CB replied with thanks and offering apologies that Aaron was not included in the fieldwork as the proponent instructed which RAPs would be involved. | Email  |                                                       |

**Appendix 1 Figure 2: Advertisement.**

**Appendix 1 Figure 3: Letter to Agencies (sample).**

Our ref: AU008068



Unit 2A, 45 Fitzroy Street  
Carrington NSW 2294  
T +61 2 4940 4200

16 March 2023

Heritage NSW  
Locked Bag 5020  
Parramatta NSW 2124  
By email: [heritagemailbox@environment.nsw.gov.au](mailto:heritagemailbox@environment.nsw.gov.au)

To Whom It May Concern

**Re: Idemitsu Boggabri Solar Farm, Narrabri LGA – Aboriginal Cultural Heritage Assessment**

RPS has been engaged by Idemitsu Renewable Developments Australia (the Proponent) to undertake an Aboriginal Cultural Heritage Assessment for a proposed solar farm development.

The Project Area is in Boggabri in the Narrabri Local Government Area and within the Red Chief Local Aboriginal Land Council boundaries (See Figure 1).

The Project Area lies approximately 1.1 kilometres from Leards Forest Road to the west of Boggabri Coal Mine. The Aboriginal Cultural Heritage Assessment report (ACHAR) is required to accompany a Statement of Environmental Effects (SEE) being prepared for the Development Application (DA) to be submitted by the Proponent.

In accordance with Stage 1 of the *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010*, RPS is seeking to identify Aboriginal people or groups who may hold cultural knowledge relevant to determining the significance of Aboriginal objects and/or places within the Project Area.

If you are aware of any Aboriginal person/organisation who may hold cultural knowledge, please contact us using the details below. We would appreciate your response by the 7<sup>th</sup> April 2023.

Yours sincerely,

For RPS AAP Consulting Pty Ltd

**Kristen Tola**  
Heritage Consultant  
[Kristen.tola@rpsgroup.com.au](mailto:Kristen.tola@rpsgroup.com.au)  
0414 011 015

**Figure 1 Boggabri Indicative Site Layout Plan**





## Appendix 1 Figure 4: Responses from Agencies.

**From:** [Conor Wakefield](#)  
**To:** [Kristen Tola](#)  
**Cc:** [Helen Orr](#)  
**Subject:** Gomeroi - ACHA - Idemitsu Boggabri Solar Farm, Narrabri LGA – Aboriginal Cultural Heritage Assessment  
**Date:** Thursday, 23 March 2023 1:37:05 PM  
**Attachments:** [image001.png](#)  
[Agency letter\\_NTSC.pdf](#)

**CAUTION:** This email originated from outside of RPS.

Dear Kristen,

Thank you for providing the **attached** letter.

Please register the Applicant for the Gomeroi People native title determination application (NSD37/2019) ('**Gomeroi Applicant**') in relation to the Idemitsu Boggabri Solar Farm ACHA.

Please direct any further updates addressed to the Gomeroi Applicant to myself and Helen Orr (copied to this email).

Kind regards,

**Conor Wakefield** | Solicitor



NTSCORP proudly acknowledge that our office is situated on the country of the Gadigal People. We also acknowledge and pay our respect to their Elders past and present.

t 61 2 9310 3188 f 02 9310 4177

m 0498 980 212

e: [cwakefield@ntscorp.com.au](mailto:cwakefield@ntscorp.com.au) | w [www.ntscorp.com.au](http://www.ntscorp.com.au)

Level 1, 44-70 Rosehill Street, Redfern, NSW 2016 Australia

NTSCORP is committed to supporting local Aboriginal businesses where possible through the purchase of goods and services.

Caution: This message is intended only for the addressee. It is confidential and may be legally privileged. If you are not the intended recipient, any disclosure, copying, or distribution is prohibited and may be unlawful. By opening any attachment, you agree that NTSCORP Limited (NTSCORP) will not be liable for any loss resulting from viruses or other defects. Any views in this message are those of the individual sender, except where the sender expressly and with authority, states them to be the views of NTSCORP.  
Please consider the environment before printing this email

**From:** Kristen Tola <[Kristen.Tola@rpsgroup.com.au](mailto:Kristen.Tola@rpsgroup.com.au)>

**Sent:** Thursday, 16 March 2023 10:00 AM

**To:** Info <[information@ntscorp.com.au](mailto:information@ntscorp.com.au)>

**Subject:** AU008068 - ACHA - Request for cultural knowledge holders

You don't often get email from [kristen.tola@rpsgroup.com.au](mailto:kristen.tola@rpsgroup.com.au). [Learn why this is important](#)

**CAUTION:** This email originated from outside of the organization. Do not click links or open attachments unless you recognize the sender and know the content is safe.

Please find the attached letter for your attention.

Thank you

**Kristen Tola** (She/Her)  
Heritage Consultant  
RPS | Australia Asia Pacific  
Unit 2A, 45 Fitzroy Street

**From:** [admin@tamworthlalc.com.au](mailto:admin@tamworthlalc.com.au)  
**To:** [Kristen Tola](#)  
**Subject:** FW: AU008068 - ACHA - Request for cultural knowledge holders list  
**Date:** Wednesday, 24 May 2023 8:47:58 AM  
**Attachments:** [image001.png](#)  
[image002.png](#)  
[image003.png](#)  
[image004.png](#)  
[Agency Letter TLALC.pdf](#)

**CAUTION:** This email originated from outside of RPS.

Good Morning,

Thank you for your email. In regard to this matter, you will need to contact the Red Chief Local Aboriginal Land Council. I have attached their email for you.

[officeadmin@redchiefalac.com.au](mailto:officeadmin@redchiefalac.com.au)

Kind Regards,  
 Lakeisha

Lakeisha Hile  
 Administration Assistant  
 Tamworth Local Aboriginal Land Council  
 PO Box 57  
 Tamworth NSW 2340  
 Phone: 02 6766 9028  
 Email [admin@tamworthlalc.com.au](mailto:admin@tamworthlalc.com.au)



[Click Here to Visit Website >>](#)



*I would like to acknowledge the traditional custodians of the Gamilaroi/Gomeri/Kamilaroi nation and it's people. I recognise their continuing connection to the land I work on and I pay my respects to Elders past and present, and also acknowledge the youth of whom will be our future leaders.*

*Consider the environment. Please don't print this e-mail unless really necessary.*

**From:** Kristen Tola <[Kristen.Tola@rpsgroup.com.au](mailto:Kristen.Tola@rpsgroup.com.au)>  
**Sent:** Tuesday, May 23, 2023 4:04 PM  
**To:** [admin@tamworthlalc.com.au](mailto:admin@tamworthlalc.com.au)  
**Subject:** AU008068 - ACHA - Request for cultural knowledge holders list

From: [Geospatial Search Requests](#)  
 To: [Kristen Tola](#)  
 Subject: RE: SR23/423 - ACHA - Request for cultural knowledge holders list - SR23/423 [DEC+OFFICIAL]  
 Date: Thursday, 16 March 2023 2:09:33 PM  
 Attachments: [Image001.png](#)

CAUTION: This email originated from outside of RPS.  
 OFFICIAL

Your ref: AU008068 Our ref: SR23/423

Dear Kristen Tola,

Thank you for your search request, please find your results below.

#### Search Results

The results provided are based on the information you supplied and are derived from a search of the following Tribunal databases:

- Schedule of Native Title Determination Applications
- Register of Native Title Claims
- Native Title Determinations
- Indigenous Land Use Agreements (Registered and notified)

#### Results for overlapping native title matters in NSW:

| Feature ID  | Tenure   | Cadastral Data As At | Feature Area SqKm | Overlapping Native Title Feature |                |                         |                    |
|-------------|----------|----------------------|-------------------|----------------------------------|----------------|-------------------------|--------------------|
|             |          |                      |                   | NNTT File Number                 | Name           | Category                | % Selected Feature |
| 21NDP754940 | FREEHOLD | 5/08/2022            | 2.8017            |                                  |                |                         |                    |
|             |          |                      |                   | NC20116058                       | General People | Applications (Schedule) | 2.8017 100.00%     |
|             |          |                      |                   | NC20116058                       | General People | Applications (RNTC)     | 2.8017 100.00%     |

For more information about the Tribunal's registers or to search the registers yourself and obtain copies of relevant register extracts, please visit our [website](#).

Information on native title claims and freehold land can also be found on the Tribunal's website here: [Native title claims and freehold land](#).

**Please note:** There may be a delay between a native title determination application being lodged in the Federal Court and its transfer to the Tribunal. As a result, some native title determination applications recently filed with the Federal Court may not appear on the Tribunal's databases.

The search results are based on analysis against external boundaries of applications only. Native title applications commonly contain exclusions clauses which remove areas from within the external boundary. To determine whether the areas described are in fact subject to claim, you need to refer to the "Area covered by claim" section of the relevant Register Extract or Schedule Extract and any maps attached.

#### Search results and the existence of native title

Please note that the enclosed information from the Register of Native Title Claims and/or the Schedule of Applications is not confirmation of the existence of native title in this area. This cannot be confirmed until the Federal Court makes a determination that native title does or does not exist in relation to the area. Such determinations are registered on the National Native Title Register.

#### The Tribunal accepts no liability for reliance placed on enclosed information

The enclosed information has been provided in good faith. Use of this information is at your sole risk. The National Native Title Tribunal makes no representation, either express or implied, as to the accuracy or suitability of the information enclosed for any particular purpose and accepts no liability for use of the information or reliance placed on it.

If you have any further queries, please do not hesitate to contact us via [GeospatialSearch@NNTT.gov.au](mailto:GeospatialSearch@NNTT.gov.au)

Regards,

Geospatial Searches  
 National Native Title Tribunal | Perth  
 Email: [GeospatialSearch@nntt.gov.au](mailto:GeospatialSearch@nntt.gov.au) | [www.nntt.gov.au](http://www.nntt.gov.au)

From: Kristen Tola <[Kristen.Tola@rpggroup.com.au](mailto:Kristen.Tola@rpggroup.com.au)>  
 Sent: Thursday, 16 March 2023 7:00 AM  
 To: Geospatial Search Requests <[GeospatialSearch@NNTT.gov.au](mailto:GeospatialSearch@NNTT.gov.au)>  
 Subject: SR23/423 - AU008068 - ACHA - Request for cultural knowledge holders list

Caution: This is an external email. DO NOT click links or open attachments unless you recognise the sender and know the content is safe.

Please find the attached request, for your attention.

Thank you.

Kristen Tola (She/Her) Heritage Consultant  
 RPS | Australia Asia Pacific  
 Unit 3A, 45 Fitzroy Street  
 Carrington NSW 2204, Australia  
 T +61 2 4940 4200  
 D +61 2 4940 4211 M +61 414 011 015  
 E [kristen.tola@rpggroup.com.au](mailto:kristen.tola@rpggroup.com.au)



Follow us on: [rpggroup.com](#) | [LinkedIn](#) | [Facebook](#) | [Instagram](#) | [YouTube](#)  
 We acknowledge the Traditional Owners of Country throughout Australia and recognise their continuing connection to land, waters and community. We pay our respect to them and their cultures and to Elders past and present.  
[Click here](#) to find out more about our Reconciliation Action Plan.

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**From:** [Conor Wakefield](#)  
**To:** [Kristen Tola](#)  
**Cc:** [Helen Orr](#)  
**Subject:** Gomeroi - ACHA - Idemitsu Boggabri Solar Farm, Narrabri LGA – Aboriginal Cultural Heritage Assessment  
**Date:** Thursday, 23 March 2023 1:37:05 PM  
**Attachments:** [image001.png](#)  
[Agency letter\\_NTSC.pdf](#)

**CAUTION:** This email originated from outside of RPS.

Dear Kristen,

Thank you for providing the **attached** letter.

Please register the Applicant for the Gomeroi People native title determination application (NSD37/2019) ('**Gomeroi Applicant**') in relation to the Idemitsu Boggabri Solar Farm ACHA.

Please direct any further updates addressed to the Gomeroi Applicant to myself and Helen Orr (copied to this email).

Kind regards,  
**Conor Wakefield** | Solicitor



NTSCORP proudly acknowledge that our office is situated on the country of the Gadigal People. We also acknowledge and pay our respect to their Elders past and present.

t 61 2 9310 3188 f 02 9310 4177

m 0498 980 212

e: [cwakefield@ntscorp.com.au](mailto:cwakefield@ntscorp.com.au) | w [www.ntscorp.com.au](http://www.ntscorp.com.au)

Level 1, 44-70 Rosehill Street, Redfern, NSW 2016 Australia

NTSCORP is committed to supporting local Aboriginal businesses where possible through the purchase of goods and services.

Caution: This message is intended only for the addressee. It is confidential and may be legally privileged. If you are not the intended recipient, any disclosure, copying, or distribution is prohibited and may be unlawful. By opening any attachment, you agree that NTSCORP Limited (NTSCORP) will not be liable for any loss resulting from viruses or other defects. Any views in this message are those of the individual sender, except where the sender expressly and with authority, states them to be the views of NTSCORP.

Please consider the environment before printing this email

**From:** Kristen Tola <[Kristen.Tola@rpsgroup.com.au](mailto:Kristen.Tola@rpsgroup.com.au)>  
**Sent:** Thursday, 16 March 2023 10:00 AM  
**To:** Info <[information@ntscorp.com.au](mailto:information@ntscorp.com.au)>  
**Subject:** AU008068 - ACHA - Request for cultural knowledge holders

You don't often get email from [kristen.tola@rpsgroup.com.au](mailto:kristen.tola@rpsgroup.com.au). [Learn why this is important](#)

**CAUTION:** This email originated from outside of the organization. Do not click links or open attachments unless you recognize the sender and know the content is safe.

Please find the attached letter for your attention.

Thank you

**Kristen Tola** (She/Her)  
 Heritage Consultant  
 RPS | Australia Asia Pacific  
 Unit 2A, 45 Fitzroy Street





24 March 2023

By email: [Kristen.tola@rpsgroup.com.au](mailto:Kristen.tola@rpsgroup.com.au)

Kristen Tola  
Heritage Consultant  
RPS  
Unit 2A, 45 Fitzroy St  
CARRINGTON NSW 2294

Dear Kristen,

**Aboriginal Cultural Heritage Assessment – proposed Idemitsu Boggabri Solar Farm,  
north east of Boggabri, NSW: request for list of potential Aboriginal stakeholders**

We refer to your email and letter to this Office, dated 16 March 2023, requesting contact information for Aboriginal organisations, stakeholders and/or people who may have cultural knowledge relevant to the proposed Idemitsu Boggabri Solar Farm development, north east of Boggabri, NSW, as part of an Aboriginal Cultural Heritage Assessment (ACHA).

Under Section 170 of the *Aboriginal Land Rights Act 1983 (NSW)*, the Office of the Registrar is required to maintain the Register of Aboriginal Owners (RAO) for New South Wales. A search of the RAO has shown that there are currently no Registered Aboriginal Owners in the project area.

As identified in your letter, the proposed development and study area falls within the boundaries of Red Chief Local Aboriginal Land Council (LALC). We suggest you contact Red Chief LALC (contact details provided below), as they may wish to participate or contribute. However, as no specific Lot and DP details have been provided to narrow the specific location of the development area, we also recommend you contact Narrabri LALC, as the area appears to be proximate to the boundary between the two LALCs.

Yours sincerely

Brendan Smith  
Senior Project Officer  
Office of the Registrar, Aboriginal Land Rights Act 1983

Red Chief Local Aboriginal Land Council  
26a Chandos Street  
GUNNEDAH NSW 2380  
Ph: (02) 6742 3602  
Email: [officeadmin@redchiefalc.com.au](mailto:officeadmin@redchiefalc.com.au)

Narrabri Local Aboriginal Land Council  
96 Barwan Street  
NARRABRI NSW 2390  
Ph: 02 6792 4228  
Email: [ceo@narrabrilalc.com.au](mailto:ceo@narrabrilalc.com.au)

Address: Level 3, 2 – 10 Wentworth Street, PARRAMATTA NSW 2150  
Post: P.O Box 787, PARRAMATTA NSW 2124  
Phone: 02 8575 1160

**From:** [Lisa Berges](#)  
**To:** [Kristen Tola](#)  
**Subject:** Automatic reply: AU008068 - ACHA - Request for cultural knowledge holders  
**Date:** Thursday, 16 March 2023 10:04:32 AM

---

**CAUTION:** This email originated from outside of RPS.

Red Chief Local Aboriginal Land Council is currently under Administration.

Please make all enquiries to:  
Tim Gumbleton  
M: 0418 919 882  
E: [tim.gumbleton@rsm.com.au](mailto:tim.gumbleton@rsm.com.au)  
**RSM Australian Partners**

To contact the Red Chief office call 02 67 423602

Thank you

## Appendix 1 Figure 5: Letter to Community Members (sample).

**Our ref: AU213008068.002 EOI letter**

Date: 16 May 2023

Dear Sir/Madam,

**Invitation for an Expression of Interest Boggabri Solar Farm Aboriginal Cultural Heritage Assessment**

RPS has been engaged by Idemitsu Renewable Developments Australia Pty Ltd (Idemitsu), the proponent, to prepare an Aboriginal Cultural Heritage Assessment Report (ACHAR) for Boggabri Solar Farm.

The solar farm is located at Boggabri, approximately 10km north-east of the town of Boggabri in the Narrabri Shire LGA. The proposed development will involve construction of a 4.95MWac solar farm with various ancillary facilities and features (the project). The proposal area is located at 306 Therribi Road and includes Lot 21 DP754490.

The proposed works will be assessed as a Regionally Significant Development under the provisions of Schedule 1 & 6 *State Environmental Planning Policy (Planning Systems) 2021*. As the project is expected to have a Capital Investment Value (CIV) of below \$30 million and is not in an environmentally sensitive area of State significance, the proposed development is not categorised as State Significant Development (SSD).

RPS, on behalf of the proponent, is writing to you to ask if you would like to register an expression of interest to participate in the Aboriginal consultation for this project. We have already been in contact with Heritage NSW, Narrabri Shire Council, Red Chief Local Aboriginal Land Council, Office of the Registrar, Local Land Services, National Native Title Tribunal, Native Title Services Corporation Limited (NTSCorp) as per the *DECCW Aboriginal Cultural Heritage (ACH) Consultation Requirements for Proponents* (2010). As Red Chief Local Aboriginal Land Council is currently under administration, we have been advised to contact Narrabri Local Aboriginal Land Council.

If you would like to register your interest in Aboriginal community consultation for this project, could you please respond in writing or phone by **31 May 2023**.

In accordance with the ACH Consultation Requirements, if your organisation would like to register an expression of interest, your details will be forwarded to Heritage NSW and Narrabri Local Aboriginal Land Council, unless you inform us that you do not want your details released.

If you require any further details or clarification, please do not hesitate to contact Kristen Tola via details provided below or register your interest at:

**Mail:** Unit 2A, 45 Fitzroy St  
Carrington NSW 2294

**Email:** [Kristen.tola@rpsgroup.com.au](mailto:Kristen.tola@rpsgroup.com.au)

**Phone:** 0414 011 015

Yours sincerely,  
for RPS AAP Consulting Pty Ltd



**Kristen Tola**  
Heritage Consultant



Unit 2A, 45 Fitzroy Street  
Carrington NSW 2294  
T +61 2 4940 4200

RPS AAP Consulting Pty Ltd. Registered in Australia No. 97 117 883 173  
[rpsgroup.com](http://rpsgroup.com)

Page 1

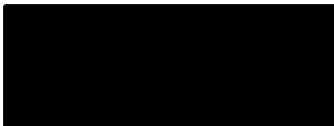
## Appendix 1 Figure 6: Assessment Methodology (sample).



Our ref: AU213008068

Unit 2A, 45 Fitzroy Street  
Carrington NSW 2294  
T +61 2 4940 4200

Date: 5 June 2023



By email: ngurrugu74@outlook.com

Dear Aaron and Natalene

**Re: Boggabri Solar Farm**

Thank you for your registration of interest in this project. This field survey will be undertaken to inform the Aboriginal Heritage Assessment Report (ACHAR) and the Aboriginal Heritage Impact Permit (AHIP) application. The survey will be undertaken to investigate further archaeological potential within the project area, including the methodology for the visual inspection and collection of information regarding cultural significance.

We are seeking your organisation's input into the heritage assessment methodology as per the Aboriginal Cultural Heritage Consultation Requirements (ACHCRs). We have attached a feedback form which you may wish to use in response to the field survey methodology.

If you could provide your feedback to RPS by 5pm on Monday 3<sup>rd</sup> July 2023, either by email or return mail that would be greatly appreciated. Please address methodology feedback to:

**RPS AAP Consulting Pty Ltd**  
Sarah van der Linde

Unit 2A, 45 Fitzroy Street  
Carrington NSW 2294  
Phone: 02 4940 4200  
Email: sarah.vanderlinde@rpsgroup.com.au

We trust this information is sufficient for your purposes, however, should you require any further details or clarification please do not hesitate to contact Sarah van der Linde on the details provided.

Yours sincerely,  
for RPS AAP Consulting Pty Ltd

for **Sarah van der Linde**  
Senior Heritage Consultant  
Sarah.vanderLinde@rpsgroup.com.au



Our ref: Methodology

## **Aboriginal Cultural Heritage Assessment Report for Boggabri Solar Farm, Boggabri, NSW: Project Information and Protocols for Sensitive Cultural Information**

The following information has been provided in accordance with the ACHCR process. Information has been provided on the proposed project (as required by Stage 2 ACHCRs), see **Figure 1 and 2**. Idemitsu Renewable Developments Australia (Idemitsu) proposes to construct a 4.95MWac solar farm with various ancillary facilities and features to provide renewable energy for all mining operations at Boggabri Coal Mine within the Project Area (**Figure 2**). The field survey will be undertaken to gather information regarding the cultural significance of the Project Area (Stage 3) as required by the ACHCRs.

### **Project Information**

RPS AAP Consulting Pty Ltd (RPS) has been engaged by Idemitsu to prepare an Aboriginal Cultural Heritage Assessment Report (ACHAR) for the Boggabri Solar Farm located in the Narrabri Local Government Area (LGA) (**Figure 1**). As a part of the ACHAR, potential impacts on Aboriginal cultural heritage will be assessed, and appropriate recommendations made.

As part of the ACHCR process Aboriginal stakeholders are asked to provide feedback to information sent regarding the project, as well as provide cultural heritage information as appropriate in accordance with the role specified in the ACHCR 2010, pages 15-16. RPS, on behalf Idemitsu, in accordance with their role under the ACHCRs is consulting with the Aboriginal stakeholders, supplying suitable project information and providing the opportunity for Aboriginal stakeholder to provide input into the heritage management process as specified in the ACHCRs 2010, pages 16-17.

### **Aboriginal Cultural Heritage Assessment Methodology**

The methodology for the ACHAR comprises:

- A review of environmental background and heritage context;
- An Aboriginal Heritage Information Management System (AHIMS) search;
- Formulation of a predictive model;
- Archaeological field survey of the study area;
- Assessment of significance; and,
- Formulation of recommendations for heritage management.

The above components of the Aboriginal heritage assessment methodology will be completed in consultation with Aboriginal stakeholders.

RPS invites Aboriginal stakeholders to provide culturally appropriate information verbally or in writing with regards to this project (a feedback form is attached and may be used as necessary). This includes any places of cultural value which may or may not contain archaeological material.

Cultural information provided by Aboriginal stakeholders will be recorded in the Aboriginal consultation log and discussed in the report, unless the information is too sensitive to be made public. If this is the case, the attached protocol will be adopted (**Figure 4**), or another protocol adopted as agreed by the Aboriginal stakeholder/s.

As part of this methodology Aboriginal stakeholders will be provided with the draft report for comment over a **28-day review period**, as per page 14 of the ACHCRs.



Our ref: Methodology

Figure 2: Proposed Works





Our ref: Methodology

## Methodology for Fieldwork

Fieldwork will be conducted in accordance with the requirements set out in the *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales* (DECCW 2010) and will comprise an archaeological survey of the study area in order to identify surface sites of potential sub-surface deposits.

## Archaeological Survey

### Survey Aims

The purpose of the survey is to inspect visible ground surfaces, observe exposed soil profiles or other visible features such as shell midden, stone artefact scatters and rock shelters or similar, in addition to assessing whether potential archaeological deposits are present in the Project Area. The survey also aims to record cultural sites or Aboriginal landscapes, if identified by the Aboriginal stakeholders.

### Sampling Strategy

The purpose of a sampling strategy is to provide a framework for conducting archaeological surveys in a manner which can be quantified and thus compared to other survey reports in the local landscape and for regional comparison (Burke and Smith 2004). The sampling strategy used for this assessment will target all landforms which may be impacted by the proposed works and where possible, targeted landforms which have been identified as having archaeological potential.

The Project Area includes landforms such as transgressive sand dunes, coastal rock outcrops, vegetated and existing disturbed areas. All are included in the survey sampling strategy. Where possible these landforms will be subject to a pedestrian survey. In addition, the following landforms are identified as having potential for Aboriginal sites to occur and will be targeted during the survey; sand dunes, ground surface exposures and vegetated areas.

### Field Methods

The survey will be conducted on foot (pedestrian) and target the landforms identified in the sampling strategy above. The area surveyed will be recorded in survey units.

Each survey unit will be mapped and recorded in accordance with landforms outlined in the Sample Strategy, Project Area boundaries, disturbance area boundaries, changes in survey conditions (such as visibility or ground surface exposure) and/or other relevant considerations. The mapping of survey units will be undertaken on the basis of GPS recorded data and with reference to aerial and topographic information. The recording of survey units will be undertaken using representative digital photographs and field notes which include observations of soils, ground surface exposure and visibility, vegetation cover, levels of ground surface disturbance, erosion and similar observations. The field notes will provide a basis for the reporting of survey coverage and calculating survey effectiveness as presented in the survey results section. It is required that Aboriginal sites identified are recorded and submitted to the AHIMS database. Such recording involves the documentation of the material traces of past Aboriginal land use, including the spatial extent of sites and other obvious physical boundaries. Aboriginal cultural sites identified by Aboriginal stakeholders may not always involve material traces and boundaries of such sites, if identified, will be mapped on the basis of information provided by the stakeholders. The position of such sites needs to be recorded by GPS receivers and mapped accordingly.

Artefacts will be recorded in an appropriate manner: where possible the length, width, thickness and weight of artefacts will be recorded as well as artefact type and raw material where applicable. Additional recording and analysis will be undertaken as required.

### Process for Gathering Information about Cultural Significance

In order to gather information about cultural significance, Aboriginal stakeholders will be provided with several opportunities to have input into the heritage assessment and management process. These opportunities are summarised on the following page and the process briefly outlined in Figure 3.



#### Our ref: Methodology

This letter has outlined the nature of the project including mapping, heritage assessment methodology and protocols for handling culturally sensitive information. A feedback form is attached to this letter which can be used to provide input into the assessment methodology.

A pre-fieldwork meeting (on the morning of the survey) will provide an opportunity to meet the RPS team and opportunity to review the maps of the Project Area, as well as discuss field survey methods and any cultural information relevant to the project. The pre-fieldwork meeting will involve two steps: the first will be a group discussion; the second will allow the opportunity for individual discussions with each stakeholder group. This second step is to identify if there is any confidential cultural information which should not be made public. The steps/levels of consultation will be made available throughout the process. Minutes of the meetings will be kept and agreed upon by all parties.

A toolbox talk will be conducted before field work commences and the opportunity will be given to raise any issues or comment on the fieldwork progress.

A post field work meeting will be conducted at the end of the day. This meeting will outline the areas which have been surveyed, a summary of Aboriginal sites observed (if applicable) and the discussion of cultural significance. In particular there will be an opportunity to discuss the criteria for the assessment of significance outlined in the OEH guidelines (2011:7-11):

- Social;
- Historic; and,
- Aesthetic

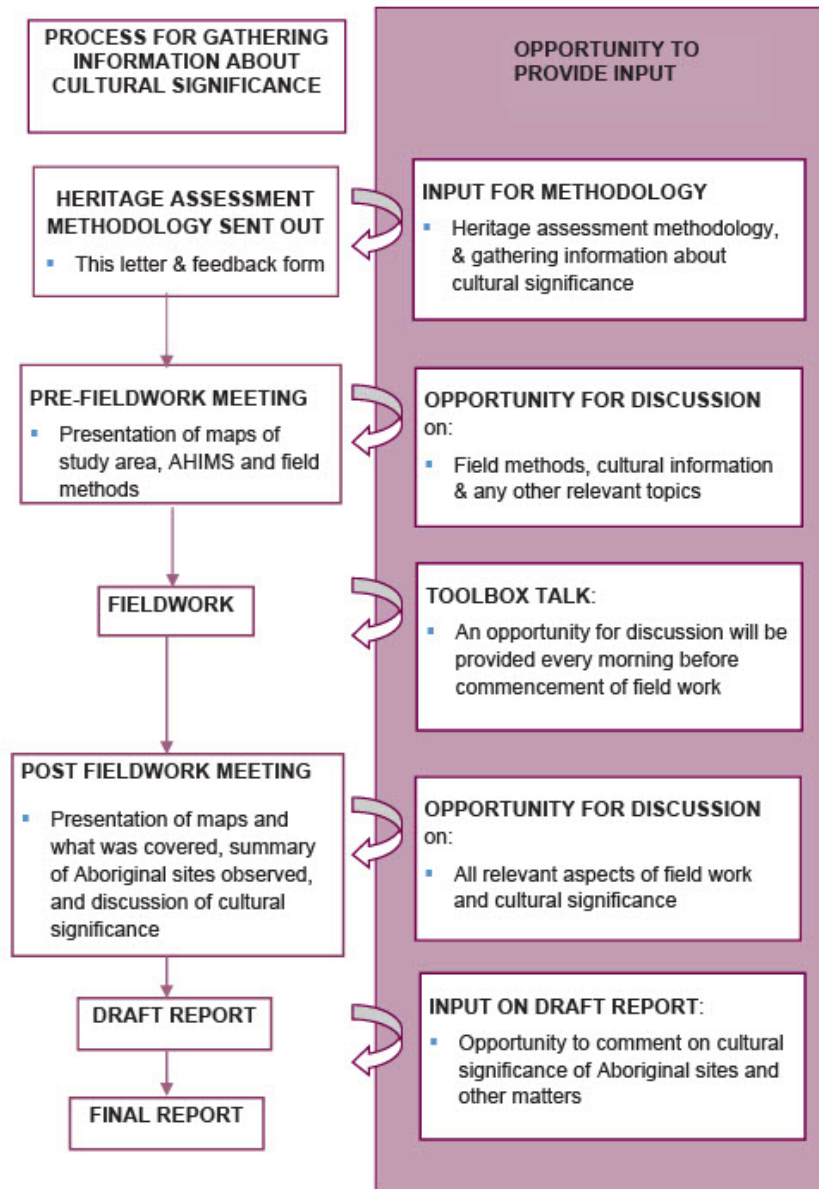
Another opportunity for the assessment of significance will be provided during the review of the draft report.

The draft report will be sent to Aboriginal stakeholders and the opportunity to assess the significance of Aboriginal sites identified in the Project Area will be provided. An opportunity for feedback on relevant aspects of the assessment will also be provided at this stage. Aboriginal stakeholders will be provided with the draft report for comment over a **28-day review period**, as per page 14 of the ACHCRs.

Cultural information provided by Aboriginal stakeholders will be recorded in the Aboriginal consultation log and discussed in the report, unless the information is too sensitive to be made public. If this is the case, the attached protocol will be adopted (**Figure 4**), or another protocol adopted as agreed by the Aboriginal stakeholder/s.

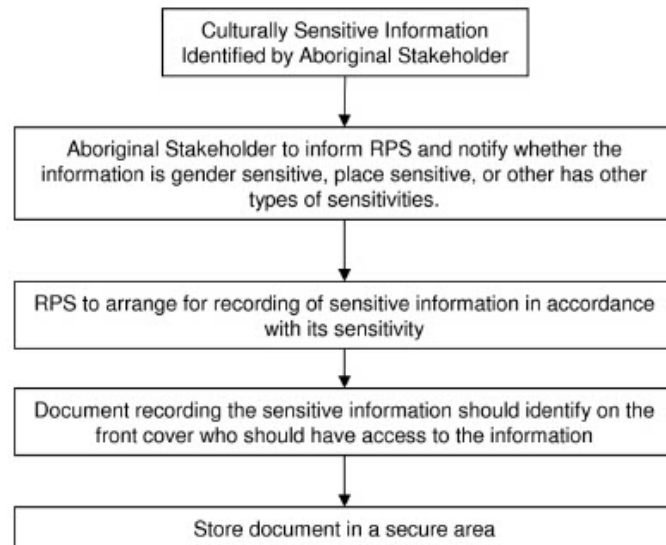
Our ref: Methodology

**Figure 3: Summary of Process for Gathering information about Cultural Significance and Opportunities for Registered Parties' Input**



Our ref: Methodology

**Figure 4: Culturally Sensitive Information Protocol**



Our ref: Methodology

**Aboriginal Feedback Form for the Aboriginal Cultural Heritage Assessment Report - BOGGABRI SOLAR FARM, Boggabri NSW**

I have been sent information regarding the proposed heritage assessment methodology, including protocols for the management of sensitive cultural information, for the Aboriginal Cultural Heritage Assessment Report, I seek to endorse the proposed methodology, unless otherwise stated below, or with the following amendments:

|  |
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|  |

Name.....  
Registered Organisation.....  
Signature.....  
Date.....

Please send this document signed within 28 days back to **Sarah van der Linde** via:

- **Post:** Unit 2, 45 Fitzroy Street, Carrington NSW 2294
- **Email:** [Sarah.vanderLinde@rpsgroup.com.au](mailto:Sarah.vanderLinde@rpsgroup.com.au)



Our ref: Methodology

## REFERENCES

Burke, H. and C. Smith (2004). The Archaeologist's Field Handbook. Crows Nest, Allen and Unwin.

DECCW (2010). Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales. Part 6 National Parks and Wildlife Act 1974. G. S., Department of Environment, Climate Change and Water.

OEH (2011). Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in NSW, State of NSW and the Office of Environment and Heritage, Department of Premier and Cabinet.

Our ref: Methodology

Figure 2: Proposed Works

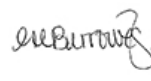


## Appendix 1 Figure 7: Letter advising RAPs of consultancy change.

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                  |                                                                                 |
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|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | <b>OzArk Environment &amp; Heritage</b><br>Dubbo   Queanbeyan      T: 02 6882 0118<br>Wollongong   Newcastle      enquiry@ozarkehm.com.au<br>www.ozarkehm.com.au | <b>ABN 59 104 582 354</b><br>145 Wingewarra St<br>PO Box 2069<br>DUBBO NSW 2830 |
| 17/10/2023<br><div style="background-color: yellow; padding: 2px 5px; display: inline-block;">Name</div>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                  |                                                                                 |
| <b>MERRIOWN SOLAR FARM TEST EXCAVATION<br/>PROGRAM &amp; ACHAR PREPARATION</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                  |                                                                                 |
| <p>Thank you for your continuing interest in the Boggabri Solar Farm project (the Project). This letter is to introduce ourselves to you as the consulting firm that has been chosen to take this project forward in partnership with Boggabri Coal (the Proponent) and yourselves. OzArk Environment &amp; Heritage (OzArk) will be assisting in the completion of the remaining elements of this heritage assessment project, which includes the test excavation program and the Aboriginal Cultural Heritage Assessment Report (ACHAR).</p> <p>As you will be aware, RPS carried out the survey of the Project Area in August this year, recording five Aboriginal stone artefact sites, two being isolated finds and three being small open artefact scatters, all in at least partially disturbed contexts. Due to the proximity to Merrygowen Creek and as Aboriginal sites were recorded, a limited test excavation is warranted to understand the nature, extent and integrity of the deposits that comprise the study area.</p> <p>Shortly we will be distributing the test excavation methodology for your review and comment. OzArk looks forward to working with you on this Project.</p> <p>If you have any queries, please don't hesitate to reach out.</p> <div style="text-align: center; margin-top: 20px;">  </div> <div style="margin-top: 20px;"> <p>Catherine Burrowes<br/>         OzArk Consultation Officer<br/> <a href="mailto:catherine@ozarkehm.com.au">catherine@ozarkehm.com.au</a><br/>         (02) 6882 0118</p> </div> |                                                                                                                                                                  |                                                                                 |

## Appendix 1 Figure 8: Stage 4 correspondence.

Stage 4 cover letter

|                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                 |                                                                                 |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------|
|                                                                                                                                                                                                                                               | <b>OzArk Environment &amp; Heritage</b><br>Dubbo   Queanbeyan T: 02 6882 0118<br>Wollongong   Newcastle enquiry@ozarkehm.com.au<br>Katoomba www.ozarkehm.com.au | <b>ABN 59 104 582 354</b><br>145 Wingewarra St<br>PO Box 2069<br>DUBBO NSW 2830 |
| <p>2 February 2024</p>                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                 |                                                                                 |
| <p><b><i>ABORIGINAL CULTURAL HERITAGE ASSESSMENT REPORT FOR THE MERRIOWN SOLAR FARM</i></b></p>                                                                                                                                                                                                                                |                                                                                                                                                                 |                                                                                 |
| <p>Dear Members,</p>                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                 |                                                                                 |
| <p>Thank-you for your continued participation as a Registered Aboriginal Party (RAP) and involvement in the above-mentioned project.</p>                                                                                                                                                                                       |                                                                                                                                                                 |                                                                                 |
| <p>Idemitsu Renewable Developments Australia Pty Ltd (the Proponent) would like to offer you the opportunity to provide feedback on the draft report that has been undertaken in accordance with stage four (4) of the <i>Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010</i> (ACHCR).</p>          |                                                                                                                                                                 |                                                                                 |
| <p>As per the ACHCRs we are required to give you twenty-eight (28) days to supply feedback on the attached document. This period closes on the <b>Friday 1 March 2024</b>. Should our office not be contacted within this time frame, we will presume that you are satisfied with the contents of the report as it stands.</p> |                                                                                                                                                                 |                                                                                 |
| <p>If you need any help supplying feedback or have any queries, please do not hesitate to contact our office.</p>                                                                                                                                                                                                              |                                                                                                                                                                 |                                                                                 |
| <p>Kind regards,</p>                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                 |                                                                                 |
|                                                                                                                                                                                                                                             |                                                                                                                                                                 |                                                                                 |
| <p>Catherine Burrowes<br/><b>Office Manager/ Community Liaison</b></p>                                                                                                                                                                                                                                                         |                                                                                                                                                                 |                                                                                 |



RAP responses to the draft ACHAR

Re: Stage 4 - Merriown Solar Farm

AT

Aaron Talbott <[REDACTED]>  
To: Catherine Burrowes

Reply

Reply All

Forward

You forwarded this message on 2/02/2024 2:15 PM.

Fri 2/02/2024 1:52 PM

Yaama

You expect me to comment after the disrespectful treatment I received. Get it right please. It's a joke the whole process. Stolen land and you companies want to play politics with people's lives and mental health.

Maybe you should ring my mother and apologise to her for not engaging. Don't use the proponents act as justification because I am already recognised throughout the region and have worked with your company previously.

Not a happy chap that's for sure

Regards

Aaron Talbott

Re: Stage 4 - Merriown Solar Farm

CF

Cindy Foley <[REDACTED]>  
To: Catherine Burrowes

Reply

Reply All

Forward

You don't often get email from [foley197948@gmail.com](mailto:foley197948@gmail.com). [Learn why this is important](#)

Fri 2/02/2024 2:35 PM

Looks good to me.

On Fri, 2 Feb 2024, 1:05 pm Catherine Burrowes, <[catherine@ozarkehm.com.au](mailto:catherine@ozarkehm.com.au)> wrote:

Re: Stage 4 - Merriown Solar Farm

LC

lilly carroll <[REDACTED]>  
To: Catherine Burrowes

Reply

Reply All

Forward

Fri 2/02/2024 4:01 PM

Hi Catherine

Hi, we have read your methodology and is happy with everything

Thanks Paul  
[Sent from Yahoo Mail for iPhone](#)

## APPENDIX 2: AHIMS SEARCH RESULTS

### 2023 search



#### AHIMS Web Services (AWS) Search Result

Your Ref/PO Number : AU213008068.002

Client Service ID : 747637

RPS Australia East Pty Ltd - Pitt Street Sydney

Date: 24 January 2023

Level 13 255 Pitt Street

Sydney New South Wales 2000

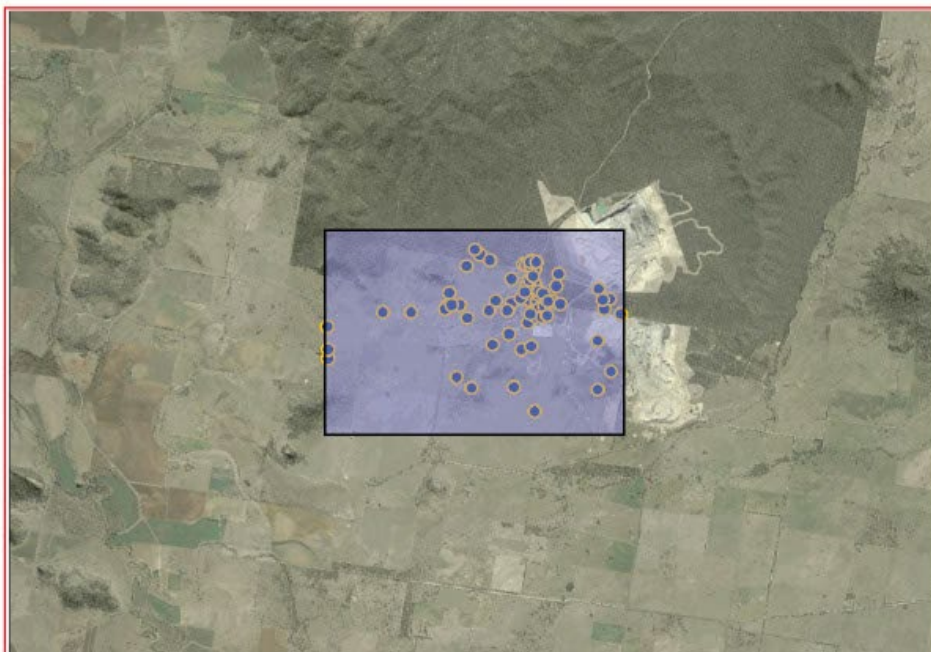
Attention: Sarah Van Der Linde

Email: sarah.vanderlinde@rpsgroup.com.au

Dear Sir or Madam:

**AHIMS Web Service search for the following area at Lat, Long From : -30.6495, 150.1009 - Lat, Long To : -30.6125, 150.1627, conducted by Sarah Van Der Linde on 24 January 2023.**

The context area of your search is shown in the map below. Please note that the map does not accurately display the exact boundaries of the search as defined in the paragraph above. The map is to be used for general reference purposes only.



A search of Heritage NSW AHIMS Web Services (Aboriginal Heritage Information Management System) has shown that:

|    |                                                                       |
|----|-----------------------------------------------------------------------|
| 77 | Aboriginal sites are recorded in or near the above location.          |
| 0  | Aboriginal places have been declared in or near the above location. * |

**If your search shows Aboriginal sites or places what should you do?**

- You must do an extensive search if AHIMS has shown that there are Aboriginal sites or places recorded in the search area.
- If you are checking AHIMS as a part of your due diligence, refer to the next steps of the Due Diligence Code of practice.
- You can get further information about Aboriginal places by looking at the gazettal notice that declared it. Aboriginal places gazetted after 2001 are available on the [NSW Government Gazette](https://www.legislation.nsw.gov.au/gazette) (<https://www.legislation.nsw.gov.au/gazette>) website. Gazettal notices published prior to 2001 can be obtained from Heritage NSW upon request

**Important information about your AHIMS search**

- The information derived from the AHIMS search is only to be used for the purpose for which it was requested. It is not to be made available to the public.
- AHIMS records information about Aboriginal sites that have been provided to Heritage NSW and Aboriginal places that have been declared by the Minister;
- Information recorded on AHIMS may vary in its accuracy and may not be up to date. Location details are recorded as grid references and it is important to note that there may be errors or omissions in these recordings,
- Some parts of New South Wales have not been investigated in detail and there may be fewer records of Aboriginal sites in those areas. These areas may contain Aboriginal sites which are not recorded on AHIMS.
- Aboriginal objects are protected under the National Parks and Wildlife Act 1974 even if they are not recorded as a site on AHIMS.
- This search can form part of your due diligence and remains valid for 12 months.

Level 6, 10 Valentine Ave, Parramatta 2150  
 Locked Bag 5020 Parramatta NSW 2124  
 Tel: (02) 9585 6345

ABN 34 945 244 274  
 Email: [ahims@environment.nsw.gov.au](mailto:ahims@environment.nsw.gov.au)  
 Web: [www.heritage.nsw.gov.au](http://www.heritage.nsw.gov.au)



## AHIMS Web Services (AWS)

### Extensive search - Site list report

Your Ref/PO Number : AU213008068.002  
Client Service ID : 747640

| SiteID    | SiteName         | Datum     | Zone                                               | Easting | Northing | Context | Site Status ** | SiteFeatures | SiteTypes                            | Reports |
|-----------|------------------|-----------|----------------------------------------------------|---------|----------|---------|----------------|--------------|--------------------------------------|---------|
| 20-4-0574 | TC9/15           | Recorders | Ms.Taryn Gooley                                    | 56      | 226360   | 6608543 | Open site      | Destroyed    | Artefact :-                          | Permits |
|           | Contact          | GDA       |                                                    |         |          |         |                |              |                                      |         |
| 20-4-0526 | LFNV80           | Recorders | Ms.Taryn Gooley                                    | 56      | 226282   | 6608635 | Open site      | Valid        | Artefact :-                          | 103378  |
|           | Contact          | GDA       | Mrs.Angela Besant                                  |         |          |         |                |              |                                      |         |
| 20-4-0583 | BC30 (ST)        | Recorders | Mrs.Angela Besant                                  | 56      | 226425   | 6608589 | Open site      | Valid        | Modified Tree (Carved or Scarred) :- | Permits |
|           | Contact          | GDA       |                                                    |         |          |         |                |              |                                      |         |
| 20-4-0584 | TC2/14           | Recorders | Mrs.Angela Besant                                  | 56      | 226722   | 6608998 | Open site      | Destroyed    | Artefact :-                          | Permits |
|           | Contact          | GDA       | Mrs.Angela Besant,Ms.Taryn Gooley                  | 56      | 225058   | 6606658 | Open site      | Valid        | Artefact :-                          | Permits |
| 20-4-0604 | VEP IA16         | Recorders | University of Queensland,Mr.Reiner Mantel          | 56      | 222194   | 6607364 | Open site      | Valid        | Artefact :-                          | Permits |
| 20-4-0671 | VEP AS 13        | Recorders | University of Queensland,Ms.Jodie Crossman         | 56      | 224758   | 6606874 | Open site      | Valid        | Artefact :-                          | Permits |
| 20-4-0663 | VEP IA17         | Recorders | University of Queensland,Mr.Reiner Mantel          | 56      | 224570   | 6608561 | Open site      | Valid        | Artefact :-                          | Permits |
| 20-4-0740 | BC 20/17         | Recorders | Mrs.Angela Besant,Insite Heritage Pty Ltd          | 56      | 227811   | 6607058 | Open site      | Valid        | Grinding Groove :-                   | Permits |
| 20-4-0873 | Tarrawonga GG1   | Recorders | Doctor.Matthew Whincop,Whincop Archaeology Pty Ltd | 56      | 222158   | 6607812 | Open site      | Valid        | Artefact :-                          | Permits |
| 20-4-0925 | TPW ASS1         | Recorders | Mrs.Angela Besant,Insite Heritage Pty Ltd          | 56      | 222197   | 6607169 | Open site      | Valid        | Artefact :-                          | Permits |
| 20-4-0926 | TPW AS S3        | Recorders | Mrs.Angela Besant,Insite Heritage Pty Ltd          | 56      | 226270   | 6609238 | Open site      | Valid        | Hearth :-                            | Permits |
| 20-4-0979 | Mod8_2/20        | Recorders | Mrs.Angela Besant,Insite Heritage Pty Ltd          | 56      | 226691   | 6608744 | Open site      | Valid        | Artefact :-                          | Permits |
| 20-4-0980 | Mod8_3/20 Cloned | Recorders | Mrs.Angela Besant,Insite Heritage Pty Ltd          | 56      | 226521   | 6608441 | Open site      | Valid        | Modified Tree (Carved or Scarred) :- | Permits |
| 20-4-0981 | Mod8_4/20        | Recorders | Mrs.Angela Besant,Insite Heritage Pty Ltd          | 56      | 226349   | 6608568 | Open site      | Valid        | Artefact :-                          | Permits |
| 20-4-0982 | Mod8_5/20        | Recorders | Mrs.Angela Besant,Insite Heritage Pty Ltd          |         |          |         |                |              |                                      |         |

Report generated by AHIMS Web Service on 24/01/2023 for Sarah Van Der Linde for the following area at Lat, Long From : -30.6495, 150.1009 - Lat, Long To : -30.6125, 150.1627. Number of Aboriginal sites and Aboriginal objects found is 77  
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## AHIMS Web Services (AWS)

### Extensive search - Site list report

Your Ref/PO Number : AU213008068.002  
Client Service ID : 747640

| SiteID    | SiteName                                                          | Datum     | Zone                                                                              | Easting | Northing | Context   | Site Status ** | SiteFeatures        | SiteTypes                                                                   | Reports       |
|-----------|-------------------------------------------------------------------|-----------|-----------------------------------------------------------------------------------|---------|----------|-----------|----------------|---------------------|-----------------------------------------------------------------------------|---------------|
| 20-4-0229 | LFNV 77, 78                                                       | GDA       | 56                                                                                | 223825  | 6608155  | Open site | Destroyed      | Artefact : 10       |                                                                             | 101940,103378 |
|           | Contact                                                           | Recorders | Mrs.Angela Besant,Mrs.Angela Besant                                               |         |          | Open site | Valid          |                     |                                                                             | 101906,103378 |
| 20-4-0198 | Restriction applied. Please contact ahims@environment.nsw.gov.au. | Recorders | Mrs.Angela Besant                                                                 | 56      | 225900   | 6606697   | Open site      | Valid               | Artefact : 2                                                                | 101906,103378 |
| 20-4-0199 | BCD 2                                                             | Recorders | Mrs.Angela Besant                                                                 | 56      | 226322   | 6606222   | Open site      | Valid               | Artefact : 1                                                                | 101906,103378 |
| 20-4-0200 | BCD 3                                                             | Recorders | Mrs.Angela Besant                                                                 | 56      | 227984   | 6608219   | Open site      | Partially Destroyed | Modified Tree (Carved or Scarred) : 1                                       | 103378        |
| 20-4-0347 | TCEP-ST-010                                                       | Recorders | Kayandel Archaeological Services,RPS Australia East Pty Ltd - Hamilton,Mr.Warwick | 56      | 226201   | 6609171   | Closed site    | Valid               | Artefact :-                                                                 | 103378        |
| 20-4-0507 | Isolated Find Flake                                               | Recorders | Ms.Jane Delaney-John                                                              | 56      | 226239   | 6609162   | Closed site    | Valid               | Aboriginal Resource and Gathering :-<br>Aboriginal Ceremony and Dreaming :- | 103378        |
| 20-4-0505 | Leard Stare Forest Grinding Stone Portable                        | Recorders | Ms.Jane Delaney-John                                                              | 56      | 224486   | 6608228   | Open site      | Valid               | Artefact : 1                                                                | 103378        |
| 20-4-0474 | NV79                                                              | Recorders | Mrs.Angela Besant,Insite Heritage Pty Ltd                                         | 56      | 226169   | 6609233   | Closed site    | Valid               | Artefact :-                                                                 | 103378        |
| 20-4-0510 | Leard Forest                                                      | Recorders | Ms.Jane Delaney-John                                                              | 56      | 226178   | 6609239   | Closed site    | Valid               | Artefact :-                                                                 | 103378        |
| 20-4-0511 | Leard Forest Old Camp 3                                           | Recorders | Ms.Jane Delaney-John                                                              | 56      | 226200   | 6609177   | Closed site    | Valid               | Artefact :-                                                                 | 103378        |
| 20-4-0512 | Leard Forest - Old Camp                                           | Recorders | Ms.Jane Delaney-John                                                              | 56      | 226346   | 6608647   | Open site      | Valid               | Artefact :-                                                                 | 103378        |
| 20-4-0565 | NV 84                                                             | Recorders | Mrs.Angela Besant                                                                 | 56      | 226368   | 6608585   | Open site      | Valid               | Artefact :-                                                                 | 103378        |
| 20-4-0566 | NV 85                                                             | Recorders | Mrs.Angela Besant                                                                 | 56      | 226251   | 6608783   | Open site      | Destroyed           | Artefact :-                                                                 | 103378        |
| 20-4-0570 | TC5/15                                                            | Recorders | Ms.Taryn Gooley                                                                   | 56      | 226722   | 6608998   | Open site      | Destroyed           | Artefact :-                                                                 | 103378        |
| 20-4-0571 | TC6/15                                                            | Recorders | Ms.Taryn Gooley                                                                   |         |          |           |                |                     |                                                                             |               |

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## AHIMS Web Services (AWS)

### Extensive search - Site list report

Your Ref/PO Number : AU213008068.002

Client Service ID : 747640

| SiteID    | SiteName             | Datum     | Zone                                                 | Easting | Northing | Context   | Site Status **      | SiteFeatures                               | SiteTypes | Reports       |
|-----------|----------------------|-----------|------------------------------------------------------|---------|----------|-----------|---------------------|--------------------------------------------|-----------|---------------|
| 20-4-0143 | BC 50                | GDA       | 56                                                   | 225982  | 6608482  | Open site | Not a Site          | Modified Tree (Carved or Scarred) : 1      |           | 103378        |
|           | Contact Searle       | Recorders | Mr.Giles (dup ID#12832) Hamm                         |         |          |           |                     |                                            |           |               |
| 20-4-0144 | BC 51                | GDA       | 56                                                   | 226179  | 6608523  | Open site | Valid               | Modified Tree (Carved or Scarred) : 1      |           |               |
|           | Contact Searle       | Recorders | Insite Heritage Pty Ltd,Mr.Giles (dup ID#12832) Hamm |         |          |           |                     |                                            |           |               |
| 20-4-0145 | BC 52                | GDA       | 56                                                   | 226306  | 6608432  | Open site | Destroyed           | Modified Tree (Carved or Scarred) : 1      |           | 103378        |
|           | Contact Searle       | Recorders | Mr.Giles (dup ID#12832) Hamm,Ms.Taryn Gooley         |         |          |           |                     |                                            |           |               |
| 20-4-0146 | BC 53                | GDA       | 56                                                   | 225786  | 6608877  | Open site | Valid               | Artefact : 1                               |           |               |
|           | Contact Searle       | Recorders | Mr.Giles (dup ID#12832) Hamm                         |         |          |           |                     |                                            |           |               |
| 20-4-0148 | BCHR1                | GDA       | 56                                                   | 225485  | 6608430  | Open site | Valid               | Artefact : 1                               |           |               |
|           | Contact Searle       | Recorders | Mr.Giles (dup ID#12832) Hamm                         |         |          |           |                     |                                            |           |               |
| 20-4-0149 | BCHR2                | GDA       | 56                                                   | 225368  | 6608222  | Open site | Valid               | Artefact : 1                               |           |               |
|           | Contact Searle       | Recorders | Mr.Giles (dup ID#12832) Hamm                         |         |          |           |                     |                                            |           |               |
| 20-4-0150 | BCHR3                | GDA       | 56                                                   | 224793  | 6608318  | Open site | Valid               | Artefact : 1                               |           |               |
|           | Contact Searle       | Recorders | Mr.Giles (dup ID#12832) Hamm                         |         |          |           |                     |                                            |           |               |
| 20-4-0151 | BCHR4                | GDA       | 56                                                   | 224630  | 6608316  | Open site | Valid               | Artefact : 1                               |           |               |
|           | Contact Searle       | Recorders | Mr.Giles (dup ID#12832) Hamm                         |         |          |           |                     |                                            |           |               |
| 20-4-0152 | BCHR5                | GDA       | 56                                                   | 224530  | 6608290  | Open site | Valid               | Artefact : 1                               |           |               |
|           | Contact Searle       | Recorders | Mr.Giles (dup ID#12832) Hamm                         |         |          |           |                     |                                            |           |               |
| 20-4-0155 | BCHR6                | AGD       | 56                                                   | 223161  | 6607947  | Open site | Valid               | Artefact : 1                               |           |               |
|           | Contact Searle       | Recorders | Archaeological Risk Assessment Services (ARAS)       |         |          |           |                     |                                            |           |               |
| 20-4-0161 | NST 1                | AGD       | 56                                                   | 227448  | 6606507  | Open site | Valid               | Modified Tree (Carved or Scarred) : 1      |           |               |
|           | Contact              | Recorders | Mr.John Appleton                                     |         |          |           |                     |                                            |           |               |
| 20-4-0196 | Boggabri Coal Pad 1  | AGD       | 56                                                   | 225915  | 6607271  | Open site | Not a Site          | Potential Archaeological Deposit (PAD) : 1 |           |               |
|           | Contact              | Recorders | Mrs.Angela Besant                                    |         |          |           |                     |                                            |           |               |
| 20-4-0224 | LF NV 24, 51-61 & 63 | GDA       | 56                                                   | 224946  | 6608068  | Open site | Partially Destroyed | Artefact : 145                             |           | 101940,103378 |
|           | Contact              | Recorders | Mrs.Angela Besant,Mrs.Angela Besant                  |         |          |           |                     |                                            |           |               |
| 20-4-0228 | LFNV 49, 50 & 62     | GDA       | 56                                                   | 224896  | 6609111  | Open site | Valid               | Artefact : 26                              |           | 101940,103378 |
|           | Contact              | Recorders | Mrs.Angela Besant                                    |         |          |           |                     |                                            |           |               |

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## AHIMS Web Services (AWS)

### Extensive search - Site list report

Your Ref/PO Number : AU213008068.002

Client Service ID : 747640

| SiteID    | SiteName       | Datum     | Zone                                            | Easting | Northing | Context   | Site Status **      | SiteFeatures                          | SiteTypes | Reports |
|-----------|----------------|-----------|-------------------------------------------------|---------|----------|-----------|---------------------|---------------------------------------|-----------|---------|
| 20-4-0125 | BC31           | GDA       | 56                                              | 225354  | 6609238  | Open site | Partially Destroyed | Artefact : 1                          |           | 103378  |
|           | Contact Searle | Recorders | Mrs.Angela Besant,Mrs.Giles (dup ID#12832) Hamm |         |          |           |                     |                                       |           |         |
| 20-4-0126 | BC32           | GDA       | 56                                              | 225147  | 6609354  | Open site | Valid               | Artefact : 1                          |           | 103378  |
|           | Contact Searle | Recorders | Mr.Giles (dup ID#12832) Hamm                    |         |          |           |                     |                                       |           |         |
| 20-4-0127 | BC33           | GDA       | 56                                              | 225058  | 6609442  | Open site | Valid               | Artefact : 1                          |           | 103378  |
|           | Contact Searle | Recorders | Mr.Giles (dup ID#12832) Hamm                    |         |          |           |                     |                                       |           |         |
| 20-4-0130 | BC37           | GDA       | 56                                              | 226785  | 6608396  | Open site | Not a Site          | Modified Tree (Carved or Scarred) : 1 |           | 103378  |
|           | Contact Searle | Recorders | Mr.Giles (dup ID#12832) Hamm,Ms.Taryn Gooley    |         |          |           |                     |                                       |           |         |
| 20-4-0131 | BC38           | GDA       | 56                                              | 226524  | 6608158  | Open site | Valid               | Artefact : 144                        |           |         |
|           | Contact Searle | Recorders | Mr.Giles (dup ID#12832) Hamm                    |         |          |           |                     |                                       |           |         |
| 20-4-0132 | BC39           | GDA       | 56                                              | 226422  | 6608122  | Open site | Valid               | Artefact : 1                          |           |         |
|           | Contact Searle | Recorders | Mr.Giles (dup ID#12832) Hamm                    |         |          |           |                     |                                       |           |         |
| 20-4-0133 | BC 40          | GDA       | 56                                              | 226468  | 6608332  | Open site | Valid               | Artefact : 10                         |           |         |
|           | Contact Searle | Recorders | Mr.Giles (dup ID#12832) Hamm                    |         |          |           |                     |                                       |           |         |
| 20-4-0134 | BC 42          | GDA       | 56                                              | 226309  | 6608430  | Open site | Destroyed           | Artefact : 6                          |           | 103378  |
|           | Contact Searle | Recorders | Mrs.Angela Besant,Mrs.Giles (dup ID#12832) Hamm |         |          |           |                     |                                       |           |         |
| 20-4-0135 | BC 41          | GDA       | 56                                              | 226333  | 6608273  | Open site | Valid               | Artefact : 3                          |           |         |
|           | Contact Searle | Recorders | Mr.Giles (dup ID#12832) Hamm                    |         |          |           |                     |                                       |           |         |
| 20-4-0136 | BC 43          | GDA       | 56                                              | 226155  | 6608455  | Open site | Destroyed           | Artefact : 15                         |           | 103378  |
|           | Contact Searle | Recorders | Mrs.Angela Besant,Mrs.Giles (dup ID#12832) Hamm |         |          |           |                     |                                       |           |         |
| 20-4-0137 | BC 44          | GDA       | 56                                              | 226186  | 6608185  | Open site | Destroyed           | Artefact : 4                          |           |         |
|           | Contact Searle | Recorders | Mrs.Angela Besant,Mrs.Giles (dup ID#12832) Hamm |         |          |           |                     |                                       |           |         |
| 20-4-0138 | BC 45          | GDA       | 56                                              | 226282  | 6608124  | Open site | Destroyed           | Artefact : 4                          |           |         |
|           | Contact Searle | Recorders | Mrs.Angela Besant,Mrs.Giles (dup ID#12832) Hamm |         |          |           |                     |                                       |           |         |
| 20-4-0139 | BC 46          | GDA       | 56                                              | 226098  | 6608743  | Open site | Partially Destroyed | Artefact : 28                         |           | 103378  |
|           | Contact Searle | Recorders | Mrs.Angela Besant,Mrs.Giles (dup ID#12832) Hamm |         |          |           |                     |                                       |           |         |
| 20-4-0140 | BC 47          | GDA       | 56                                              | 226157  | 6608862  | Open site | Destroyed           | Artefact : 3                          |           | 103378  |
|           | Contact Searle | Recorders | Mrs.Angela Besant,Mrs.Giles (dup ID#12832) Hamm |         |          |           |                     |                                       |           |         |
| 20-4-0141 | BC 48          | GDA       | 56                                              | 226223  | 6608938  | Open site | Valid               | Artefact : 3                          |           |         |
|           | Contact Searle | Recorders | Mr.Giles (dup ID#12832) Hamm                    |         |          |           |                     |                                       |           |         |
| 20-4-0142 | BC 49          | GDA       | 56                                              | 226057  | 6608625  | Open site | Destroyed           | Artefact : 1                          |           | 103378  |
|           | Contact Searle | Recorders | Mrs.Angela Besant,Mrs.Giles (dup ID#12832) Hamm |         |          |           |                     |                                       |           |         |

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## AHIMS Web Services (AWS)

### Extensive search - Site list report

Your Ref/PO Number : AU213008068.002

Client Service ID : 747640

| SiteID    | SiteName      | Datum     | Zone | Easting | Northing                                                                  | Context   | Site Status ** | SiteFeatures                                | SiteTypes      | Reports |
|-----------|---------------|-----------|------|---------|---------------------------------------------------------------------------|-----------|----------------|---------------------------------------------|----------------|---------|
| 20-4-0017 | Nagero Creek; | AGD       | 56   | 225704  | 6608190                                                                   | Open site | Destroyed      | Artefact : -                                | Open Camp Site | 103378  |
|           | Contact       | Recorders |      |         | Mrs.Angela Besant,Karen Flick                                             |           |                | Permits                                     |                |         |
| 20-4-0388 | BCS 5         | GDA       | 56   | 226147  | 6608004                                                                   | Open site | Destroyed      | Artefact : 1                                |                | 103378  |
|           | Contact       | Recorders |      |         | Mrs.Angela Besant,Jnsite Heritage Pty Ltd                                 |           |                | Permits                                     |                |         |
| 20-4-0389 | BCS 6         | GDA       | 56   | 225719  | 6608229                                                                   | Open site | Destroyed      | Artefact : 1                                |                | 103378  |
|           | Contact       | Recorders |      |         | Mrs.Angela Besant,Jnsite Heritage Pty Ltd                                 |           |                | Permits                                     |                |         |
| 20-4-0392 | BCS 3         | GDA       | 56   | 225775  | 6607762                                                                   | Open site | Destroyed      | Artefact : 1                                |                | 103378  |
|           | Contact       | Recorders |      |         | Mrs.Angela Besant,Jnsite Heritage Pty Ltd                                 |           |                | Permits                                     |                |         |
| 20-4-0393 | BCS 4         | GDA       | 56   | 226222  | 6607532                                                                   | Open site | Destroyed      | Artefact : 1                                |                |         |
|           | Contact       | Recorders |      |         | Mrs.Angela Besant,Jnsite Heritage Pty Ltd                                 |           |                | Permits                                     |                |         |
| 20-4-0092 | NAS 1         | GDA       | 56   | 227537  | 6607675                                                                   | Open site | Destroyed      | Artefact : 4                                |                |         |
|           | Contact       | Recorders |      |         | Mr.John Appleton,RPS Australia East Pty Ltd - Hamilton,Mrs.Tessa Boer-Mah |           |                | Permits                                     | 2312           |         |
| 20-4-0093 | NIS 01        | GDA       | 56   | 227537  | 6607675                                                                   | Open site | Destroyed      | Artefact : 1                                |                |         |
|           | Contact       | Recorders |      |         | Mr.John Appleton,RPS Australia East Pty Ltd - Hamilton,Mrs.Tessa Boer-Mah |           |                | Permits                                     | 2312           |         |
| 20-4-0111 | BC-17         | GDA       | 56   | 227644  | 6608315                                                                   | Open site | Destroyed      | Artefact : 1                                |                |         |
|           | Contact       | Recorders |      |         | Mr.Giles (dup ID#12832) Hamm,RPS Australia East Pty Ltd - Hamilton        |           |                | Permits                                     |                |         |
| 20-4-0113 | BC-19         | GDA       | 56   | 227622  | 6608492                                                                   | Open site | Destroyed      | Artefact : 1                                |                |         |
|           | Contact       | Recorders |      |         | Mr.Giles (dup ID#12832) Hamm,RPS Australia East Pty Ltd - Hamilton        |           |                | Permits                                     |                |         |
| 20-4-0114 | BC-20         | GDA       | 56   | 227531  | 6608729                                                                   | Open site | Valid          | Artefact : 1                                |                |         |
|           | Contact       | Recorders |      |         | Mr.Giles (dup ID#12832) Hamm                                              |           |                | Permits                                     |                |         |
| 20-4-0115 | BC-21         | GDA       | 56   | 226251  | 6609073                                                                   | Open site | Valid          | Artefact : 1                                |                |         |
|           | Contact       | Recorders |      |         | Mr.Giles (dup ID#12832) Hamm                                              |           |                | Permits                                     |                |         |
| 20-4-0116 | BC-22         | GDA       | 56   | 227767  | 6608516                                                                   | Open site | Destroyed      | Artefact : 1                                |                | 103378  |
|           | Contact       | Recorders |      |         | Mr.Giles (dup ID#12832) Hamm,RPS Australia East Pty Ltd - Hamilton        |           |                | Permits                                     |                |         |
| 20-4-0117 | BC-23         | GDA       | 56   | 226605  | 6608460                                                                   | Open site | Not a Site     | Modified Tree<br>(Carved or Scarred) :<br>1 |                |         |
|           | Contact       | Recorders |      |         | Mrs.Angela Besant,Jnsite Heritage Pty Ltd,Mr.Giles (dup ID#12832) Hamm    |           |                | Permits                                     |                |         |
| 20-4-0121 | BC-27         | GDA       | 56   | 226238  | 6609120                                                                   | Open site | Valid          | Artefact : 1                                |                |         |
|           | Contact       | Recorders |      |         | Mr.Giles (dup ID#12832) Hamm                                              |           |                | Permits                                     |                |         |
| 20-4-0122 | BC-28         | GDA       | 56   | 226159  | 6609147                                                                   | Open site | Valid          | Artefact : 1                                |                |         |
|           | Contact       | Recorders |      |         | Mr.Giles (dup ID#12832) Hamm                                              |           |                | Permits                                     |                |         |
| 20-4-0123 | BC-29         | GDA       | 56   | 226090  | 6609164                                                                   | Open site | Valid          | Artefact : 1                                |                |         |
|           | Contact       | Recorders |      |         | Mr.Giles (dup ID#12832) Hamm                                              |           |                | Permits                                     |                |         |
| 20-4-0124 | BC30          | GDA       | 56   | 226018  | 6609174                                                                   | Open site | Valid          | Artefact : 1                                |                |         |
|           | Contact       | Recorders |      |         | Mr.Giles (dup ID#12832) Hamm                                              |           |                | Permits                                     |                |         |

Report generated by AHIMS Web Service on 24/01/2023 for Sarah Van Der Linde for the following area at Lat, Long From : -30.6495, 150.1009 - Lat, Long To : -30.6125, 150.1627. Number of Aboriginal sites and Aboriginal objects found is 77

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## AHIMS Web Services (AWS)

### Extensive search - Site list report

Your Ref/PO Number : AU213008068.002

Client Service ID : 747640

| SiteID                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | SiteName | Datum | Zone | Easting | Northing | Context | Site Status ** | SiteFeatures | SiteTypes | Reports |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|-------|------|---------|----------|---------|----------------|--------------|-----------|---------|
| <p><b>** Site status</b></p> <p><b>Valid</b> - The site has been recorded and accepted onto the system as valid</p> <p><b>Destroyed</b> - The site has been completely impacted or harmed usually as consequence of permit activity but sometimes also after natural events. There is nothing left of the site on the ground but proponents should proceed with caution.</p> <p><b>Partially Destroyed</b> - The site has been only partially impacted or harmed usually as consequence of permit activity but sometimes also after natural events. There might be parts or sections of the original site still present on the ground</p> <p><b>Not a site</b> - The site has been originally entered and accepted onto AHIMS as a valid site but after further investigations it was decided it is NOT an aboriginal site. Impact of this type of site does not require permit but Heritage NSW should be notified</p> |          |       |      |         |          |         |                |              |           |         |

Report generated by AHIMS Web Service on 24/01/2023 for Sarah Van Der Linde for the following area at Lat, Long From : -30.6495, 150.1009 - Lat, Long To : -30.6125, 150.1627. Number of Aboriginal sites and Aboriginal objects found is 77

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## 2024 search



AHIMS Web Services (AWS)

Extensive search - Site list report

Your Ref/PO Number : 4145

Client Service ID : 870005

| SiteID    | SiteName                                 | Datum                     | Zone                                                                      | Easting | Northing | Context   | Site Status ** | SiteFeatures                          | SiteTypes               | Reports |
|-----------|------------------------------------------|---------------------------|---------------------------------------------------------------------------|---------|----------|-----------|----------------|---------------------------------------|-------------------------|---------|
| 20-4-0017 | Nagero Creek;<br><a href="#">Contact</a> | AGD                       | 56                                                                        | 225704  | 6608190  | Open site | Destroyed      | Artefact : -                          | Open Camp Site          | 103378  |
| 20-4-0388 | BCS 5<br><a href="#">Contact</a>         | <a href="#">Recorders</a> | Mrs.Angela Besant,Karen Flick                                             |         |          | Open site | Destroyed      | Artefact : 1                          | <a href="#">Permits</a> | 103378  |
| 20-4-0389 | BCS 6<br><a href="#">Contact</a>         | <a href="#">Recorders</a> | Mrs.Angela Besant,Insite Heritage Pty Ltd                                 |         |          | Open site | Destroyed      | Artefact : 1                          | <a href="#">Permits</a> | 103378  |
| 20-4-0392 | BCS 3<br><a href="#">Contact</a>         | <a href="#">Recorders</a> | Mrs.Angela Besant,Insite Heritage Pty Ltd                                 |         |          | Open site | Destroyed      | Artefact : 1                          | <a href="#">Permits</a> | 103378  |
| 20-4-0393 | BCS 4<br><a href="#">Contact</a>         | <a href="#">Recorders</a> | Mrs.Angela Besant,Insite Heritage Pty Ltd                                 |         |          | Open site | Destroyed      | Artefact : 1                          | <a href="#">Permits</a> |         |
| 20-4-0092 | NAS 1<br><a href="#">Contact</a>         | <a href="#">Recorders</a> | Mrs.Angela Besant,Insite Heritage Pty Ltd                                 |         |          | Open site | Destroyed      | Artefact : 4                          | <a href="#">Permits</a> |         |
| 20-4-0093 | NIS 01<br><a href="#">Contact</a>        | <a href="#">Recorders</a> | Mr John Appleton,RPS AAP Consulting Pty Ltd - Hamilton,Mrs.Tessa Boer-Mah |         |          | Open site | Destroyed      | Artefact : 1                          | <a href="#">Permits</a> | 2312    |
| 20-4-0111 | BC-17<br><a href="#">Contact</a>         | <a href="#">Recorders</a> | Mr John Appleton,RPS AAP Consulting Pty Ltd - Hamilton,Mrs.Tessa Boer-Mah |         |          | Open site | Destroyed      | Artefact : 1                          | <a href="#">Permits</a> | 2312    |
| 20-4-0113 | BC-19<br><a href="#">Contact</a>         | <a href="#">Recorders</a> | Mr.Giles (dup ID#12832) Hamm,RPS AAP Consulting Pty Ltd - Hamilton        |         |          | Open site | Destroyed      | Artefact : 1                          | <a href="#">Permits</a> |         |
| 20-4-0114 | BC-20<br><a href="#">Contact</a>         | <a href="#">Recorders</a> | Mr.Giles (dup ID#12832) Hamm                                              |         |          | Open site | Valid          | Artefact : 1                          | <a href="#">Permits</a> |         |
| 20-4-0115 | BC-21<br><a href="#">Contact</a>         | <a href="#">Recorders</a> | Mr.Giles (dup ID#12832) Hamm                                              |         |          | Open site | Valid          | Artefact : 1                          | <a href="#">Permits</a> |         |
| 20-4-0116 | BC-22<br><a href="#">Contact</a>         | <a href="#">Recorders</a> | Mr.Giles (dup ID#12832) Hamm                                              |         |          | Open site | Destroyed      | Artefact : 1                          | <a href="#">Permits</a> | 103378  |
| 20-4-0117 | BC-23<br><a href="#">Contact</a>         | <a href="#">Recorders</a> | Mr.Giles (dup ID#12832) Hamm,RPS AAP Consulting Pty Ltd - Hamilton        |         |          | Open site | Not a Site     | Modified Tree (Carved or Scarred) : 1 | <a href="#">Permits</a> |         |
| 20-4-0121 | BC-27<br><a href="#">Contact</a>         | <a href="#">Recorders</a> | Mrs.Angela Besant,Insite Heritage Pty Ltd,Mr.Giles (dup ID#12832) Hamm    |         |          | Open site | Valid          | Artefact : 1                          | <a href="#">Permits</a> |         |
| 20-4-0122 | BC-28<br><a href="#">Contact</a>         | <a href="#">Recorders</a> | Mr.Giles (dup ID#12832) Hamm                                              |         |          | Open site | Valid          | Artefact : 1                          | <a href="#">Permits</a> |         |
| 20-4-0123 | BC-29<br><a href="#">Contact</a>         | <a href="#">Recorders</a> | Mr.Giles (dup ID#12832) Hamm                                              |         |          | Open site | Valid          | Artefact : 1                          | <a href="#">Permits</a> |         |
| 20-4-0124 | BC30<br><a href="#">Contact</a>          | <a href="#">Recorders</a> | Mr.Giles (dup ID#12832) Hamm                                              |         |          | Open site | Valid          | Artefact : 1                          | <a href="#">Permits</a> |         |

Report generated by AHIMS Web Service on 05/03/2024 for Eleanore Martin for the following area at Lat, Long From : -30.6495, 150.1009 - Lat, Long To : -30.6125, 150.1627. Number of Aboriginal sites and Aboriginal objects found is 87

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AHIMS Web Services (AWS)

Extensive search - Site list report

Your Ref/PO Number : 4145

Client Service ID : 870005

| SiteID    | SiteName       | Datum     | Zone                                           | Easting | Northing | Context   | Site Status **      | SiteFeatures                          | SiteTypes | Reports |
|-----------|----------------|-----------|------------------------------------------------|---------|----------|-----------|---------------------|---------------------------------------|-----------|---------|
| 20-4-0125 | BC31           | GDA       | 56                                             | 225354  | 6609238  | Open site | Partially Destroyed | Artefact : 1                          |           | 103378  |
|           | Contact Searle | Recorders | Mrs.Angela Besant,Mr.Giles (dup ID#12832) Hamm |         |          |           |                     | Permits                               |           |         |
| 20-4-0126 | BC32           | GDA       | 56                                             | 225147  | 6609354  | Open site | Valid               | Artefact : 1                          |           | 103378  |
|           | Contact Searle | Recorders | Mr.Giles (dup ID#12832) Hamm                   |         |          |           |                     | Permits                               |           |         |
| 20-4-0127 | BC33           | GDA       | 56                                             | 225058  | 6609442  | Open site | Valid               | Artefact : 1                          |           | 103378  |
|           | Contact Searle | Recorders | Mr.Giles (dup ID#12832) Hamm                   |         |          |           |                     | Permits                               |           |         |
| 20-4-0130 | BC37           | GDA       | 56                                             | 226785  | 6608396  | Open site | Not a Site          | Modified Tree (Carved or Scarred) : 1 |           | 103378  |
|           | Contact Searle | Recorders | Mr.Giles (dup ID#12832) Hamm,Ms.Taryn Gooley   |         |          |           |                     | Permits                               |           |         |
| 20-4-0131 | BC38           | GDA       | 56                                             | 226524  | 6608158  | Open site | Valid               | Artefact : 144                        |           |         |
|           | Contact Searle | Recorders | Mr.Giles (dup ID#12832) Hamm                   |         |          |           |                     | Permits                               |           |         |
| 20-4-0132 | BC39           | GDA       | 56                                             | 226422  | 6608122  | Open site | Valid               | Artefact : 1                          |           |         |
|           | Contact Searle | Recorders | Mr.Giles (dup ID#12832) Hamm                   |         |          |           |                     | Permits                               |           |         |
| 20-4-0133 | BC 40          | GDA       | 56                                             | 226468  | 6608332  | Open site | Valid               | Artefact : 10                         |           |         |
|           | Contact Searle | Recorders | Mr.Giles (dup ID#12832) Hamm                   |         |          |           |                     | Permits                               |           |         |
| 20-4-0134 | BC 42          | GDA       | 56                                             | 226309  | 6608430  | Open site | Destroyed           | Artefact : 6                          |           | 103378  |
|           | Contact Searle | Recorders | Mrs.Angela Besant,Mr.Giles (dup ID#12832) Hamm |         |          |           |                     | Permits                               |           |         |
| 20-4-0135 | BC 41          | GDA       | 56                                             | 226333  | 6608273  | Open site | Valid               | Artefact : 3                          |           |         |
|           | Contact Searle | Recorders | Mr.Giles (dup ID#12832) Hamm                   |         |          |           |                     | Permits                               |           |         |
| 20-4-0136 | BC 43          | GDA       | 56                                             | 226155  | 6608455  | Open site | Destroyed           | Artefact : 15                         |           | 103378  |
|           | Contact Searle | Recorders | Mrs.Angela Besant,Mr.Giles (dup ID#12832) Hamm |         |          |           |                     | Permits                               |           |         |
| 20-4-0137 | BC 44          | GDA       | 56                                             | 226186  | 6608185  | Open site | Destroyed           | Artefact : 4                          |           |         |
|           | Contact Searle | Recorders | Mrs.Angela Besant,Mr.Giles (dup ID#12832) Hamm |         |          |           |                     | Permits                               |           |         |
| 20-4-0138 | BC 45          | GDA       | 56                                             | 226282  | 6608124  | Open site | Destroyed           | Artefact : 4                          |           |         |
|           | Contact Searle | Recorders | Mrs.Angela Besant,Mr.Giles (dup ID#12832) Hamm |         |          |           |                     | Permits                               |           |         |
| 20-4-0139 | BC 46          | GDA       | 56                                             | 226098  | 6608743  | Open site | Partially Destroyed | Artefact : 28                         |           | 103378  |
|           | Contact Searle | Recorders | Mrs.Angela Besant,Mr.Giles (dup ID#12832) Hamm |         |          |           |                     | Permits                               |           |         |
| 20-4-0140 | BC 47          | GDA       | 56                                             | 226157  | 6608862  | Open site | Destroyed           | Artefact : 3                          |           | 103378  |
|           | Contact Searle | Recorders | Mrs.Angela Besant,Mr.Giles (dup ID#12832) Hamm |         |          |           |                     | Permits                               |           |         |
| 20-4-0141 | BC 48          | GDA       | 56                                             | 226223  | 6608938  | Open site | Valid               | Artefact : 3                          |           |         |
|           | Contact Searle | Recorders | Mr.Giles (dup ID#12832) Hamm                   |         |          |           |                     | Permits                               |           |         |
| 20-4-0142 | BC 49          | GDA       | 56                                             | 226057  | 6608625  | Open site | Destroyed           | Artefact : 1                          |           | 103378  |
|           | Contact Searle | Recorders | Mrs.Angela Besant,Mr.Giles (dup ID#12832) Hamm |         |          |           |                     | Permits                               |           |         |

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AHIMS Web Services (AWS)

Extensive search - Site list report

Your Ref/PO Number : 4145

Client Service ID : 870005

| SiteID    | SiteName             | Datum | Zone | Easting   | Northing                                             | Context   | Site Status **      | SiteFeatures                               | SiteTypes | Reports       |
|-----------|----------------------|-------|------|-----------|------------------------------------------------------|-----------|---------------------|--------------------------------------------|-----------|---------------|
| 20-4-0143 | BC 50                | GDA   | 56   | 225982    | 6608482                                              | Open site | Not a Site          | Modified Tree (Carved or Scarred) : 1      |           | 103378        |
|           | Contact Searle       |       |      | Recorders | Mr.Giles (dup ID#12832) Hamm                         |           |                     | Permits                                    |           |               |
| 20-4-0144 | BC 51                | GDA   | 56   | 226179    | 6608523                                              | Open site | Valid               | Modified Tree (Carved or Scarred) : 1      |           |               |
|           | Contact Searle       |       |      | Recorders | Insite Heritage Pty Ltd,Mr.Giles (dup ID#12832) Hamm |           |                     | Permits                                    |           |               |
| 20-4-0145 | BC 52                | GDA   | 56   | 226306    | 6608432                                              | Open site | Destroyed           | Modified Tree (Carved or Scarred) : 1      |           | 103378        |
|           | Contact Searle       |       |      | Recorders | Mr.Giles (dup ID#12832) Hamm,Ms.Taryn Gooley         |           |                     | Permits                                    |           |               |
| 20-4-0146 | BC 53                | GDA   | 56   | 225786    | 6608877                                              | Open site | Valid               | Artefact : 1                               |           |               |
|           | Contact Searle       |       |      | Recorders | Mr.Giles (dup ID#12832) Hamm                         |           |                     | Permits                                    |           |               |
| 20-4-0148 | BCHR1                | GDA   | 56   | 225485    | 6608430                                              | Open site | Valid               | Artefact : 1                               |           |               |
|           | Contact Searle       |       |      | Recorders | Mr.Giles (dup ID#12832) Hamm                         |           |                     | Permits                                    |           |               |
| 20-4-0149 | BCHR2                | GDA   | 56   | 225368    | 6608222                                              | Open site | Valid               | Artefact : 1                               |           |               |
|           | Contact Searle       |       |      | Recorders | Mr.Giles (dup ID#12832) Hamm                         |           |                     | Permits                                    |           |               |
| 20-4-0150 | BCHR3                | GDA   | 56   | 224793    | 6608318                                              | Open site | Valid               | Artefact : 1                               |           |               |
|           | Contact Searle       |       |      | Recorders | Mr.Giles (dup ID#12832) Hamm                         |           |                     | Permits                                    |           |               |
| 20-4-0151 | BCHR4                | GDA   | 56   | 224630    | 6608316                                              | Open site | Valid               | Artefact : 1                               |           |               |
|           | Contact Searle       |       |      | Recorders | Mr.Giles (dup ID#12832) Hamm                         |           |                     | Permits                                    |           |               |
| 20-4-0152 | BCHR5                | GDA   | 56   | 224530    | 6608290                                              | Open site | Valid               | Artefact : 1                               |           |               |
|           | Contact Searle       |       |      | Recorders | Mr.Giles (dup ID#12832) Hamm                         |           |                     | Permits                                    |           |               |
| 20-4-0155 | BCHR6                | AGD   | 56   | 223161    | 6607947                                              | Open site | Valid               | Artefact : 1                               |           |               |
|           | Contact Searle       |       |      | Recorders | Archaeological Risk Assessment Services (ARAS)       |           |                     | Permits                                    |           |               |
| 20-4-0161 | NST 1                | AGD   | 56   | 227448    | 6606507                                              | Open site | Valid               | Modified Tree (Carved or Scarred) : 1      |           |               |
|           | Contact              |       |      | Recorders | Mr.John Appleton                                     |           |                     | Permits                                    |           |               |
| 20-4-0196 | Boggabri Coal Pad 1  | AGD   | 56   | 225915    | 6607271                                              | Open site | Not a Site          | Potential Archaeological Deposit (PAD) : 1 |           |               |
|           | Contact              |       |      | Recorders | Mrs.Angela Besant                                    |           |                     | Permits                                    |           |               |
| 20-4-0224 | LF NV 24, 51-61 & 63 | GDA   | 56   | 224946    | 6608068                                              | Open site | Partially Destroyed | Artefact : 145                             |           | 101940,103378 |
|           | Contact              |       |      | Recorders | Mrs.Angela Besant,Mrs.Angela Besant                  |           |                     | Permits                                    |           | 8             |
| 20-4-0228 | LFNV 49, 50 & 62     | GDA   | 56   | 224896    | 6609111                                              | Open site | Valid               | Artefact : 26                              |           | 101940,103378 |
|           | Contact              |       |      | Recorders | Mrs.Angela Besant                                    |           |                     | Permits                                    |           | 8             |

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AHIMS Web Services (AWS)

Extensive search - Site list report

Your Ref/PO Number : 4145

Client Service ID : 870005

| SiteID    | SiteName                                                          | Datum     | Zone                                                                           | Easting | Northing | Context     | Site Status **      | SiteFeatures                                                                              | SiteTypes | Reports       |
|-----------|-------------------------------------------------------------------|-----------|--------------------------------------------------------------------------------|---------|----------|-------------|---------------------|-------------------------------------------------------------------------------------------|-----------|---------------|
| 20-4-0229 | LFNV 77, 78                                                       | GDA       | 56                                                                             | 223825  | 6608155  | Open site   | Destroyed           | Artefact : 10                                                                             |           | 101940,103378 |
|           | Contact                                                           | Recorders | Mrs.Angela Besant,Mrs.Angela Besant                                            |         |          |             |                     | Permits                                                                                   |           |               |
| 20-4-0198 | Restriction applied. Please contact ahims@environment.nsw.gov.au. |           |                                                                                |         |          | Open site   | Valid               |                                                                                           |           | 101906,103378 |
|           | Contact                                                           | Recorders | Mrs.Angela Besant                                                              |         |          |             |                     | Permits                                                                                   |           |               |
| 20-4-0199 | BCD 2                                                             | GDA       | 56                                                                             | 225900  | 6606697  | Open site   | Valid               | Artefact : 2                                                                              |           | 101906,103378 |
|           | Contact                                                           | Recorders | Mrs.Angela Besant                                                              |         |          |             |                     | Permits                                                                                   |           |               |
| 20-4-0200 | BCD 3                                                             | GDA       | 56                                                                             | 226322  | 6606222  | Open site   | Valid               | Artefact : 1                                                                              |           | 101906,103378 |
|           | Contact                                                           | Recorders | Mrs.Angela Besant                                                              |         |          |             |                     | Permits                                                                                   |           |               |
| 20-4-0347 | TCEP-ST-010                                                       | GDA       | 56                                                                             | 227984  | 6608219  | Open site   | Partially Destroyed | Modified Tree (Carved or Scarred) : 1                                                     |           | 103378        |
|           | Contact                                                           | Recorders | Kayandel Archaeological Services,RPS AAP Consulting Pty Ltd - Hamilton,Mr.Warw |         |          |             |                     | Permits                                                                                   |           |               |
| 20-4-0507 | Isolated Find Flake                                               | GDA       | 56                                                                             | 226201  | 6609171  | Closed site | Valid               | Artefact : -                                                                              |           | 103378        |
|           | Contact                                                           | Recorders | Ms.Jane Delaney-John                                                           |         |          |             |                     | Permits                                                                                   |           |               |
| 20-4-0505 | Leard Stare Forest Grinding Stone Portable                        | GDA       | 56                                                                             | 226239  | 6609162  | Closed site | Valid               | Aboriginal Resource and Gathering : -, Aboriginal Ceremony and Dreaming : -, Artefact : - |           | 103378        |
|           | Contact                                                           | Recorders | Ms.Jane Delaney-John                                                           |         |          |             |                     | Permits                                                                                   |           |               |
| 20-4-0474 | NV79                                                              | GDA       | 56                                                                             | 224486  | 6608228  | Open site   | Valid               | Artefact : 1                                                                              |           | 103378        |
|           | Contact                                                           | Recorders | Mrs.Angela Besant,Insite Heritage Pty Ltd                                      |         |          |             |                     | Permits                                                                                   |           |               |
| 20-4-0510 | Leard Forest                                                      | GDA       | 56                                                                             | 226169  | 6609233  | Closed site | Valid               | Artefact : -                                                                              |           | 103378        |
|           | Contact                                                           | Recorders | Ms.Jane Delaney-John                                                           |         |          |             |                     | Permits                                                                                   |           |               |
| 20-4-0511 | Leard Forest Old Camp 3                                           | GDA       | 56                                                                             | 226178  | 6609239  | Closed site | Valid               | Artefact : -                                                                              |           | 103378        |
|           | Contact                                                           | Recorders | Ms.Jane Delaney-John                                                           |         |          |             |                     | Permits                                                                                   |           |               |
| 20-4-0512 | Leard Forest - Old Camp                                           | GDA       | 56                                                                             | 226200  | 6609177  | Closed site | Valid               | Artefact : -                                                                              |           | 103378        |
|           | Contact                                                           | Recorders | Ms.Jane Delaney-John                                                           |         |          |             |                     | Permits                                                                                   |           |               |
| 20-4-0565 | NV 84                                                             | GDA       | 56                                                                             | 226346  | 6608647  | Open site   | Valid               | Artefact : -                                                                              |           |               |
|           | Contact                                                           | Recorders | Mrs.Angela Besant                                                              |         |          |             |                     | Permits                                                                                   |           |               |
| 20-4-0566 | NV 85                                                             | GDA       | 56                                                                             | 226368  | 6608585  | Open site   | Valid               | Artefact : -                                                                              |           |               |
|           | Contact                                                           | Recorders | Mrs.Angela Besant                                                              |         |          |             |                     | Permits                                                                                   |           |               |
| 20-4-0570 | TCS/15                                                            | GDA       | 56                                                                             | 226251  | 6608783  | Open site   | Destroyed           | Artefact : -                                                                              |           |               |
|           | Contact                                                           | Recorders | Ms.Taryn Gooley                                                                |         |          |             |                     | Permits                                                                                   |           |               |
| 20-4-0571 | TC6/15                                                            | GDA       | 56                                                                             | 226722  | 6608998  | Open site   | Destroyed           | Artefact : -                                                                              |           |               |
|           | Contact                                                           |           |                                                                                |         |          |             |                     |                                                                                           |           |               |

Report generated by AHIMS Web Service on 05/03/2024 for Eleanore Martin for the following area at Lat, Long From : -30.6495, 150.1009 - Lat, Long To : -30.6125, 150.1627. Number of Aboriginal sites and Aboriginal objects found is 87

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AHIMS Web Services (AWS)

Extensive search - Site list report

Your Ref/PO Number : 4145

Client Service ID : 870005

| SiteID    | SiteName                    | Datum     | Zone                                                                        | Easting | Northing | Context | Site Status ** | SiteFeatures | SiteTypes | Reports                               |         |
|-----------|-----------------------------|-----------|-----------------------------------------------------------------------------|---------|----------|---------|----------------|--------------|-----------|---------------------------------------|---------|
| 20-4-0574 | Contact<br>TC9/15           | Recorders | Ms.Taryn Gooley                                                             | GDA     | 56       | 226360  | 6608543        | Open site    | Destroyed | Artefact : -                          | Permits |
| 20-4-0526 | Contact<br>LFNV80           | Recorders | Ms.Taryn Gooley                                                             | GDA     | 56       | 226282  | 6608635        | Open site    | Valid     | Artefact : -                          | Permits |
| 20-4-0583 | Contact<br>BC30 (ST)        | Recorders | Mrs.Angela Besant                                                           | GDA     | 56       | 226425  | 6608589        | Open site    | Valid     | Modified Tree (Carved or Scarred) : - | Permits |
| 20-4-0584 | Contact<br>TC2/14           | Recorders | Mrs.Angela Besant                                                           | GDA     | 56       | 226722  | 6608998        | Open site    | Destroyed | Artefact : -                          | Permits |
| 20-4-0604 | Contact<br>VEP IA16         | Recorders | Mrs.Angela Besant,Ms.Taryn Gooley                                           | GDA     | 56       | 225058  | 6606658        | Open site    | Valid     | Artefact : -                          | Permits |
| 20-4-0671 | Contact<br>VEP AS 13        | Recorders | University of Queensland,Mr.Reiner Mantei                                   | GDA     | 56       | 222194  | 6607364        | Open site    | Valid     | Artefact : -                          | Permits |
| 20-4-0663 | Contact<br>VEP IA17         | Recorders | University of Queensland,Ms.Jodie Crossman                                  | GDA     | 56       | 224758  | 6606874        | Open site    | Valid     | Artefact : -                          | Permits |
| 20-4-0740 | Contact<br>BC 20/17         | Recorders | University of Queensland,Mr.Reiner Mantei                                   | GDA     | 56       | 224570  | 6608561        | Open site    | Valid     | Artefact : -                          | Permits |
| 20-4-0873 | Contact<br>Tarrawonga GG1   | Recorders | Mrs.Angela Besant,Insite Heritage Pty Ltd                                   | GDA     | 56       | 227811  | 6607058        | Open site    | Valid     | Grinding Groove : -                   | Permits |
| 20-4-0925 | Contact<br>TPW AS51         | Recorders | Doctor.Matthew Whincop,Whincop Archaeology Pty Ltd                          | GDA     | 56       | 222158  | 6607812        | Open site    | Valid     | Artefact : -                          | Permits |
| 20-4-0926 | Contact<br>TPW AS 53        | Recorders | Mrs.Angela Besant,Insite Heritage Pty Ltd                                   | GDA     | 56       | 222197  | 6607169        | Open site    | Valid     | Artefact : -                          | Permits |
| 20-4-0979 | Contact<br>Mod8_2/20        | Recorders | Mrs.Angela Besant,Insite Heritage Pty Ltd                                   | GDA     | 56       | 226270  | 6609238        | Open site    | Valid     | Hearth : -                            | Permits |
| 20-4-0980 | Contact<br>Mod8_3/20 Cloned | Recorders | Mrs.Angela Besant,Insite Heritage Pty Ltd                                   | GDA     | 56       | 226691  | 6608744        | Open site    | Valid     | Artefact : -                          | Permits |
| 20-4-0981 | Contact<br>Mod8_4/20        | Recorders | Mrs.Angela Besant,Insite Heritage Pty Ltd                                   | GDA     | 56       | 226521  | 6608441        | Open site    | Valid     | Modified Tree (Carved or Scarred) : - | Permits |
| 20-4-0982 | Contact<br>Mod8_5/20        | Recorders | Mrs.Angela Besant,Insite Heritage Pty Ltd                                   | GDA     | 56       | 226349  | 6608568        | Open site    | Valid     | Artefact : -                          | Permits |
| 20-4-1123 | Contact<br>Merriown 8       | Recorders | Mrs.Angela Besant,Insite Heritage Pty Ltd                                   | GDA     | 56       | 224207  | 6607718        | Open site    | Valid     | Artefact : -                          | Permits |
|           | Contact                     | Recorders | OzArk Environmental and Heritage Management - Dubbo,Doctor.Bernadette Drabs |         |          |         |                |              |           |                                       | Permits |

Report generated by AHIMS Web Service on 05/03/2024 for Eleanore Martin for the following area at Lat, Long From : -30.6495, 150.1009 - Lat, Long To : -30.6125, 150.1627. Number of Aboriginal sites and Aboriginal objects found is 87

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AHIMS Web Services (AWS)

Extensive search - Site list report

Your Ref/PO Number : 4145

Client Service ID : 870005

| SiteID    | SiteName     | Datum     | Zone                                                                          | Easting | Northing | Context   | Site Status ** | SiteFeatures | SiteTypes | Reports |         |
|-----------|--------------|-----------|-------------------------------------------------------------------------------|---------|----------|-----------|----------------|--------------|-----------|---------|---------|
| 20-4-1109 | Nagero IF1   | GDA       | 56                                                                            | 224763  | 6607692  | Open site | Valid          | Artefact : - |           |         |         |
|           | Contact      | Recorders | OzArk Environmental and Heritage Management - Dubbo, Miss. Tenae Robertson    |         |          |           |                |              |           |         | Permits |
| 20-4-1110 | Merriown IF1 | GDA       | 56                                                                            | 223896  | 6609383  | Open site | Valid          | Artefact : - |           |         |         |
|           | Contact      | Recorders | OzArk Environmental and Heritage Management - Dubbo, Miss. Tenae Robertson    |         |          |           |                |              |           |         | Permits |
| 20-4-1116 | Merriown 4   | GDA       | 56                                                                            | 224343  | 6607927  | Open site | Valid          | Artefact : - |           |         |         |
|           | Contact      | Recorders | OzArk Environmental and Heritage Management - Dubbo, Doctor. Bernadette Drabs |         |          |           |                |              |           |         | Permits |
| 20-4-1117 | Merriown 3   | GDA       | 56                                                                            | 224348  | 6607972  | Open site | Valid          | Artefact : - |           |         |         |
|           | Contact      | Recorders | OzArk Environmental and Heritage Management - Dubbo, Doctor. Bernadette Drabs |         |          |           |                |              |           |         | Permits |
| 20-4-1118 | Merriown 5   | GDA       | 56                                                                            | 224337  | 6607900  | Open site | Valid          | Artefact : - |           |         |         |
|           | Contact      | Recorders | OzArk Environmental and Heritage Management - Dubbo, Doctor. Bernadette Drabs |         |          |           |                |              |           |         | Permits |
| 20-4-1119 | Merriown 2   | GDA       | 56                                                                            | 224294  | 6608183  | Open site | Valid          | Artefact : - |           |         |         |
|           | Contact      | Recorders | OzArk Environmental and Heritage Management - Dubbo, Doctor. Bernadette Drabs |         |          |           |                |              |           |         | Permits |
| 20-4-1120 | Merriown 1   | GDA       | 56                                                                            | 224147  | 6608168  | Open site | Valid          | Artefact : - |           |         |         |
|           | Contact      | Recorders | OzArk Environmental and Heritage Management - Dubbo, Doctor. Bernadette Drabs |         |          |           |                |              |           |         | Permits |
| 20-4-1121 | Merriown 6   | GDA       | 56                                                                            | 224380  | 6608182  | Open site | Valid          | Artefact : - |           |         |         |
|           | Contact      | Recorders | OzArk Environmental and Heritage Management - Dubbo, Doctor. Bernadette Drabs |         |          |           |                |              |           |         | Permits |
| 20-4-1122 | Merriown 7   | GDA       | 56                                                                            | 224120  | 6607991  | Open site | Valid          | Artefact : - |           |         |         |
|           | Contact      | Recorders | OzArk Environmental and Heritage Management - Dubbo, Doctor. Bernadette Drabs |         |          |           |                |              |           |         | Permits |

\*\* Site Status

Valid - The site has been recorded and accepted onto the system as valid

Destroyed - The site has been completely impacted or harmed usually as consequence of permit activity but sometimes also after natural events. There is nothing left of the site on the ground but proponents should proceed with caution

Partially Destroyed - The site has been only partially impacted or harmed usually as consequence of permit activity but sometimes also after natural events. There might be parts or sections of the original site still present on the ground

Not a site - The site has been originally entered and accepted onto AHIMS as a valid site but after further investigations it was decided it is NOT an aboriginal site. Impact of this type of site does not require permit but Heritage NSW should be notified

Report generated by AHIMS Web Service on 05/03/2024 for Eleanore Martin for the following area at Lat, Long From : -30.6495, 150.1009 - Lat, Long To : -30.6125, 150.1627. Number of Aboriginal sites and Aboriginal objects found is 87

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## APPENDIX 3: TEST EXCAVATION METHODOLOGY



View of Boggabri Coal Mine railway line to the north of the Survey Area.

### ARCHAEOLOGICAL TEST EXCAVATION METHODOLOGY

#### MERRIOWN SOLAR FARM

NARRABRI SHIRE LOCAL GOVERNMENT AREA

NOVEMBER 2023

Report prepared by  
OzArk Environment & Heritage  
for Idemitsu Renewable Developments Australia



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[www.ozarkehm.com.au](http://www.ozarkehm.com.au)

## DOCUMENT CONTROLS

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                 |                                                                                                                                                                       |  |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| Proponent                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Idemitsu Renewable Developments Australia Pty Ltd               |                                                                                                                                                                       |  |
| Document Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Archaeological Test Excavation Methodology: Merriown Solar Farm |                                                                                                                                                                       |  |
| File Location                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | OzArk Job No.                                                   |                                                                                                                                                                       |  |
| S:\OzArk EHM Data\Clients\Idemitsu Australia\Merriown solar farm ACHAR and test ex Sept 23\Test excavation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 4145                                                            |                                                                                                                                                                       |  |
| Document Status: V3.0 FINAL                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                 | Date: 24 November 2023                                                                                                                                                |  |
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| OzArk and client edits                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                 | V2.0: BC prepares for client release 20/10/23                                                                                                                         |  |
| Final document                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                 | V3.0 BC finalises 24/11/23                                                                                                                                            |  |
| Prepared for                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                 | Prepared by                                                                                                                                                           |  |
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### **Acknowledgement**

OzArk acknowledge the traditional custodians of the area on which this assessment will take place and pay respect to their beliefs, cultural heritage, and continuing connection with the land. We also acknowledge and pay respect to the post-contact experiences of Aboriginal people with attachment to the area and to the Elders, past and present, as the next generation of role models and vessels for memories, traditions, culture and hopes of local Aboriginal people.



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## 1 INTRODUCTION

### 1.1 PREAMBLE

Bogabri Coal (the proponent) intends to develop the Merriown Solar Farm (the project), located 40 kilometres (km) north of Gunnedah within the Narrabri Shire Local Government Area (LGA). The proposed solar farm covers a Project Area of approximately 13 hectares (ha) to accommodate the solar arrays and associated infrastructure which is to be located at 333 Leards Forest Road, Bogabri (Lot 21 DP754940).

OzArk Environment and Heritage (OzArk) has been commissioned by Idemitsu to prepare an archaeological test excavation methodology and conduct archaeological test excavations in accordance with the *Code of Practice for the Investigation of Aboriginal Objects in New South Wales* (Code of Practice; DECCW 2010) for the project. Archaeological test excavation is required to determine if subsurface archaeological material is present and to provide management recommendations in relation to the findings.

This methodology has been prepared in accordance with Stage 3 of the *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010* (ACHCRs; DECCW 2010a).

### 1.2 BACKGROUND TO THE TEST EXCAVATION PROGRAM

RPS was initially engaged to prepare the Aboriginal Cultural Heritage Assessment Report (ACHAR) for the project prior to a consultancy changeover.

RPS Group (RPS) conducted a field survey over a 27 ha area (the Survey Area) for the project on 26 July 2023 which was accompanied by four representatives from Registered Aboriginal Parties (RAPs).

Recommendation was made by RPS that investigation in the form of subsurface archaeological test excavation be carried out to establish the nature and extent of any Aboriginal objects and/or deposits that are/may be present within the Project Area. Subsurface test excavation will also assist in determining any cultural heritage constraints that were not possible through the survey due to low visibility.

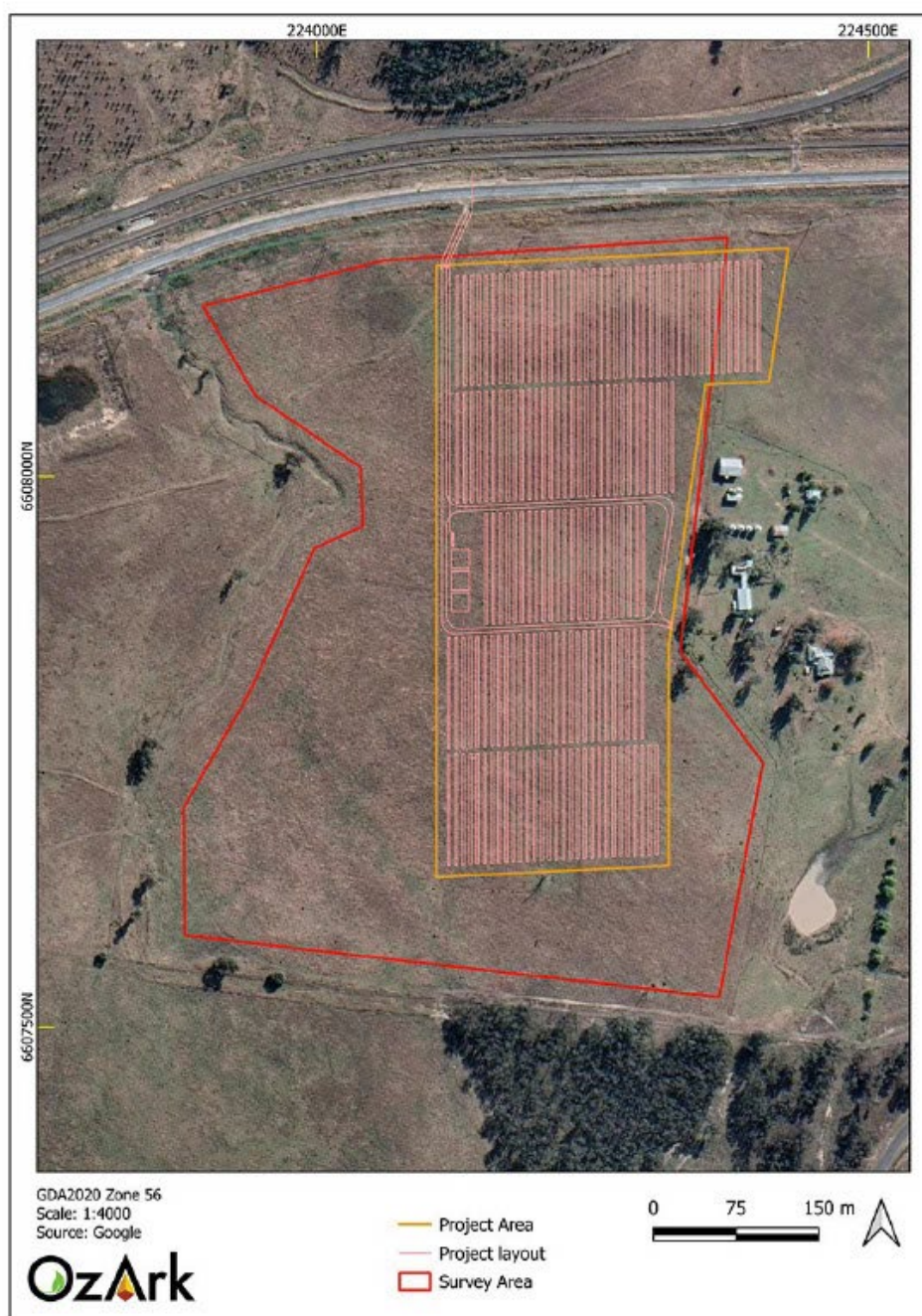
OzArk has been engaged to run the test excavation program and to prepare the ACHAR.

### 1.3 PROJECT AREA

The Project Area describes the area allocated to construction works and associated infrastructural zones (e.g. laydown area) (Figure 1-1). This encompasses approximately 13 ha of land almost entirely within the Survey Area. Two small portions are outside the Survey Area boundary, one to the north and one to the northeast, measuring 0.03 and 0.645 ha respectively. The area to the north is part of the Bogabri Mine Project Approval Area and 50 metres (m) either side of the haul road has already been surveyed and is included in the Bogabri Mine Cultural

Heritage Management Plan curtilage. Because of this, this area did not require further assessment for the project. The small area to the northeast was not surveyed but will be investigated by the test excavation program.

**Figure 1-1: Aerial of Survey and Project Areas.**





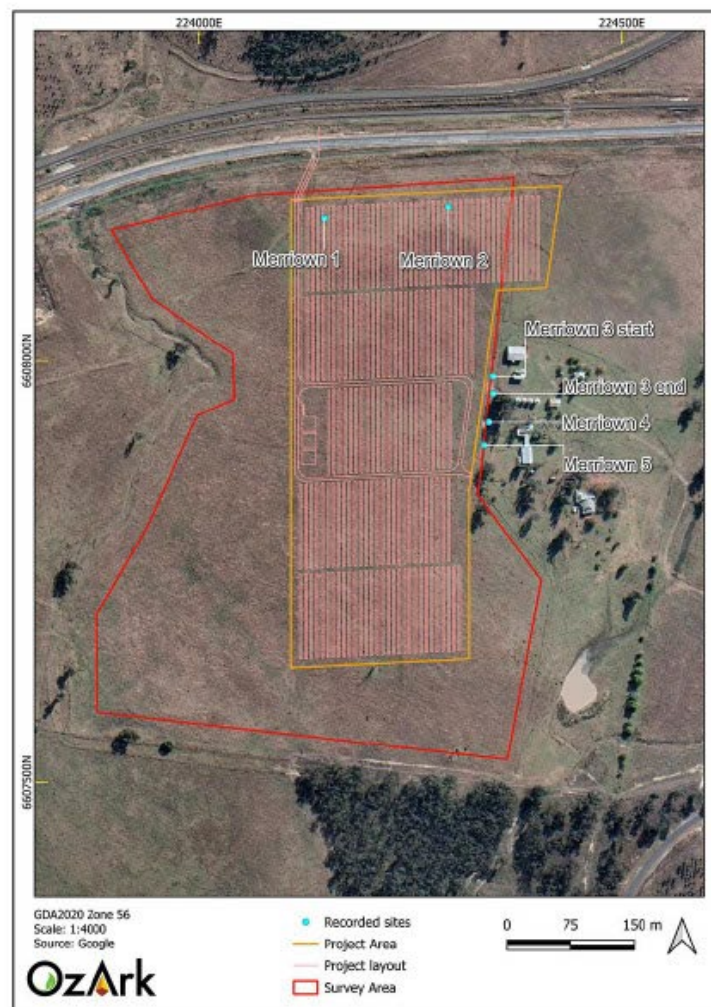
## 1.4 SURVEY AREA

The Survey Area describes the area previously surveyed by RPS. This is the area in which most impacts associated with the project will be located. The Survey Area covers approximately 27 ha, approximately 10 km northeast of the township of Boggabri and 2 km west of the Boggabri Coal Mine (BCM).

The RPS survey resulted in five newly identified Aboriginal cultural heritage sites (Figure 1-2). Of these newly recorded sites, three were isolated finds and two were low-density artefact scatters.

There are two sites (Merriown 1 and Merriown 2), each consisting of isolated artefacts, within the Project Area which may be impacted by the project,

Figure 1-2: Sites recorded by RPS.





## 1.5 CODE REQUIREMENTS FOR THE TEST EXCAVATION PROGRAM

Excavations undertaken as per the Code of Practice do not require an Aboriginal Heritage Impact Permit (AHIP) under the *National Parks and Wildlife Act 1974* (NPW Act).

The Code of Practice lists several requirements pertaining to test excavation. These requirements are enumerated below and further information pertaining to these requirements follow in subsequent sections of this document.

- **Requirement 14** (Test excavation which is not excluded from the definition of harm):

*Sub-surface investigation will not be excluded from harm where they are carried out in the following areas:*

- a) in or within 50 m of an area where burial sites are known or are likely to exist
- b) in or within 50 m of a declared Aboriginal place
- c) in or within 50 m of a rock shelter, shell midden or earth mound
- d) in areas known or suspected to be Aboriginal missions or previous Aboriginal reserves or institutes
- e) in areas known or suspected to be conflict or contact sites.
  - The test excavation locations are not located within the vicinity of the items listed under Requirement 14 of the Code of Practice.
- **Requirement 15a** (Consultation): As the proposed archaeological test excavation program is part of the project, consultation has been ongoing with the RAPs and has been completed to the stage described in subclause 60C (6) of the *National Parks and Wildlife Regulation 2019* (NPW Regulation).
- **Requirement 15b** (Test excavation sampling strategy): This document sets out the proposed sampling strategy for the test excavation program.
- **Requirement 15c** (Notification):
  - the location of the proposed test excavation and the subject area.
    - This document sets out the proposed location of the test excavation program (see **Section 4.3**).
  - the name and contact details of the legal entity with overall responsibility for the project.
    - Idemitsu Renewable Developments Australia Pty Ltd, GPO Box 301, Brisbane QLD 4001.
  - the name and contact details of the person who will be carrying out the test excavations where this is different to the legal entity with overall responsibility for the project.
    - OzArk Environment & Heritage, 145 Wingewarra St, Dubbo NSW 2830

- the proposed date of commencement, and estimated date of completion, of the test excavations.
  - Anticipated commencement: 27 November 2023
  - Anticipated completion: 1 December 2023

Weather permitting, the projected period for the excavation is five days.
- the location of the temporary storage location for any Aboriginal objects uncovered during the test excavations.
  - Aboriginal objects recovered during the excavations will be temporarily stored in a locked cupboard at 145 Wingewarra Street, Dubbo, NSW (OzArk office) for analysis. Other objects, such as faunal or charcoal samples, may be sent to third party specialists for analysis.
- **Requirement 16a (Test Excavation):**
  - The test excavation program will adhere to Requirement 16a of the Code of Practice as set out in this document (see **Section 4.5**).
- **Requirement 16b (Objects recovered during test excavations):**
  - Aboriginal objects recovered during the excavations will be analysed at 145 Wingewarra Street, Dubbo, NSW (OzArk office). When not being analysed, the objects will be temporarily stored in a locked cupboard at 145 Wingewarra Street, Dubbo, NSW. The long-term management of any recovered artefacts will be determined in consultation with the RAPs.
- **Requirement 17 (When to stop test excavations):** the test excavation program will adhere to the requirements set out in the Code of Practice: *Any test excavation carried out under this requirement will cease when suspected human remains area encountered; or when enough information has been recovered to adequately characterise the objects present with regard to their nature and significance.*
  - OzArk shall ensure that this Requirement is adhered to during the test excavation program. This will include ceasing work as soon as human skeletal material is noted and immediately notifying the police. If the skeletal material is determined to be Aboriginal, Heritage NSW will be immediately notified.

## 1.6 CONSULTATION ON THIS METHODOLOGY

Consultation for the project was commenced by RPS and has followed the guidelines established in the ACHCRs (DECCW 2010a).

On 16 May 2023 an advertisement was placed in the *North West Courier Mail* requesting expressions of interest in being consulted about the project. In addition, the following agencies were contacted to identify potential stakeholders for the area: Heritage NSW; the Red Chief Local Aboriginal Land Council (LALC); the Narrabri LALC; the Tamworth LALC; the Office of The Registrar, *Aboriginal Land Rights Act 1983*; the National Native Title Tribunal; Native Title

Services Corporation Limited (NTSCORP); the Narrabri LGA; and the North West Local Land Services.

Twenty-three individuals and groups have advised that they wish to be consulted in relation to the project. These include:

- AGA Services
- AT Gomilaroi Cultural Consultancy
- Brian Draper
- Cindy and Gloria Foley
- Cucatua Culture Consultants
- Didge Ngunawal Clan (DNC)
- Edgerton Kwiembal AC
- Girragirra Murun Aboriginal Corporation
- Gomeroi Murri Ganuurr Yuuray Wadi Palinka
- Gomeroi Namoi
- Gomery Cultural Consultants
- Jeremy Duncan
- Konanggo Aboriginal Cultural Heritage Services
- Michael Long
- RAW Cultural Healing
- Red Chief Local Aboriginal Land Council (LALC)
- Stakeholder 1 (requested name withheld)
- Stakeholder 2 (requested name withheld)
- Thomas Dahlstrom
- Troy Silver
- Vicky Hannah Gomeroi Duncan
- Wallanbah Aboriginal Site Conveyancing
- Wingarra Wilay Aboriginal Corporation

These individuals/groups constitute the RAPs for the project.

## 2 CULTURAL VALUES

### 2.1 INTRODUCTION TO CULTURAL VALUES

*No matter who you are, we all have culture. Each person's culture is important; it's part of what makes us who we are.*

Australianstogether.org.au

Many Aboriginal people in Australia have a unique view of the world that's distinct from the mainstream. Land, family, law, ceremony, and language are five key interconnected elements of Aboriginal culture. For example, families are connected to the land through the kinship system, and this connection to land comes with specific roles and responsibilities which are enshrined in the law and observed through ceremony. In this way, the five elements combine to create a way of seeing and being in the world that is distinctly Aboriginal.

Fundamentally, culture is living and is not static:

- Culture is acquired - we learn about culture from others in our community, including our parents
- Culture is shared - culture does not exist in a vacuum, it is shared amongst a group of people
- Culture defines core values - because we have been taught our culture and share it with our cultural group, we tend to form the same core values
- Cultures resist change but are not static - culture does and can change, but change is usually slow and gradual.

#### 2.1.1 Connection to Country

Aboriginal and Torres Strait Islander peoples are connected to Country through lines of descent (paternal and maternal), as well as clan and language groups.

Although in the past (and sometimes into the present) there have been conflicts between different tribal groups, these were rarely over land. Aboriginal and Torres Strait Islander people have such a strong sense of belonging to country; they have no desire to own the land of others.

Territory is defined by spiritual as well as physical links. Landforms have deep meaning, recorded in art, stories, songs, and dance. Songlines or Dreaming Tracks as well as kinship structures link Aboriginal peoples to the territories of other groups. In the past, these links were also used for trade.

*"When we say Country we might mean homeland, or tribal or clan area and in saying so we may mean something more than just a place; somewhere on the map. We are not necessarily referring to place in a geographical sense. But we are talking about the whole of the landscape, not just the places on it."*

Professor Mick Dodson AM, August 2007



### 2.1.2 Managing Country

Living on this land for around 50,000 years, Aboriginal and Torres Strait Islanders established effective ways to use and sustain resources. One important aspect is the right of certain people to control the use of resources in a particular area. Aboriginal and Torres Strait Islander people don't see themselves as 'owning' land, animals, plants, or nature, but rather belonging with these things as equal parts of creation.

The rights of different groups to live in and manage certain areas of land are clear and recorded through art, stories, songs, and dance.

Deep cultural and spiritual values like totemism have also played an important part in Aboriginal and Torres Strait Islander resource management. Totemism is a belief and value system that connects human beings to other animals, plants, and aspects of nature. Groups and individuals are assigned a particular animal that they are related to and must care for. This gives them a profound sense of connection to and responsibility for the natural world.

Aboriginal and Torres Strait Islanders people have a wide range of traditional methods for gathering food including fish traps, subsistence agriculture, hunting and harvesting a wide range of natural fruits and vegetables. Some groups of people would stay in one place, while others moved around the land according to the seasons, to ensure sustainable and rich food supplies, and to fulfil their spiritual and cultural obligations.

Even before 1788 there were complex relationships for long distance trade between Aboriginal and Torres Strait Islander communities especially for coastal shells and stone hatchets. When people from different groups met socially to share resources, for ceremonies or to settle disputes, they brought items to exchange. Items included stones for hatchets, kangaroo skins, timber for spears, ochre or clay for paint and marine shells for decoration. The exchange of objects was not motivated by a desire for wealth accumulation but a social system to build connection between people and groups.

### 2.1.3 Recognising lore

In much of eastern Australia, Aboriginal communities live their lives like most Australians. However, in certain crucial areas, particularly associated with family, leadership roles, and caring for Country, Aboriginal lore continues, even in the most urbanised communities.

## 2.2 IDENTIFYING CULTURAL VALUES

A major aim of this assessment is to identify any cultural values within the landscape in which the project is located so that those values can be recognised and incorporated into the ACHAR's management recommendations.

Any cultural values relating to the Project Area will be captured by the OzArk archaeologists (if such information is provided by RAPs during the test excavation) and included in the ACHAR.

Understanding cultural landscapes can only come from the views of a particular community, in this case, the Aboriginal community. Unless informed, OzArk will not know of the community's feelings towards the cultural landscape in which the project will be located. Should any RAPs have knowledge of cultural values regarding the Project Area that they wish to share or that may affect the test excavation methodology set out in **Section 4**, OzArk invites them to contact us so that these values can be recorded and/or responded to in the methodology.

#### **2.2.1 Use of information collected**

An ACHAR will be prepared for the project which articulates Aboriginal cultural values and associated conservation methods across the Project Area, as identified during the consultations. The ACHAR will be circulated to all RAPs for comment as is set out in the ACHCRs. The ACHAR will be available to Heritage NSW for their consideration of the project and the report will be publicly available.

#### **2.2.2 Public / confidential information**

Information will be treated in accordance with instructions received by Aboriginal informants. Information described as confidential (culturally sensitive) will not be detailed in the publicly available report. Confidential information should be made available to the proponent, its heritage consultants, and Heritage NSW so that significant cultural values can be conserved. On advice from the provider of the information, a redacted ACHAR would be made available to the wider public where any sensitive cultural information is removed.

#### **2.2.3 Copyright**

Information collected for this assessment remains the property of the Aboriginal informants and the author. Without written permission from individual informants and the author information may not be used for purposes other than those outlined above.

### 3 ARCHAEOLOGICAL CONTEXT

The test excavation program follows the results of a pedestrian survey across the Survey Area (Section 1.6).

No previous subsurface archaeological investigation has occurred within the Project Area nor have subsurface investigations been undertaken in closely adjacent landforms. However, there are several regional archaeological studies which are in general proximity to the Project Area. The land within and surrounding the nearby Boggabri Coal Mine has also undergone intense archaeological investigation since its development.

These studies have been summarised briefly below and reveal a rich archaeological record characterised by stone artefacts and the products from their manufacture. Most sites are open archaeological deposits, with other site types such as grinding grooves and scarred trees also recorded in the region.

#### 3.1 REGIONAL ARCHAEOLOGICAL INVESTIGATIONS

##### Thompson 1981

A survey was conducted between Boggabri and Gunnedah (approximately 20–70 km from the Survey Area). During the survey, 29 sites and 11 isolated finds were recorded. Site types included artefact scatters, axe grinding grooves, scarred trees, and a single mythological site. A close spatial association between sites and water sources was evident.

##### Haglund 1983

A survey was conducted at the Maules Creek Coal Mine (approximately 13 km from the Project Area). A total of 13 sites were identified and these included six artefact scatters and seven isolated finds. Retouched flakes, cores, and flakes were the most common artefact types. It was noted that recorded sites should not be regarded as separate occurrences, but as part of a general scatter of stone artefacts on and in most flat and/or gently sloping surfaces in the vicinity of temporary water sources. Lack of sites about the 340 m contour interpreted as a product of generally unfavourable environmental conditions for occupation, including a lack of surface water and the prevalence of steep, stony surfaces.

##### Balme 1986

A survey of the Pilliga sand region and the Pilliga State Forests (approximately 30 km from the Project Area) was conducted in 1986. The study found that open campsites were the dominant site type, typically identified on erosion surfaces in valleys, alongside streamlines. Most sites were between 20–50 artefacts. Quartz was the dominant raw material type. Silcrete, quartzite, jasper, fine-grained volcanic, and chert were also used. It was concluded that the lack of variety of

alternative resources, such as permanent waterholes, may explain why there is little evidence of intensive Aboriginal occupation in the Pilliga Forests.

#### Dallas 1986

A survey of the rail loop and coal haul route for the Maules Creek Coal mine (approximately 13 km from the Project Area) was conducted in 1986. The survey identified four sites along or adjacent to the haul route and no sites were identified on the rail loop. Three of the sites were open artefact scatters, numbering 2, 11, and 14 artefacts. Artefact material included quartz, mudstone, siltstone, agate, volcanic, chalcedony, and silcrete. The fourth site was a rock shelter with one identified stone artefact on the floor of the shelter and three artefacts between the shelter and the creek.

#### Roberts 1991

A survey was conducted through the Pilliga Forests (approximately 30 km from the Project Area). As a result, 89 sites were identified, including 24 open campsites, 62 scarred trees, and three rock shelters. It was noted that quartz was the dominant raw material type. It was also noted that poor ground surface visibility away from water sources prohibits an effective assessment of the relationship between water sources and the extent of Aboriginal activities in the forest. Roberts proposed that Aboriginal people may have utilised the forest's creeks as 'corridors' for movement and suggested that the distribution of scarred trees likely reflects post-contact European land practices.

#### NSW National Parks and Wildlife Service (Purcell 2002)

A large-scale regional survey of the Brigalow Belt South Bioregion (within which the Project Area lies) was conducted by Philip Purcell in 2002. A total of 1940 sites were identified. Of these, 311 sites were identified in the Liverpool Plains, 303 in the Pilliga Outwash, and 609 in the Pilliga Forests. Sites frequently occurred in the Alluvial Group, where 668 sites were identified in total, likely due to the association of the group with water features. The most prolific site types were open camp sites and isolated finds. 90% of the sites recorded were located within 200–300 m of water.

#### R.W. Corkery & Co, 2005a & b

Two surveys were conducted in East Boggabri (approximately 15 km from the Project Area) by Corkery & Co during 2005. During the first survey four Aboriginal sites were identified, including a possible scarred tree, two low density artefact scatters, and one isolated find of a basalt hatchet head made from a river cobble. The second survey identified four Aboriginal sites comprising of chipped stone artefact scatters with artefact totals ranging from 5–20.



### 3.2 ARCHAEOLOGICAL INVESTIGATIONS FOR BOGGABRI COAL MINE

#### ARAS 2005 & 2007

In 2004 Giles Hamm undertook an assessment of Aboriginal heritage values within the then proposed Boggabri Coal Mine focussing on the Leard State Forest (1 km north of the Project Area) and adjacent Nagero Wetlands. Overall, the investigation identified 61 Aboriginal cultural heritage sites (30 artefact scatters, 26 isolated artefacts, and five scarred trees).

Hamm returned in 2006 to complete artefact salvage and subsurface investigations, including geotechnical analysis. Test excavations at two sites, BC 35 and BC 41, recovered 179 and 30 stone artefacts respectively. The raw material distribution at both sites was dominated by rhyolitic tuff, followed by silcrete and chalcedony at BC 35, and quartz at BC 41. Subsurface artefacts discovered using grader scrapes across more general areas in the Leard Forest and Nagero Creek catchment produced the same or similar raw material distributions.

Geotechnical analysis was conducted at select locations including an area, named Section 4, placed at the southern edge of Leard Forest at a distance of roughly 1–2 km from the Project Area and in matching landforms i.e. flat floodplain traversed by distributary channels with agricultural disturbances. Hamm (ARAS 2007:28) noted that the only location where Aboriginal artefacts were found in this section was on a distinct terrace landform above the bed of a modern terrace.

In the final report, Hamm (ARAS 2007:31–32) made several conclusions to describe the pattern of archaeological site distribution in the landforms studied, he determined that:

*Aboriginal people undoubtedly visited but rarely occupied the high sandstone and conglomerate ridges but sites are found there because the soils are shallow and ground cover is low. The intermediate zone in the landscape between the stony ridges and the top of the alluvial fans, where there is considerable fluctuation in the water availability and resource richness, is perhaps the area most often occupied. Much of the mine site and the sedimentation pond lie in this environment. It is also where the strongest development of texture contrast soils occurs, and all of the usual archaeological constraints associated with the biomantles of these soils will apply to any site. In short these are:*

- *Open sites are unlikely to be stratified in a chronologically useful sense*
- *Artefacts will be confined to the biomantle*
- *Artefacts will have been subject to surface dispersion, limited down-slope movement, and differential burial or exposure by bioturbation agents and they will contribute to a stone layer between the A and B-horizon where artefacts of all ages accumulate*

- *Despite the taphonomic processes affecting artefact distribution in the soil some site use patterns, such as knapping floors, may survive in plan form but with an extended vertical distribution of their components and possible mixing with artefacts from other events*
- *Because artefactual burial is an ongoing process, surface visibility will be poor except where material has been exposed by erosion*
- *The only means of dating any sites in this landscape will be by recognition of cultural sequences of artefacts, or from the recovery of intact 'hearths' or burials. All other dates, especially those based on detrital charcoal, and including those based on thermo-luminescence, will be spurious because artefacts can move through soil material of any age.*

#### Insite Heritage 2010

Angela Besant conducted a field survey in the southern portion of the BCM area in 2009, which included approximately 9 ha in the southern part of the current Project Area. Identified during survey were 77 Aboriginal cultural heritage sites, of which 29 were isolated finds, 34 open artefact scatters, and 14 scarred trees. Two patches of grinding grooves on sandstone bedrock in Leard State Forest were also identified during a subsequent survey, although they were considered relatively poor examples of their site type (Insite 2010:73). None of the recorded sites were located within the Project or Survey Area boundaries. As a result of the survey, the potential for subsurface artefacts in the Leard State Forest was assessed by Besant to be high, and it is possible that expansive sites could be located on the lower and upper slopes within the forest. The sites in the Leard State Forest were assessed by Besant as being of high scientific significance at a local level, as they are relatively rare in their regional context.

#### Kayandel 2011

In 2011, an additional 14 Aboriginal cultural heritage sites were recorded on BCM land during the Tarrawonga Cultural Heritage Assessment. The recorded artefact materials were comprised of quartzite, chalcedony, silt stone, volcanic, and fine-grained silicious. Most artefacts recorded were small. It was suggested that this provides potential evidence for flaking technology evolution, i.e. the production of geometric microliths (Kayandel 2011:57).

#### Insite Heritage 2015

In 2015 Insite Heritage were commissioned to prepare an Aboriginal Cultural Heritage assessment for the Boggabri Coal Mine Modification 5. Six Aboriginal cultural heritage sites were identified across the four areas surveyed.

- Item 1: Roma Bore Hole and Pipeline: one open site (eight artefacts) in a disturbed context was located and an area of PAD identified
- Items 2 & 3: Cooboobindi Bore Hole, Pipeline, Power Line & Access: five artefacts located on access road and two artefacts located within a ploughed field

- Item 4: Victoria Park auxiliary infrastructure: one scatter of seven artefacts over an area of 50 x 50 m located on the pipeline route on disturbed ground
- Item 5: Bellevue Pipeline: artefact scatter of 100 objects over a 50 x 50 m area on ground heavily disturbed by ploughing
- Item 6: Bellevue pipeline – low density artefact scatter and three isolated finds on an unformed road and adjacent paddock.

#### UQ Culture & Heritage, 2017

Sneddon & Whincop prepared an Aboriginal Heritage Conservation Strategy for Maules Creek Coal Mine, Tarrawonga Coal Project, BCM, and related Biodiversity Offset Areas. It was noted that a total of 67 Aboriginal cultural heritage sites are the subject of the Boggabri Cultural Heritage Management Plan (CHMP) (Idemitsu 2013). Of those, 21 Aboriginal Heritage Information Management System (AHIMS) sites had been salvaged, and two AHIMS sites were partially salvaged in 2013. A total of nine AHIMS sites and one partial site remained to be salvaged at that date and 32 whole and two partial AHIMS sites were to be retained.

### **3.3 ARCHAEOLOGICAL CONTEXT: SUMMARY**

The archaeological investigations surrounding the Project Area as summarised above indicate that:

- Open sites consisting of stone artefact scatters, modified trees, and isolated stone artefacts are the most common site types in the region
- Aboriginal people may have utilised the forest's creeks as 'corridors' for movement
- The intermediate zone in the landscape between the stony ridges and the top of the alluvial fans, where there is considerable fluctuation in the water availability and resource richness, is perhaps the area most often occupied
- Artefact material includes quartz, mudstone, siltstone, agate, volcanic, chalcedony, and silcrete.

## 4 TEST EXCAVATION METHODOLOGY

### 4.1 PURPOSE OF THE TEST EXCAVATION METHODOLOGY

The purpose of the test excavation program is to understand more completely the nature of the subsurface material across the Project and Survey Areas. Data obtained from the test excavation program will inform the mitigation and management options in the forthcoming revised ACHAR.

The aims are therefore to:

1. Establish the extent and nature the of subsurface archaeological deposits
2. Use the data gained from the test excavation program to better evaluate the archaeological significance of the Project Area
3. Develop, in consultation with the RAPs and the proponent, an informed strategy for the management of impacts to any Aboriginal cultural heritage likely to be impacted by the project.

### 4.2 RESEARCH QUESTIONS

While any test excavation program is limited in the level of research objectives it can achieve due to the restricted nature of the excavations, the test excavations within the Survey Area will attempt to shed light on:

- Does the Project and Survey Areas contain subsurface archaeological material? If so,
  - What is the nature of that material?
  - What is the distribution of material?
  - Is the deposit intact?
  - Is there evidence of previous land use disturbance?
  - What is the age of the deposit?
  - Is there archaeological material that can be dated?
  - Is the deposit stratified?
- How does the artefactual material and stratigraphy identified at the site compare to other archaeological excavations undertaken in the local area and the region?
- Is there evidence providing insight into the tasks Aboriginal people were undertaking?
- What are the cultural values of the deposit? How does the local Aboriginal community understand the value of the deposit?



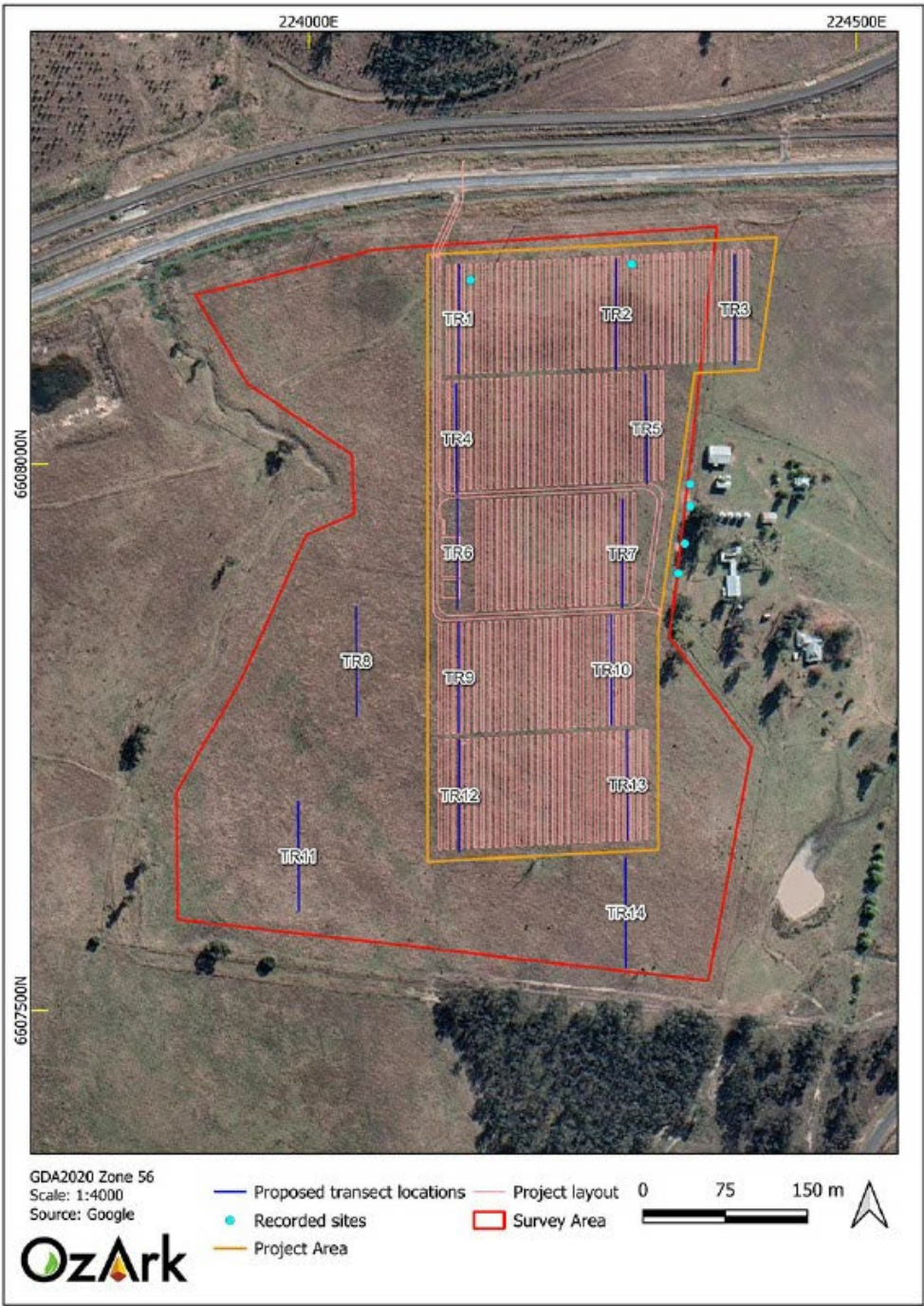
### 4.3 PROPOSED TEST EXCAVATION AREAS

Fourteen locations have been selected across the Project and Survey Areas to provide a clearer picture of the subsurface archaeological potential. (Figure 4-1). This number includes three transects which have been placed outside of the Project Area but within the Survey Area to inform any future expansion. One transect has been placed in the small portion of the Project Area that extends outside of the Survey Area so that there can be certainty about the archaeological potential of this area.

Each transect will be arranged as a linear 100 m transect each containing six test units (TU) spaced 20 m apart. Thus, a total of 84 TUs (0.5 x 0.5 m) are proposed to be investigated. Figure 4-1 shows the preliminary layout of transects, however, the ultimate location of the transects and their associated TUs will be determined in the field so that both are placed at the most advantageous locations (i.e. away from disturbances etc).

The locations of Transect 1 and Transect 2 have been selected to sample landforms near where the two artefacts within the Project Area (Merriown 1 and 2) were recorded by RPS. Testing closer to sites Merriown 3 to Merriown 5 is determined to be unnecessary as the land immediately adjacent to these sites are not within the Project Area and will not be impacted by the project.

Figure 4-1: Proposed excavation transect locations.



#### 4.4 SAMPLING STRATEGY

The excavation program will be undertaken by archaeologists and representatives of RAPs and will include the following aspects:

1. Fourteen areas will be investigated by the test excavation program. The 11 transects in the Project Area will be investigated as a priority and the three transects outside the Project Area but within the Survey Area (Transects 8, 11, and 14) will be investigated as a secondary priority.
2. The location for the proposed test excavation program and approximate transect locations are shown on **Figure 4-1**. It is noted that there can be some flexibility in the field about the precise location of an area to test and the precise location of excavation transects. Any decisions about where to place excavation areas will be done in consultation with the RAPs who are in present at the time.
3. At each location, the TUs will be spaced apart in intervals of at least 20 m so that a broad representation of the landforms will be obtained. Some minor movement off this grid may be needed to avoid vegetation or areas of disturbance. No TU will be closer than 5 m to another.
4. Prior to any excavation, the area will be recorded via digital photography.
5. Initial TUs will be excavated in five centimetre (cm) spits to determine whether archaeological stratigraphy is present. If not, spit size will be increased to 10 cm. If archaeological stratigraphy is present, this will be used, so long as the stratigraphic layers are less than 10 cm deep. Otherwise, excavation will remain at 5 cm or 10 cm spits.
6. The excavated material from all squares will be sieved on site using dry sieving through a five millimetre (mm) sieve. A 3 mm sieve will be available should the deposits and artefacts being recorded suggest that it would be warranted to use a smaller sieve size.
7. If the soils at a location are deep, the decision on when to stop excavation will rest with the Excavation Director although Requirement 16a, point 9 will be followed. This states: *Test excavation units must be excavated to at least the base of the identified Aboriginal object-bearing units, and must continue to confirm the soils below are culturally sterile.*
8. Each excavator (by hand) will be responsible for sieving the deposit from their TU, retrieving the artefacts and, in conjunction with the supervising archaeologist, correctly recording their provenance. There could be some room for assistance with the sieving, but a self-contained approach is preferable. Deposits will be sieved on to tarpaulins and the spoil used to backfill the TU once it has been photographed and recorded.
9. A standard excavation recording form will be used for each TU. Details will include: date, site recorder, spit number and excavation depth, description of the soil profile with Munsell



colours being used as appropriate, measured section of the excavation, and soil pH recordings (when necessary or appropriate).

10. It is envisioned that the excavation crew will consist of an Excavation Director, two assistant archaeologists and four representatives from the RAPs. The excavator of each TU, in conjunction with the Excavation Director, will be responsible for ensuring all forms are correctly completed. It will be the archaeologists' responsibility to perform all photographic tasks, undertake any planning and section drawing if required, and to ensure that a correct location of each TU is maintained.
11. Given that the work will be reasonably physical, all persons conducting activities must be fit for work.
12. If intact archaeological deposits or archaeological features are encountered, then additional archaeological TUs may be excavated to ensure documentation of any features and/or retrieval of artefacts and other relevant archaeological material. A feature would include a high density of artefacts within a TU, or a square containing rare or unusual artefacts (such as artefacts constructed from a stone type rarely represented in the area or less-common tool forms such as ground edge hatchet heads, hammerstones, etc.), or other signs of human occupation i.e. ground ovens/hearths or charcoal concentrations. Any expansion must adhere to Requirement 16 (5). Any expansion would only occur with the consent of the Excavation Director who will determine if an expansion is required to gain the appropriate scientific information.
13. Rather than expanding around an individual square as set out in Point 12, it is more likely that any expansion will involve setting out an additional transect at 90 degrees to a transect that has demonstrated significant and intact archaeological deposits. The perpendicular transect will be used to assist in determining the spatial spread of the subsurface deposits.
14. Section drawings and photographs will be completed for all TUs to show the soil profile.
15. Analysis of all excavated lithics will be made to determine the site's characteristics and to enable the site to be compared with other sites in the region. Analysis will also assist in determining what type of activities the Aboriginal people carried out at the site and their relationship with local resources (fauna, flora, water, and stone). All artefacts will be analysed and selectively photographed. If charcoal from a secure stratigraphic context is obtained, it may be sent to a laboratory for Carbon 14 dating (subject to the proponent's agreement).
16. All faunal remains, if recovered, will be analysed by a fauna specialist. Remnant shell and bone fragments may assist in determining what foods Aboriginal people may have eaten at the specific site and may elucidate possible foraging strategies. In conjunction with *in situ*



stone tools, bone/shell fragments may also provide evidence of specific usage of stone tools for food processing.

17. Artefacts will remain at the OzArk office (145 Wingewarra Street, Dubbo NSW) until the analysis is complete. Once complete, the artefacts will remain at the OzArk office where they will be kept at a locked location until point 19 below is enacted.
18. The results of the test excavation program will inform the forthcoming ACHAR. Excavation results will be used to advise further courses of action in relation to the management and mitigation options for the Project Area.
19. Once all salvage activities for the project are complete (should the project be approved), artefacts will be amalgamated and managed as per the AHIP. Artefacts will be either be subject to a future Care Agreement negotiated between the RAPs and Heritage NSW; or reburied in accordance with Requirement 26 of the Code of Practice. The long-term management of any recovered artefacts will be determined in consultation with the RAPs.

#### **4.5 SAMPLING STRATEGY COMPLIANCE WITH THE CODE OF PRACTICE: REQUIREMENT 16**

- 1 *Test excavation units must be placed on a systematic grid appropriate to the scale of the area—either PAD or site—being investigated e.g. 10 m intervals, 20 m intervals, or other justifiable and regular spacing.*
  - The sampling strategy outlined above complies with this requirement. All TUs will be at least 20 m apart along each of the transects. The transects will be at least 10 m apart. This will provide an adequate sample to be able to understand the subsurface potential at the Project and Survey Areas.
- 2 *Any test excavation point must be separated by at least 5 m.*
  - The sampling strategy outlined above complies with this requirement as all pits will be separated by at least 20 m. The only variation to this is if the Excavation Director determines that expansion is required. In this case, additional TUs will be placed around the TU of interest but will be at least 5 m from the original TU unless there is a compelling archaeological reason for excavating directly adjacent to the original TU (i.e. the need to recover a fragile item etc.).
- 3 *Test excavations units must be excavated using hand tools only.*
  - All test excavations will be done by hand.
- 4 *Test excavations must be excavated in 0.5 m x 0.5 m units.*
  - All TUs will measure 0.5 x 0.5 m.
- 5 *Test excavations units may be combined and excavated as necessary to understand the site characteristics, however:*

- i) *the maximum continuous surface area of a combination of test excavation units at any single excavation point conducted in accordance with point 1 (above) must be no greater than 3 m<sup>2</sup>*
    - The sampling strategy outlined above complies with this requirement.
  - ii) *the maximum surface area of all test excavation units must be no greater than 0.5% of the area—either PAD or site—being investigated.*
    - The number of TUs undertaken as part of this program will be managed to ensure that this requirement is satisfied.
- 6 *Where the 0.5 m x 0.5 m excavation unit is greater than 0.5% of the area then point 5 (ii) (above) does not apply.*
  - Not applicable.
- 7 *The first excavation unit must be excavated and documented in 5 cm spits at each area—either PAD or site—being investigated. Based on the evidence of the first excavation unit, 10 cm spits or sediment profile/stratigraphic excavation (whichever is smaller) may then be implemented.*
  - The test excavation program will commence with 5 cm spits until it is clear that 10 cm spits can be excavated.
- 8 *All material excavated from the test excavation units must be sieved using a 5 mm aperture wire-mesh sieve.*
  - All deposits will be sieved through a 5mm mesh sieve. A 3 mm mesh sieve will be available if required.
- 9 *Test excavation units must be excavated to at least the base of the identified Aboriginal object-bearing units and must continue to confirm the soils below are culturally sterile.*
  - This requirement will be fulfilled in the field and all TUs will be excavated to the basal clays or where it is considered that culturally sterile units are present. The decision on when this point is reached will rest with the Excavation Director.
- 11 *Photographic and scale-drawn records of the stratigraphy/soil profile, features and informative Aboriginal objects must be made for each single excavation point.*
  - The Excavation Director will ensure that this requirement is met during the test excavation program.
- 12 *Test excavations units must be backfilled as soon as practicable.*
  - All TUs will be backfilled with the sieved deposits from that TU.

- 13     *Following test excavation, an Aboriginal Site Impact Recording form must be completed and submitted to the AHIMS Registrar as soon as practicable, for each AHIMS site that has been the subject of test excavation in accordance with the requirements of the Code.*
- It will be the responsibility of OzArk to ensure that this requirement is met.

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- UQ Culture & Heritage 2017 UQ Culture and Heritage Unit, 2017. *Aboriginal Heritage Conservation Strategy: Maules Creek Coal Mine, Tarrawonga Coal Project, Boggabri Coal Mine, and Related Biodiversity Offset Areas*. Prepared for Whitehaven Coal Limited and Idemitsu Australia Resources.

## APPENDIX 4: ABORIGINAL HERITAGE: UNANTICIPATED FINDS PROTOCOL

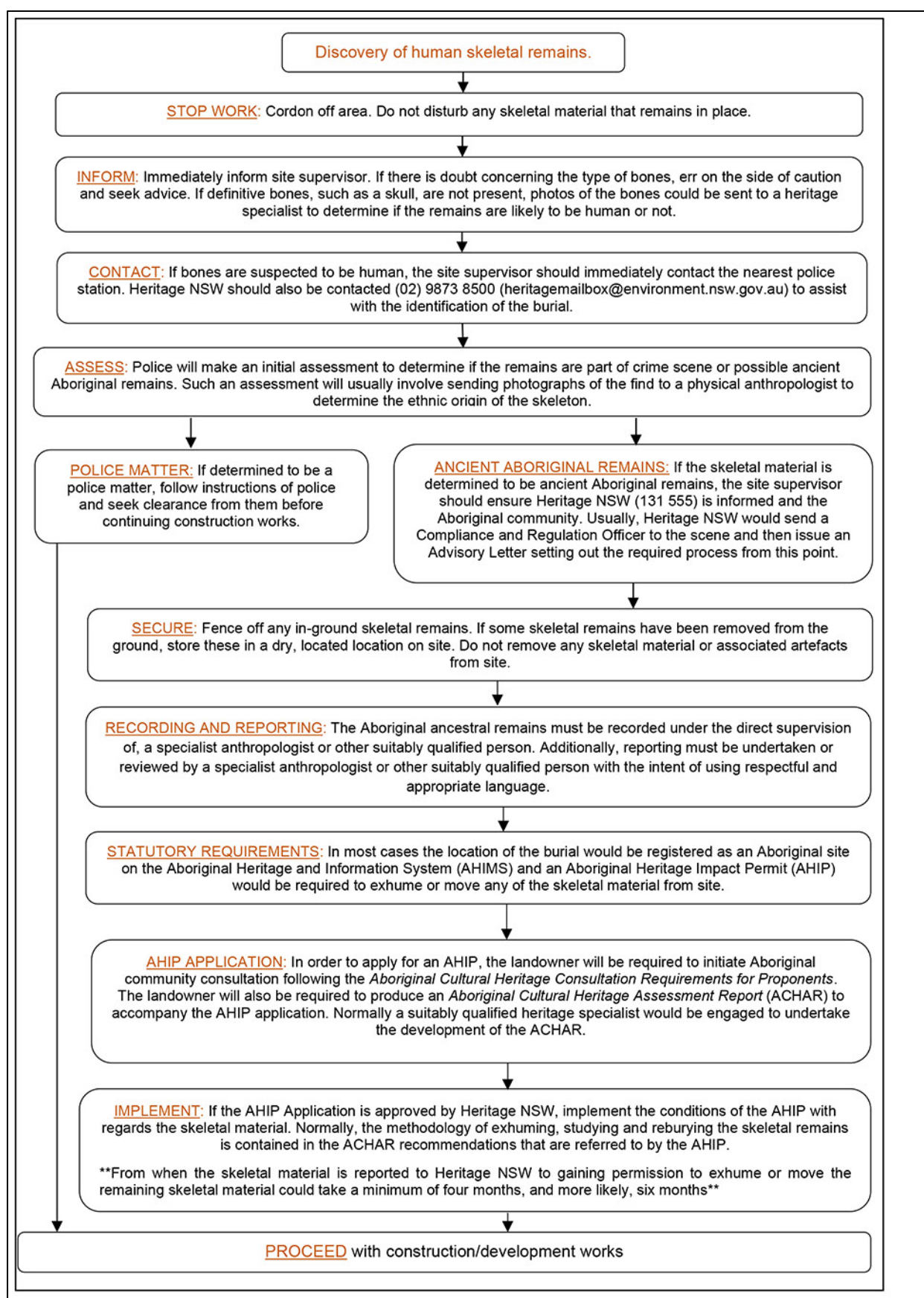
An Aboriginal artefact is anything which is the result of past Aboriginal activity. This includes stone (artefacts, rock engravings etc.), plant (culturally scarred trees) and animal (if showing signs of modification; i.e. smoothing, use). Human bone (skeletal) remains may also be uncovered while onsite.

Cultural heritage significance is assessed by the Aboriginal community and is typically based on traditional and contemporary lore, spiritual values, and oral history, and may also consider scientific and educational value.

Protocol to be followed if previously unrecorded or unanticipated Aboriginal object(s) are encountered:

1. If any Aboriginal object is discovered and/or harmed in, or under the land, while undertaking the proposed development activities, the proponent must:
  - a. Not further harm the object
  - b. Immediately cease all work at the particular location
  - c. Secure the area to avoid further harm to the Aboriginal object
  - d. Notify Heritage NSW as soon as practical on (02) 9873 8500 (heritagemailbox@environment.nsw.gov.au), providing any details of the Aboriginal object and its location; and
  - e. Not recommence any work at the particular location unless authorised in writing by Heritage NSW.
2. If Aboriginal burials are unexpectedly encountered during the activity, work must stop immediately, the area secured to prevent unauthorised access and NSW Police and Heritage NSW contacted.
3. Cooperate with the appropriate authorities and relevant Aboriginal community representatives to facilitate:
  - a. The recording and assessment of the find(s)
  - b. The fulfilment of any legal constraints arising from the find(s), including complying with Heritage NSW directions
  - c. The development and implementation of appropriate management strategies, including consultation with stakeholders and the assessment of the significance of the find(s).
4. Where the find(s) are determined to be Aboriginal object(s), recommencement of work in the area of the find(s) can only occur in accordance with any consequential legal requirements and after gaining written approval from Heritage NSW (in this case, through a variation to the approved AHIP).

## APPENDIX 5: UNANTICIPATED SKELETAL REMAINS PROTOCOL



Date: 04 April 2024

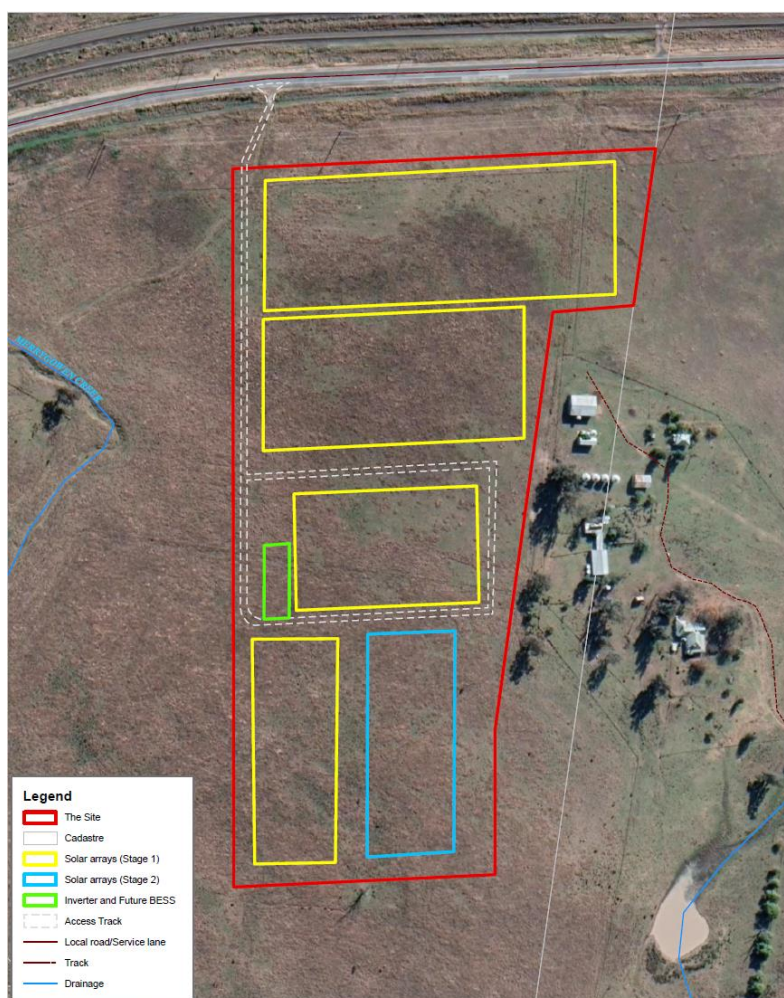
Idemitsu Renewable Developments Australia  
Shaun Vagne  
Project Development Engineer - Renewables  
Level 9, 175 Eagle Street  
Brisbane QLD 4000

Dear Shaun,

**RE: Preliminary Site Investigations, 333 Leards Forest Road, Boggabri NSW, (Lot21/DP754940)**

## 1 INTRODUCTION

Idemitsu Renewable Developments Australian Pty Ltd (IRDA) (the client) is the renewable energy development branch of Idemitsu Kosan in Australia. It is responsible for the development of Merriown Solar Farm proposed by Boggabri Coal Operations Pty Ltd at 333 Leards Forest Road, Boggabri NSW (the site). The boundary of the development site and future site features are shown in Figure 1-1.



**Figure 1-1 The Site**



## 1.1 Background

In brief, RPS understands that Idemitsu Renewables operates alongside the company's mining operations arm Idemitsu Australia. The desired outcome of the Merriown Solar Farm is to provide energy for Boggabri Coal Mine's operations to become fully self-sufficient, running solely on renewable energy during daytime mining operations. The physical components of the proposed development will occupy approximately 13ha of land located in the south-western corner of the site.

## 1.2 Purpose and Objectives

The purpose of this PSI is to address a Request For Information (RFI) from Narrabri Shire Council, which was:

- Contamination – provide a Preliminary Investigation as per the requirements of SEPP (Resilience and Hazards) clause 4.6(4)(b) given the land involves a change of use of land formerly used for agricultural activities. This is a mandatory requirement that a consent authority must consider prior to determining the DA. Although a commentary is made regarding contamination within the SEE, it should be prepared by a suitably qualified contaminated land professional as per the "Managing Land Contamination – Planning Guidelines" 1998.

## 1.3 Scope of Works

This PSI is based on a desktop review only and no site inspection or intrusive contamination investigation has been completed. The scope of works undertaken to inform the PSI included the following:

- Desktop review of site setting information (including but not limited to: title and planning, topography and drainage, geology and hydrogeology, and groundwater use information).
- Desktop review of public records (including but not limited to: EPA records, public databases, title information, aerial imagery, business use records and maps).
- Preparation of this letter report detailing the findings of the PSI.

## 1.4 Regulatory Framework

The PSI was undertaken in general accordance with the following:

- Contaminated Land Management Act 1997 (NSW CLM Act).
- National Environment Protection Council (1999) National Environment Protection (Assessment of Contaminated Sites) Measure, as amended in 2013 (NEPM 2013).
- Standards Australia (2005) Australian Standards AS4482.1 Guide to the Sampling and Investigation of Potentially Contaminated Soil (AS4482.1).

## 2 SITE SETTING

Information in the table below is taken from information in reports prepared by a third party Land Insight (Appendix A). Potentially contaminating activities are shown in bold.

### 2.1 Site Description and Setting

**Table 2-1 Site Description and Site Setting**

| Site Information                      | Details                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|---------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Site Address                          | 333 Leards Forest Road, Boggabri NSW                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Parcel Reference                      | Lot21/DP754940                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Local Government                      | Narrabri Shire Council                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Zoning                                | RU1 - Primary Production: (pub. 24-2-2023)                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Site Area                             | Approximately 90.1 hectares (ha).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Site Owner                            | Boggabri Coal Operations PTY LTD                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Current Land Use                      | <b>Agriculture.</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Proposed Future Land Use              | Agriculture and Solar Energy Generation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Surface and Subsurface Infrastructure | A number of buildings (farm house and storage / maintenance sheds) with associated infrastructure. Unknown fuel storage / maintenance pits / waste management / laydown areas identified at the site. Three water storage locations adjacent to road / railway identified on site.                                                                                                                                                                                                                                     |
| Surrounding Land Use                  | <b>Agriculture / Farmland</b> surrounds the property. The Boggabri Coal Mine Access Road and <b>Railway</b> is directly to the North of the site, where <b>Boggabri Coal Mine</b> is approximately 1 kilometre to the east of the site where associated facilities include <b>substations, fuel / hazardous chemicals storage, training areas, water treatment and other associated facilities with mining operations.</b> Leard State Forrest is located on the North Western Boundary which is a sensitive receptor. |

### 2.2 Hydrogeological Setting

Information in the table below is taken from Land Insight Report (Appendix A), supplemented with an online search (including NSW Hydrogeological Maps, Google Earth and Google Maps).

**Table 2-2 Hydrogeological Setting**

| Site Aspects                         | Description                                                                                                                                                                                                                                              |
|--------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Surface Water Receptors              | Merrygowen Creek located west of the proposed development.                                                                                                                                                                                               |
| Topography and Drainage              | Relatively flat. In areas to the north of the site, there is approximately a 2% gradient from north to south, where stormwater would drain to Merrygowen Creek. Drainage not known. Likely combination of onsite drainage system and surface water flow. |
| Regional geology                     | Colluvial and residual deposits with Quaternary (base) to Pleistocene (top) age. North of site is mainly Boggabri Volcanics with Asselian (base) to Sakmarian (top) age.                                                                                 |
| Aquifer Geological Unit              | Fractured or fissured, extensive aquifers of low to moderate productivity.                                                                                                                                                                               |
| Groundwater depth                    | 7.6-29.0 meters below ground level (mbgl).                                                                                                                                                                                                               |
| Groundwater flow direction           | South-West towards Merrygowen Creek (based on site topography and nearby surface water receptors).                                                                                                                                                       |
| Groundwater Salinity                 | 500-3,000 mg/L.                                                                                                                                                                                                                                          |
| Groundwater Uses (Based on Salinity) | Irrigation.<br>All stock.<br>Drinking (Desirable palatability <600 mg/L; acceptable palatability <900 mg/L (WHO 2004; ADWG 2011).)                                                                                                                       |

| Site Aspects                            | Description                                                                                                                                                             |
|-----------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Registered Groundwater Bore Information | One bore registered for unknown purposes, located on site.<br>Note: unregistered groundwater bores may be present in the area that do not appear on relevant databases. |
| Acid Sulphate Soils                     | Low probability of occurrence.                                                                                                                                          |

### 3 DESKTOP REVIEW

Information in the tables below are taken from Land Insight Reports (**Error! Reference source not found.**). A buffer of up to 1 km from the sites has generally been applied. Potentially contaminating activities are highlighted in bold.

**Table 3-1 EPA Public Records Review**

| Record                                        | Comment                                                                                                                                                                    |
|-----------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| EPA List of Contaminated Land Public Register | Not identified.                                                                                                                                                            |
| EPA Clean Up, Penalty Notices and Orders      | Five Penalty Notices in total issued to Boggabri Coal Operations PTY LTD (Contravene condition of licence ( <b>noise and Pollute Waters</b> )).                            |
| EPA Licensed Activities (issued)              | Boggabri Coal Operations PTY LTD ( <b>mining for coal, Crushing, grinding or separating, Coal works</b> )<br>Environmental Protection License – EPL12407                   |
| EPA Regulated Delicensed Facilities           | Coal & Allied Industries Limited (Miscellaneous licensed <b>discharge to waters (wet weather only)</b> ).<br>Forestry Corporation of New South Wales (Logging operations). |

**Table 3-2 Other Public Records Review**

| Record                                            | Comment                                                                                                                                                                                                                                                                                    |
|---------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Former Gasworks                                   | None identified.                                                                                                                                                                                                                                                                           |
| Potentially Contaminating Activities onsite       | <b>Rail Corridor</b> , current <b>agriculture</b> operations and <b>Boggabri Coal Operations PTY LTD</b> .                                                                                                                                                                                 |
| Former Fuel Facilities                            | None identified. Power fuel storage facilities on neighbouring mining operation.                                                                                                                                                                                                           |
| Waste Management Facilities                       | Potential for historical land fill onsite (none identified).                                                                                                                                                                                                                               |
| Drycleaners, Motor Garages and Service Stations   | None identified.                                                                                                                                                                                                                                                                           |
| EPA, Defence and Airservices PFAS Sites           | None identified.                                                                                                                                                                                                                                                                           |
| Bushfire Prone Areas                              | Vegetation Buffer / Vegetation Category 1 (Northwest of site).                                                                                                                                                                                                                             |
| Flood Planning Area                               | Floodplain Management Plan for The Upper Namoi Valley Floodplain 2019.                                                                                                                                                                                                                     |
| Erosion Hazard (Moderate to Very High categories) | Landslip Erosion Risk – Extreme limitations – Very High<br>Water Erosion Risk – Moderate to severe limitations – Moderate<br>Water Erosion Risk – Severe limitations – High<br>Water Erosion Risk – Extreme limitations – Very High<br>Wind Erosion Risk – Moderate Limitations – Moderate |

**Table 3-3 Historical Records**

| Record                        | Comment                                                                                                                                                                                                                                                                                                                                                           |
|-------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Business Directories          | Stanford L V & Sons farmed onsite, before the property was purchased by Boggabri Coal Operations PTY LTD.                                                                                                                                                                                                                                                         |
| Mining and Exploration Titles | Authorisation A 355, Authorisation A 339, Mining Lease ML1755.                                                                                                                                                                                                                                                                                                    |
| Aerial Images                 | Aerial images from 1956 to 2023 were reviewed.<br>The site was in use for agricultural purposes. The only main alteration to the site occurred between 1997 and 2010 when the road, railway and one pond / dam were constructed onsite. Agricultural buildings and infrastructure remained constant to the east of site through the aerial imagery review period. |

## 4 CONTAMINATION POTENTIAL

Potentially contaminated activities identified on the site and surrounds are discussed in the table below.

**Table 4-1 Contamination Potential on the Sites and Surrounds**

| Site    | Potentially Contaminating Activity                     | Contaminants of Potential Concern (cPOC)                                                                                                                                                                                             | Comment                                                                                                                             |
|---------|--------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|
| Onsite  | Rail easement                                          | Petroleum hydrocarbons (benzene, toluene, ethylbenzene and xylenes – BTEX, and total petroleum hydrocarbons – TPH)<br>Herbicides and pesticides (organochlorine pesticides – OCP and organophosphorous pesticides – OPP)<br>Asbestos | Shallow soil and fill may be impacted by cPOC.<br>Shallow groundwater may be impacted by cPOC.                                      |
|         | Former agricultural land use and potential landfilling | Herbicides and pesticides (OCP and OPP)<br>Petroleum hydrocarbons (BTEX, and – TPH), Metals, Fertilisers (nitrogen and phosphorous compounds)<br>Asbestos                                                                            | Residual contamination is possible.<br>No landfilling was identified, however may have some areas where minor landfilling occurred. |
| Offsite | Agricultural land use                                  | Herbicides and pesticides (OCP and OPP)<br>Fertilisers (nitrogen and phosphorous compounds)                                                                                                                                          | A regional nitrogen contamination plume may be present given the widespread agricultural land use in the surrounding area.          |
|         | Mining Operations                                      | Petroleum hydrocarbons (BTEX, and – TPH), Metals, Fertilisers (nitrogen and phosphorous compounds)                                                                                                                                   | Operations offsite to the east may impact groundwater onsite.                                                                       |



## 5 PRELIMINARY CONCEPTUAL SITE MODEL

A Preliminary Conceptual Site Model of Contamination has been prepared which is outlined in the table below.

**Table 5-1 Preliminary Conceptual Site Model of Contamination**

| Source                                                                                                                                         | Contaminant and Media                                        | Pathway                                            | Receptor                                        | Comment on Likelihood of Pathway Completion                                                                                                               |
|------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------|----------------------------------------------------|-------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|
| Fertiliser, fuel / oil storage, railway easement and associated infrastructure associated with agriculture (septic tank, possible landfilling) | Shallow soil and fill (Petroleum hydrocarbons BTEX, and TPH) | Wind erosion.<br>Dust inhalation<br>Dermal contact | Onsite workers, Residents in farmhouse          | Potentially complete. Could be managed via appropriate OHS practises (use of PPE, etc.).                                                                  |
|                                                                                                                                                | Herbicides and pesticides (OCP and OPP)                      | Incidental ingestion                               |                                                 |                                                                                                                                                           |
|                                                                                                                                                | Metals, Fertilisers (nitrogen and phosphorous compounds)     | Plant / animal uptake                              | Uptake by plant roots, and ingestion by animals | Potentially complete.                                                                                                                                     |
|                                                                                                                                                | Asbestos                                                     |                                                    |                                                 |                                                                                                                                                           |
|                                                                                                                                                | Groundwater (Petroleum hydrocarbons BTEX, and TPH)           | Migration and its extraction<br>Dermal contact     | Offsite extractive groundwater bore users.      | Potential for migration of impacted groundwater sourced from site / offsite irrigation bore, (none were identified that are hydraulically down gradient). |
|                                                                                                                                                | Herbicides and pesticides (OCP and OPP)                      | Incidental ingestion                               | Ecosystems in Merrygowen Creek                  |                                                                                                                                                           |
|                                                                                                                                                | Metals, Fertilisers (nitrogen and phosphorous compounds)     | Uptake by groundwater dependent ecosystems         |                                                 |                                                                                                                                                           |

## 6 SUMMARY AND CONCLUSIONS

Based on the information gathered during the desktop review, RPS has identified the following:

- The site has been used for agricultural purposes (farming and grazing).
- A railway and road were constructed through the site between 1997 and 2010.
- The site has five Penalty Notices associated with Boggabri Coal Operations PTY LTD.
- The site has been identified as a potential risk from Bushfire, Flood and Erosion (landslip, water and wind) impacts.
- There is potential for soil and fill to be impacted by current and former activities onsite. Groundwater may also be impacted by activities from both onsite and offsite activities.

## 7 RECOMMENDATIONS

Potential risks have been identified during this desktop Preliminary Site Investigation, however as the site is to be developed for Solar Power Generation, the risks identified for this beneficial use are **low**. These risks are to be managed as follows:

- Bushfire – Proposed Development Site over a kilometre away from Vegetation Category 1. Will be managed in accordance with the SEE, and / or CEMP.
- Flood and Erosion – Will be managed in accordance with the SEE, and / or CEMP.
- Unexpected Contamination / Environmental / Heritage discoveries – Develop and Implement an Unexpected Finds Protocol in conjunction with the SEE, and / CEMP.

## 8 CLOSING REMARKS

Please do not hesitate Ruairi Hanly should you wish to discuss the contents of this letter report.

Yours sincerely,  
for RPS AAP Consulting Pty Ltd



**Ruairi Hanly**  
Practice Lead  
ruairi.hanly@rpsgroup.com.au  
+61 424 320 354



### Appendices:

Appendix A - Land Insight Reports

## Appendix A Land Insight Reports



# Due Diligence Insight Report

333 Leards Forest Road  
Boggabri, NSW

15 Mar 2024

Report n°:  
LI-4030 DDR



# Understanding your report

Thank you for ordering your report from Land Insight. If you have any feedback, questions or queries, please get in touch with us at [orders@landinsight.co.au](mailto:orders@landinsight.co.au).

Your Report has been produced by Land Insight and contains information related to current and historical land use information, environmental risks and hazards.

The information presented in this report includes Land Insights' comprehensive research into current and historical land use derived from Land Insight's proprietary National Land Use Atlas (NLUA), environmental risk information and data available from public databases, third party providers, local and state authorities. The report also includes detailed property and soil setting information, hydrogeology, identification of potential pollution and contamination along with ground and natural hazards. The records identified are presented within a 200 to 2000m radius (buffer zone) from the boundaries of the Property searched, depending on the screened constraint. The report is separated and grouped into easy to navigate sections as per Summary below:

|                                                                                     |                  |                                                        |                                                                                                                                                                                                                                           |
|-------------------------------------------------------------------------------------|------------------|--------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|    | <b>Section 1</b> | <b>PROPERTY SETTING</b>                                | Sensitive Receptors, Planning Controls, Zoning, Heritage, Soil and Land Information, Geology and Topography                                                                                                                               |
|    | <b>Section 2</b> | <b>HYDROGEOLOGY</b>                                    | Groundwater Bores and Other Borehole investigations, Groundwater Dependent Ecosystems (GDE), Aquifer and Wetland, Other Hydrogeology information.                                                                                         |
|  | <b>Section 3</b> | <b>ENVIRONMENTAL REGISTERS, LICENCES AND INCIDENTS</b> | Contaminated Land Public Register, Licences, Audits and Orders, Sites Regulated by Other Jurisdictional Body (Former Gaswork sites / PFAS sites, UXO Areas), Historical Landfills, Derelict Mines and National Pollutant Inventory (NPI). |
|  | <b>Section 4</b> | <b>POTENTIALLY CONTAMINATED AREAS</b>                  | Potentially Contaminating activities (Industries, businesses and activities that may cause contamination), Historical Potentially Contaminating activities and Historical Land Use.                                                       |
|  | <b>Section 5</b> | <b>NATURAL HAZARDS</b>                                 | Erosion hazard, Flood hazards, Bushfire prone land and Bushfire history.                                                                                                                                                                  |

**This report includes** data listed on page 4 (table of contents). All sources of data and definitions are provided in the Product Guide (Attached). For a full list of references, metadata, publications or additional information not provided in this report, please contact [orders@landinsight.co.au](mailto:orders@landinsight.co.au).

**This report does not include** information derived from a physical inspection. It is important to note that a site inspection can present information relevant to other risks and hazards that may not be identified by this Report.

Due to the ongoing nature of database development and frequency of updates provided by various state government regulators and data sources, the data displayed within this report is only current from date of production. While every effort is made to ensure the details in your Report are correct, Land Insight cannot guarantee the accuracy or completeness of the information and/or data provided.

**This Report, and your use of it, is regulated by Land Insight's Terms and Conditions. For more information, see Land Insight's Product Guide.**

# Data maintenance schedule

| Dataset name                                                                                         | Update frequency | Dataset buffer |
|------------------------------------------------------------------------------------------------------|------------------|----------------|
| <b>Section 1 - Property Setting</b>                                                                  |                  |                |
| Sensitive Receptors                                                                                  | Quarterly        | 200m           |
| Planning Controls ( <i>Zoning, Planning Instruments, Other planning information</i> )                | Quarterly        | 500m           |
| State and Local Heritage                                                                             | Quarterly        | 200m           |
| Commonwealth, National and World Heritage Areas                                                      | Annually         | 200m           |
| Soil Landscape and Land Use Information                                                              | Annually         | 500m           |
| Salinity Hazard                                                                                      | Annually         | 500m           |
| Radon Level                                                                                          | Annually         | 500m           |
| State, Local and National Acid Sulfate Soil (ASS)                                                    | Annually         | 500m           |
| Geology                                                                                              | Annually         | 500m           |
| Naturally Occurring Asbestos Potential                                                               | Annually         | 500m           |
| Topography                                                                                           | As required      | 500m           |
| <b>Section 2 - Hydrogeology</b>                                                                      |                  |                |
| Groundwater Aquifers                                                                                 | Annually         | 2000m          |
| Wetlands                                                                                             | Annually         | 2000m          |
| Groundwater Bores                                                                                    | Annually         | 2000m          |
| Drinking Water Catchments                                                                            | Annually         | 500m           |
| Groundwater Prohibition/Restricted Use/Exclusion Zones                                               | Annually         | 500m           |
| Hydrogeologic Units                                                                                  | Annually         | 500m           |
| Groundwater Dependent Ecosystems                                                                     | Annually         | 500m           |
| Other Borehole Locations ( <i>Coal Seam Gas, Petroleum Wells, other boreholes</i> )                  | Annually         | 500m           |
| <b>Section 3 - Environmental Registers, Licences and Incidents</b>                                   |                  |                |
| Contaminated Land Public Register                                                                    | Monthly          | 1000m          |
| Licences, Approvals, Audits, Authorisations & Assessments                                            |                  |                |
| Licences                                                                                             | Monthly          | 1000m          |
| Surrendered Licences                                                                                 | Monthly          | 1000m          |
| Clean Up Notices, Penalty Notices and Orders                                                         | Monthly          | 1000m          |
| Permissions                                                                                          | Monthly          | 1000m          |
| Audits                                                                                               | Monthly          | 1000m          |
| Authorisations                                                                                       | Monthly          | 1000m          |
| Sites Regulated by other Jurisdictional Body                                                         |                  |                |
| Contaminated Legacy Areas ( <i>James Hardies Asbestos, Pasminco Smelter and Uranium sites</i> )      | Quarterly        | 2000m          |
| Defence 3 Year Regional Contamination Investigation Program (RCIP)                                   | Quarterly        | 2000m          |
| Defence Sites - Current and Former                                                                   | Ongoing          | 2000m          |
| Unexploded Ordnance (UXO) Sites - Department of Defence (DoD)                                        | Annually         | 2000m          |
| Former Gasworks Sites                                                                                | Ongoing          | 2000m          |
| PFAS Investigation Sites ( <i>EPA PFAS Investigation Program/s, AirServices Australia etc.</i> )     | Monthly          | 2000m          |
| NPI Industrial Facilities                                                                            | Annually         | 2000m          |
| <b>Section 4 - Potentially Contaminated Areas</b>                                                    |                  |                |
| Potentially Contaminating Activities (PCA) ( <i>Petrol Stations, Dry cleaners, Waste sites etc</i> ) | Ongoing          | 500m           |
| Historical Business Directory ( <i>Commercial and Trade Directory Data from 1990-2020</i> )          | Not required     | 200m           |
| <b>Section 5 - Natural Hazards</b>                                                                   |                  |                |
| Bushfire Prone Areas                                                                                 | Bi-annual        | 500m           |
| Bushfire History                                                                                     | Bi-annual        | 500m           |
| Erosion Hazard                                                                                       | Bi-annual        | 500m           |
| Flood Hazard                                                                                         | Ongoing          | 500m           |

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#### ATTACHMENTS

Attachment A - Report Maps

Attachment B - Historical Imagery

Land Insight Product Guide and Terms and Conditions





## Section 1 Property Setting

### 1.1 SENSITIVE RECEPTORS

Map 1.1 (200m Buffer)

| Sensitive receptor | Type                     | Distance (m) | Direction |
|--------------------|--------------------------|--------------|-----------|
| Leard State Forest | State / Provincial Parks | 0.1          | North     |

### 1.2a PLANNING CONTROLS

Map 1.2a (500m Buffer)

#### Zoning

| Zoning | Type               | Details                                | Distance (m) | Direction |
|--------|--------------------|----------------------------------------|--------------|-----------|
| RU1    | Primary Production | Narrabri Local Environmental Plan 2012 | 0.0          | Onsite    |
| RU3    | Forestry           | Narrabri Local Environmental Plan 2012 | 0.1          | North     |

### 1.2b PLANNING OVERLAYS

Map 1.2b (500m Buffer)

#### Environmental Planning Instruments

| Name                               | Type     | Details                                | Distance (m) | Direction |
|------------------------------------|----------|----------------------------------------|--------------|-----------|
| Minimum Lot Size (sq m): 100-199.9 | Lot Size | Narrabri Local Environmental Plan 2012 | 0.0          | Onsite    |

#### Other Planning Information

| Name           | Type | Details | Distance (m) | Direction |
|----------------|------|---------|--------------|-----------|
| Not identified | -    | -       | -            | -         |

## 1.3 HERITAGE

## Map 1.3 (200m Buffer)

### State and Local Heritage Registers

| Site ID        | Site Name | Type | Details | Distance (m) | Direction |
|----------------|-----------|------|---------|--------------|-----------|
| Not identified | -         | -    | -       | -            | -         |

### Australian Heritage Database Register

| Site ID        | Site Name | Type | Details | Distance (m) | Direction |
|----------------|-----------|------|---------|--------------|-----------|
| Not identified | -         | -    | -       | -            | -         |

Commonwealth Heritage List, National Heritage List and World Heritage Area.

## 1.4a SOIL AND LAND USE INFORMATION

## Map 1.4a (500m Buffer)

### Soil Landscape

| Code  | Name             | Soil Group        | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Distance (m) | Direction |
|-------|------------------|-------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|-----------|
| CObpk | Barbers Pinnacle | Colluvial         | Landscape— Steep to precipitous hills and scarps on Permian Rhyolite and other acid to intermediate volcanics in the Boggabri Hills. Cliffs, cliff footslopes, scree slopes and hillslopes with slopes >30%, occasionally >70%, local relief <180 m, elevation 240 – 440 m. Mostly uncleared woodland and open forest. Soils— Shallow, rapidly drained Lithic Leptic Tenosols (Lithosols) on upper slopes. Shallow to moderately deep, welldrained Red Vertosols (Red Clays) on mid to lower slopes inbetween/below cliffs and scree slopes.                                                                                                                                                                                                                            | 0.0          | Onsite    |
| STddw | Driggle Draggie  | Stagnant alluvial | Landscape— Extensive stagnant alluvial plains, alluvial fans and sheet-flood fans on Quaternary and older alluvium which form westward draining plains from the Melville Range. Slopes <1%, local relief <9 m, elevation 240 – 260 m. Complex mosaic of grassland and woodland extensively cleared for mixed cropping and grazing. Soils— Dominated by giant imperfectly drained Gypsic Brown Vertosols (Brown Clays), giant poorly drained Brown Vertosols (Brown Clays), and giant very poorly drained Grey Vertosols (Grey Clays), with some very deep to giant poorly drained clay loamy Grey Chromosols (Solodic Soils) and silty Brown Sodosols (Solodic Soils). Some low rise areas have very deep, imperfectly drained Eutrophic Brown Dermosols (Brown Clays). | 0.0          | Onsite    |
| ERhay | Hartfell         | Erosional         | Landscape—rolling to undulating low hills on Permian-Carboniferous rhyolites, rhyolite tuffs and rhyodacite of the Gunnedah Volcanics. Local relief to 50 m, slope range 8–20% with rounded to relatively flat crests, elevation range 280–338 m. Rock outcrop approximately 50%. Partially cleared open-woodland with a grass or shrub understorey. Soils—shallow to moderately deep (50–150 cm) stony Red Earths (Gn2.14, Gn2.15) and Lithosols (Um5.41, Um4.23).                                                                                                                                                                                                                                                                                                     | 0.0          | Onsite    |
| TRvey | Velyama          | Transferral       | Landscape— Broad, very gently to gently inclined, long (500 - 1,000 m) footslopes and coalescing fans on alluvium and colluvium from the Jurassic basalts of the Garrawilla Volcanics in the Mullaley Hills, with extensive linear gilgai. Slopes 0 - 8%, local relief <50                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 0.0          | Onsite    |

| Code  | Name    | Soil Group  | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Distance (m) | Direction |
|-------|---------|-------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|-----------|
|       |         |             | m, elevation 300 - 470 m. Closed- grassland with scattered trees and open-woodland on upper footslopes mostly cleared for agriculture. Soils—Very deep, moderately well-drained Self-mulching Black Vertosols (Black Earths), with Grey Vertosols (Grey Clays) in poorly drained areas.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |              |           |
| TRbyr | Brentry | Transferral | <p>Landscape—6.6 km<sup>2</sup> level to gently undulating drainage plains and fans on Quaternary alluvium from Permian quartz sandstones and conglomerates. Local relief &lt;20 m; elevation 245–290 m; slopes 0–2%.</p> <p>Mostly cleared open woodland, with isolated patches remaining in upper catchment areas and where the landscape meets the volcanic Quaternary alluvium of the Coxs Creek Floodplain. Soils—giant, imperfectly drained Brown Sodosols (Solonetz; Solonized Solonetz) are present on plains, lower footslopes and alluvial fans, with very deep (&gt;1.5 m) Calcic Brown Dermosols (Wiesenboden) at junctions with alluvial plains. Gravelly Brown Dermosols (some affinity with Red-brown Earths and Solonetz) are present where erosion has completely removed topsoil layers. Qualities and limitations—localised poor drainage; localised high run-on on lower slopes; localised flood hazard near alluvial plains; localised seasonal waterlogging; known saline discharge area; localised dryland salinity; known recharge area; high sheet, rill, gully and wind erosion risk; non-cohesive soils (localised); Callitris spp. (cypress pines) regrowth potential. Soils have localised high plasticity; localised shrink-swell potential; commonly sodic/dispersive at depth; high erodibility; localised hardsetting surfaces; high permeability in loose topsoil</p> | 280.1        | North     |

### Salinity

| Salinity Hazard | Type | Details | Distance (m) | Direction |
|-----------------|------|---------|--------------|-----------|
| Not identified  | -    | -       | -            | -         |

### Radon

| Radon Level (Bq/m <sup>3</sup> ) | Distance (m) | Direction |
|----------------------------------|--------------|-----------|
| 9                                | 0.0          | Onsite    |

Typical radon levels in Australia are low and the values shown are the average values for each census district. For specific location, factors such as the local geology and house type could lead to different values. (ARPANSA).

## 1.4b ACID SULFATE SOIL

## Map 1.4b (500m Buffer)

### State and Local Acid Sulfate Soil Registers

| Name           | Classification | Description | Distance (m) | Direction |
|----------------|----------------|-------------|--------------|-----------|
| Not identified | -              | -           | -            | -         |

To ensure that development does not disturb, expose or drain acid sulfate soils and cause environmental damage, development consent may be required for the carrying out of works within areas and land shown on the Acid Sulfate Soils Map.

### National Acid Sulfate Soil Register

| Name                                   | Classification                | Description                                                          | Distance (m) | Direction |
|----------------------------------------|-------------------------------|----------------------------------------------------------------------|--------------|-----------|
| Atlas of Australian Acid Sulfate Soils | Low Probability of occurrence | Acid sulfate soil generally within upper 1m in wet / riparian areas. | 0.0          | Onsite    |

Source: ASRIS Atlas of Australian Sulfate Soils (CSIRO). Acid Sulfate Soils (ASS) are all those soils in which sulfuric acid may be produced, is being produced, or has been produced in amounts that have a lasting effect on main soil characteristics.

## 1.5 GEOLOGY AND TOPOGRAPHY

## Map 1.5 (500m Buffer)

### Geology

| Map Sheet                                                   | Code   | Formation                       | Age                                    | Group                   | Dominant Lithology | Description                                                                                                                | Distance (m) | Direction |
|-------------------------------------------------------------|--------|---------------------------------|----------------------------------------|-------------------------|--------------------|----------------------------------------------------------------------------------------------------------------------------|--------------|-----------|
| NSW Metamorphic dataset - Seamless Geology v. 2.1, May 2021 | Putg   | Boggabri Volcanics              | Asselian (base) to Sakmarian (top)     | Ungrouped Permian units | Rhyolite           | Rhyolite and dacitic (emplaced as lavas), tuff (emplaced as ash flows) with interbedded shale. Rare trachyte and andesite. | 0.0          | Onsite    |
| NSW Metamorphic dataset - Seamless Geology v. 2.1, May 2021 | QH_avf | Alluvial fan deposits           | Quaternary (base) to Now (top)         | Alluvium                | Clastic sediment   | Unconsolidated gravel, sand, silt and clay.                                                                                | 0.0          | Onsite    |
| NSW Metamorphic dataset - Seamless Geology v. 2.1, May 2021 | Q_cr   | Colluvial and residual deposits | Quaternary (base) to Pleistocene (top) | Colluvium               | Clastic sediment   | Undifferentiated colluvial and residual deposits.                                                                          | 0.0          | Onsite    |

### Naturally Occurring Asbestos Potential (NOA)

| Category       | On the Property? | Within Buffer? |
|----------------|------------------|----------------|
| Not identified | -                | -              |

### Topography

|                     |                |
|---------------------|----------------|
| Topography (Onsite) | 260 - 360 mAHD |
|---------------------|----------------|





## Section 2 Hydrogeology



### 2.1 GDE & HYDROGEOLOGY CONSTRAINTS

Map 2.1 (2000m Buffer)

#### Aquifer Type

| Type                                                                      | Distance (m) | Direction  |
|---------------------------------------------------------------------------|--------------|------------|
| Fractured or fissured, extensive aquifers of low to moderate productivity | 0.0          | Onsite     |
| Porous, extensive highly productive aquifers                              | 415.2        | South-west |

#### Groundwater Protection Areas

| Name           | Water Plan Area | Distance (m) | Direction |
|----------------|-----------------|--------------|-----------|
| Not identified | -               | -            | -         |

#### Wetlands

| Name           | Description | Distance (m) | Direction |
|----------------|-------------|--------------|-----------|
| Not identified | -           | -            | -         |

#### Groundwater Dependent Ecosystems (GDE) - Aquatic (Surface)

| Potential      | Distance (m) | Direction |
|----------------|--------------|-----------|
| Not identified | -            | -         |

*Aquatic - Ecosystems that rely on the Surface expression of groundwater.*

## Groundwater Dependent Ecosystems (GDE) - Terrestrial (Subsurface)

| Potential                                      | Distance (m) | Direction |
|------------------------------------------------|--------------|-----------|
| Low potential GDE - from regional studies      | 0.0          | Onsite    |
| Moderate potential GDE - from regional studies | 0.0          | Onsite    |

Terrestrial - Ecosystems that rely on the Subsurface expression of groundwater.

## Groundwater Licences (Western Australia)

| Map ID         | WRI number | Allocation (KL) | Address | All Parties | Distance (m) | Direction |
|----------------|------------|-----------------|---------|-------------|--------------|-----------|
| Not identified | -          | -               | -       | -           | -            | -         |

## Groundwater Bores

| Map ID | Groundwater Bore ID | Authorised Purpose         | Completion Date | Drilled Depth (m) | Final Depth (m) | SWL (m) | Salinity (mg/l) | Yield (L/s) | Distance (m) | Direction  |
|--------|---------------------|----------------------------|-----------------|-------------------|-----------------|---------|-----------------|-------------|--------------|------------|
| 16     | GW020434            | Unknown                    | 01/01/1927      | Null              | 85.3            | Null    | Salty           | Null        | 0.0          | Onsite     |
| 15     | GW020432            | Unknown                    | 01/01/1963      | Null              | 48.8            | Null    | Null            | Null        | 50.7         | East       |
| 7      | GW026419            | Water supply               | 01/07/1966      | 60.1              | 60.0            | Null    | Good            | Null        | 165.9        | East       |
| 6      | GW031986            | Unknown                    | 01/01/1927      | 39.6              | 39.6            | Null    | Null            | Null        | 167.0        | West       |
| 12     | GW020438            | Water supply for livestock | 01/01/1963      | Null              | Null            | Null    | Null            | Null        | 231.5        | South      |
| 9      | GW003115            | Unknown                    | 01/07/1932      | 82.9              | 82.9            | 29.0    | Good            | Null        | 706.5        | East       |
| 5      | GW001508            | Water supply               | 01/03/1925      | 73.8              | 73.8            | 21.9    | Fresh           | 0.5         | 937.5        | South      |
| 2      | GW026454            | Water supply               | 01/08/1966      | 85.3              | Null            | Null    | Good            | 0.1         | 945.4        | South      |
| 1      | GW036010            | Exploration or research    | 01/04/1974      | 40.5              | Null            | Null    | Null            | Null        | 948.2        | South-east |
| 19     | GW970703            | Monitoring                 | 07/01/2014      | 96.0              | 94.0            | Null    | Null            | 0.4         | 1026.8       | South-east |
| 11     | GW967881            | Monitoring                 | 24/04/2006      | 32.0              | 32.0            | 29.0    | Null            | Null        | 1045.7       | East       |
| 14     | GW020437            | Unknown                    | 01/01/1963      | Null              | 36.6            | Null    | Null            | Null        | 1536.0       | East       |
| 13     | GW969634            | Monitoring                 | 23/06/2005      | 45.0              | 45.0            | Null    | Null            | Null        | 1574.8       | East       |
| 8      | GW004925            | Unknown                    | 01/01/2013      | 44.2              | 44.2            | 7.6     | Stock           | 0.4         | 1578.2       | West       |
| 10     | GW967860            | Monitoring                 | 23/06/2006      | 100.0             | 100.0           | Null    | Null            | Null        | 1640.3       | East       |
| 22     | GW970927            | Test bore                  | 14/12/2010      | 38.0              | 38.0            | Null    | Null            | Null        | 1735.7       | West       |
| 21     | GW970926            | Test bore                  | 14/12/2010      | 42.0              | 42.0            | Null    | Null            | Null        | 1743.4       | West       |
| 17     | GW970683            | Monitoring                 | 03/12/2013      | 0.0               | 78.2            | Null    | Null            | Null        | 1747.2       | West       |
| 18     | GW970684            | Monitoring                 | 15/11/2013      | 22.0              | 21.0            | Null    | Null            | Null        | 1747.7       | West       |
| 23     | GW970928            | Test bore                  | 14/12/2010      | 42.0              | 42.0            | Null    | Null            | Null        | 1754.9       | West       |
| 20     | GW970925            | Test bore                  | 13/12/2010      | 42.0              | 42.0            | Null    | Null            | Null        | 1762.7       | West       |

| Map ID | Groundwater Bore ID | Authorised Purpose | Completion Date | Drilled Depth (m) | Final Depth (m) | SWL (m) | Salinity (mg/l) | Yield (L/s) | Distance (m) | Direction  |
|--------|---------------------|--------------------|-----------------|-------------------|-----------------|---------|-----------------|-------------|--------------|------------|
| 4      | GW000507            | Unknown            | 01/04/2020      | 60.7              | 60.7            | 23.6    | Fresh           | 0.8         | 1861.5       | North-east |
| 3      | GW000526            | Unknown            | 01/08/2020      | 105.2             | 105.2           | Null    | Fresh           | Null        | 1908.8       | East       |

Note: The use of the symbol "-" or "Null" indicates that no records were found.

### Groundwater Bores Driller Lithology Details

| Groundwater Bore ID | From Depth – To Depth (m)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Lithology | Distance (m) | Direction  |
|---------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|--------------|------------|
| GW020434            | Null                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |           | 0.0          | Onsite     |
| GW020432            | Null                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |           | 50.7         | East       |
| GW026419            | 0m-4.57m Clay red hard<br>4.57m-9.45m Rock decomposed<br>9.45m-10.06m Clay gravel<br>10.06m-12.19m Clay<br>12.19m-39.62m Clay gravel<br>39.62m-41.76m Clay<br>41.76m-42.06m Gravel<br>42.06m-42.67m Water bearing<br>42.67m-50.9m Clay<br>50.9m-51.51m Water bearing<br>51.51m-60.05m Clay<br>60.05m-60.06m Water supply                                                                                                                                                                                                                                                            |           | 165.9        | East       |
| GW031986            | 0m-39.62m Alluvium water supply                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |           | 167.0        | West       |
| GW020438            | Null                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |           | 231.5        | South      |
| GW003115            | 0m-0.61m Soil<br>0.61m-5.49m Conglomerate<br>5.49m-17.07m Clay yellow gravel<br>17.07m-26.21m Clay yellow gravel mixed<br>26.21m-41.15m Rock yellow<br>41.15m-82.91m Rock grey hard water supply                                                                                                                                                                                                                                                                                                                                                                                    |           | 706.5        | East       |
| GW001508            | 0m-1.52m Topsoil<br>1.52m-5.18m Clay gravel<br>5.18m-5.49m Wash gravel<br>5.49m-12.5m Clay gravel<br>12.5m-17.68m Clay<br>17.68m-18.29m Gravel<br>18.29m-23.47m Clay<br>23.47m-23.77m Gravel<br>23.77m-24.69m Clay<br>24.69m-32m Rock green<br>32m-32.31m Gravel<br>32.31m-46.33m Rock green<br>46.33m-49.99m Soapstone<br>49.99m-73.76m Rock hard water supply                                                                                                                                                                                                                     |           | 937.5        | South      |
| GW026454            | 0m-4.88m Clay wet<br>4.88m-5.18m Gravel<br>5.18m-5.49m Clay<br>5.49m-19.51m Rock decomposed<br>19.51m-33.53m Clay gravel<br>33.53m-42.67m Sandstone<br>42.67m-67.06m Greenstone<br>67.06m-85.34m Rock hard water supply some soft seams                                                                                                                                                                                                                                                                                                                                             |           | 945.4        | South      |
| GW036010            | 0m-1.52m Clay - grey, containing 20% sand to fine gravel (5mm)<br>0m-1.52m Topsoil<br>1.52m-3.05m Clay - light brown containing 10% gravel 2-12mm, mineralogy mostly quartz and vrf<br>1.52m-12.19m Clay sandy<br>3.05m-4.57m As above<br>4.57m-6.1m Clay 50% brown sand 20% white-brown, fine to med, subangular, gravel 30% white-brown 2-15mm, subrounded, mostly quartz, jasper, porphyry, chert, rock fragments<br>6.1m-7.62m Clay - 60% brown, gravel 30%, white brown, 2-20mm, subrounded to subangular. mineralogy as above, sand 10% med to coarse<br>7.62m-9.14m As above |           | 948.2        | South-east |

| Groundwater Bore ID | From Depth – To Depth (m)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Lithology | Distance (m) | Direction  |
|---------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|--------------|------------|
|                     | 9.14m-10.67m Clay - brown containing sand to fine gravel (to 5mm)<br>10.67m-12.19m Clay - light brown, very sandy<br>12.19m-13.72m Clay - 40% light brown, sand 30% white to brown, fine to coarse, subangular, gravel 30% white, 2-8mm, subrounded, chert, jasper, qtz, porphyry, rfs<br>12.19m-24.38m Gravel claybound<br>13.72m-15.24m Clay - 40% brown, gravel 40% red-brown, 2-10mm, subrounded, fair sorting, mineralogy as above, sand 20% fine to coarse<br>15.24m-16.76m Gravel - 50% brown 2-6mm subangular to subrounded, quartz, jasper, chert, porphyry, rock fragments. sand 20% brown, coarse, subangular. clay 30% brown<br>16.76m-18.29m Clay - 40% light brown, gravel 40% , red brown, subrounded, mineralogy as above, sand 20% brown, fine to coarse<br>18.29m-19.81m Gravel - 60% white brown, 2-20mm, subangular, quartz, porphyry, vrf clay 30% light brown. sand 10% brown, fine to med<br>19.81m-21.34m Gravel 80% red brown, mostly 5-25mm, subrounded, quartz, rhyolite, porphyry, shale, mafic vrf. sand 10% red brown, coarse, clay 10% brown<br>21.34m-22.86m As above<br>22.86m-24.38m Gravel 60% light brown, 10-20mm, subrounded, quartz, biotite, orthoclase porphyry, rhyolite, jasper, vrf. clay 30% light brown. sand 10% light brown, med to coarse<br>24.38m-25.91m Clay - 60% light grey, containing 40% gravel, rhyolite, volcanic extrusives, porphyries, mafic vrf, chert, quartz, jasper<br>24.38m-27.43m Gravel some clay bands<br>25.91m-27.43m Gravel - 80% white to light brown, 2-20mm, subrounded, mostly extrusive volcanic rock fragments. sand 10% fine to coarse. clay 10% light brown<br>27.43m-28.96m Clay<br>27.43m-28.96m Clay - light brown containing 10% fine to coarse sand<br>28.96m-30.48m Gravel - 60% light brown, 2-10mm, subangular, mineralogy as above, sand 20% fine to coarse, clay - 20% light brown<br>28.96m-36.58m Gravel claybound<br>30.48m-32.01m Gravel - 80% light brown, mostly 5-15mm, subrounded, mineralogy as above. sand 10% fine to coarse, clay, 10% light grey<br>32.01m-33.54m Clay - grey, containing 30% volcanic rock fragments, 2-15mm subangular<br>33.54m-35.06m Gravel - 60% white brown, 2-8mm, subangular, fair sorting, mineralogy as above. clay 30% greyish, sand 10%, white grey, fine to coarse<br>35.06m-39.62m Clay - white, contains 15% gravel 2-8mm (weathered bedrock - breakdown from rhyolite)<br>36.58m-39.62m Sandstone weathered<br>39.62m-40.54m Bedrock<br>39.62m-39.94m Rhyolite, light grey, very hard, showing signs of flow bands. samples are highly weathered along fractures. slightly ferruginous again along fractures |           |              |            |
| GW970703            | Null                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |           | 1026.8       | South-east |
| GW967881            | 0m-3m Sandy clay<br>3m-5m Clay<br>5m-13m Sandy clay<br>13m-19m Sandy clay<br>19m-26m Sandy clay<br>26m-32m Sandy clay                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |           | 1045.7       | East       |
| GW020437            | Null                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |           | 1536.0       | East       |
| GW969634            | 0m-0.5m Soil, buff brown<br>0.5m-28m Acid volcanic, light buff brown, altered<br>28m-36m Acid volcanic, buff brown, altered<br>36m-42m Acid volcanic, orangey brown, altered<br>42m-45m Basic volcanic, light green, altered clayey                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |           | 1574.8       | East       |
| GW004925            | 0m-44.2m Cement white clay water supply                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |           | 1578.2       | West       |
| GW967860            | 0m-3m Topsoil<br>3m-34m Volcanic<br>34m-39m Volcanic<br>39m-68m Volcanic<br>68m-74m Volacanic<br>74m-76m Volcanic<br>76m-92.5m Volcanic<br>92.5m-94m Volcanic<br>94m-100m Volcanic                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |           | 1640.3       | East       |



| Groundwater Bore ID | From Depth – To Depth (m)                                                                                                                                                                                                                                                                                                                                                                                                                                 | Lithology | Distance (m) | Direction  |
|---------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|--------------|------------|
| GW970927            | Null                                                                                                                                                                                                                                                                                                                                                                                                                                                      |           | 1735.7       | West       |
| GW970926            | Null                                                                                                                                                                                                                                                                                                                                                                                                                                                      |           | 1743.4       | West       |
| GW970683            | Null                                                                                                                                                                                                                                                                                                                                                                                                                                                      |           | 1747.2       | West       |
| GW970684            | Null                                                                                                                                                                                                                                                                                                                                                                                                                                                      |           | 1747.7       | West       |
| GW970928            | Null                                                                                                                                                                                                                                                                                                                                                                                                                                                      |           | 1754.9       | West       |
| GW970925            | Null                                                                                                                                                                                                                                                                                                                                                                                                                                                      |           | 1762.7       | West       |
| GW000507            | 0m-8.23m Clay surface<br>0m-8.23m Gravel<br>8.23m-16.46m Rock gravel<br>16.46m-27.13m Gravel<br>27.13m-29.26m Gravel hard sandstone<br>29.26m-30.48m Rock hard<br>30.48m-32m Rock hard gravel<br>32m-42.06m Sandstone<br>42.06m-44.81m Coal small seams<br>42.06m-44.81m Sandstone<br>44.81m-47.55m Sandstone<br>47.55m-52.43m Sandstone white<br>52.43m-57.91m Sand rock white<br>57.91m-60.66m Coal seams<br>57.91m-60.66m Sand rock white water supply |           | 1861.5       | North-east |
| GW000526            | 0m-3.35m Clay gravel<br>3.35m-4.88m Gravel rock<br>4.88m-7.01m Sandstone yellow<br>7.01m-10.06m Rock green<br>10.06m-12.19m Sand rock yellow<br>12.19m-30.48m Rock<br>30.48m-33.22m Sandstone grey yellow soak<br>33.22m-46.33m Rock green hard<br>46.33m-56.69m Sand rock green<br>56.69m-87.78m Rock green<br>87.78m-90.83m Sandstone grey hard<br>90.83m-98.76m Sandstone red<br>98.76m-102.41m Shale sandy<br>102.41m-105.16m Rock reddish            |           | 1908.8       | East       |

Note: The use of the symbol "-" or "Null" indicates that no records were found.

## 2.2 GROUNDWATER AND OTHER BORES

### Map 2.2 (2000m Buffer)

#### Groundwater Restricted Use Zones

| Name / Number  | Address | Site History | Description | Distance (m) | Direction |
|----------------|---------|--------------|-------------|--------------|-----------|
| Not identified | -       | -            | -           | -            | -         |

#### Groundwater Salinity

| Class                  | Salinity Value | Source                           | Distance (m) | Direction |
|------------------------|----------------|----------------------------------|--------------|-----------|
| Non-Saline (<3000mg/L) | 500 - 1500     | Office of Water, New South Wales | 0.0          | Onsite    |
| Non-Saline (<3000mg/L) | 1500 - 3000    | Sinclair Knight Merz             | 0.0          | Onsite    |
| Saline (>3000mg/L)     | 3000 - 5000    | Sinclair Knight Merz             | 1010.6       | East      |

## Other Known Borehole Investigations (Coal Seam Gas (CSG), Petroleum Wells and Other Boreholes)

| Borehole ID | Purpose    | Project                                                         | Client/ License                      | Date Drilled | Depth (m) | Distance (m) | Direction  |
|-------------|------------|-----------------------------------------------------------------|--------------------------------------|--------------|-----------|--------------|------------|
| BMF_TP33    | Test Pit   | Boggabri Mine Expansion Feasibility Study                       | Idemitsu Australia Resources Pty Ltd | 14/02/2009   | 3.0       | 0.0          | Onsite     |
| BMF_TP35    | Test Pit   | Boggabri Mine Expansion Feasibility Study                       | Idemitsu Australia Resources Pty Ltd | 14/02/2009   | 3.0       | 0.0          | Onsite     |
| BMF_TP36    | Test Pit   | Boggabri Mine Expansion Feasibility Study                       | Idemitsu Australia Resources Pty Ltd | 14/02/2009   | 2.9       | 0.0          | Onsite     |
| BMF_TP39    | Test Pit   | Boggabri Mine Expansion Feasibility Study                       | Idemitsu Australia Resources Pty Ltd | 14/02/2009   | 2.8       | 0.0          | Onsite     |
| BMF_TP30    | Test Pit   | Boggabri Mine Expansion Feasibility Study                       | Idemitsu Australia Resources Pty Ltd | 14/02/2009   | 3.0       | 52.6         | West       |
| BMF_TP40    | Test Pit   | Boggabri Mine Expansion Feasibility Study                       | Idemitsu Australia Resources Pty Ltd | 14/02/2009   | 3.0       | 146.3        | East       |
| BMF_BH23    | Borehole   | Boggabri Mine Expansion Feasibility Study                       | Idemitsu Australia Resources Pty Ltd | 14/02/2009   | 11.3      | 251.9        | East       |
| BMF_TP45    | Test Pit   | Boggabri Mine Expansion Feasibility Study                       | Idemitsu Australia Resources Pty Ltd | 14/02/2009   | 3.0       | 333.6        | East       |
| BMF_BH24    | Borehole   | Boggabri Mine Expansion Feasibility Study                       | Idemitsu Australia Resources Pty Ltd | 14/02/2009   | 11.4      | 383.1        | East       |
| BMF_TP51    | Test Pit   | Boggabri Mine Expansion Feasibility Study                       | Idemitsu Australia Resources Pty Ltd | 14/02/2009   | 3.0       | 560.2        | East       |
| BMF_TP44    | Test Pit   | Boggabri Mine Expansion Feasibility Study                       | Idemitsu Australia Resources Pty Ltd | 14/02/2009   | 2.5       | 591.0        | East       |
| BMF_TP41    | Test Pit   | Boggabri Mine Expansion Feasibility Study                       | Idemitsu Australia Resources Pty Ltd | 14/02/2009   | 3.0       | 722.7        | East       |
| BMF_TP27    | Test Pit   | Boggabri Mine Expansion Feasibility Study                       | Idemitsu Australia Resources Pty Ltd | 14/02/2009   | 3.0       | 778.8        | West       |
| BMF_BH29    | Borehole   | Boggabri Mine Expansion Feasibility Study                       | Idemitsu Australia Resources Pty Ltd | 14/02/2009   | 11.8      | 786.7        | North-east |
| BMF_TP57    | Test Pit   | Boggabri Mine Expansion Feasibility Study                       | Idemitsu Australia Resources Pty Ltd | 14/02/2009   | 3.2       | 789.4        | East       |
| BMF_TP43    | Test Pit   | Boggabri Mine Expansion Feasibility Study                       | Idemitsu Australia Resources Pty Ltd | 14/02/2009   | 3.0       | 795.2        | East       |
| BMF_TP58    | Test Pit   | Boggabri Mine Expansion Feasibility Study                       | Idemitsu Australia Resources Pty Ltd | 14/02/2009   | 3.1       | 798.6        | East       |
| BMF_TP50    | Test Pit   | Boggabri Mine Expansion Feasibility Study                       | Idemitsu Australia Resources Pty Ltd | 14/02/2009   | 3.1       | 890.2        | North-east |
| BMF_TP63    | Test Pit   | Boggabri Mine Expansion Feasibility Study                       | Idemitsu Australia Resources Pty Ltd | 14/02/2009   | 3.0       | 938.4        | East       |
| MIN_43323   | Null       | DPI Minerals Borehole Register - Department Of Water Resources, | Department Of Water Resources,       | Null         | 0.0       | 947.7        | South-east |
| 043323      | Water Well | Water Bore                                                      | Department Of Water Resources        | Null         | -9999.0   | 948.4        | South-east |
| BMF_TP59    | Test Pit   | Boggabri Mine Expansion Feasibility Study                       | Idemitsu Australia Resources Pty Ltd | 14/02/2009   | 3.2       | 975.6        | East       |

| Borehole ID | Purpose  | Project                                   | Client/ License                      | Date Drilled | Depth (m) | Distance (m) | Direction |
|-------------|----------|-------------------------------------------|--------------------------------------|--------------|-----------|--------------|-----------|
| BMF_TP56    | Test Pit | Boggabri Mine Expansion Feasibility Study | Idemitsu Australia Resources Pty Ltd | 14/02/2009   | 3.1       | 1041.6       | East      |
| BMF_TP55    | Test Pit | Boggabri Mine Expansion Feasibility Study | Idemitsu Australia Resources Pty Ltd | 14/02/2009   | 3.0       | 1107.6       | East      |
| BMF_TP62    | Test Pit | Boggabri Mine Expansion Feasibility Study | Idemitsu Australia Resources Pty Ltd | 14/02/2009   | 3.2       | 1229.4       | East      |
| BMF_TP60    | Test Pit | Boggabri Mine Expansion Feasibility Study | Idemitsu Australia Resources Pty Ltd | 14/02/2009   | 3.0       | 1281.0       | East      |
| BMF_TP54    | Test Pit | Boggabri Mine Expansion Feasibility Study | Idemitsu Australia Resources Pty Ltd | 14/02/2009   | 3.0       | 1357.1       | East      |
| BMF_TP65    | Test Pit | Boggabri Mine Expansion Feasibility Study | Idemitsu Australia Resources Pty Ltd | 14/02/2009   | 3.1       | 1414.3       | East      |
| BMF_TP61    | Test Pit | Boggabri Mine Expansion Feasibility Study | Idemitsu Australia Resources Pty Ltd | 14/02/2009   | 3.2       | 1447.0       | East      |
| BMF_TP53    | Test Pit | Boggabri Mine Expansion Feasibility Study | Idemitsu Australia Resources Pty Ltd | 14/02/2009   | 3.0       | 1485.4       | East      |
| BMF_TP24    | Test Pit | Boggabri Mine Expansion Feasibility Study | Idemitsu Australia Resources Pty Ltd | 14/02/2009   | 3.0       | 1522.7       | West      |
| BMF_TP48    | Test Pit | Boggabri Mine Expansion Feasibility Study | Idemitsu Australia Resources Pty Ltd | 14/02/2009   | 3.0       | 1537.9       | East      |
| BMF_TP49    | Test Pit | Boggabri Mine Expansion Feasibility Study | Idemitsu Australia Resources Pty Ltd | 14/02/2009   | 3.1       | 1582.3       | East      |
| BMF_TP52    | Test Pit | Boggabri Mine Expansion Feasibility Study | Idemitsu Australia Resources Pty Ltd | 14/02/2009   | 3.0       | 1654.7       | East      |
| BMF_TP47    | Test Pit | Boggabri Mine Expansion Feasibility Study | Idemitsu Australia Resources Pty Ltd | 14/02/2009   | 3.0       | 1735.4       | East      |

Note: The use of the symbol "-" or "Null" indicates that no records were found.



## Section 3 Environmental Registers, Licences and Incidents



### 3.1 CONTAMINATED LAND PUBLIC REGISTER

Map 3.1 (1000m Buffer)

#### Contaminated Sites

| Register Type  | Site Name | Address | Description | Details | Distance (m) | Direction |
|----------------|-----------|---------|-------------|---------|--------------|-----------|
| Not identified | -         | -       | -           | -       | -            | -         |

If the record does not contain a complete street address and/or cannot be located, the records' geographic location will be approximated and reported as being within the surrounding area.

| Table 3.1.1 Contaminated Land Public Register |                                             |                                                                                     |
|-----------------------------------------------|---------------------------------------------|-------------------------------------------------------------------------------------|
| State                                         | Regulatory Body                             | Information included in this search (by state)                                      |
| ACT                                           | EPA (Environment Protection Authority)      | Contaminated Land Search Register of Contaminated Sites                             |
| NSW                                           | EPA (Environment Protection Authority)      | Sites Notified as Contaminated Records of Notices                                   |
| NT                                            | EPA (Environment Protection Authority)      | Contaminated Land Audit Pollution Abatement Notice                                  |
| QLD                                           | DES (Department of Environment and Science) | Contaminated Land Search (Environmental Management and Contaminated Land Registers) |
| SA                                            | EPA (Environment Protection Authority)      | Site Contamination Index                                                            |
| TAS                                           | EPA (Environment Protection Authority)      | Regulated Sites and Premises Lutana and Parts of Hobarts Eastern Shore              |
| VIC                                           | EPA (Environment Protection Authority)      | Priority Sites Register Pollution Abatement Notice                                  |



| Table 3.1.1 Contaminated Land Public Register |                                                         |                             |
|-----------------------------------------------|---------------------------------------------------------|-----------------------------|
| WA                                            | DWER (Department of Water and Environmental Regulation) | Contaminated Sites Database |

This search contains information retrieved from the relevant state authority, agency/department, or government authority that notifies and identifies contaminated land. The list only contains contaminated sites that the regulatory body is aware of or that have been notified by owners or occupiers as contaminated land. The sites are recorded on the register at various stages of the assessment and/or remediation process. If a site is not on the list, it does not necessarily mean the site is not contaminated.

## 3.2 LICENCES, APPROVALS & ASSESSMENTS

## Map 3.2 (500m Buffer)

### Licences

| Licence N° | Type               | Licence holder                          | Location Name                            | Premise Address                                                    | Activity                                                      | Dist. (m)* | Direct     |
|------------|--------------------|-----------------------------------------|------------------------------------------|--------------------------------------------------------------------|---------------------------------------------------------------|------------|------------|
| 12407      | Issued             | BOGGABRI COAL OPERATIONS PTY LTD        | Boggabri Coal Mine                       | 386 LEARD FOREST ROAD, BOGGABRI NSW                                | Mining for coal                                               | 0.0        | Onsite     |
| 12407      | Issued             | BOGGABRI COAL OPERATIONS PTY LTD        | Boggabri Coal Mine                       | 386 LEARD FOREST ROAD, BOGGABRI NSW                                | Crushing, grinding or separating                              | 0.0        | Onsite     |
| 12407      | Issued             | BOGGABRI COAL OPERATIONS PTY LTD        | Boggabri Coal Mine                       | 386 LEARD FOREST ROAD, BOGGABRI NSW                                | Coal works                                                    | 0.0        | Onsite     |
| 5112       | Surrendered        | COAL & ALLIED INDUSTRIES LIMITED        | MAULES CREEK COAL LEASE NO. 375          | BOGGABRI, NSW 2382                                                 | Miscellaneous licensed discharge to waters (wet weather only) | 442.6      | North-west |
| 12981      | No longer in force | FORESTRY CORPORATION OF NEW SOUTH WALES | IFOA Area "the Brigalow-Nandewar Region" | Brigalow and Nandewar Community Conservation Area, DUBBO, NSW 2830 | Logging operations                                            | Not mapped | Not mapped |
| 12981      | No longer in force | FORESTRY CORPORATION OF NEW SOUTH WALES | IFOA Area "the Brigalow-Nandewar Region" | Brigalow and Nandewar Community Conservation Area, DUBBO, NSW 2830 | Logging operations                                            | Not mapped | Not mapped |

If the record does not contain a complete street address and/or cannot be located, the records' geographic location will be approximated and reported as being within the surrounding area.

\* Not mapped – Licences that are applied to larger areas and/or without specific definition; such as waterways, forests etc will still be identified in the search results but will not be shown within the map.

### Audits

| N°             | Type | Licence holder | Location Name | Premise Address | Activity | Dist. (m)* | Direction |
|----------------|------|----------------|---------------|-----------------|----------|------------|-----------|
| Not identified | -    | -              | -             | -               | -        | -          | -         |

If the record does not contain a complete street address and/or cannot be located, the records' geographic location will be approximated and reported as being within the surrounding area.

## Clean Up, Penalty Notices and Orders

| Nº      | Type           | Licence holder                   | Location Name      | Premise Address                            | Details                                                             | Dist. (m)* | Direction |
|---------|----------------|----------------------------------|--------------------|--------------------------------------------|---------------------------------------------------------------------|------------|-----------|
| 1508989 | Penalty Notice | BOGGABRI COAL OPERATIONS PTY LTD | Boggabri Coal Mine | 386 LEARD FOREST ROAD, BOGGABRI, NSW, 2382 | Contravene condition of licence - Corporation                       | 0.0        | Onsite    |
| 1513133 | Penalty Notice | BOGGABRI COAL OPERATIONS PTY LTD | Boggabri Coal Mine | 386 LEARD FOREST ROAD, BOGGABRI, NSW, 2382 | Contravene any condition of licence relating to noise - corporation | 0.0        | Onsite    |
| 1517958 | Penalty Notice | BOGGABRI COAL OPERATIONS PTY LTD | Boggabri Coal Mine | 386 LEARD FOREST ROAD, BOGGABRI, NSW, 2382 | Contravene any condition of licence - not noise - corporation       | 0.0        | Onsite    |
| 1517959 | Penalty Notice | BOGGABRI COAL OPERATIONS PTY LTD | Boggabri Coal Mine | 386 LEARD FOREST ROAD, BOGGABRI, NSW, 2382 | Pollute waters - Corporation                                        | 0.0        | Onsite    |
| 3503258 | Penalty Notice | BOGGABRI COAL OPERATIONS PTY LTD | Boggabri Coal Mine | 386 LEARD FOREST ROAD, BOGGABRI, NSW, 2382 | Pollute waters - Corporation                                        | 0.0        | Onsite    |

*If the record does not contain a complete street address and/or cannot be located, the records' geographic location will be approximated and reported as being within the surrounding area.*

### 3.3a SITES REGULATED BY OTHER JURISDICTIONAL BODY

Map 3.3a (2000m Buffer)

#### Contaminated Legacy Areas

| Site Name      | Description | Distance (m) | Direction |
|----------------|-------------|--------------|-----------|
| Not identified | -           | -            | -         |

Includes known contaminated areas such as James Hardies Asbestos waste legacy areas, Pasminco Smelter and Uranium processing site.

#### Defence, Military Sites and UXO Areas

| Site name      | Type* | Details | Distance (m) | Direction |
|----------------|-------|---------|--------------|-----------|
| Not identified | -     | -       | -            | -         |

\*RCIP (Regional Contamination Investigation Program). UXO (Unexploded Ordnance Areas)

#### Former Gasworks Sites

| Site name      | Description | Distance (m) | Direction |
|----------------|-------------|--------------|-----------|
| Not identified | -           | -            | -         |

#### PFAS Sites

| Site name      | Type | Details | Distance (m) * | Direction |
|----------------|------|---------|----------------|-----------|
| Not identified | -    | -       | -              | -         |

### 3.3b OTHER POTENTIAL HAZARD SOURCES

Map 3.3b (500m Buffer)

#### Mines and Quarries (current and historical)

| Site name          | Description                                                                                                                                                       | Status  | Distance (m) | Direction |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|--------------|-----------|
| Boggabri Coal Mine | Boggabri Coal Mine (BCM) is an open cut coal mine located 15 km north-east of the township of Boggabri in north-western New South Wales (NSW). (Source: Idemitsu) | Current | 0.0          | Onsite    |

#### Landfills (current and historical)

| Site name      | Description | Status | Distance (m) | Direction |
|----------------|-------------|--------|--------------|-----------|
| Not identified | -           | -      | -            | -         |

#### National Pollutant Inventory (NPI)

| Facility name      | Address                         | Primary ANZSIC Class   | Latest report | Distance (m) | Direction |
|--------------------|---------------------------------|------------------------|---------------|--------------|-----------|
| Boggabri Coal Mine | 386 Leard Forest Road, Boggabri | Coal mining, open cut. | 2020/2021     | 0.0          | Onsite    |



## Section 4 Potentially Contaminated Areas



### 4.1 POTENTIALLY CONTAMINATING ACTIVITIES

Map 4.1 (200m Buffer)

Industries, businesses and activities that may cause contamination

| Map ID | Site name     | Category             | Description | Address           | Status* | Dist. (m)* | Direction |
|--------|---------------|----------------------|-------------|-------------------|---------|------------|-----------|
| 1      | Rail Corridor | Transport Operations | Null        | Boggabri NSW 2382 | Current | 0.0        | Onsite    |

**\*Status:** Information is current as when this report was created.

The operational status of the business is determined using the available data sources and does not indicate real-time conditions at the site.

Current: business is operating on the day this report was issued.

Former: business that have been closed or discontinued within 2 years from the date of this report.

#### Categories included in this search. (Notifiable activities)

|                                     |                                   |                                         |
|-------------------------------------|-----------------------------------|-----------------------------------------|
| Abattoirs                           | Explosives and Dangerous Goods    | Paint Industries                        |
| Abrasive Blasting                   | Extractive Industries             | Petrol Stations                         |
| Agriculture / Horticulture          | Fire and Rescue                   | Pharmaceuticals                         |
| Airports                            | Food Manufacturing                | Port and Marina Operations              |
| Asbestos                            | Foundry, Smelting or Refining     | Power Plants                            |
| Asphalt or Bitumen                  | Fuel Terminals & Depots           | Printing and Photography                |
| Batteries                           | Glass, Ceramics and Plastic       | Rail Industry and Associated Activities |
| Breweries / Distilleries            | Gun, Pistol or Rifle Ranges       | Rubber and Tyre                         |
| Cement, Concrete or Lime            | Hospitals and Research Facilities | Storage Tanks                           |
| Cemeteries                          | Landfill Sites                    | Substations and Switching Stations      |
| Chemicals                           | Livestock Dips                    | Textiles and Tannery                    |
| Coal Yards                          | Mechanical and Automotive         | Timber, Pulp and Paper Works            |
| Depots and Storage Yards            | Metal Fabrication and Treatments  | Waste and Recycling Facilities          |
| Dry Cleaners                        | Oil and Gas                       | Wastewater Treatment Facilities         |
| Electrical or Electrical Components | Other Infrastructure Facilities   | -                                       |

Industries, businesses, and activities identified as having an increased likelihood of causing contamination.



The industries and business activities listed above have been identified as having an increased likelihood of causing contamination and have been identified through published state and national guidelines and regulations. These industries are noted due to their potential to store or use substances that could cause contamination to the surrounding environment if not managed appropriately. The identification of these activities does not imply the presence of contamination at the site.

The records identified are based on the reported business activity and have not been assessed based on any current or previous site inspection. Please note that records not identified within this section (due to error or unforeseen omission) does not necessarily mean that the screened area is not potentially contaminated or free of any risks.

## 4.2 HISTORICAL BUSINESS DIRECTORIES

(not mapped)

| YEAR | Activity | Name                | Address             | Positional accuracy | Distance (m) | Direction |
|------|----------|---------------------|---------------------|---------------------|--------------|-----------|
| 1970 | Farmers  | Stanford L V & Sons | Merriown River, NSW | Place               |              | Onsite    |

Land Insight uses a number of address geocoding techniques and has characterised them based on completeness (match rates) and positional accuracy. When a historical street address is incomplete or a match is not found, a record identified as being in the surrounding area will be included for reference and the accuracy of the data is approximate only. An explanation of the positional accuracy records is defined in the table below.

| Historical data positional accuracy and georeferencing results explanation |                                               |                                                                                                                            |
|----------------------------------------------------------------------------|-----------------------------------------------|----------------------------------------------------------------------------------------------------------------------------|
| Positional accuracy                                                        | Georeferenced                                 | Description                                                                                                                |
| Address                                                                    | Located to the address level                  | <i>When street address and names fully match.</i>                                                                          |
| Street                                                                     | Located to the street centroid                | <i>When street names match but no exact address was found. Location is approximate.</i>                                    |
| Place                                                                      | Located to the structure, building or complex | <i>When building, residential complex or structure name match but no exact address was found. Location is approximate.</i> |
| Suburb                                                                     | Located to the suburb area                    | <i>When suburb name match but no exact address was found. Location is approximate.</i>                                     |

The data used in this section was extracted from range of historical commercial trade directories and business listings. The business addresses were geocoded using historical information and the accuracy of the data may vary due to changes to the physical address at a given locality over time or the quality of the original records. From 2005, the historical business records in this section are considered more accurate as information was extracted from digital directories with geographic coordinate location information available. On this basis, reliance on the historic listing data should be considered when assessing the risk of contamination from an activity at the site. The presence of a business listing does not definitively confirm the actual activity that has occurred at the site. For more information on how these records were geocoded and the methodology used by Land Insight, contact us at [info@landinsight.co](mailto:info@landinsight.co).

Historical business directory listings have been filtered to match activities and industries identified as PCAs in Section 4.1. Please note that any record not identified within this section (due to error or unforeseen omission) does not necessarily mean that the screened area is not potentially contaminated or free of any risks.



## Section 5 Natural Hazards



### 5.1 Fire Hazard

#### Map 5.1 (500m Buffer)

#### Bushfire Prone Areas

| Category            | Type                  | Details                                                                                                                                                                                                                   | Distance (m) | Direction |
|---------------------|-----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|-----------|
| Bushfire Prone Area | Vegetation Buffer     | Vegetation Buffer - Bush Fire Prone is an area of land that can support a bush fire or is likely to be subject to bush fire attack. Bush Fire Prone Land areas becomes the trigger for planning for bush fire protection. | 0.0          | Onsite    |
| Bushfire Prone Area | Vegetation Category 1 | Bushfire Prone Area - Vegetation Category 1 is considered to be the highest risk for bush fire. Bush Fire Prone Areas becomes the trigger for planning for bush fire protection.                                          | 0.1          | North     |

#### Bushfire History

| Type           | Season | Details | Distance (m) | Direction |
|----------------|--------|---------|--------------|-----------|
| Not identified | -      | -       | -            | -         |

## 5.2 Flood Hazard

### Map 5.2 (500m Buffer)

#### Flood Planning Area

| Category   | Type                | Details                                                               | Distance (m) | Direction |
|------------|---------------------|-----------------------------------------------------------------------|--------------|-----------|
| Floodplain | Flood Planning Area | Floodplain Management Plan For The Upper Namoi Valley Floodplain 2019 | 0.0          | Onsite    |

#### Other Flood Studies

| Category       | Type | Details | Distance (m) | Direction |
|----------------|------|---------|--------------|-----------|
| Not identified | -    | -       | -            | -         |

#### Flood History

| Type           | Season | Details | Distance (m) | Direction |
|----------------|--------|---------|--------------|-----------|
| Not identified | -      | -       | -            | -         |

The list provided is not comprehensive and does not consider all flood history. It only includes the information that is currently available.

## 5.3 Erosion Hazard

### Map 5.3 (500m Buffer)

#### Erosion Hazard

| Category              | Type                                  | Details   | Distance (m) | Direction |
|-----------------------|---------------------------------------|-----------|--------------|-----------|
| Landslip Erosion Risk | Very slight to negligible limitations | Very Low  | 0.0          | Onsite    |
|                       | Extreme limitations                   | Very High | 0.0          | Onsite    |
| Water Erosion Risk    | Moderate to severe limitations        | Moderate  | 0.0          | Onsite    |
|                       | Severe limitations                    | High      | 0.0          | Onsite    |
|                       | Extreme limitations                   | Very High | 0.0          | Onsite    |
| Wind Erosion Risk     | Very slight to negligible limitations | Very Low  | 0.0          | Onsite    |
|                       | Moderate limitations                  | Moderate  | 0.0          | Onsite    |
|                       | Slight but significant limitations    | Low       | 280.1        | North     |

**Table 5.2.1 – Flood Hazard definitions and explanations**

**Annual Exceedance Probability (AEP)** - The probability of a flood event of a given size occurring in any one year, usually expressed as a percentage annual chance

|         |                                                                                                                                                                   |
|---------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0.2%AEP | A flood event of this size is considered rare but may still occur. A flood of size or larger has a 1 in 500 chance or a 0.2% probability of occurring in any year |
| 1% AEP  | A flood of this size or larger has a 1 in 100 chance or a 1% probability of occurring in any year                                                                 |
| 2% AEP  | A flood of this size or larger has a 1 in 50 chance or a 2% probability of occurring in any year.                                                                 |



**Table 5.2.1 – Flood Hazard definitions and explanations**

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                   |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------|
| 5% AEP                                                                                                                                                                                                                                                                                                                                                                                                                                                         | A flood of this size or larger has a 1 in 20 chance or a 5% probability of occurring in any year  |
| 20%AEP                                                                                                                                                                                                                                                                                                                                                                                                                                                         | A flood of this size or larger has a 1 in 5 chance or a 20% probability of occurring in any year. |
| <b>Average Recurrence Interval (ARI).</b> The long-term average number of years between the occurrence of a flood as big as, or larger than, the selected event. For example, floods reaching a height as great as, or greater than, the 20 year ARI flood event will occur on average once every 20 years                                                                                                                                                     |                                                                                                   |
| <b>Flood Liable Land</b> - Synonymous with flood prone land, i.e. land susceptible to flooding by the Probable Maximum Flood (PMF) event. Note that the term flood liable land covers the whole floodplain, not just the part below the flood planning level                                                                                                                                                                                                   |                                                                                                   |
| <b>Flood Planning Area (FPA)</b> – Councils develop Flood Planning Areas (FPAs) as part of Flood Overlay mapping to guide future building and development in flood prone areas. The FPAs are designed to recognise the flood hazard for different flooding types.                                                                                                                                                                                              |                                                                                                   |
| <b>Flood Hazard</b> - Flood hazard is a combination of frequency of flooding, the flood depth, and the speed or velocity at which the water can travel.                                                                                                                                                                                                                                                                                                        |                                                                                                   |
| <b>Probable Maximum Flood (PMF)</b> - The largest flood that could conceivably be expected to occur at a particular location, usually estimated from probable maximum precipitation. The PMF defines the maximum extent of flood prone land, that is, the floodplain. It is difficult to define a meaningful Annual Exceedance Probability for the PMF, but it is commonly assumed to be of the order of $10^4$ to $10^7$ (once in 10,000 to 10,000,000 years) |                                                                                                   |



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# Appendix A

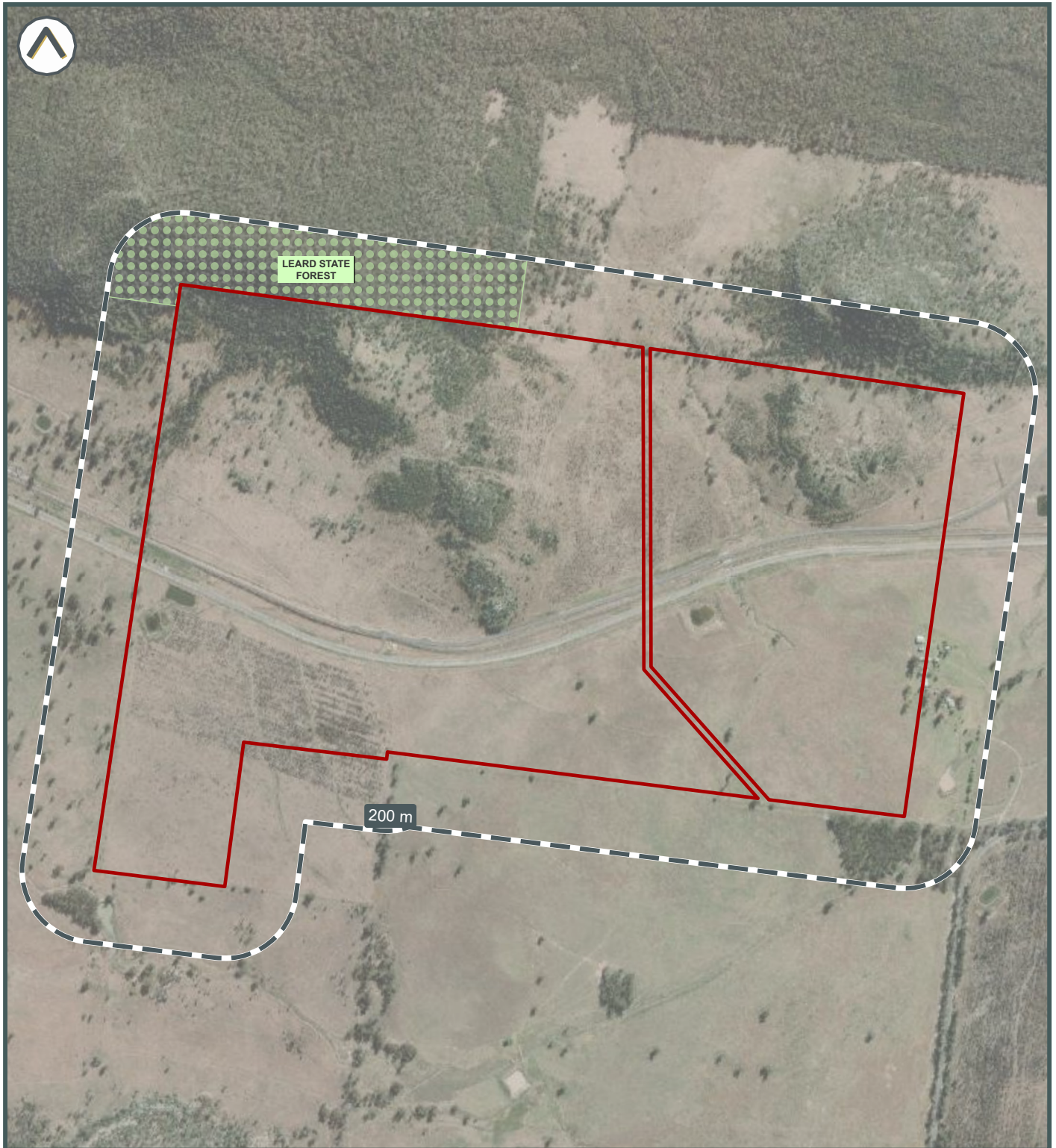
## REPORT MAPS

333 Leards Forest Road  
Boggabri, NSW





**Subject Area and Sensitive Receptors**



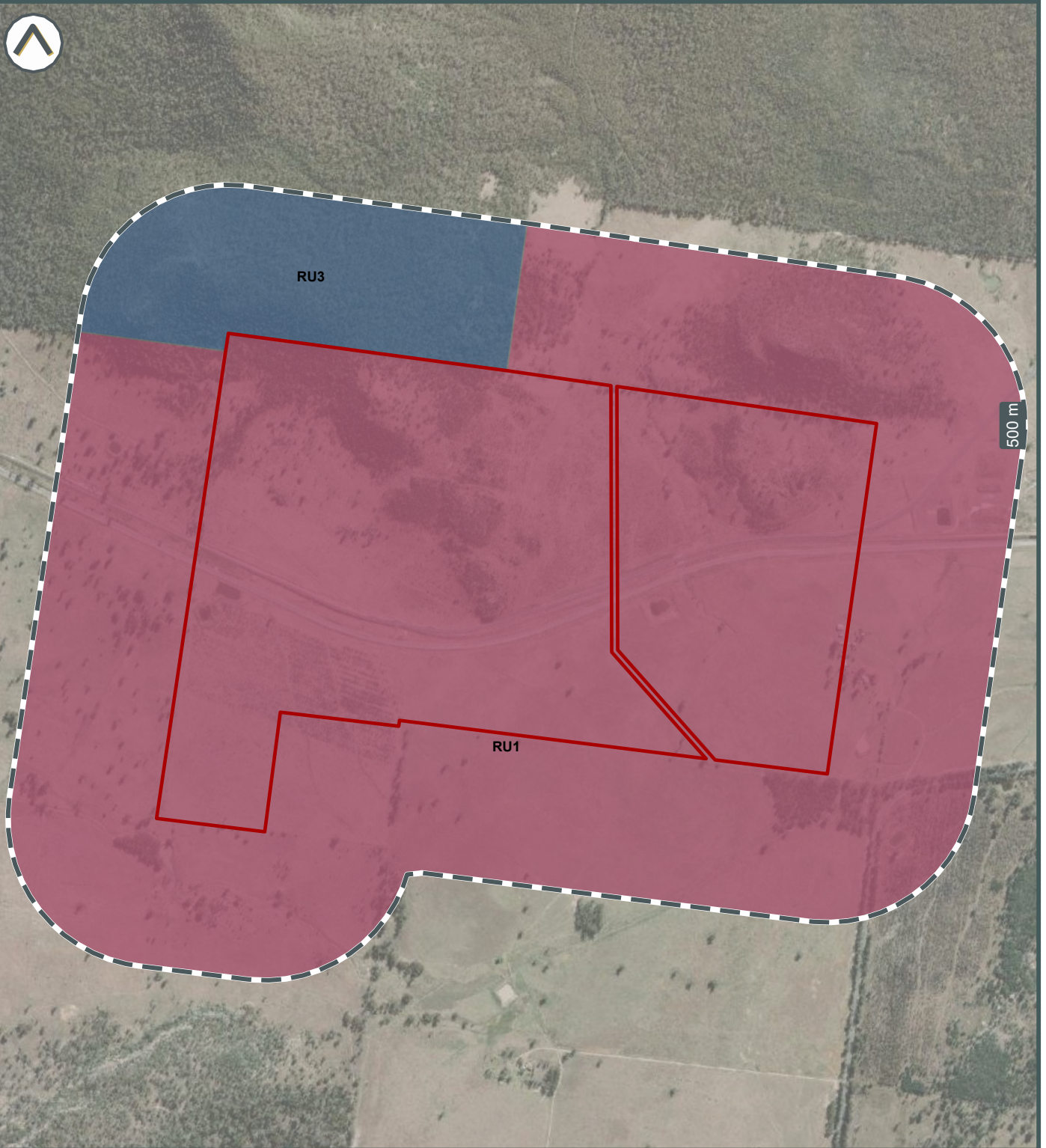
Subject area Parks







**Zoning**



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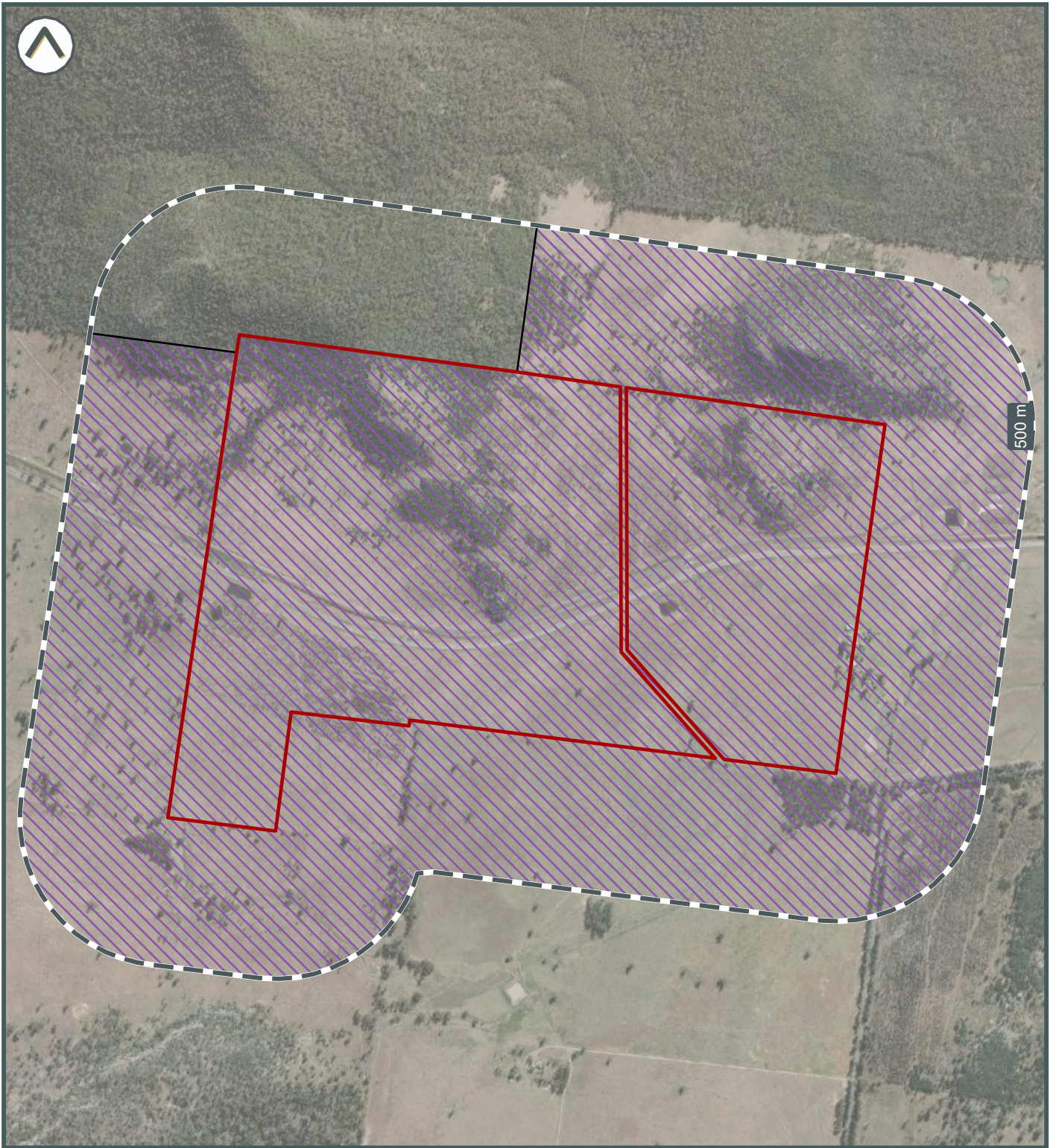
- Subject area**
- Zoning**
- Subject area
  - RU3 Forestry
  - RU1 Primary Production







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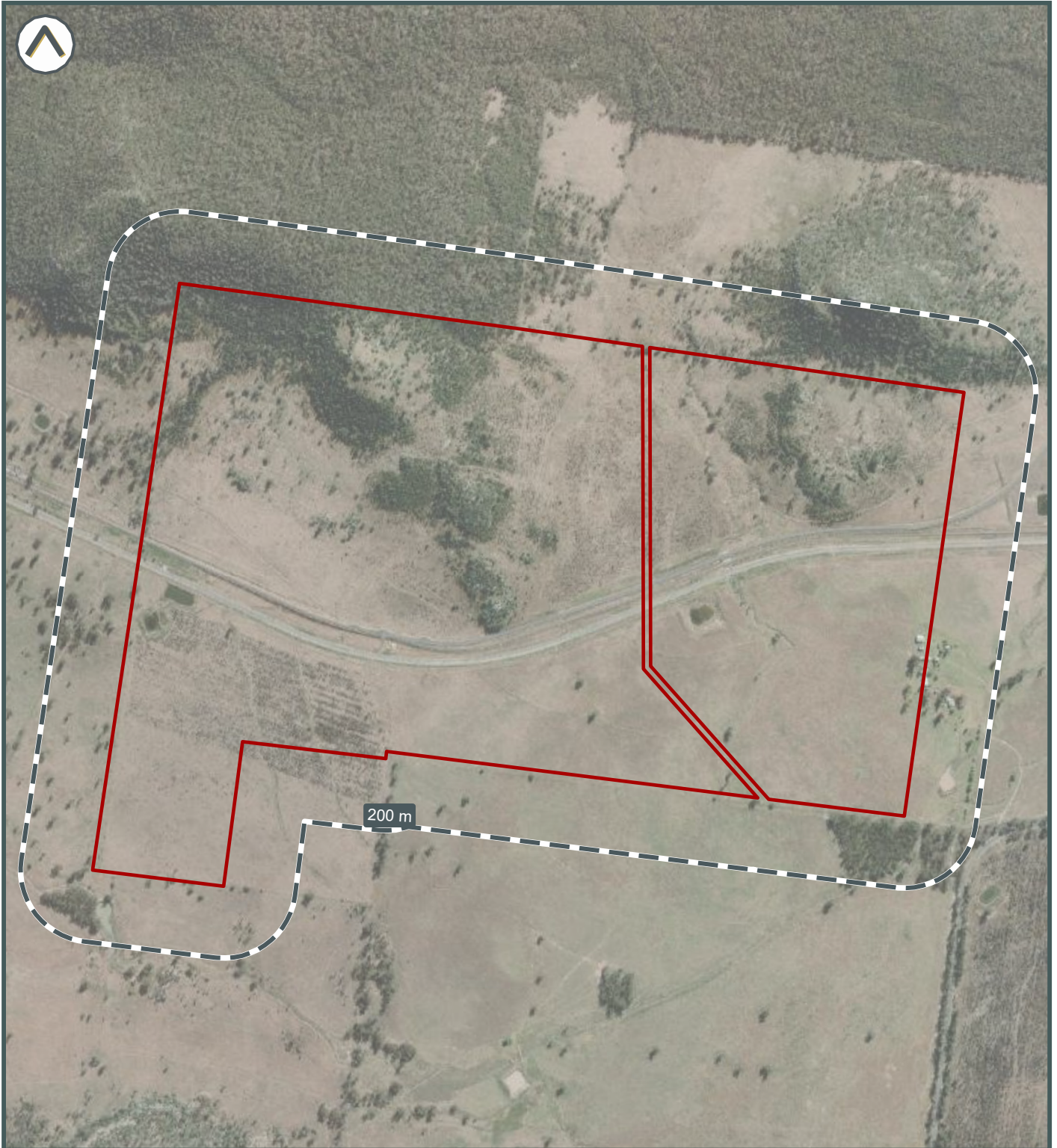


 Subject area       Planning Overlays  
 Lot Size

0    175    350    525    700    875m







 Subject area



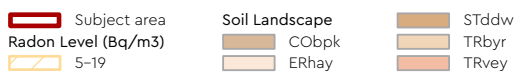




**Soil Landscape and Salinity**



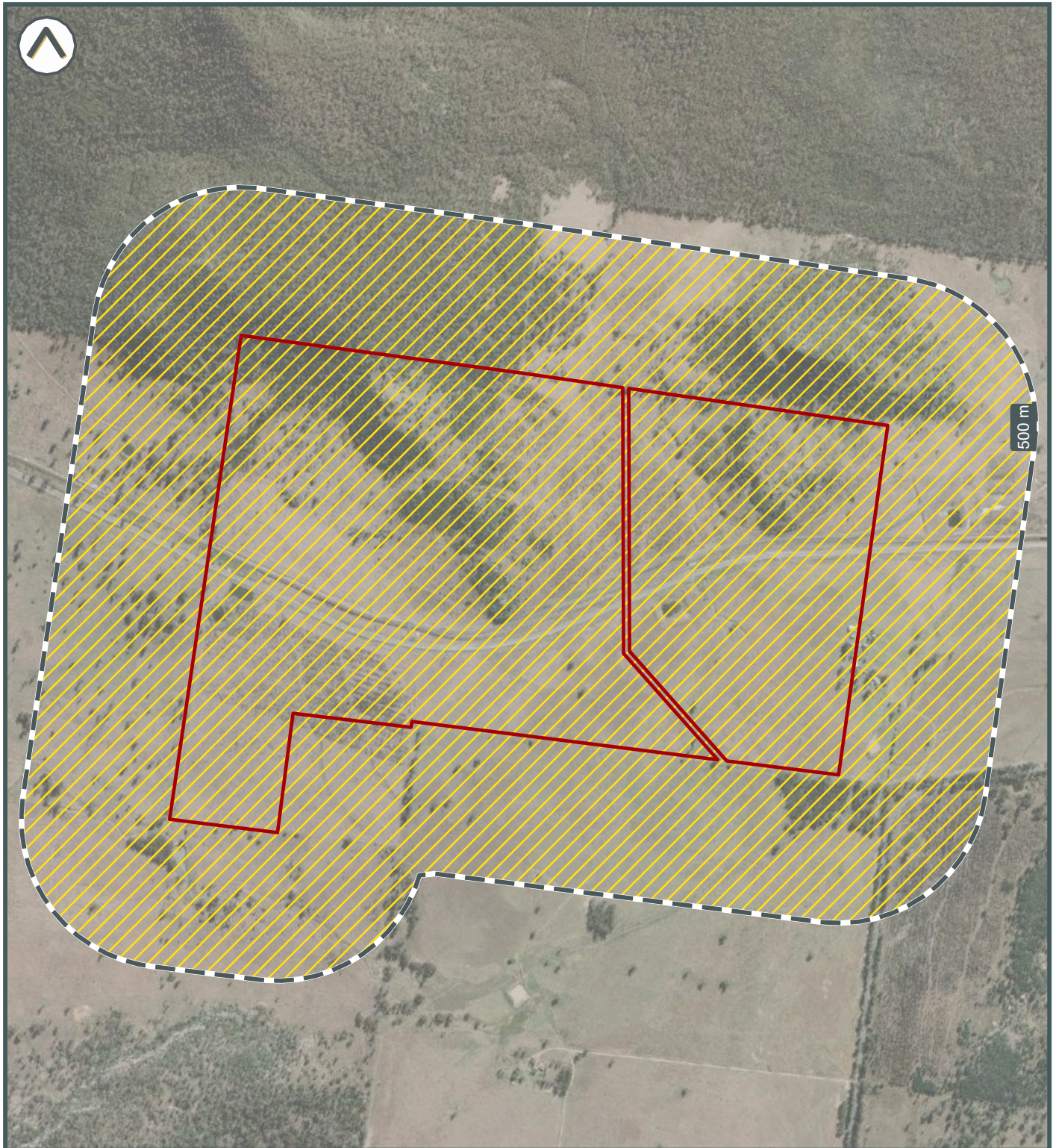
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**Acid Sulfate Soils**



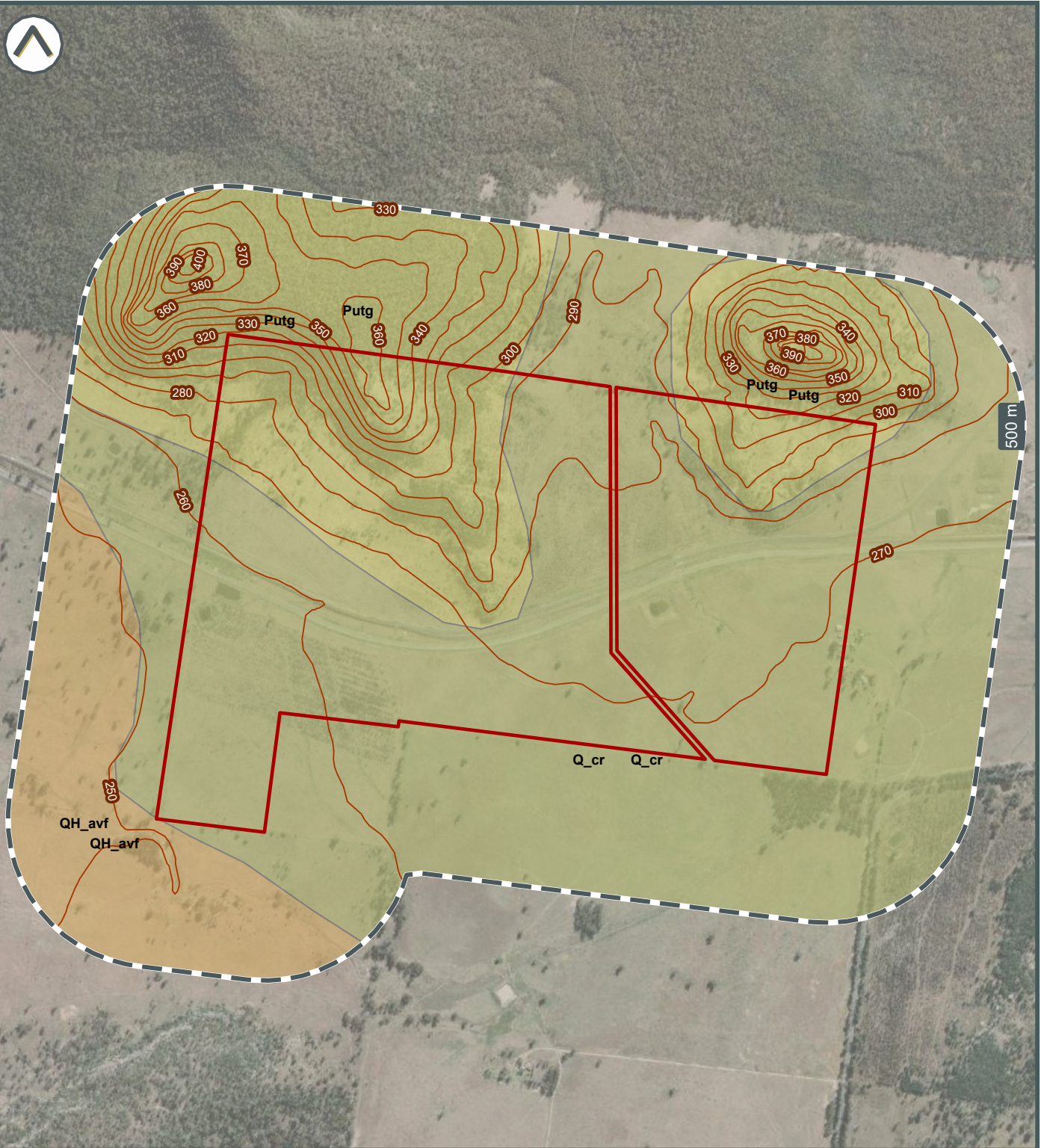
- Subject area
- Atlas of Australian Acid Sulfate Soils
- Low Probability of occurrence







Geology and Topography

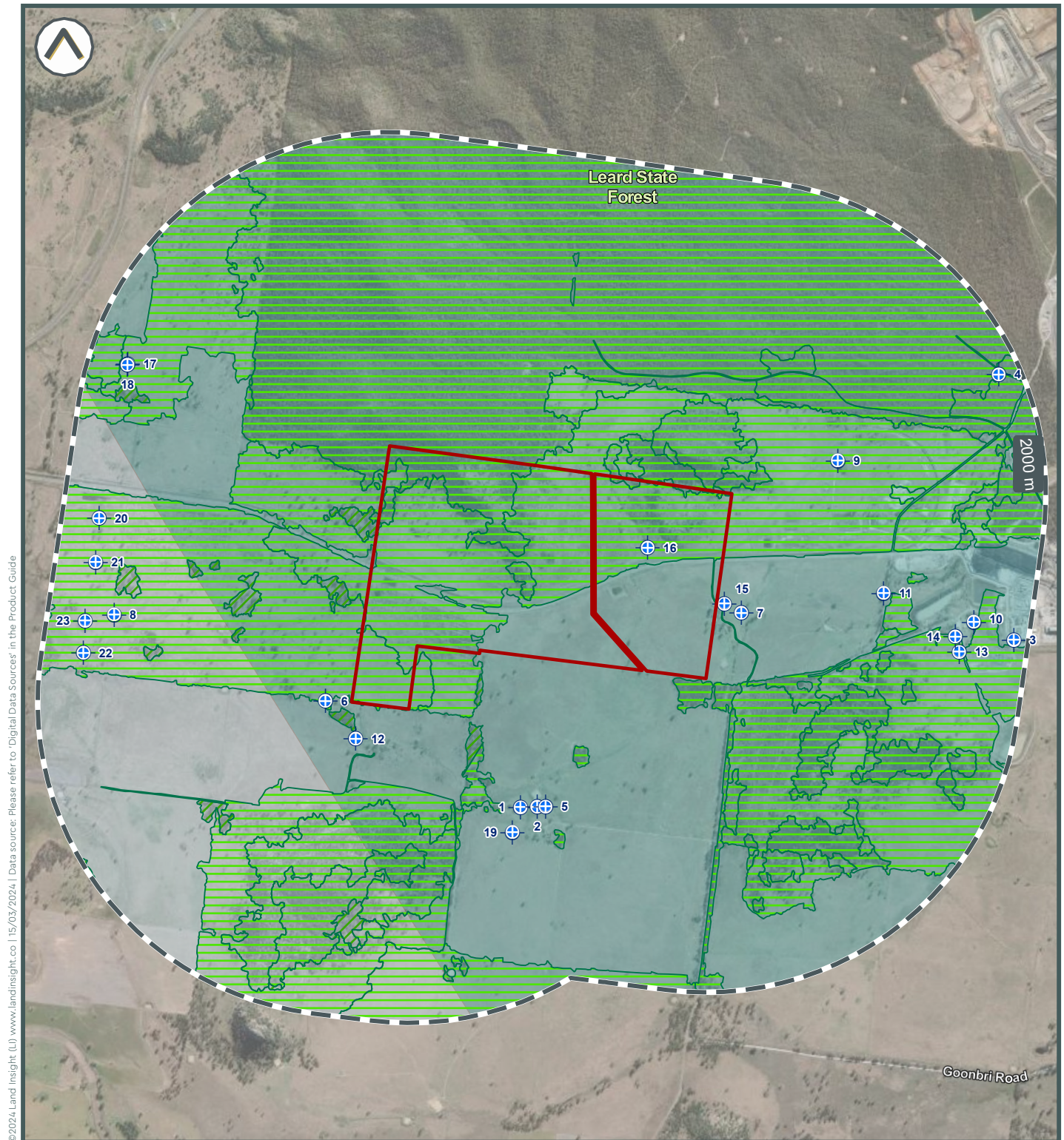


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- |  |                         |  |              |  |        |
|--|-------------------------|--|--------------|--|--------|
|  | Subject area            |  | Geology Unit |  | QH_avf |
|  | Topographic contour (m) |  | Putg         |  | Q_cr   |





**Groundwater Dependent Ecosystems & Hydrogeology Constraints**

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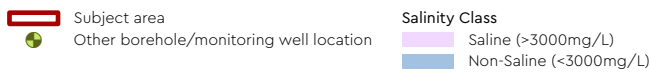
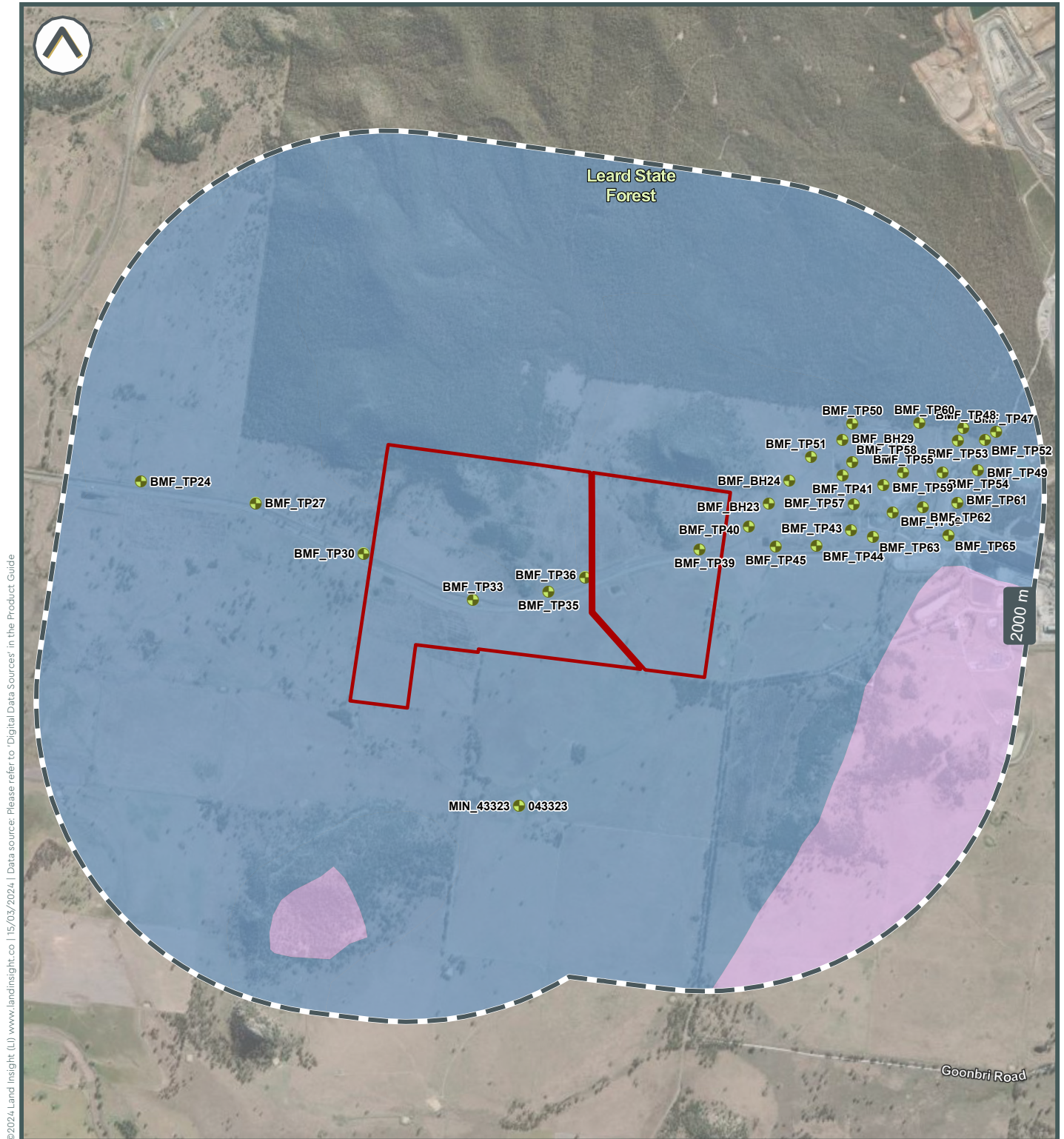
- Subject area
- Groundwater bores
- Ecosystems that rely on Subsurface presence of Groundwater
- Moderate potential GDE - from regional studies
- Low potential GDE - from regional studies
- Aquifer type
  - Fractured or fissured, extensive aquifers of low to moderate productivity
  - Porous, extensive highly productive aquifers







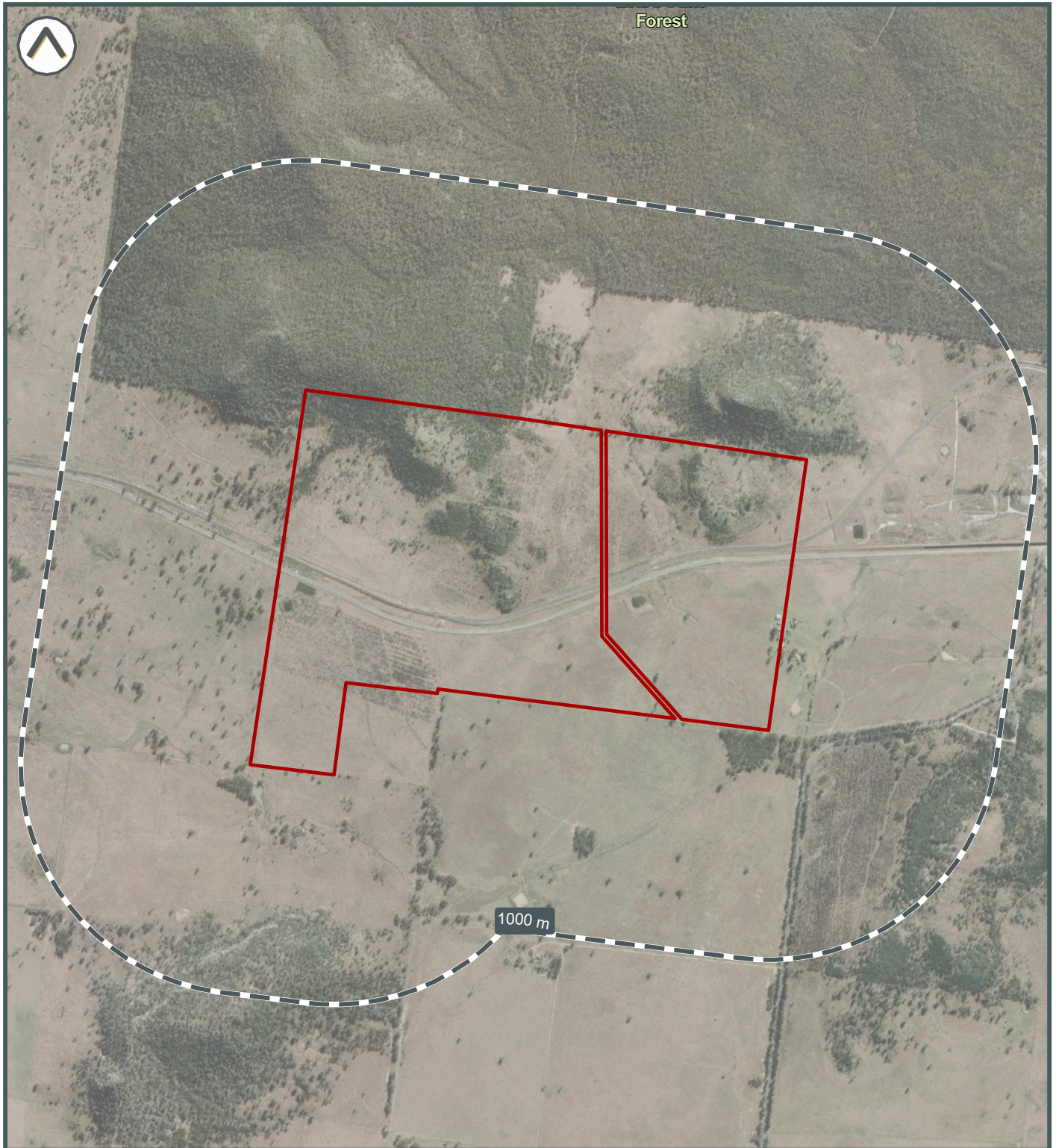
Groundwater and Other Bores







**Contaminated Land Public Register**



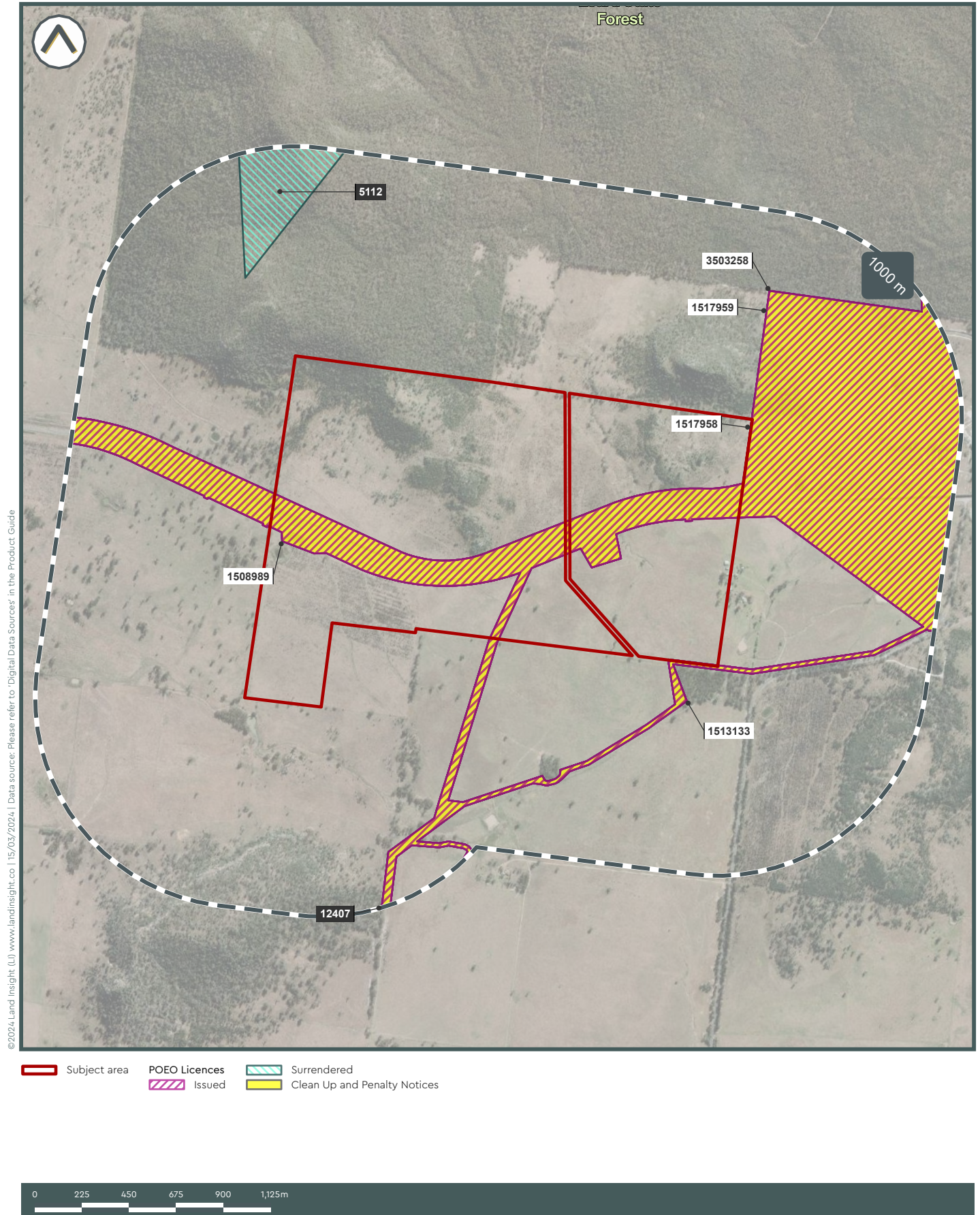
Subject area







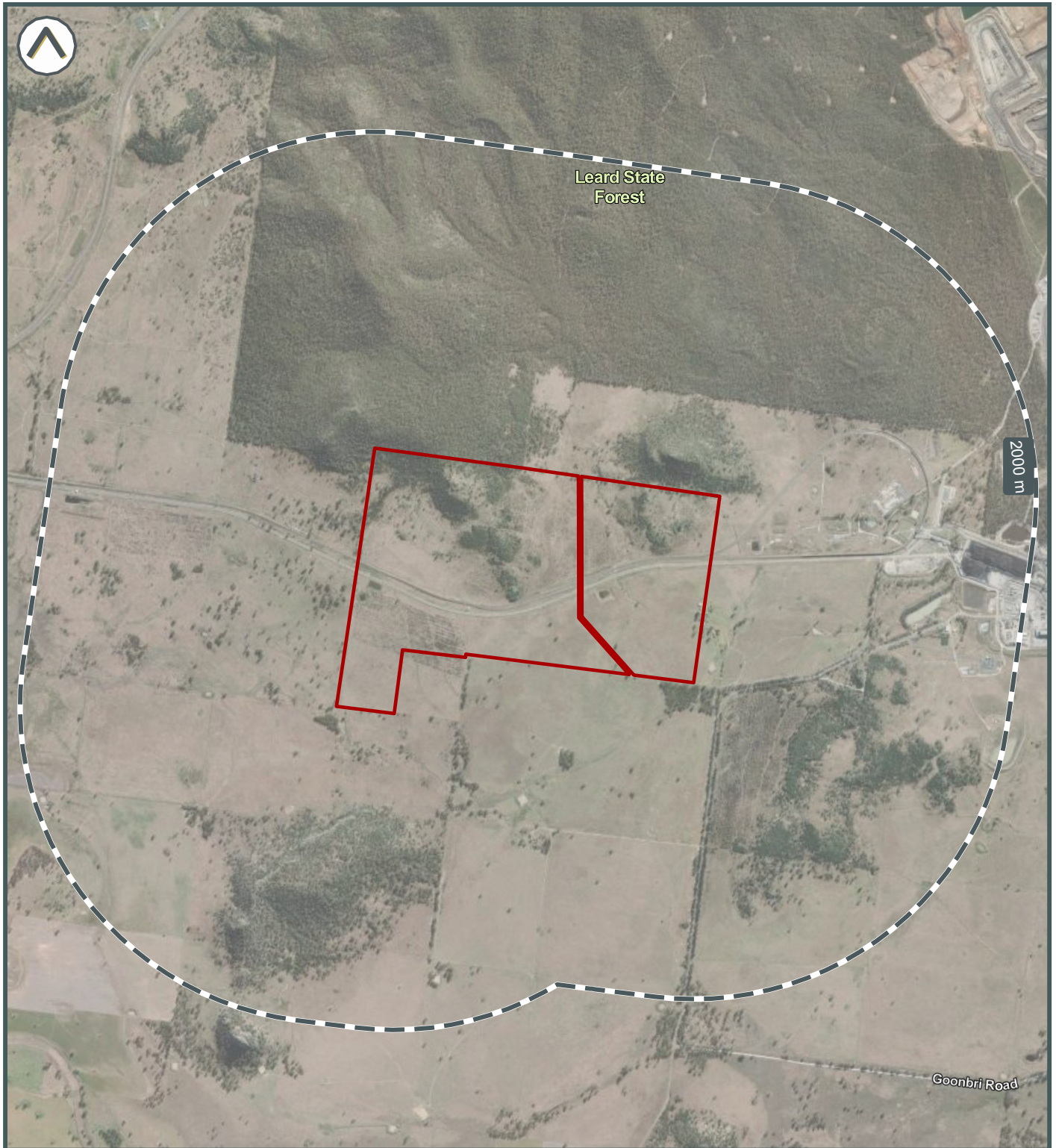
**Licences, Approvals & Assessments**







**Sites Regulated by Other Jurisdictional Body**



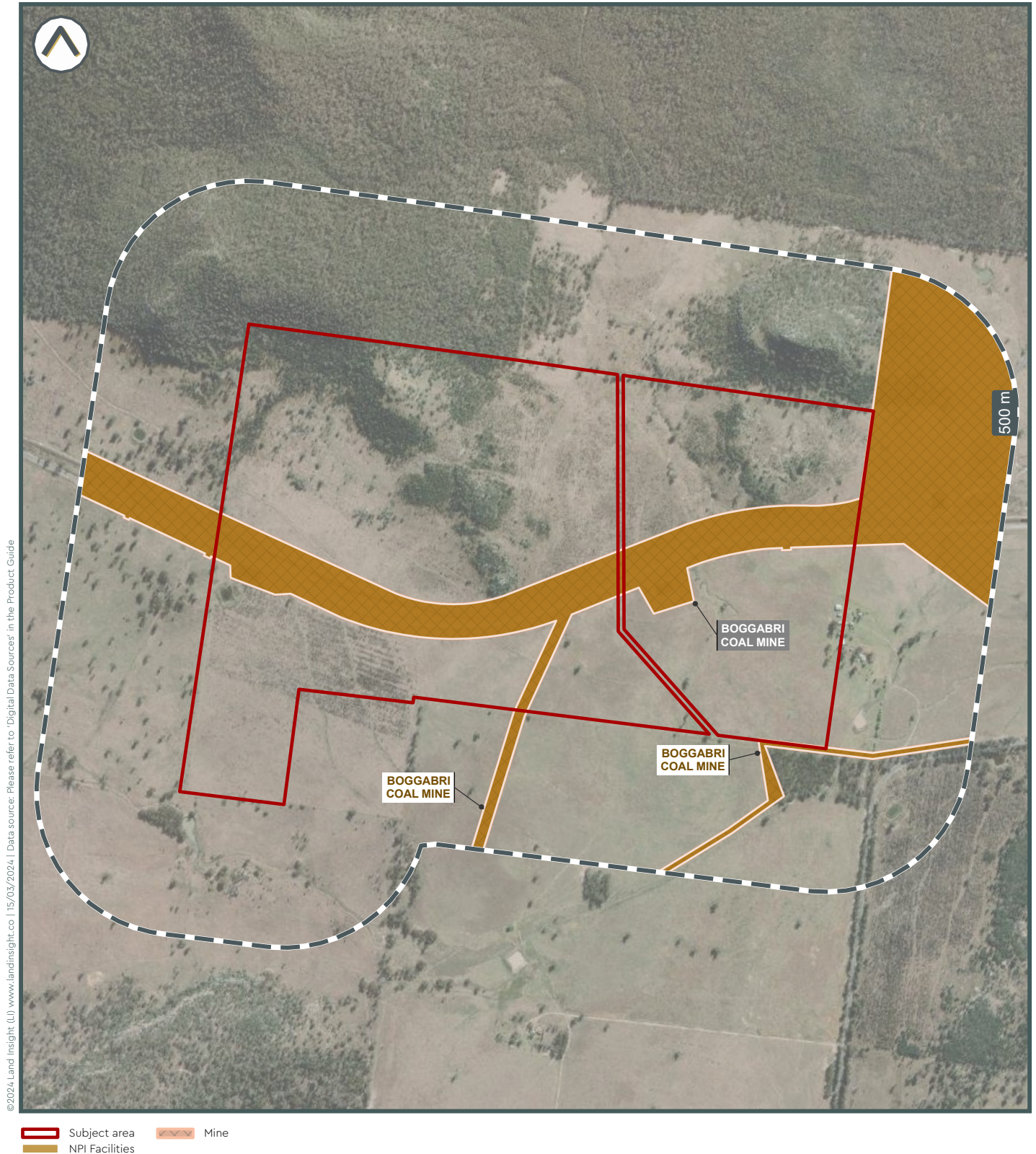
Subject area







**Other Potential Hazard Sources**







**Current Potentially Contaminating Activities (PCAs)**



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- Subject area
- Potentially Contaminating Activities
- Transport Operations

Data is current as when this report was created. However due to the turnover of business locations, some addresses may be former.

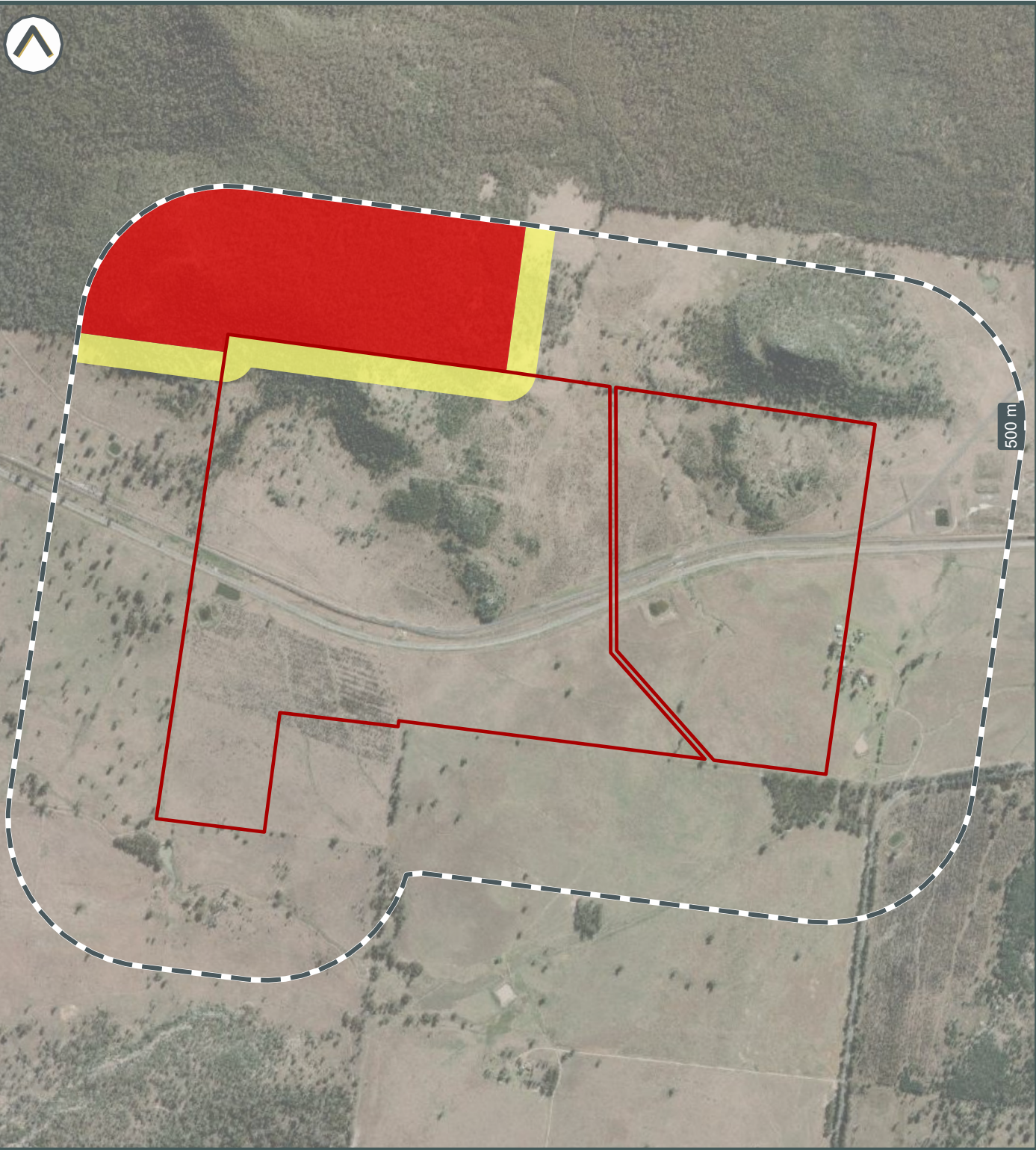


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Fire Hazards



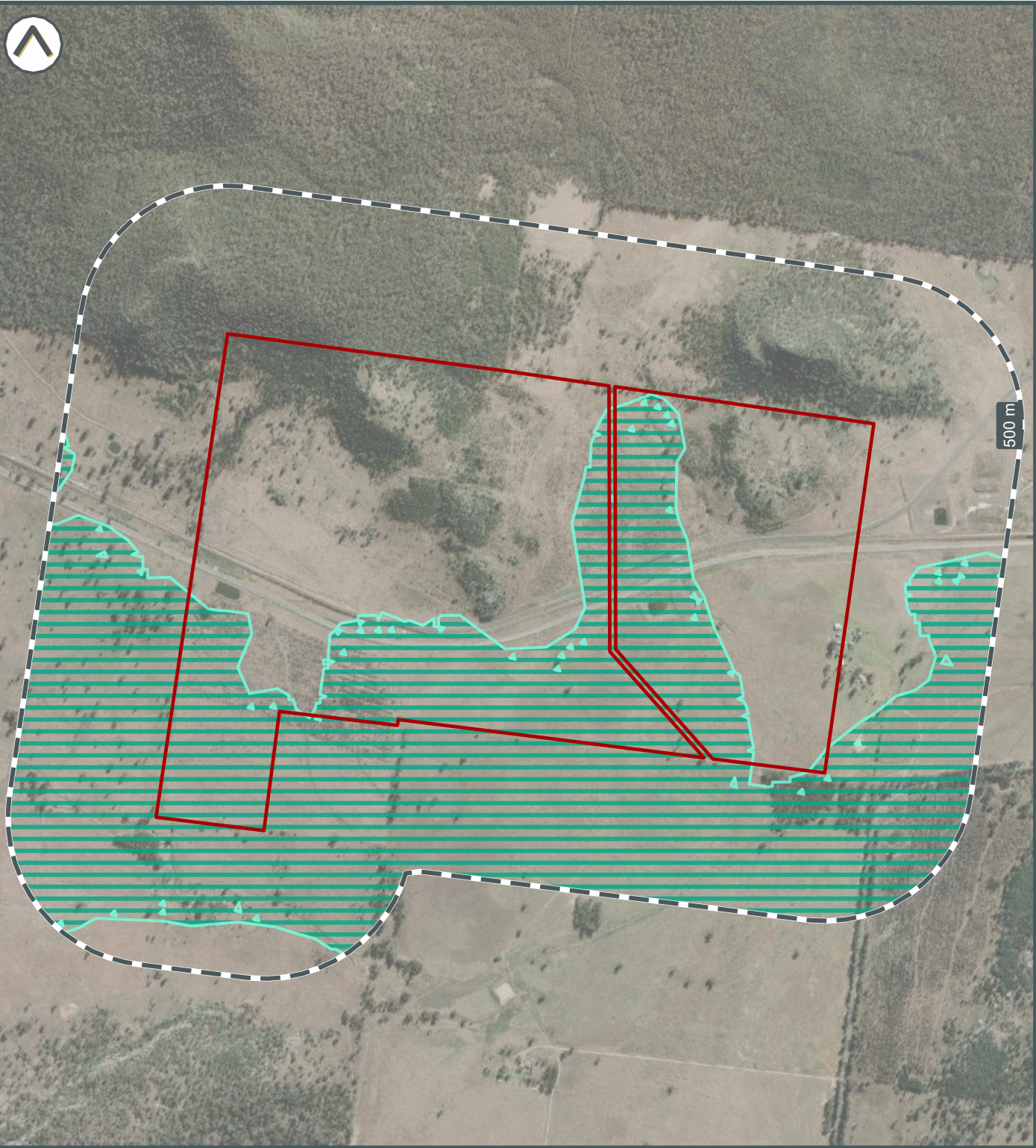
- Subject area
- Vegetation Buffer
- Bushfire Prone Area
- Vegetation Category 1







Flood Hazard



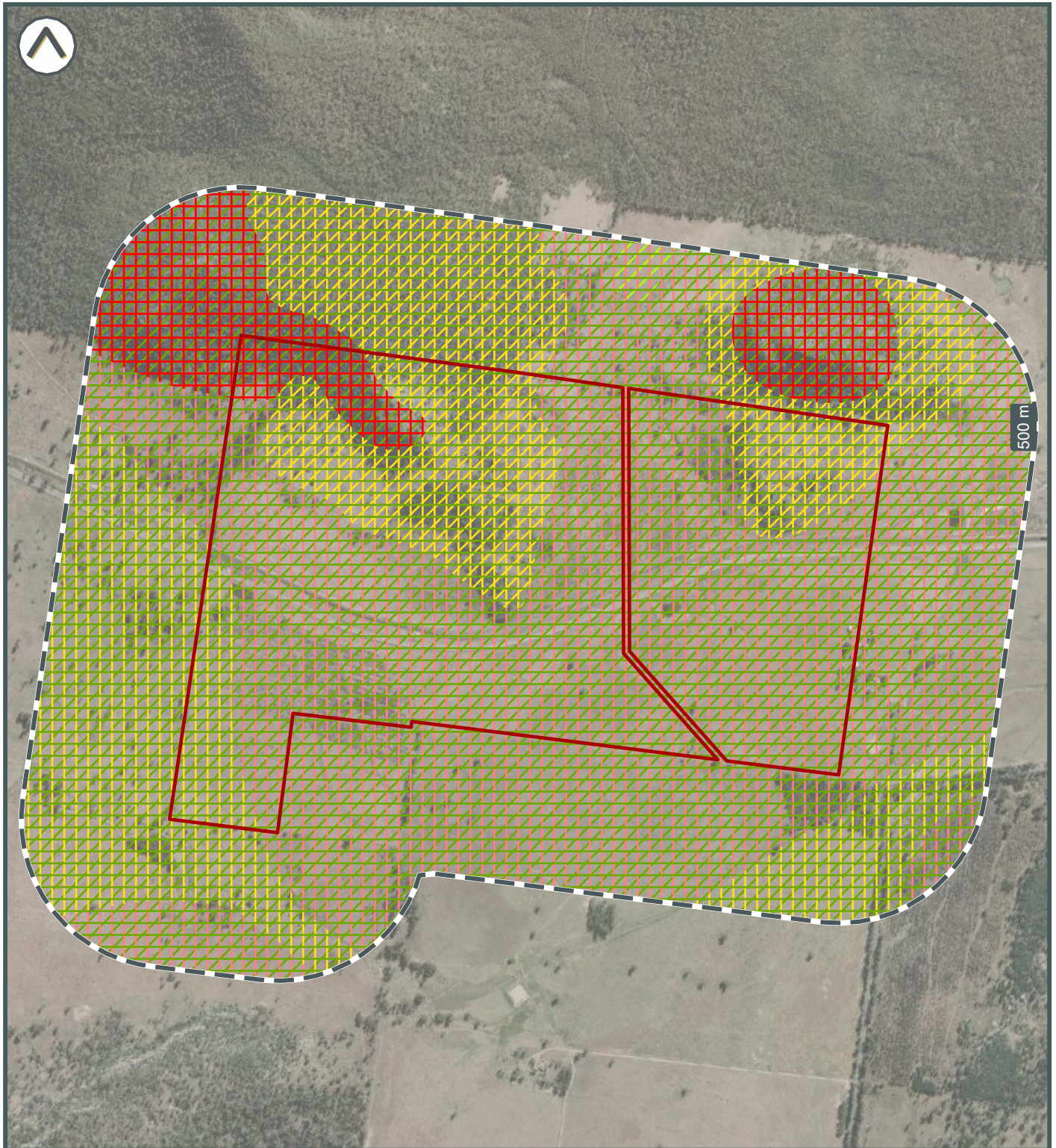
Subject area  
Category  
Floodplain







**Erosion Hazard**



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- |                   |                    |                       |
|-------------------|--------------------|-----------------------|
| Subject area      | Very Low           | Moderate              |
| Wind Erosion Risk | Water Erosion Risk | Landslip Erosion Risk |
| Moderate          | Very High          | Very High             |
| Low               | High               | Very Low              |

0 175 350 525 700 875m









An aerial photograph of a vibrant turquoise river winding through a rugged landscape. The river is flanked by steep, rocky banks covered in dense, green and yellowish vegetation. The water's clarity reveals the rocky riverbed beneath. A yellow rectangular box is overlaid on the right side of the image, containing the title and location information.

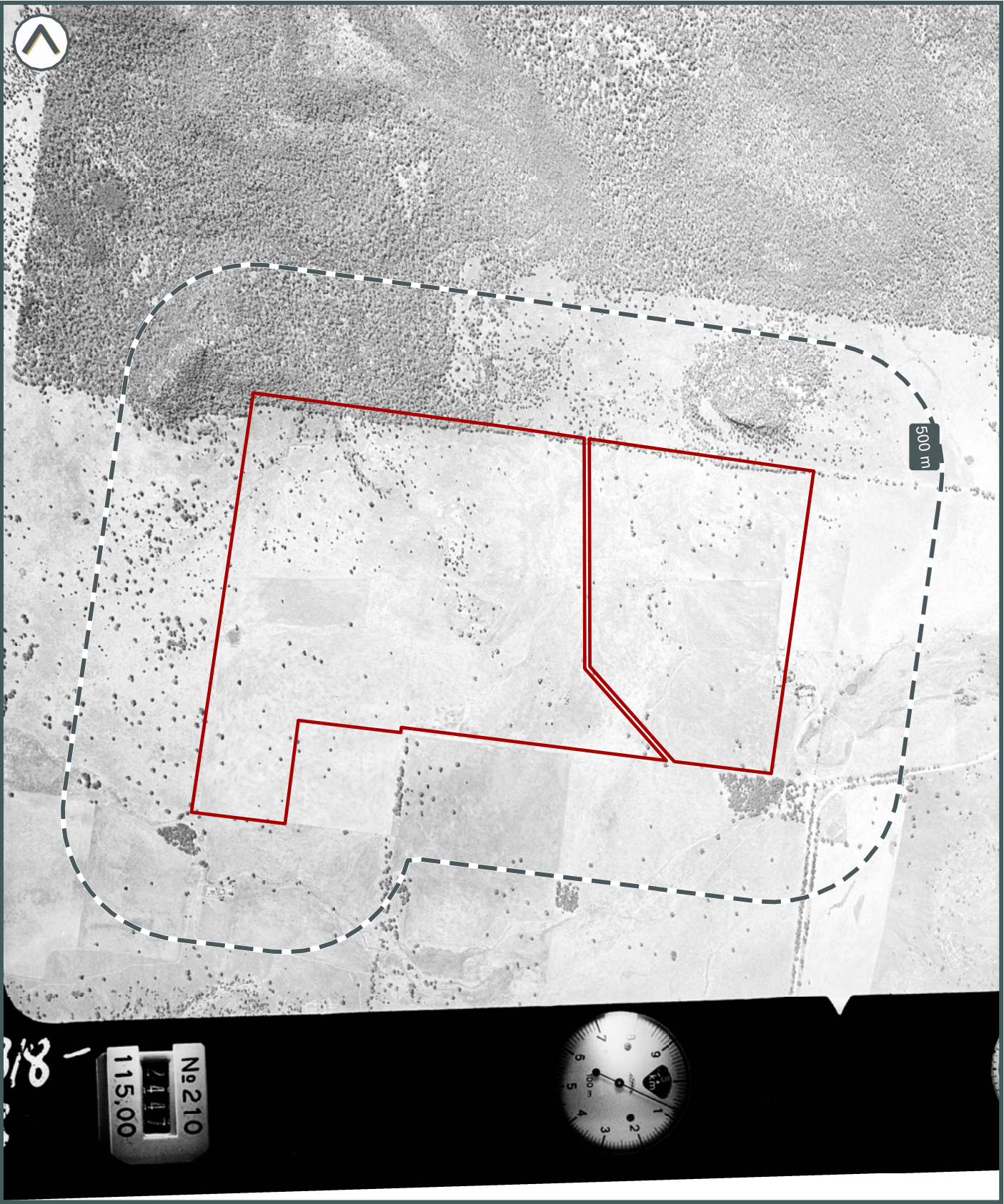
# Appendix B

HISTORIC IMAGERY

333 Leards Forest Road  
Boggabri, NSW



Historic Aerial Photograph - 1956



Subject area





Historic Aerial Photograph - 1966

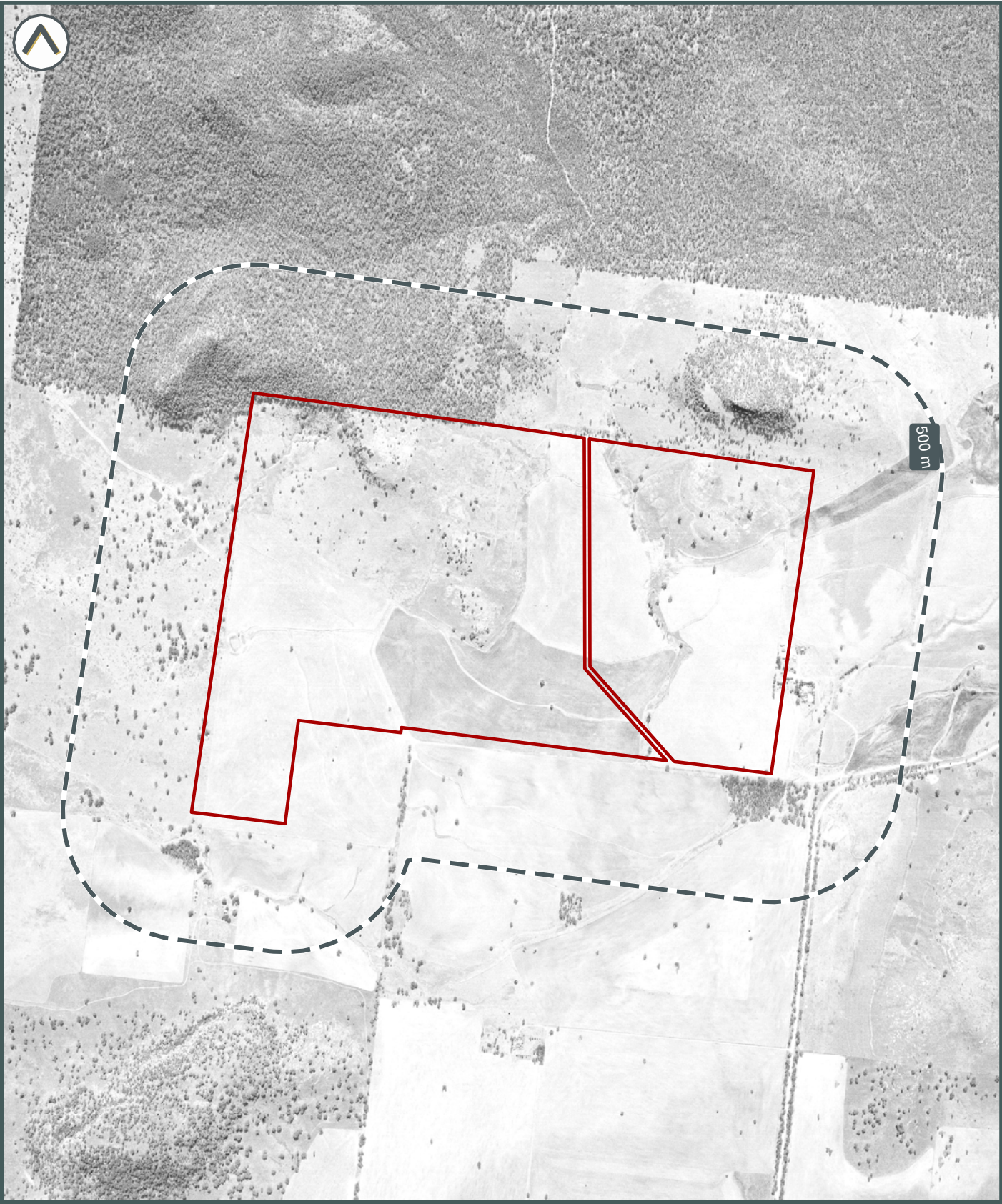


Subject area





Historic Aerial Photograph - 1975

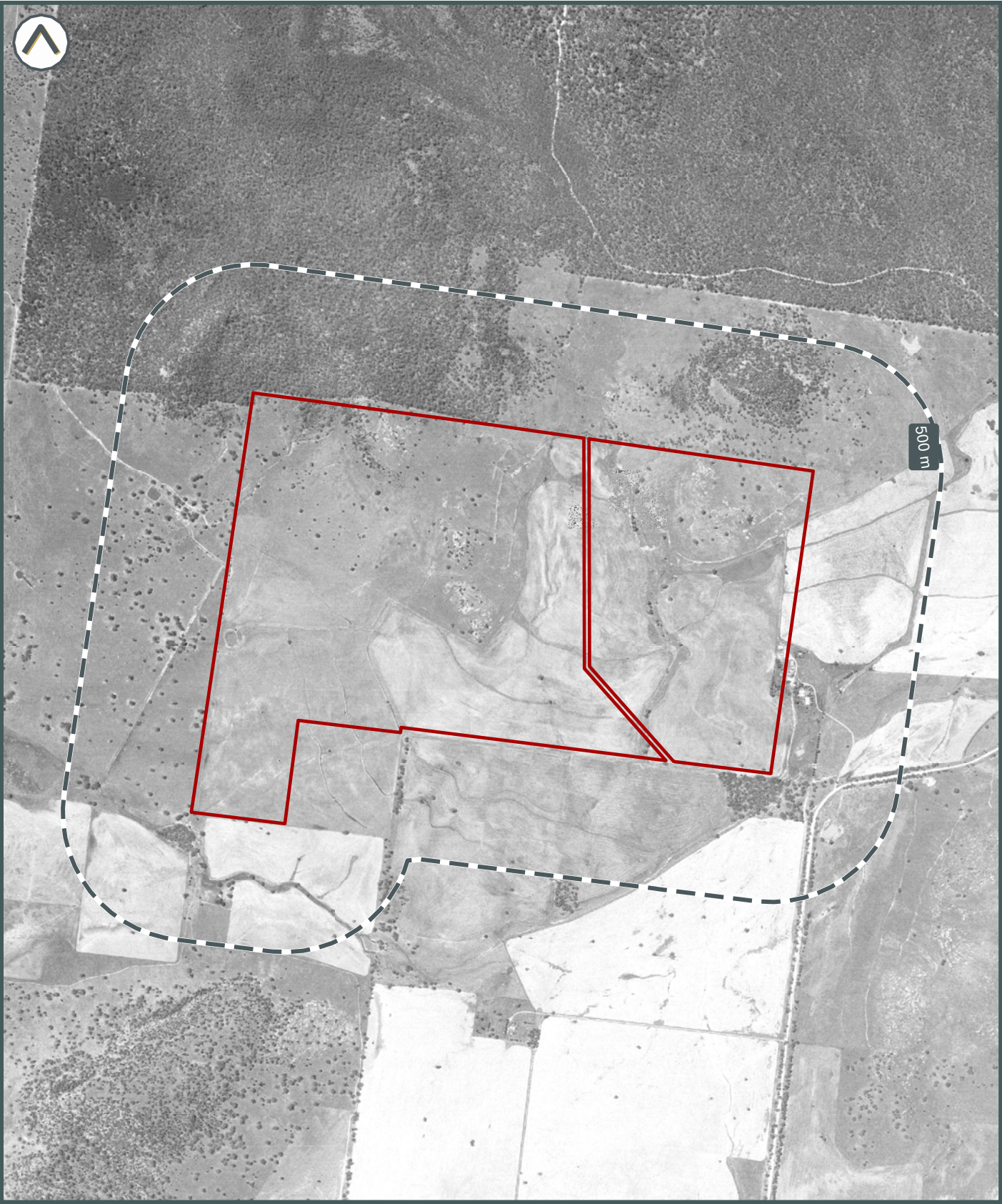


Subject area





Historic Aerial Photograph - 1978



Subject area





Historic Aerial Photograph - 1986

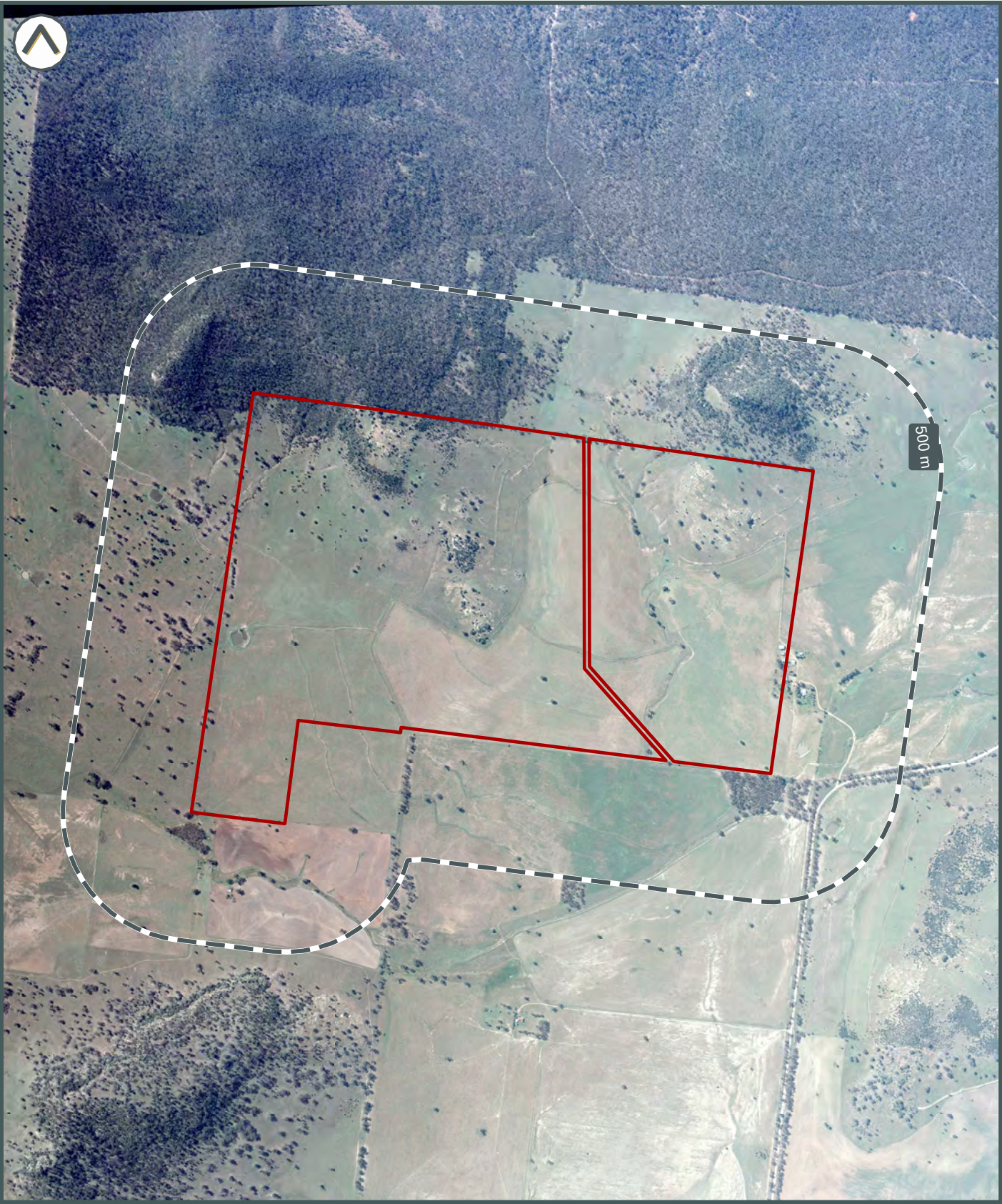


Subject area





Historic Aerial Photograph - 1991



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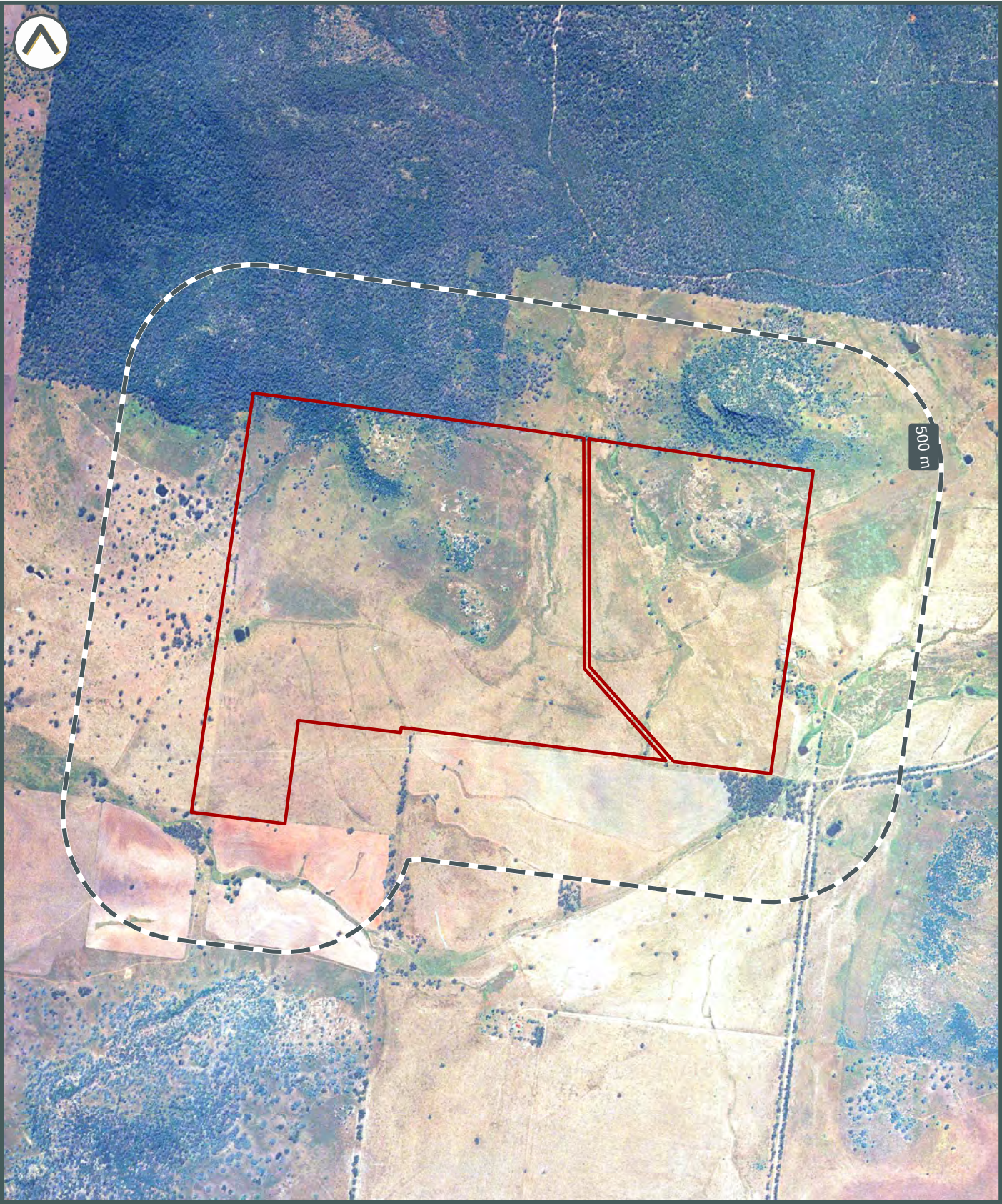
Subject area

0 190 380 570 760 950m





Historic Aerial Photograph - 1997



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Subject area





Historic Aerial Photograph - 2010



Subject area





Historic Aerial Photograph - 2011



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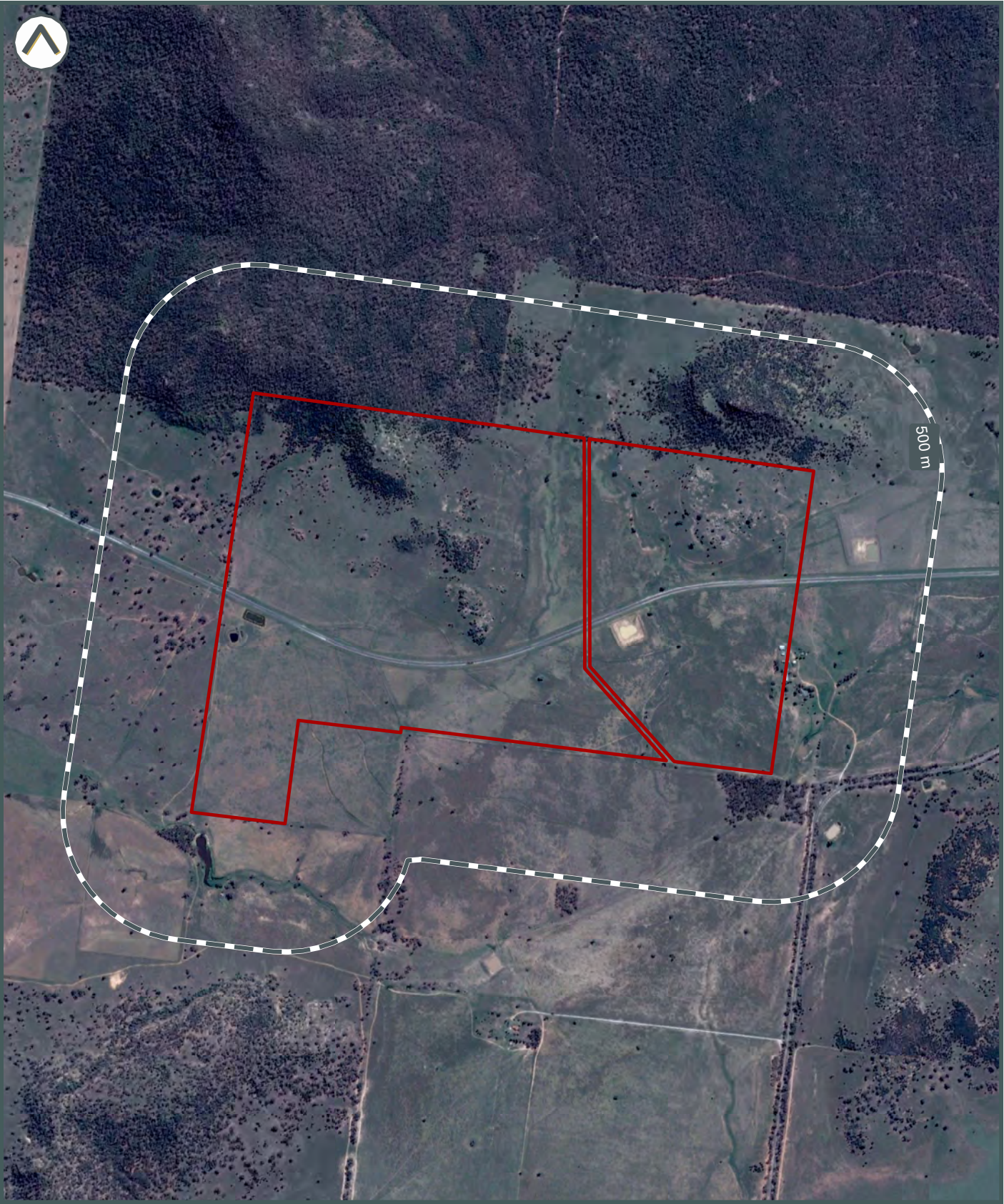
Subject area

0 190 380 570 760 950m





Historic Aerial Photograph - 2013



Subject area





Historic Aerial Photograph - 2018



Subject area

0 190 380 570 760 950m





Historic Aerial Photograph - 2023



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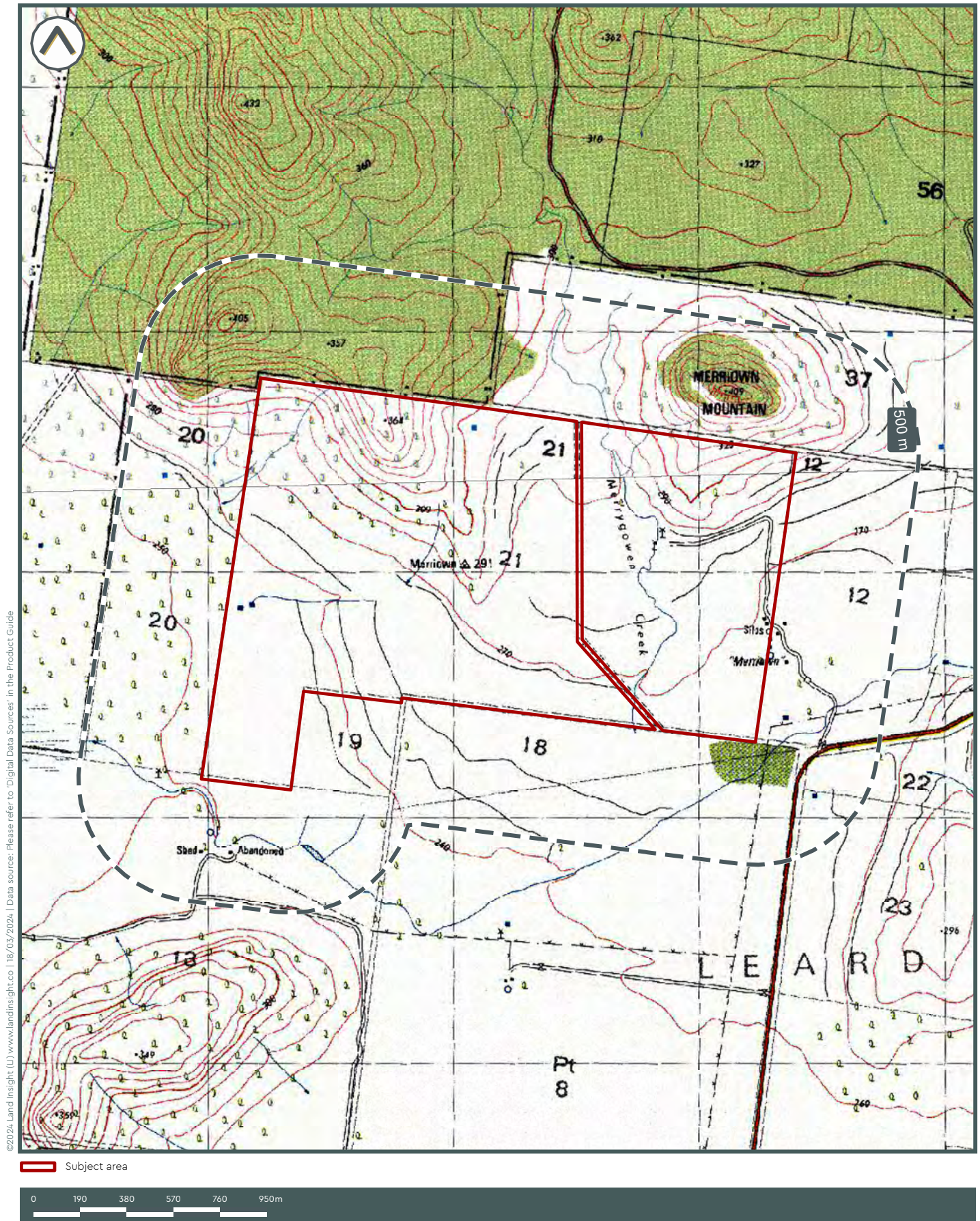
Subject area

0 190 380 570 760 950m





## 1969-1991 1:25,000 Topographic Map (Therribri 8936-4N / Boggabri 8936-4S)







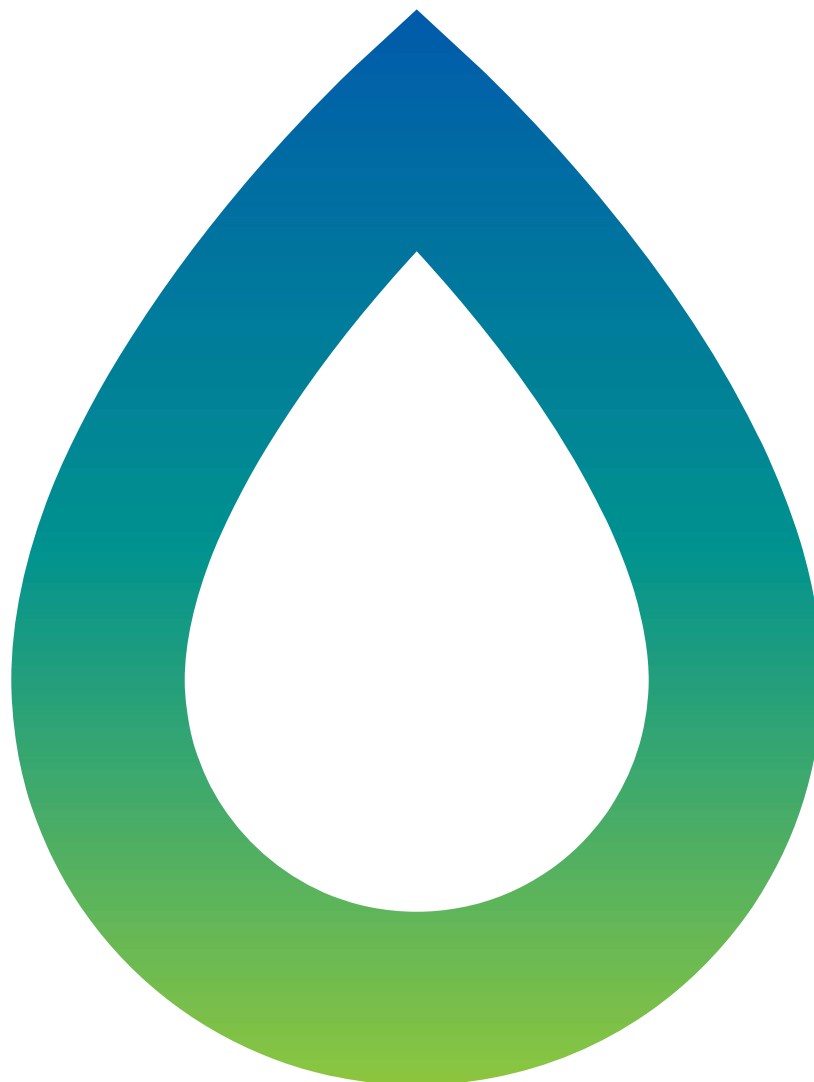
# BOGGABRI SOLAR FARM

Surface Water Assessment

RPS | Australia Asia Pacific

25 January 2024

1928-01-B





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## DETAILS

**Report Title** Boggabri Solar Farm, Surface Water Assessment  
**Client** RPS | Australia Asia Pacific

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## THIS REVISION

**Report Number** 1928-01-B  
**Date** 25 January 2024  
**Author** Todd Carlsson  
**Reviewer** David Newton

---

| Revision number | Report date | Report author | Reviewer |
|-----------------|-------------|---------------|----------|
| 0               | 25/01/24    | TC            | DN       |

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NOTE: This report has been prepared on the assumption that all information, data and reports provided to us by our client, on behalf of our client, or by third parties (e.g. government agencies) is complete and accurate and on the basis that such other assumptions we have identified (whether or not those assumptions have been identified in this advice) are correct. You must inform us if any of the assumptions are not complete or accurate. We retain ownership of all copyright in this report. Except where you obtain our prior written consent, this report may only be used by our client for the purpose for which it has been provided by us.

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## APPENDIX B MANNING’S CALCULATION OF NAGERO CREEK

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## 1 INTRODUCTION

### 1.1 BACKGROUND

WRM Water & Environment Pty Ltd (WRM) was commissioned by RPS | Australia Asia Pacific Consulting Pty Ltd (RPS) on behalf of Idemitsu Renewable Developments Australia (IRDA) to provide a Surface Water Assessment report to support development of a solar and battery facility (the Project) adjacent to IRDA's Boggabri Mine site in New South Wales. Figure 1.1 shows the location of the subject site.

RPS is engaged by IRDA to support preparation of the necessary approvals for the Project. The Project will be classed as regionally significant development under the SEPP Planning Systems 2021 and be subject to the Northern Regional Planning Panel (NRPP) as the consent authority.

There have been no previous detailed flood studies completed for the local catchments and watercourses relevant to the Project. This report details the methodology and results of hydrologic and hydraulic modelling undertaken to assess flood behaviour for site. This study aims to identify flooding constraints to assist in the development of the final project layout/configuration and necessary approvals.

### 1.2 PROJECT LOCALITY AND DESCRIPTION

IRDA have identified a property west of the mine which is outside the Mine Project Approval Area as the proposed site for the Project. This site is approximately 2.5 km from the Transgrid 132/11 kV substation and Boggabri Mine 11 kV switchyard. Figure 1.2 shows the general arrangement layout of the solar farm. Two development stages are proposed. For modelling purposes, both stages are included within the hydrologic and hydraulic modelling.

The solar farm project will comprise similar components and have similar appearance to many of the solar farms built around the world and more recently within Australia.

The development will consist of the following key components:

- Solar panels (also known as "modules").
- steel piles, module mounts and single axis trackers.
- containerised inverter rooms and transformers.
- containerised Battery Energy Storage System (BESS).
- electrical metering and switchgear housed inside a kiosk.
- underground electrical wiring.
- parking area during and after construction.
- perimeter fencing and access gates (2.3m high -1.8m chain-link + 3x barbed wire above).
- primary site entry and access gates from the haul road to the north.
- secondary site entry and access gates to the existing track to the east for connection to Leards Forest Road.
- internal access tracks (4m wide).

### 1.3 ASSESSMENT METHODOLOGY

The flood assessment has been completed using a direct-rainfall TUFLOW hydraulic model whereby rainfall is applied directly to the model grid within the contributing catchment. The model includes the full upstream catchment of Merrygowen Creek and the local overland flow paths to accurately define flood risks at the site.

Design discharges were estimated for the 10%, 5% and 1% annual exceedance probability (AEP) flood events in accordance with the current Australian Rainfall & Runoff (ARR2019) guideline. The “Extract ARR2019 to TUFLOW” QGIS plugin was utilised to extract and process the relevant rainfall hyetographs, temporal patterns, storm bursts and losses for the development site for input to the hydraulic model.

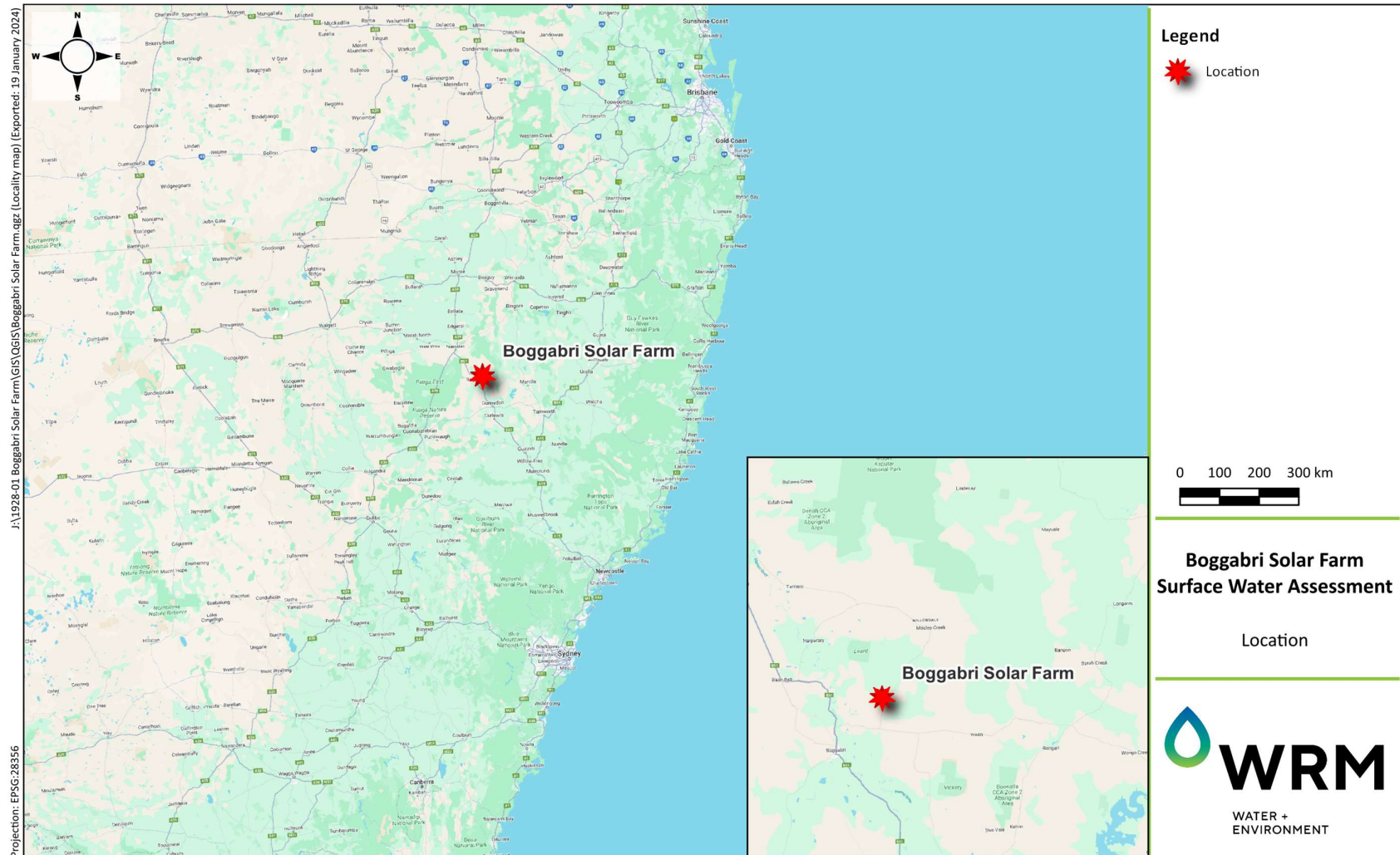
Hydraulic modelling of the proposed development was developed using the 2023-03-AC version of the TUFLOW solver. A TUFLOW hydrological (direct rainfall) and hydraulic model was developed and includes current topographic conditions and current land use conditions external to the site. The proposed development extent and site infrastructure was also incorporated through appropriate Manning’s ‘n’ surface roughness.

Details of the hydrologic and hydraulic modelling are described in Section 1 and Section 5.

### 1.4 LIMITATIONS

This assessment has been undertaken in accordance with good engineering practice. However, all models are limited by the accuracy of information, data and assumptions used for the modelling. The information produced in this report is based on the information available at the time of the analysis.

WRM has prepared this assessment on the basis of information provided by third parties, which WRM has not independently verified or checked beyond the agreed scope of work. WRM has assumed that this supplied information is complete and accurate. WRM does not accept liability in connection with such unverified information, including errors and omissions in the supplied data.



**Figure 1.1 Project Locality**



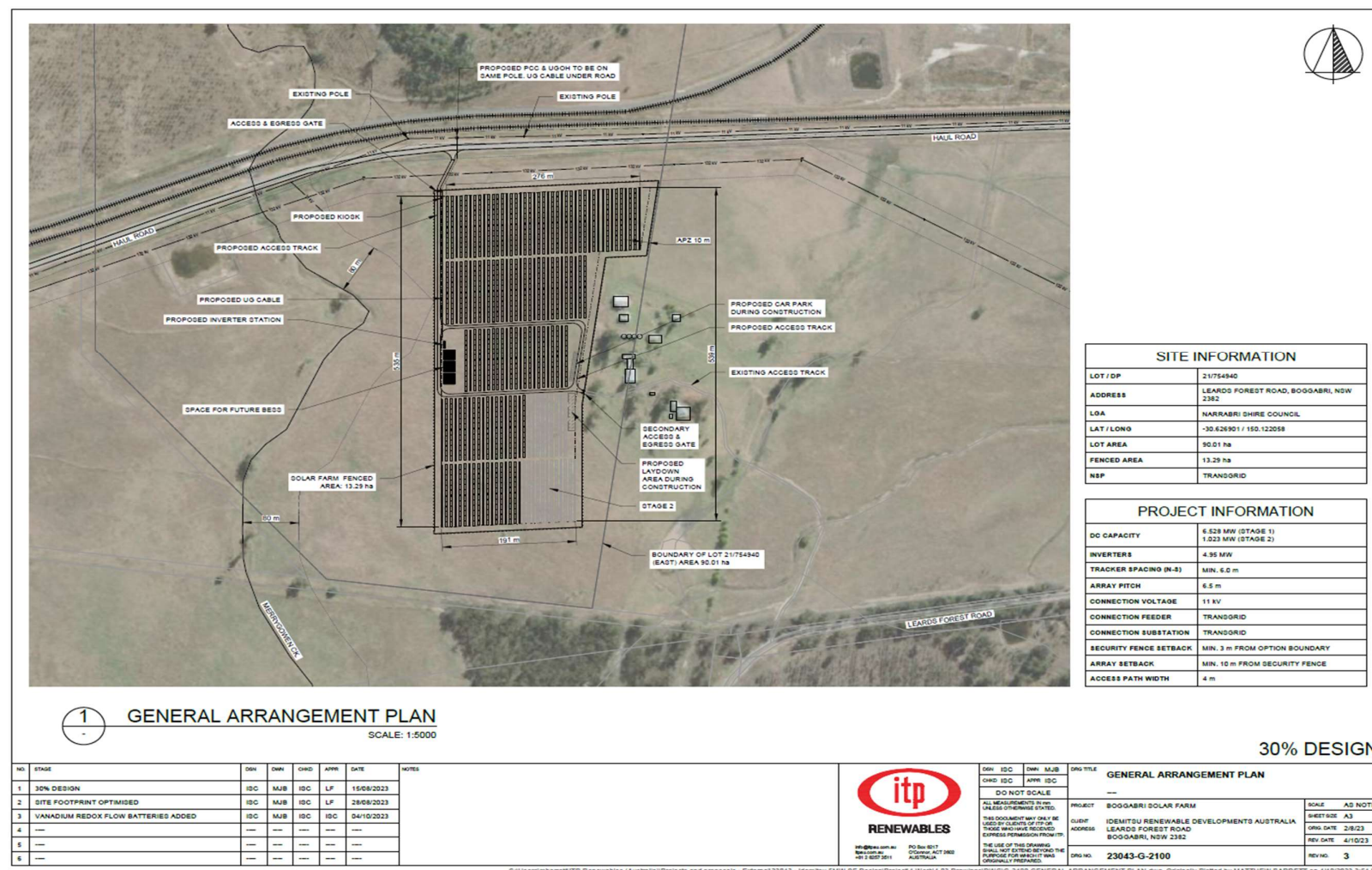


Figure 1.2 Solar Farm General Arrangement

---

## 2 AVAILABLE DATA

### 2.1 TOPOGRAPHIC DATA

The ground level elevation data was obtained from the LIDAR-Derived 1 meter Digital Elevation Model (DEM) Namoi LiDAR 2013 version. This was downloaded from the ELVIS – Elevation Information System maintained by Geoscience Australia. The 1 m DEM dataset has been captured with a point density of two points per square metre and, to a vertical accuracy of at least 0.30 m and horizontal accuracy of at least 0.80m.

### 2.2 PROJECT INFORMATION

Several digital files were provided to WRM from RPS for the Project including:

- Railway line as-constructed CAD and GIS line strings and points. This data included top and toe of railway embankments and finished levels for the railway.
- Railway and road as-constructed culvert CAD and GIS line strings and points.
- Site photos of current site surface conditions and road/railway culvert crossing.
- General site layout in PDF format.

### 2.3 DESIGN RAINFALL

The Australian Rainfall and Runoff Data Hub (ARR Datahub) is a tool that allows for easy access to the design hydrology inputs required to undertake flood estimation in Australia. The rainfall inputs for the direct rainfall TUFLOW model were adopted from the ARR Datahub website<sup>1</sup>. Rainfall parameters include Initial and continuous loss rates, temporal patterns, areal reduction factors and pre-burst depths. The design rainfall intensities were adopted from the Bureau of Meteorology 2016 Design rainfall data system.

---

<sup>1</sup> <https://data.arr-software.org/>

---

## 3 DRAINAGE CHARACTERISTICS

### 3.1 CATCHMENT DESCRIPTION

The proposed solar farm is located near the confluence of Merrygowen and Nagero Creek. Merrygowen Creek and Nagero Creek are located to the east and south of the site, respectively. Figure 3.1 illustrates the Merrygowen Creek and Nagero Creek catchments, site location and surrounding watercourses.

#### 3.1.1 Merrygowen Creek Catchment

Flooding characteristics for the site are associated with flows from Merrygowen Creek as well as overland flow paths running through the site. The Merrygowen Creek catchment to the site has an area of approximately 578 ha.

Railway and road embankments are located immediately to the north of the site. Several cross-drainage culverts allow for the conveyance of flow through the railway and road embankments and convey flow to Merrygowen Creek adjacent to the site. The existing culverts sizes are:

- 8 x 2.4m x 1.2m RCBC at the Merrygowen Creek northern railway line crossing
- 8 x 2.4m x 1.2m RCBC at the Merrygowen Creek southern railway line crossing
- 7 x 1.5m diameter RCP at the Merrygowen Creek road crossing
- 5 x 1.2m diameter RCP approximately 470m west of the Merrygowen Creek northern railway line crossing
- 5 x 1.5m diameter RCP approximately 470m west of the Merrygowen Creek southern railway line crossing
- 2 x 1.2m x 0.45m RCBC approximately 470m west of the Merrygowen Creek southern road crossing

During more frequent rainfall events, it is expected that runoff is conveyed along the base of the railway and road embankments to discharge through the existing culverts. Flow is expected to be contained within the banks of Merrygowen Creek during these rainfall events with minimal to no impact to the subject site.

During larger less frequent events, it is expected that existing culverts will be at capacity with upstream flow overtopping the railway and road embankments and flowing through the subject site. It is also expected that flow will overtop the banks of Merrygowen Creek during these rainfall events contributing to broad, shallow flow across the subject site.

#### 3.1.2 Nagero Creek Catchment

The Nagero Creek Catchment extent is shown in Figure 3.1 and has a total catchment area of 3,579 ha. The Nagero Creek catchment is impacted by upstream mining activities which have reduced the total catchment area over the various years of mining activity. This reduction in catchment area due to mine storages and infrastructure will reduce the volume and attenuate the peak flow rate downstream in Nagero Creek.

A report titled '*Continuation of Boggabri Coal Mine Project – Surface Water Assessment*' prepared by Hansen Bailey Pty Ltd in 2010 estimated peak discharges from the Nagero Creek catchment over several years of mine activity. The "Year 1" peak flow estimate has been selected for analysis as this represents the catchment with minimal mining operation activity and gives the highest estimated peak flow rate, resulting in a conservative estimate of peak discharge.



The Hansen Bailey (2010) report estimated a 1% AEP peak flow rate of 135.3 m<sup>3</sup>/s at the ‘Nagero\_4’ node. Figure 3.2 shows the location of the ‘Nagero\_4’ node in relation to the Project site.

To estimate the depth of flow and associated flood level adjacent to the site from Nagero Creek, a Manning’s calculation of a cross-section within Nagero Creek adjacent to the Project site has been undertaken. Figure 3.2 shows the cross-section location and Figure 3.3 shows the Nagero Creek cross-section profile.

Table 3.1 details the Nagero Creek cross-section profile properties and resulting Manning’s equations estimated flow conditions. Refer to Appendix B for Manning’s calculations.

**Table 3.1 Nagero Creek cross-section Properties and Manning’s calculation results, 1% AEP**

| Parameter                            | Value / Result          |
|--------------------------------------|-------------------------|
| Design flow rate (m <sup>3</sup> /s) | 135.3                   |
| Manning’s n                          | 0.03                    |
| Slope (m/m)                          | 0.007                   |
| Base width (m)                       | Varies (See Appendix B) |
| Bank slope (m/m)                     | Varies (See Appendix B) |
| Bank slope (m/m)                     | Varies (See Appendix B) |
| <b>Manning’s calculation Results</b> |                         |
| Estimated depth of flow (m)          | 1.82                    |
| Avg. Velocity (m/s)                  | 2.56                    |
| Bed level (mAHD)                     | 257.3                   |
| 1% AEP water level (mAHD)            | 259.12                  |

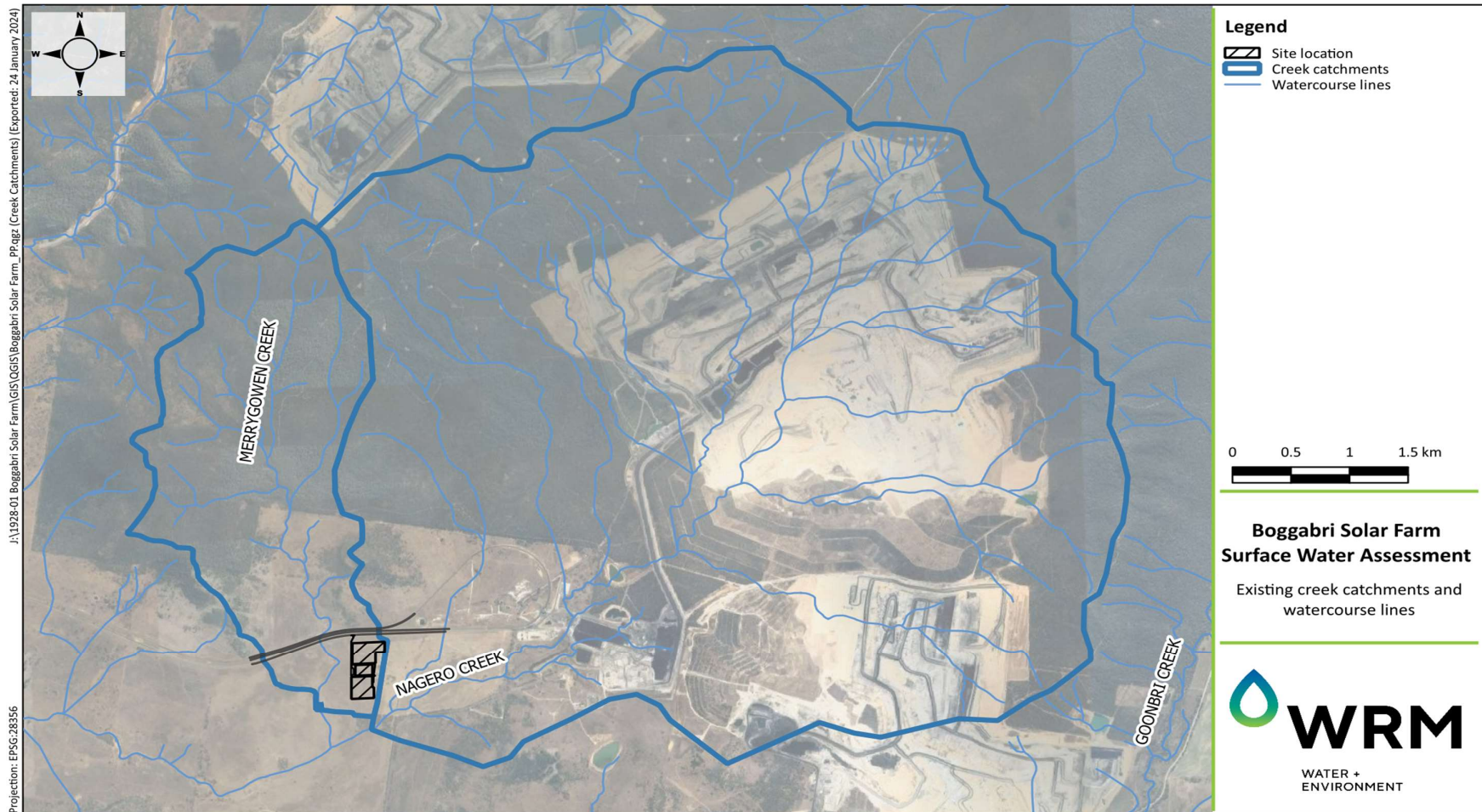
The above Manning’s calculation estimates a depth of flow of 1.82 m, indicating a water surface elevation of 259.12 mAHD. The lowest point of the Project area has a ground surface elevation of approximately 260.30m AHD (see Figure 3.2). The Project site is therefore estimated to be a minimum of 1.18 m above the Negero Creek 1% AEP flood level. Therefore, the site is not impacted by Negero Creek flooding for the 1% AEP event.

### 3.2 SITE DESCRIPTION

The site consists of open, slightly undulating land with minimal vegetation. The site falls to the southeast at a relatively constant grade of approximately 1.4%. No stormwater infrastructure is located within the proposed site area.

Merrygowen Creek is adjacent to the site and the banks of the creek channel are approximately 1.0 to 1.6 m deep. The creek makes a few sharp bends and flow is expected to overtop the creek banks during larger rainfall events. Overtopping flow will generally traverse the site as a broad sheet flow with some overland flow paths forming within rills and undefined small depressions/gullies.

Section 1.2 above notes the key components of the proposed solar farm, and the proposed site layout is shown in Figure 1.2. The solar modules (panels) are to be constructed on steel piles and will remain above the ground surface at all times. Similarly the containerised inverters, BESS and Kiosk will also be above the ground surface on concrete skids or similar. The remaining proposed infrastructure will be at ground level or below the ground surface. It is therefore expected that surface flow traversing the site will be unimpeded by the proposed site infrastructure.



**Figure 3.1 Existing Catchment and Watercourse**

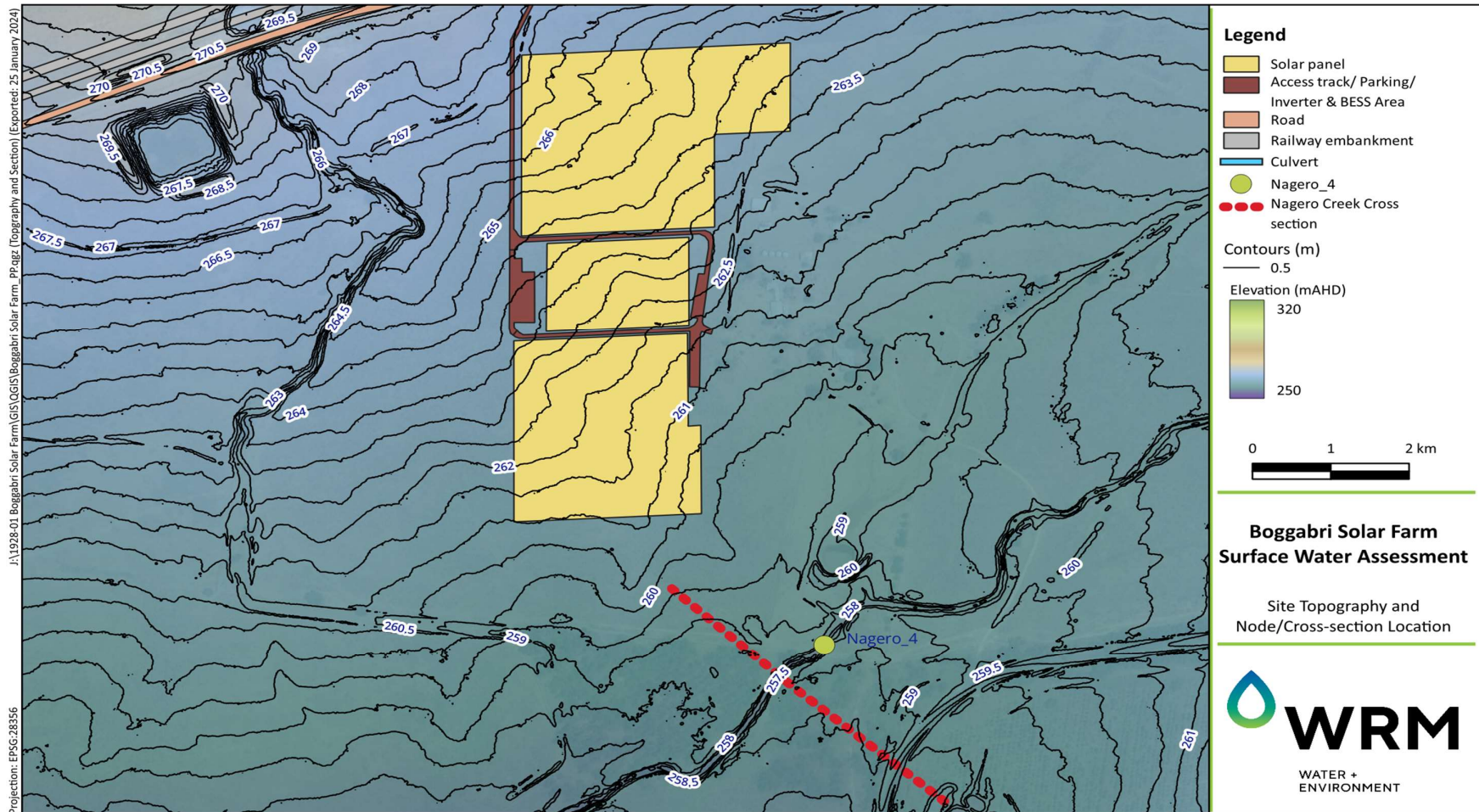
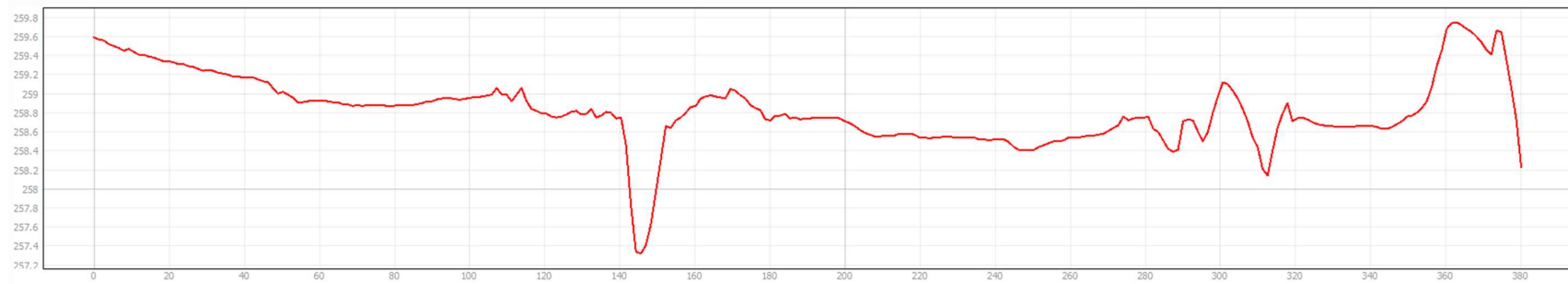


Figure 3.2 Site Topography and Node/Cross-section Location





**Figure 3.3 Nagero Creek cross-section profile**

## 4 ESTIMATION OF PEAK DISCHARGE

### 4.1 OVERVIEW

Design discharges were estimated for the 10%, 5% and 1% AEP flood events in accordance with the the current Australian Rainfall & Runoff (ARR2019) guideline. The “Extract ARR2019 to TUFLOW” QGIS plugin was utilised to extract and process the relevant rainfall hyetographs, temporal patterns, storm bursts and losses for input into the hydraulic model.

The flood assessment used a direct-rainfall TUFLOW model whereby a rainfall hyetograph is applied directly to each cell in the 2D model grid within the contributing catchment. The 2D hydraulic solver is used to route the water down the catchments.

The rainfall excess model loss method of accounting for rainfall losses was adopted.

An ensemble of ten (10) temporal patterns were modelled for each storm duration to derive a range of estimated peak discharges for each AEP of interest. The storm duration with the highest median peak discharge of the ensemble was selected and the temporal pattern that produces the peak discharge just above the ensemble median was used for design event modelling.

Owing to the unavailability of recorded streamflow data in the study area or existing flood studies for the area, the predicted flood discharges were validated using the Rational Method.

### 4.2 MODEL CONFIGURATION

#### 4.2.1 Design rainfalls and temporal patterns

Design rainfalls and temporal patterns obtained from Design Rainfall Data System<sup>2</sup> based on a single point location at the centroid of the project area were used for all assessments.

The ARR2019 guidelines contain the currently adopted methods for hydrologic flow estimation including updates to rainfall intensities, rainfall losses and temporal patterns. Part of this approach is to use an ensemble of temporal patterns (ten patterns for each storm duration) to allow for the conveyance and storage characteristics of the catchment to be represented. For the initial runs the TUFLOW model was run for all ten (10) temporal patterns for storm durations between 10 minutes and 9 hours for the 10%, 5% and 1% AEP events.

Design rainfalls for the design events 10% (1 in 10), 5% (1 in 20) and 1% (1 in 100) AEP and durations from 10 minutes to 9 hours are given in Table 4.1.

**Table 4.1 Adopted design rainfall depths**

| Duration | Design rainfall depths (mm) by AEP |        |        |
|----------|------------------------------------|--------|--------|
|          | 10% AEP                            | 5% AEP | 1% AEP |
| 10 min   | 18.0                               | 21.0   | 28.2   |
| 15 min   | 22.4                               | 26.1   | 35.3   |
| 20 min   | 25.6                               | 29.9   | 40.5   |
| 25 min   | 28.2                               | 32.9   | 44.5   |
| 30 min   | 30.3                               | 35.4   | 47.9   |
| 45 min   | 35.0                               | 40.8   | 55.2   |
| 1 hr     | 38.3                               | 44.7   | 60.3   |

<sup>2</sup> <http://www.bom.gov.au/water/designRainfalls/revised-ifd/>

| Duration | Design rainfall depths (mm) by AEP |        |        |
|----------|------------------------------------|--------|--------|
|          | 10% AEP                            | 5% AEP | 1% AEP |
| 1.5 hr   | 43.0                               | 50.1   | 67.5   |
| 2 hr     | 46.5                               | 54.1   | 72.8   |
| 3 hr     | 51.8                               | 60.2   | 80.7   |
| 4.5 hr   | 57.8                               | 67.0   | 89.7   |
| 6 hr     | 62.6                               | 72.5   | 97.1   |
| 9 hr     | 70.5                               | 81.6   | 109.0  |

Source: BOM.gov.au, 30.6375S, 150.1125E

#### 4.2.2 Design rainfall losses

The storm initial loss (IL) and continuing loss (CL) method of accounting for rainfall losses was adopted based on ARR Data Hub recommendations. The ARR Data Hub recommends an IL of 60 mm and a CL of 0.5 mm/hr. The IL was factored down in accordance with the 'Review of ARR Design Inputs for NSW' (OEH, 2019) which indicates the ARR Data Hub CL is to be multiplied by 0.4. The adopted CL is therefore 0.2 mm/hr. These rainfall losses were found to overestimate the losses within the catchment resulting in little to no runoff being generated over the modelled area over the modelled AEP events.

IL and CL were then calculated by the QGIS ARR to TUFLOW plugin with median pre-burst depths obtained from ARR Data Hub. The QGIS ARR to TUFLOW plugin outputs a 'Rainfall\_Loss.trd' file which calculates variable IL and CL loss values for each modelled event and duration for use within the TUFLOW model. The calculated CL for all events and durations was 0.2 mm/hr in accordance with the 'Review of ARR Design Inputs for NSW' requirements. These rainfall losses were found to be too small and an overestimation of peak flows was predicted.

Several combinations of IL were evaluated to ensure losses resulted in credible flow estimation within the model area. The CL of 0.2 mm/hr remained constant for all tested combinations.

Through this evaluation process it was determined that when the IL from the "Rainfall\_Loss.trd" output file was multiplied by a factor of three (3) the resulting catchment peak flows were closest to the Rational Method predicted peak flows. These IL's were therefore adopted within the model. Table 4.2 outlines the adopted loss values for the various AEP events and durations.

**Table 4.2 Adopted loss values**

| Duration | Initial Loss (mm/hr) |        |        | Continuing Loss (mm/hr) |        |        |
|----------|----------------------|--------|--------|-------------------------|--------|--------|
|          | 10% AEP              | 5% AEP | 1% AEP | 10% AEP                 | 5% AEP | 1% AEP |
| 10 min   | 10.8                 | 10.5   | 9.9    |                         |        |        |
| 15 min   | 16.2                 | 15.9   | 14.7   |                         |        |        |
| 20 min   | 21.6                 | 21.3   | 19.8   |                         |        |        |
| 25 min   | 27.0                 | 26.7   | 24.6   |                         |        |        |
| 30 min   | 32.4                 | 32.1   | 29.4   |                         | 0.2    |        |
| 45 min   | 48.3                 | 48.0   | 44.4   |                         |        |        |
| 1 hr     | 60.0                 | 60.0   | 59.1   |                         |        |        |
| 1.5 hr   | 60.0                 | 60.0   | 60.0   |                         |        |        |
| 2 hr     | 60.0                 | 60.0   | 58.8   |                         |        |        |



| Duration | Initial Loss (mm/hr) |      | Continuing Loss (mm/hr) |
|----------|----------------------|------|-------------------------|
| 3 hr     | 60.0                 | 60.0 | 48.6                    |
| 4.5 hr   | 60.0                 | 60.0 | 48.6                    |
| 6 hr     | 60.0                 | 60.0 | 48.6                    |
| 9 hr     | 60.0                 | 60.0 | 44.4                    |

### 4.3 MODEL VALIDATION

Given there is no data available for calibrating the TUFLOW peak discharges, the design discharges were validated against estimates made using the Rational Method for the Merrygowan Creek catchment during the 1% AEP event. The Rational Method is a simplified calculation widely accepted for providing reasonable peak flow estimates. The Rational Method calculations are presented in Appendix A.

To obtain the peak flow from the TUFLOW model, the storm duration with the highest median peak discharge of the ensemble was selected and the temporal pattern that produces the peak discharge just above the ensemble median was used. From the above the critical storm duration and temporal pattern was determined to be the 360 minute (6 hour) storm with temporal pattern 10. The resulting peak discharge from Catchment 1, upstream of the existing railway embankment, is shown in Table 4.3 below.

Table 4.3 compares the TUFLOW predicted design discharge against the predicted Rational Method peak discharge for the 1% AEP event. The TUFLOW design discharge compares reasonably well to the Rational Method and has therefore been adopted for this study.

**Table 4.3 TUFLOW and Rational Method discharge estimates at the railway embankment**

| 1% AEP Peak Discharge (m³/s) |                 |              |
|------------------------------|-----------------|--------------|
| TUFLOW                       | Rational Method | % Difference |
| 36.9                         | 34.7            | 6.1          |

---

## 5 HYDRAULIC MODELLING

### 5.1 OVERVIEW

Design discharges were estimated for the 10%, 5% and 1% AEP flood events in accordance with the guidelines in the current Australian Rainfall & Runoff (ARR2019). The “Extract ARR2019 to TUFLOW” QGIS plugin was utilised to extract and process the relevant rainfall hyetographs, temporal patterns storm bursts and losses for development site for input into the Hydraulic model. Modified “Rainfall\_Loss.trd” files which calculates variable IL and CL loss values for each modelled event and duration were used within the TUFLOW model as outlined in Section 4.2.2 above.

Hydraulic modelling of the proposed development was developed using the 2023-03-AC version of the TUFLOW solver. The hydraulic model results were post-processed to derive design flood parameters (e.g., depth, velocity, and surface level) for each AEP. A description of the development of the TUFLOW models is outlined below.

### 5.2 MODEL CONFIGURATION

#### 5.2.1 Topography and grid cell size

Figure 5.1 shows the TUFLOW hydraulic model configuration. The model covers an area of approximately 630 ha extending about 4.2 km upstream of the site to the top of the Merrygowen Creek catchment, and about 150 m downstream of the site. 2013 LiDAR data was adopted as the base model topography. This was supplemented by railway line as-constructed DEM data.

A 5 m grid cell size resolution with sub-grid sampling was adopted throughout the entire hydraulic model extent.

#### 5.2.2 Boundary conditions

Figure 5.1 shows the model extent and outflow boundaries in the hydraulic model. The model is a direct-rainfall with the model code boundary covering the entire model extent. A ‘2d\_rf’ boundary, which defines the area for applying rainfall directly onto the 2D domain, is provided over the full extent of the model code boundary area.

A ‘Stage-discharge’ (HQ) type boundaries were adopted as the model outflow boundaries at a fixed downstream flood slope of 2%. This slope represents the average slope of the land at the downstream boundary.

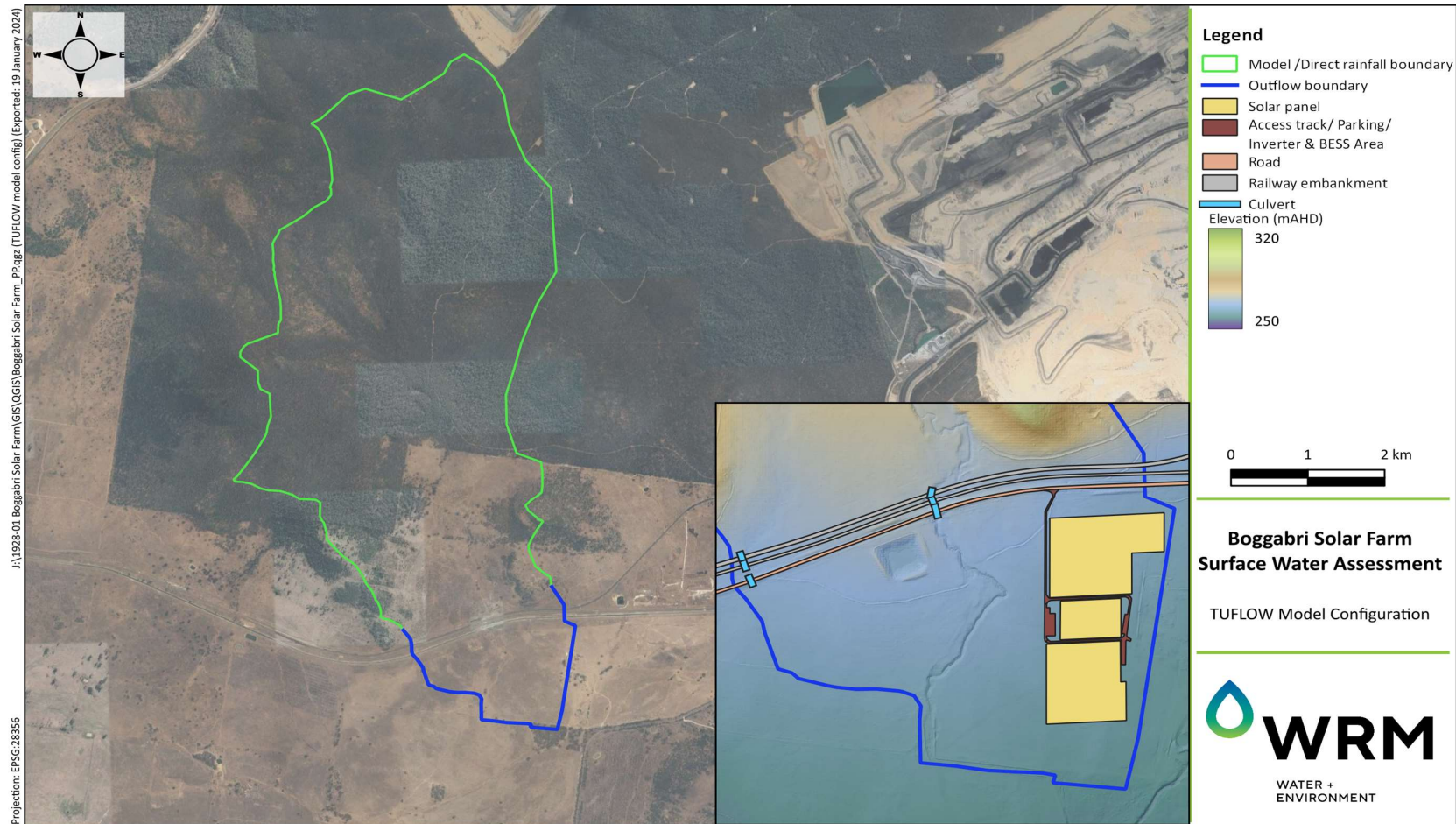


Figure 5.1 TUFLOW hydraulic model configuration



### 5.2.3 Hydraulic resistance

The TUFLOW model uses Manning's 'n' values to represent hydraulic resistance across the TUFLOW model area. The adopted Manning's 'n' values corresponding to each land use type are shown in Table 5.1.

The classification of land use areas for hydraulic modelling was based on the aerial imagery and proposed site conditions. Land use types for both Stage 1 and 2 have been adopted within the model.

Depth varying Manning's roughness was adopted for pastoral land. Table 5.2 shows the depth varying Manning's values.

**Table 5.1 Adopted Manning's 'n' coefficients**

| Land use description       | Manning's 'n' coefficient |
|----------------------------|---------------------------|
| Solar Modules (Pannels)    | 0.060                     |
| Roads                      | 0.020                     |
| Unsealed Access Track      | 0.025                     |
| Unsealed Carpark           | 0.025                     |
| Beneath Inverters and BESS | 0.025                     |
| Railway Embankment         | 0.100                     |

**Table 5.2 Depth varying Manning's n value**

| Land use description             | Depth (m) | Manning's n |
|----------------------------------|-----------|-------------|
| Light vegetation / Pastoral land | 0.05      | 0.1         |
| (Default)                        | 0.1       | 0.055       |

### 5.2.4 Hydraulic structures

A 1D pipe network has been included in the TUFLOW model to represent the existing culverts beneath railway and road embankments to the north of the site. Pipe details have been taken from railway and road as-constructed culvert CAD and GIS line strings and points provided by RPS. The number of culverts and culvert sizes are outlined in Section 3.3 above.

## 6 MODEL RESULTS

The critical storm duration and temporal pattern was determined to be the 360 minute (6 hour) storm with temporal pattern 10. The 10%, 5% and 1% AEP flood events have been modelled with the results presented as follows:

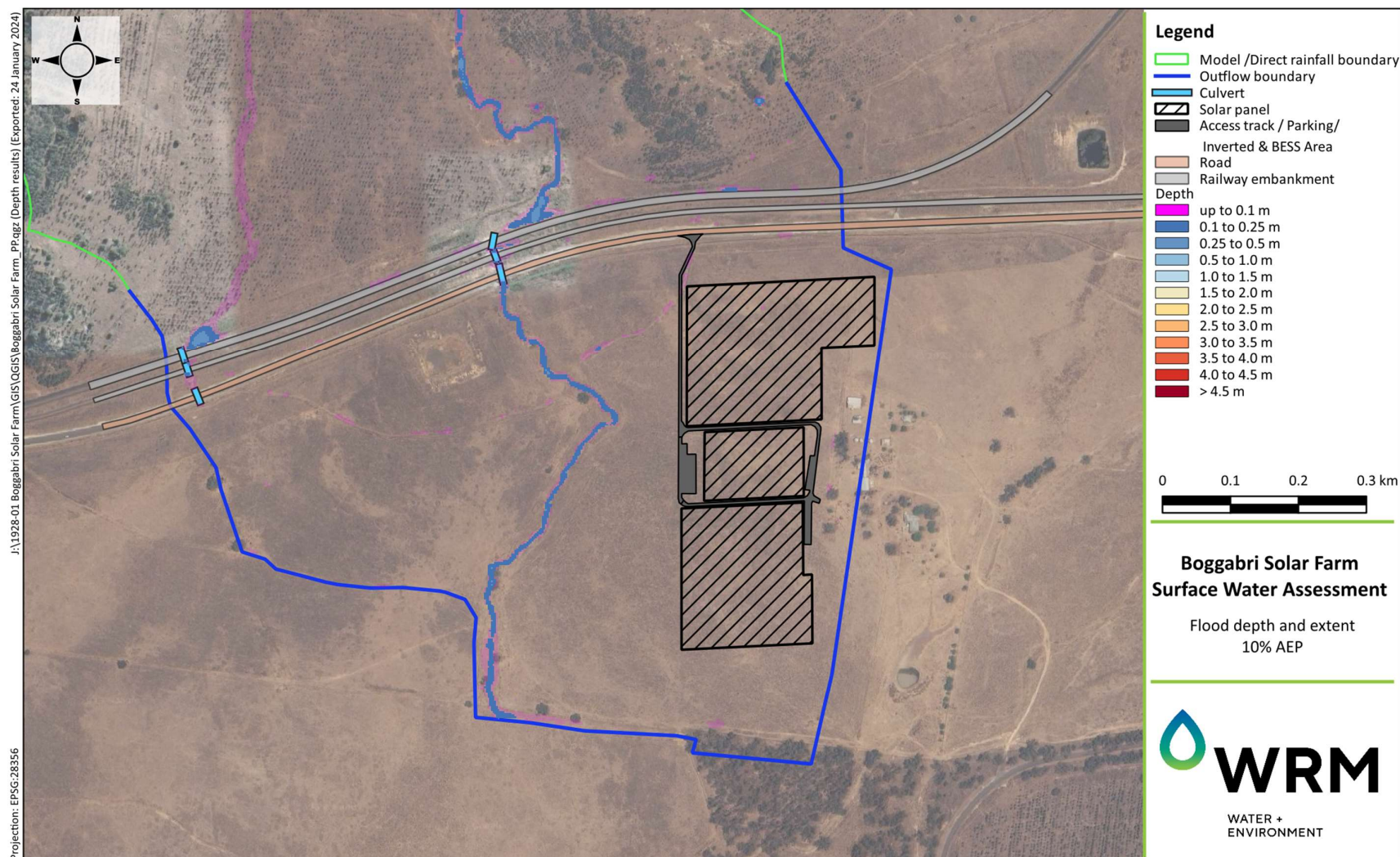
- Figure 6.1, Figure 6.2 and Figure 6.3 present the depth, velocity and velocity depth product mapping for the 10% AEP event, respectively.
- Figure 6.4, Figure 6.5 and Figure 6.6 present the depth, velocity and velocity depth product mapping for the 5% AEP event, respectively.
- Figure 6.7, Figure 6.8 and Figure 6.9 present the depth, velocity and velocity depth product mapping for the 1% AEP event, respectively.

The model results show that:

- During the 10% AEP event flow is contained within Merrygowen Creek and associated gullies draining to the creek. A small amount of runoff is predicted on some areas of the site but is considered negligible as it is minor ponding of the ground surface with no conveyance capacity.
- During the 5% AEP event, flow is generally contained within Merrygowen Creek with some overtopping of flow draining to the site. Surface runoff from the site is sufficient to promote some surface flow across the site. Table 6.1 outlines the maximum flow conditions within the proposed development site.
- During the 1% AEP event, flow overtops the banks of Merrygowen Creek and the railway line and road to the north with flow draining through the site. Surface runoff from the site is sufficient to promote surface flow across the site. Table 6.1 outlines the maximum flow conditions within the site.

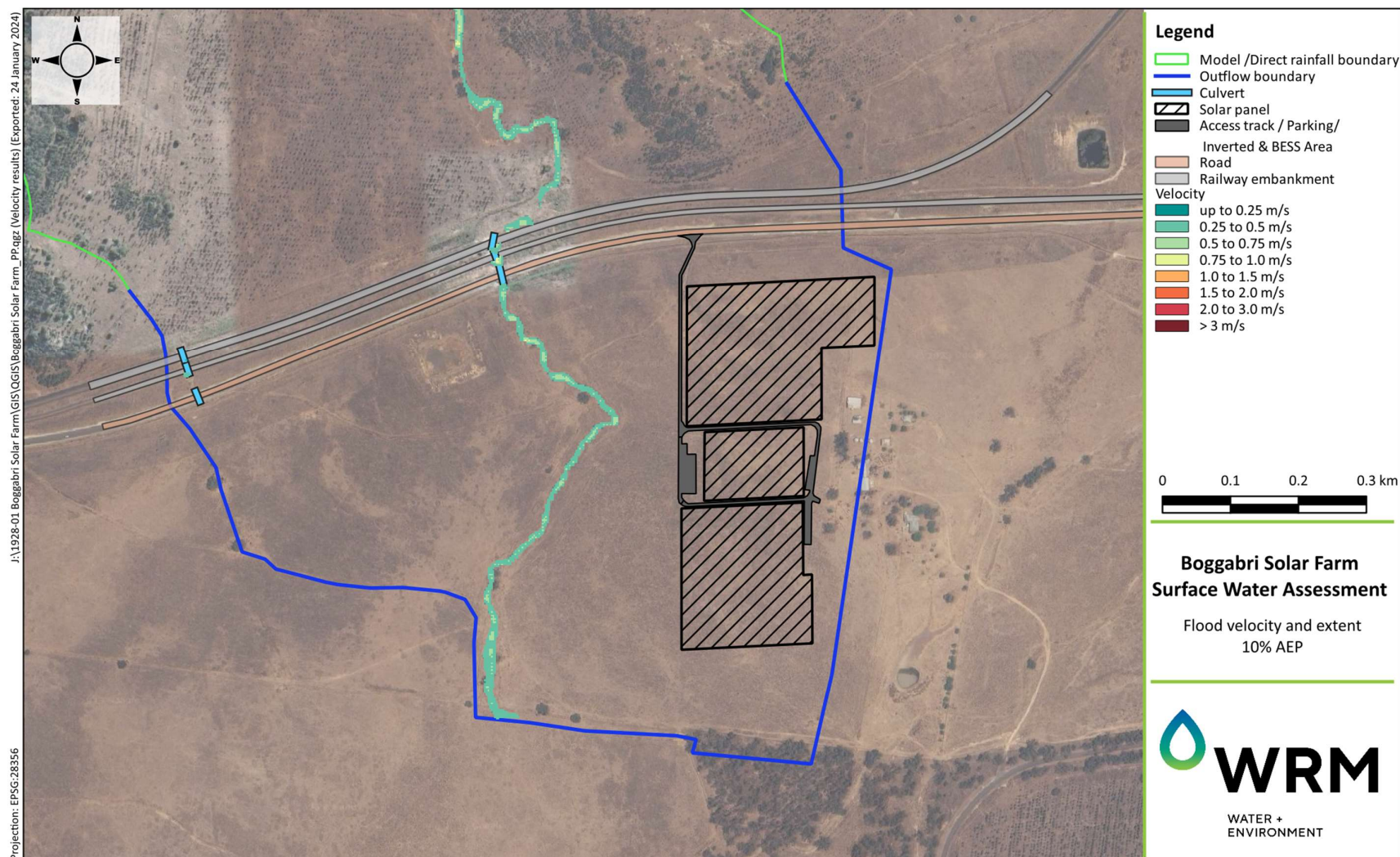
**Table 6.1 Predicted maximum site flow conditions within development site**

| Flood Characteristic                               | 5% AEP | 1% AEP |
|----------------------------------------------------|--------|--------|
| Maximum Depth (m)                                  | 0.03   | 0.15   |
| Maximum Velocity (m/s)                             | 0.20   | 1.01   |
| Maximum Velocity Depth Product (m <sup>2</sup> /s) | 0.01   | 0.11   |



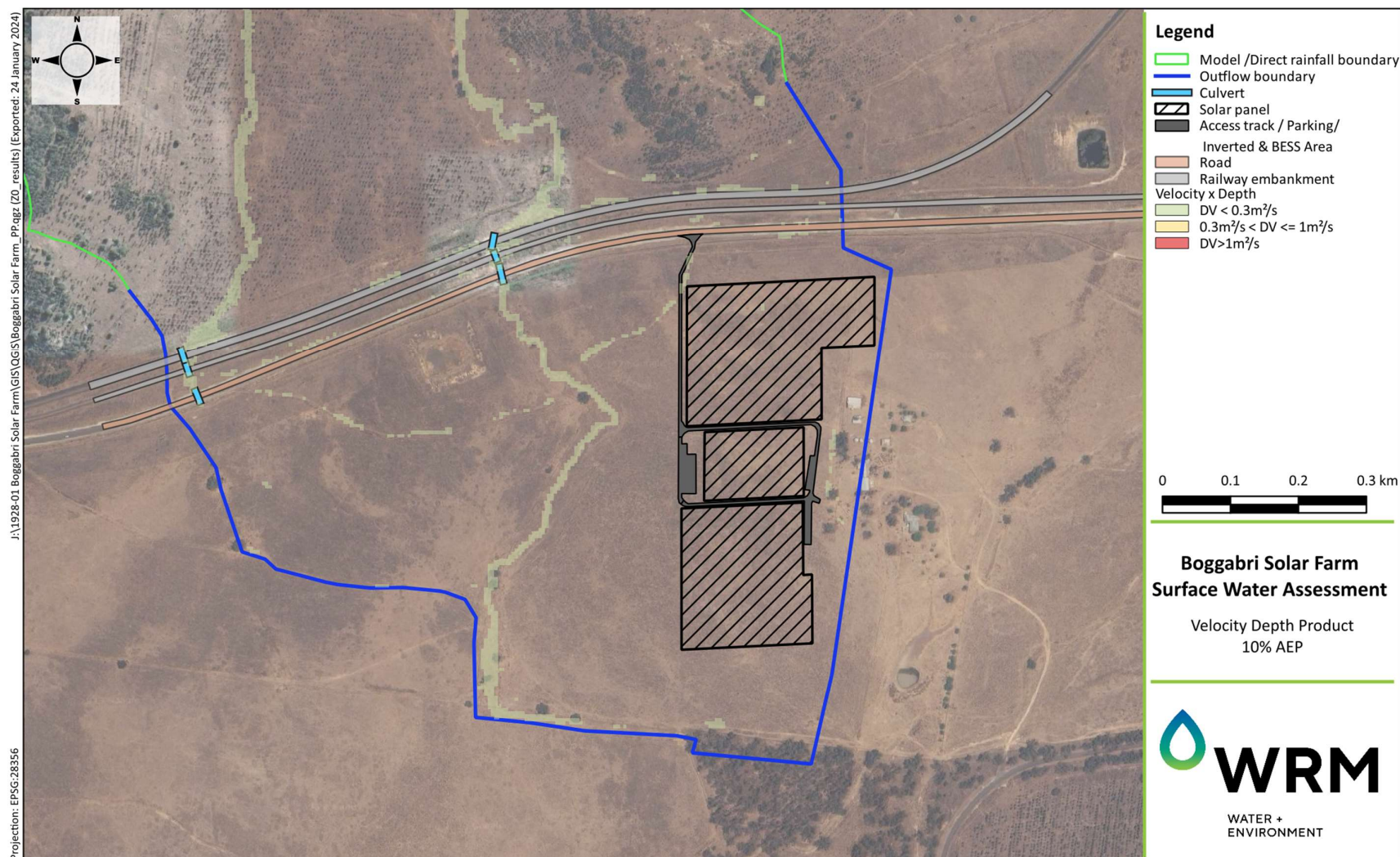
**Figure 6.1 Flood depth at 10% AEP**





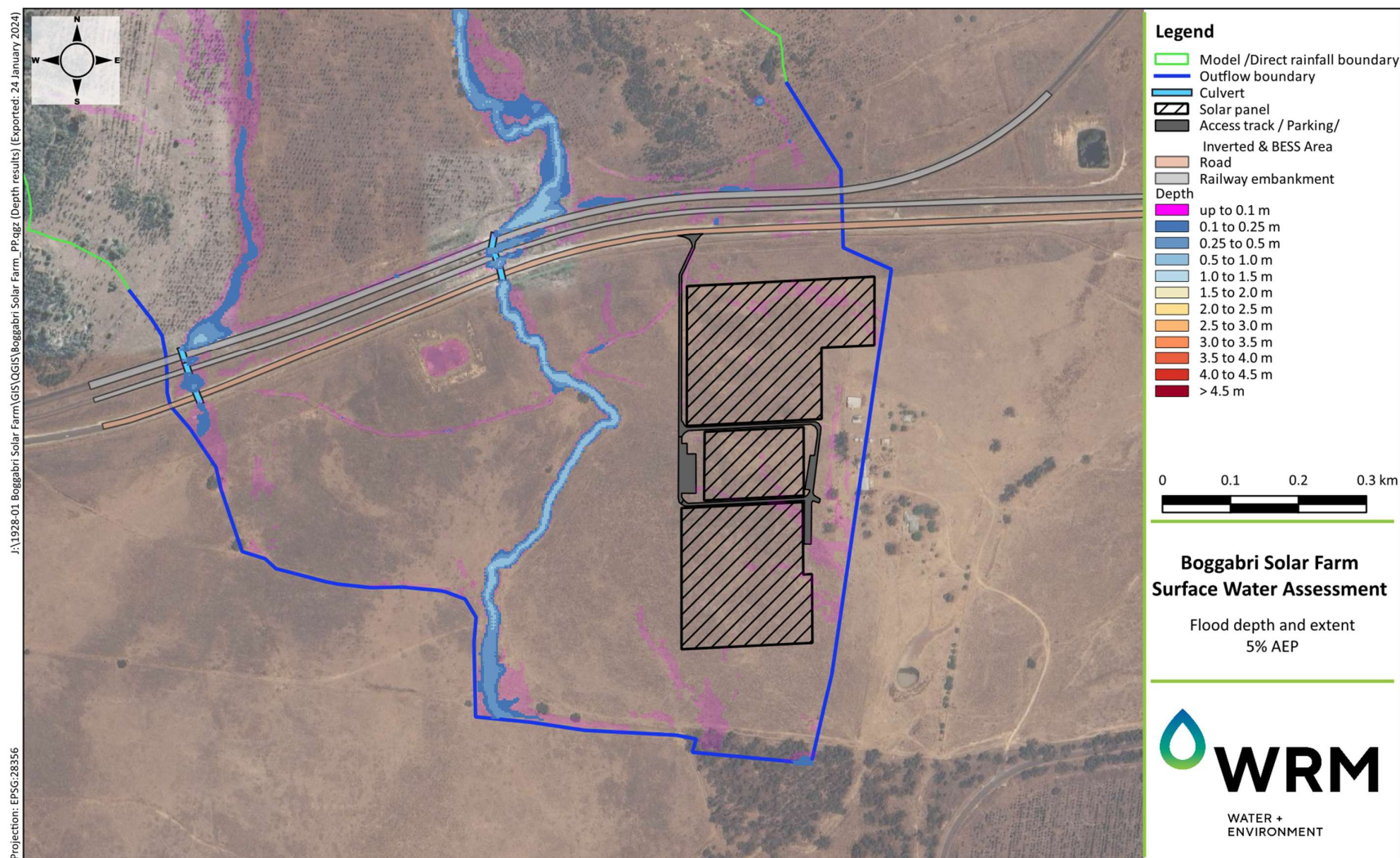
**Figure 6.2 Velocity at 10% AEP**





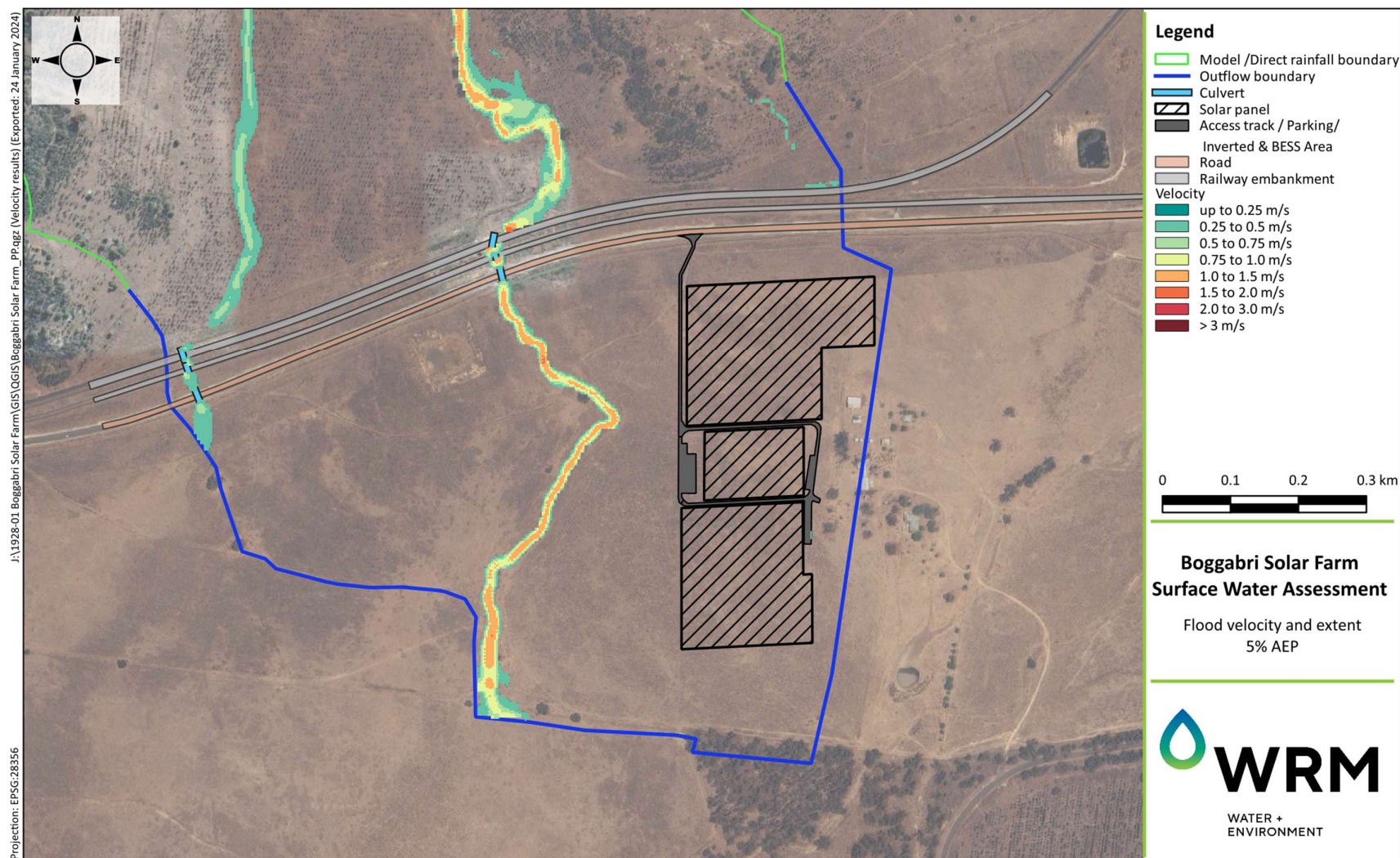
**Figure 6.3 Velocity Depth Product at 10% AEP**





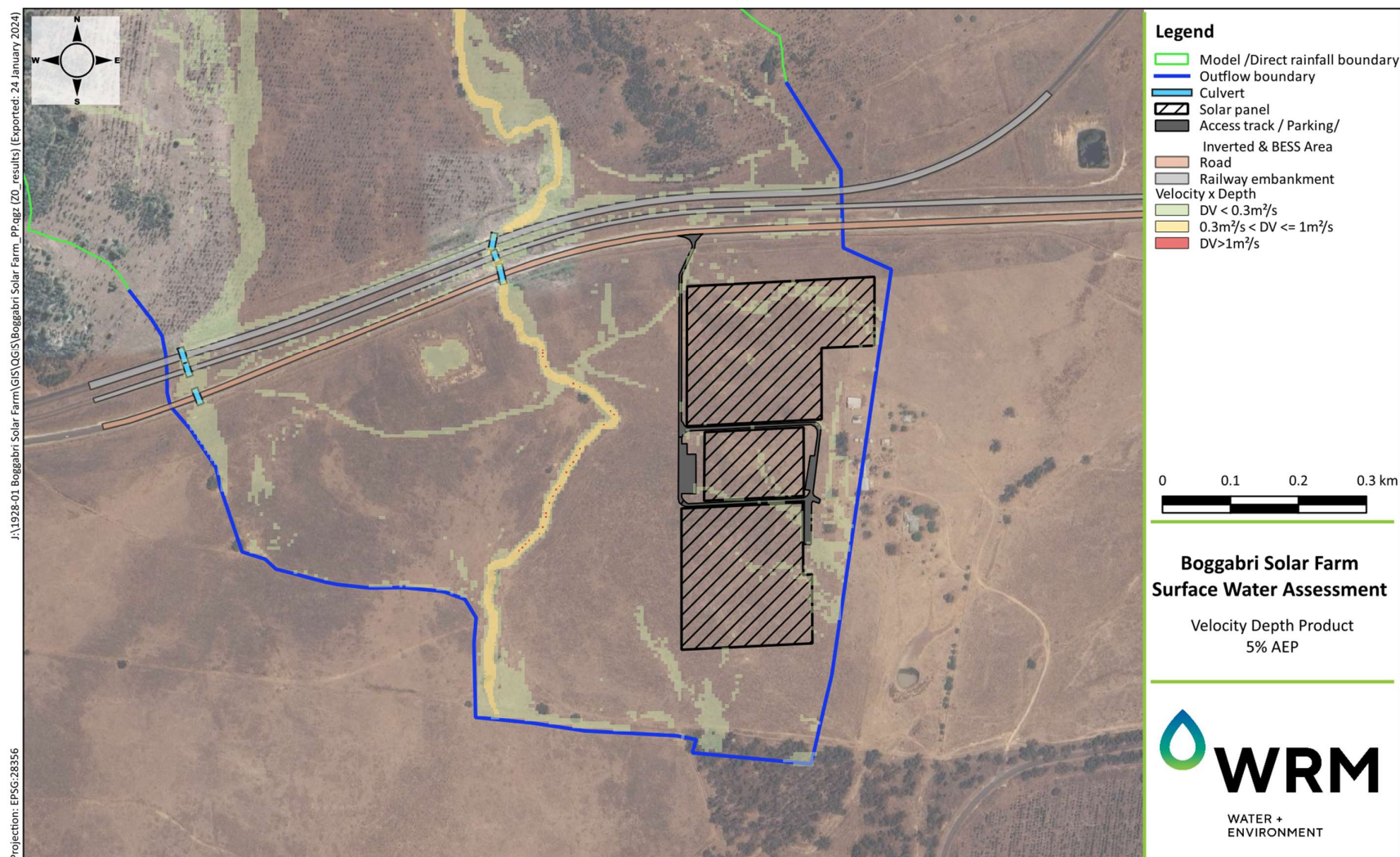
**Figure 6.4 Flood depth at 5% AEP**





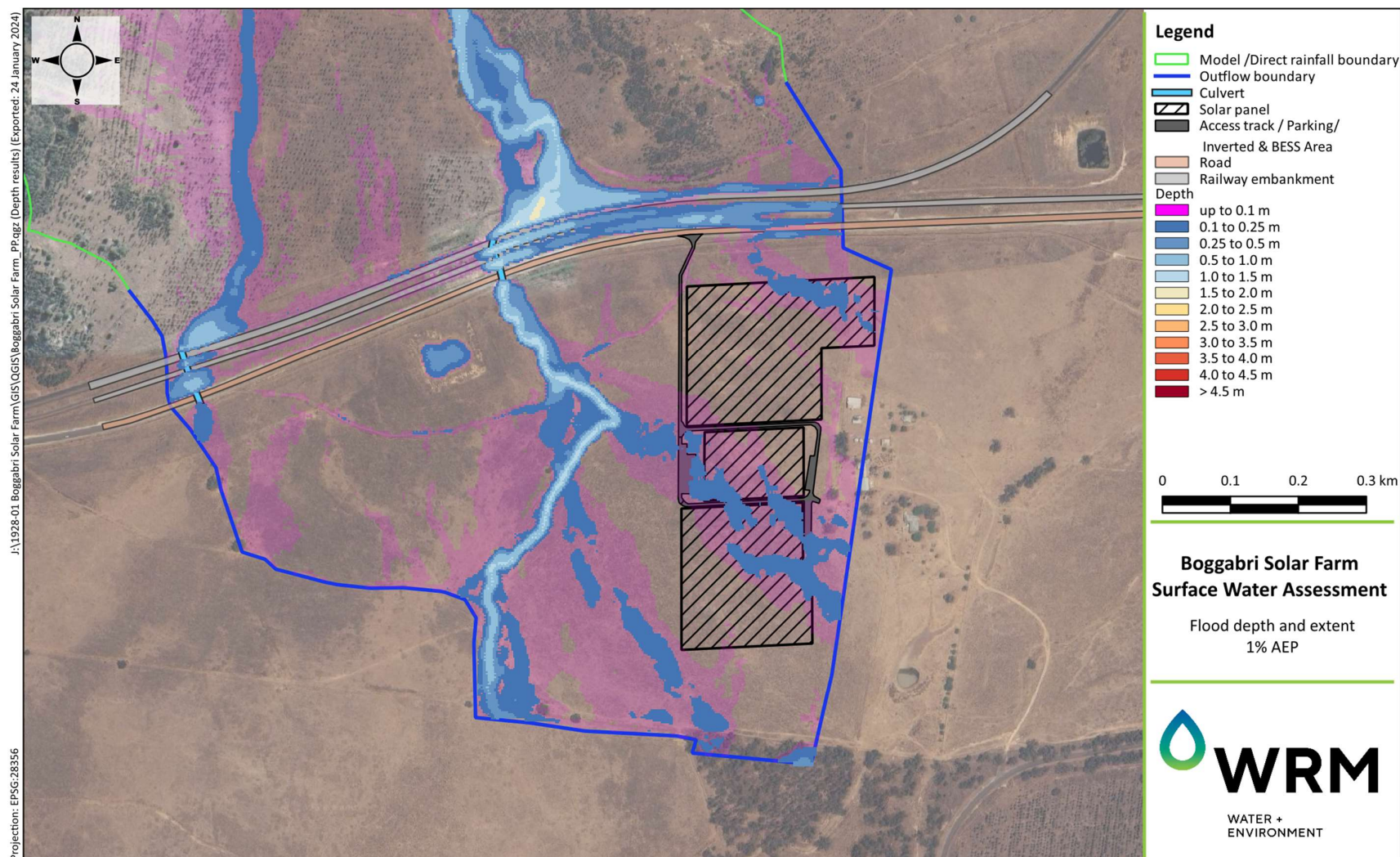
**Figure 6.5 Velocity at 5% AEP**





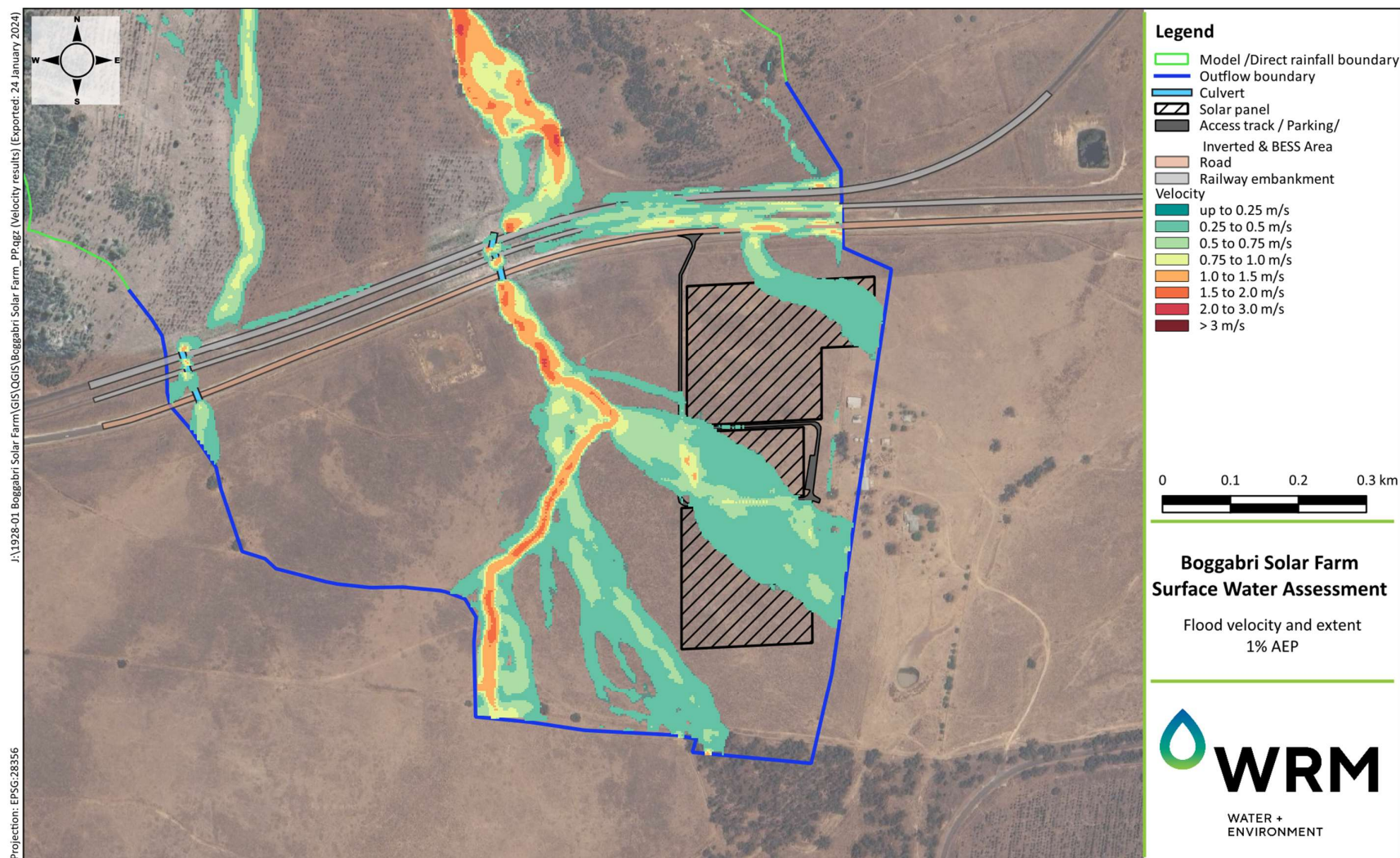
**Figure 6.6 Velocity Depth Product at 5% AEP**





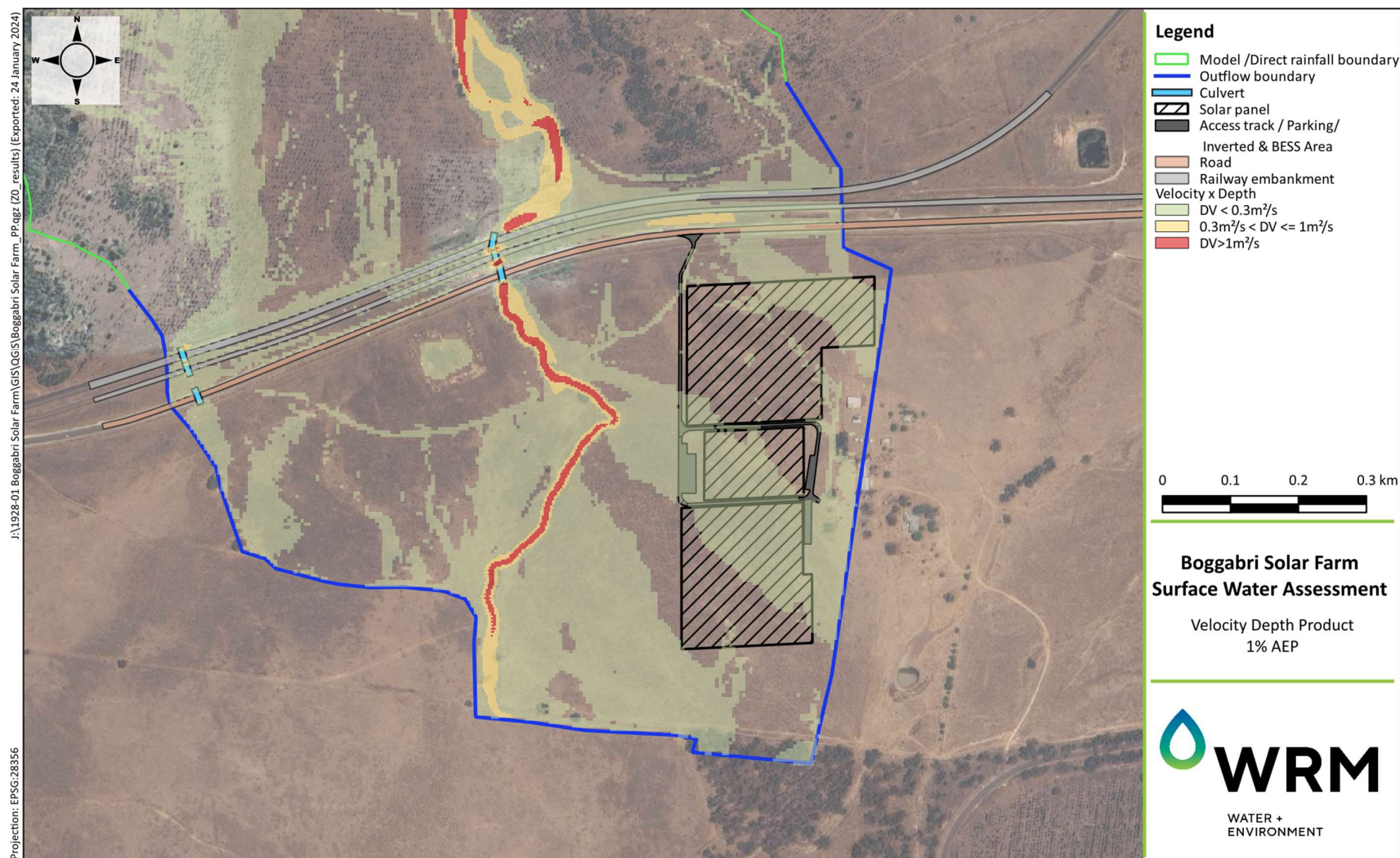
**Figure 6.7 Flood depth at 1% AEP**





**Figure 6.8 Velocity at 1% AEP**





**Figure 6.9 Velocity Depth Product at 1% AEP**

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## 7 IMPACT ASSESSMENT

### 7.1 OVERVIEW

There are two potential mechanisms by which the proposed development could have an impact on flood risk. They are:

- due to the proposed development obstructing flows.
- additional runoff due to development.

Impact assessment has been limited to constraints for site infrastructure based on flood depth, velocity and hazard outputs from the modelling.

Assessment of the flood impacts due to increased site runoff of the development on surrounding watercourses or properties is not included in the scope of work for the flood assessment at this stage.

The potential flood impacts of the following proposed infrastructure have been considered in this section:

- solar panels and their supporting steel piles;
- substation and inverter stations; and
- perimeter fencing.

### 7.2 IMPACT OF PROPOSED SOLAR PANELS AND SUPPORTING STEEL PILES

The hydraulic model results for the 10% AEP event shows the site is not flood affected from Merrygowen Creek. For the 5% and 1% AEP events the site is flood affected with maximum depth of 0.03 m and 0.15 m, respectively.

The solar panels will be positioned at least 0.4 metres above ground level on pile structures. During a heavy storm or extreme weather event, the trackers are set to move to a stow position which is just off parallel from the ground. Therefore, the panels will be located above the 5% and 1% AEP peak flood level. On this basis, there will not be any adverse impacts on the 10%, 5% and 1% AEP peak flood levels and velocities due to the proposed solar panels.

The steel piles supporting the solar panels are small and spaced far apart (at least 5 m). Therefore, the probability of debris accumulating between the steel piles is small. On this basis, there will not be any adverse impacts on peak flood levels due to the supporting steel piles, hence the steel piles were not incorporated into the TUFLOW model.

### 7.3 IMPACT OF THE PROPOSED INVERTER STATIONS, BESS AND KIOSK

The hydraulic model results for the 10% AEP event show the site is not flood affected from Merrygowen Creek. For the 5% and 1% AEP events the site is flood affected with maximum depth of 0.03 m and 0.15 m, respectively.

The Inverter Stations, BESS and Kiosk are to be housed in purpose-built shipping containers and can sit on concrete skids (e.g. SkidCrete<sup>3</sup> by Aus-Precast) approximately 0.3 m or more above ground level. Therefore, the Inverter Stations, BESS and Kiosk will be located above the 5% and 1% AEP peak flood level. On this basis, there will not be any adverse impacts on 10%, 5% and 1% AEP peak flood levels and velocities due to these proposed structures.

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<sup>3</sup> <https://aus-precaster.com.au/products-and-services/>



Where possible, containerised infrastructure should be located outside of areas identified as subject to overland flow. However, the concrete skids supporting the containerised infrastructure can be placed at each end of the container allowing for the conveyance of flow beneath the containers. Therefore, the probability of debris accumulating between the concrete skids is small. On this basis, there will not be any adverse impacts on peak flood levels due to the supporting concrete skids.

#### **7.4 IMPACT OF THE PROPOSED PERIMETER FENCING**

The subject site is impacted by flooding during the 5% and 1% AEP events. The proposed perimeter fencing is to be a steel mesh chain-link + 3x barbed wire fence. The proposed fences will be fully pervious and would allow overland flows to pass unimpeded. On this basis, the proposed perimeter fencing will not cause adverse impacts on peak flood levels and velocities.

As noted above, the peak flow velocity through the site during the 5% and 1% AEP events is predicted to be a maximum of 0.20 m/s and 1.01 m/s, respectively. Should debris build up on the perimeter fence during flood events, the fence is not expected to be damaged due to debris loading given the predicted low velocities.

#### **7.5 RISK TO LIFE FROM FLOOD**

The subject site is impacted by flooding during the 5% and 1% AEP events. Based on the predicted maximum site flow conditions in Table 6.1 above, flow conditions are defined as a H1 hazard vulnerability classification in accordance with the NSW Government 'Flood Hazard Flood Risk Management Guide FB03'. Based on the H1 definition, the site is generally safe for vehicles, people and buildings in all storm events up to and including the 1% AEP event.

Additionally, flooding at the subject site occurs up to several hours after rainfall has occurred, providing time to evacuate the area prior to the onset of flooding. On this basis, the risk to life from flood at the subject site is considered very low.

#### **7.6 ENVIRONMENTAL IMPACTS**

There are no predicted flood impacts due to the development for the 10% AEP event. The predicted flood level and velocity impacts for the 5% and 1% AEP event are localised and insignificant.

Surface runoff from land disturbing activities will be managed in accordance with industry practice for erosion and sediment control on construction sites.

On this basis, the development will not adversely affect the existing environment, cause erosion or reduce the stability of riverbanks or watercourses.

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## 8 REFERENCES

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|                             |                                                                                                                                                                                                                       |
|-----------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Ball et al, 2019            | <i>'Australian Rainfall and Runoff: A Guide to Flood Estimation'</i> , Ball J, Babister M, Nathan R, Weeks W, Weinmann E, Retallick M, Testoni I, (Editors), © Commonwealth of Australia (Geoscience Australia), 2019 |
| BMT, 2018                   | <i>'TUFLOW User Manual Build 2018-03-AD'</i> , BMT WBM Pty Ltd, 2018                                                                                                                                                  |
| BMT, 2021                   | <i>'TUFLOW Release Notes 2020-10-AB'</i> , BMT WBM Pty Ltd, 2021                                                                                                                                                      |
| Geoscience Australia, 2019  | AR&R Data Hub (software), Geoscience Australia, Version 2019_v1, April 2019, < <a href="http://data.arr-software.org/">http://data.arr-software.org/</a> >.                                                           |
| Hansen Bailey Pty Ltd, 2010 | <i>"Continuation of Boggabri Coal Mine Project – Surface Water Assessment"</i> , 2010                                                                                                                                 |

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## APPENDIX A RATIONAL METHOD CALCULATIONS

|            |             |
|------------|-------------|
| Catchment: | Catchment 1 |
|------------|-------------|

|                                          |        |
|------------------------------------------|--------|
| Catchment area and coefficient of runoff |        |
| Catchment Area (ha)                      | 511.47 |
| C <sub>10</sub>                          | 0.50   |

|                              |        |
|------------------------------|--------|
| Time of concentration        |        |
| <u>Bransby-Williams' Equ</u> |        |
| Channel length (m)           | 4750   |
| Channel slope (m/m)          | 0.060  |
| t <sub>c</sub> (mins)        | 103.18 |

|                   |     |                  |                |                             |                    |                     |
|-------------------|-----|------------------|----------------|-----------------------------|--------------------|---------------------|
| Design Discharges |     |                  |                |                             |                    |                     |
| ARI               | AEP | Frequency Factor | C <sub>y</sub> | t <sub>c</sub> <sup>b</sup> | Rainfall Intensity | Peak Discharge      |
| (years)           | (%) | F <sub>y</sub>   |                | (mins)                      | (mm/h)             | (m <sup>3</sup> /s) |
| 1                 | 63  | 0.80             | 0.40           | 103.18                      | 15.7               | 8.92                |
| 1.44              | 50  | 0.85             | 0.43           | 103.18                      | 15.7               | 9.48                |
| 4.48              | 20  | 0.95             | 0.48           | 103.18                      | 21.7               | 14.67               |
| 10                | 10  | 1.00             | 0.50           | 103.18                      | 25.9               | 18.43               |
| 20                | 5   | 1.05             | 0.53           | 103.18                      | 30.2               | 22.56               |
| 50                | 2   | 1.15             | 0.58           | 103.18                      | 36.1               | 29.48               |
| 100               | 1   | 1.20             | 0.60           | 103.18                      | 40.7               | 34.68               |



## APPENDIX B MANNING'S CALCULATION OF NAGERO CREEK

### Irregular Channel Manning Uniform Flow Calculator

#### Nagero Creek 1% AEP Flow

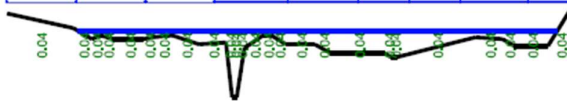
At Cross-section Location

Inputs

|                         |        |          |                            |
|-------------------------|--------|----------|----------------------------|
| Water surface elevation | 259.12 | m        | Results                    |
| Channel slope, S        | .0074  | rise/run | Q 137.67 m <sup>3</sup> /s |

Cross section points +/- (or Copy/Paste using data area)

| Point |        |            |                                     | Segment    |       |                | Region |                |         |                |      |        |
|-------|--------|------------|-------------------------------------|------------|-------|----------------|--------|----------------|---------|----------------|------|--------|
| Sta   | Elev   | n for seg- | R <sub>h</sub> , Q region boundary  | Bot. shear | T     | P <sub>w</sub> | A      | R <sub>h</sub> | Comp. v | H <sub>v</sub> | Fr   | Q      |
| m     | m      | ment       | (Bank)                              | N/m^2      | m     | m              | m^2    | m              | n       | m/s            | m    | m^3/s  |
| 0     | 259.6  |            |                                     | 0,00       |       |                |        |                |         |                |      |        |
| 42.4  | 259.2  | 0.04       | <input type="checkbox"/>            | 0,00       | 0,00  | 0,00           | 0,00   |                |         |                |      |        |
| 54.3  | 258.9  | 0.04       | <input type="checkbox"/>            | 15.96      | 8.73  | 8.73           | 0.96   |                |         |                |      |        |
| 59.6  | 259    | 0.04       | <input type="checkbox"/>            | 8,71       | 5,30  | 5,30           | 0,90   |                |         |                |      |        |
| 68.9  | 258.9  | 0.04       | <input type="checkbox"/>            | 15.96      | 9,30  | 9,30           | 1,58   |                |         |                |      |        |
| 87.4  | 258.9  | 0.04       | <input type="checkbox"/>            | 15.96      | 18,50 | 18,50          | 4,07   |                |         |                |      |        |
| 94    | 258,95 | 0.04       | <input type="checkbox"/>            | 12,34      | 6,60  | 6,60           | 1,29   |                |         |                |      |        |
| 106   | 259    | 0.04       | <input type="checkbox"/>            | 8,71       | 12,00 | 12,00          | 1,74   |                |         |                |      |        |
| 123.2 | 258.75 | 0.04       | <input type="checkbox"/>            | 26.85      | 17,20 | 17,20          | 4,21   |                |         |                |      |        |
| 140.4 | 258,8  | 0.04       | <input type="checkbox"/>            | 23,22      | 17,20 | 17,20          | 5,93   |                |         |                |      |        |
| 144.4 | 257.3  | 0.04       | <input type="checkbox"/>            | 132.07     | 4,00  | 4.27           | 4.28   |                |         |                |      |        |
| 147.4 | 257.3  | 0.04       | <input type="checkbox"/>            | 132.07     | 3,00  | 3,00           | 5,46   |                |         |                |      |        |
| 152.4 | 258.65 | 0.04       | <input type="checkbox"/>            | 34.11      | 5,00  | 5.18           | 5.73   |                |         |                |      |        |
| 164.3 | 259    | 0.04       | <input type="checkbox"/>            | 8,71       | 11,90 | 11,91          | 3,51   |                |         |                |      |        |
| 169.6 | 259    | 0.04       | <input type="checkbox"/>            | 8,71       | 5,30  | 5,30           | 0,64   |                |         |                |      |        |
| 178.9 | 258.75 | 0.04       | <input type="checkbox"/>            | 26.85      | 9,30  | 9,30           | 2,28   |                |         |                |      |        |
| 197.4 | 258.75 | 0.04       | <input type="checkbox"/>            | 26.85      | 18,50 | 18,50          | 6,85   |                |         |                |      |        |
| 208   | 258,5  | 0.04       | <input type="checkbox"/>            | 44.99      | 10,60 | 10,60          | 5,25   |                |         |                |      |        |
| 242.5 | 258,5  | 0.04       | <input type="checkbox"/>            | 44.99      | 34,50 | 34,50          | 21.39  |                |         |                |      |        |
| 246.4 | 258,4  | 0.04       | <input type="checkbox"/>            | 52.25      | 3,90  | 3,90           | 2,61   |                |         |                |      |        |
| 250.4 | 258,4  | 0.04       | <input type="checkbox"/>            | 52.25      | 4,00  | 4,00           | 2,88   |                |         |                |      |        |
| 300.7 | 258,95 | 0.04       | <input type="checkbox"/>            | 12.34      | 50,30 | 50,30          | 22.38  |                |         |                |      |        |
| 318   | 258.9  | 0.04       | <input type="checkbox"/>            | 15.96      | 17,30 | 17,30          | 3,37   |                |         |                |      |        |
| 325.9 | 258,7  | 0.04       | <input type="checkbox"/>            | 30,48      | 7,90  | 7,90           | 2,53   |                |         |                |      |        |
| 347.1 | 258,7  | 0.04       | <input type="checkbox"/>            | 30.48      | 21,20 | 21,20          | 8,90   |                |         |                |      |        |
| 363   | 259.8  | 0.04       | <input checked="" type="checkbox"/> | 0,00       | 6,07  | 6,09           | 1.27   | 0.39           | 0.04    | 1.15           | 0.07 | 137.67 |



#### Notes

##### Composite n

This calculator follows HEC-RAS Reference Manual in calculating region composite n using Chow 1959, page 136, equation 6-17 (not 6-18).

##### Rock lining

Use the Manning Trapezoidal Channel Calculator to design rock lining. This calculator is more for natural sections.



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PO Box 10703 Brisbane Adelaide Street Qld 4000  
**07 3225 0200**

Level 5, 93 Mitchell Street Darwin  
GPO Box 43348 Casuarina NT 0811  
**08 8911 0060**

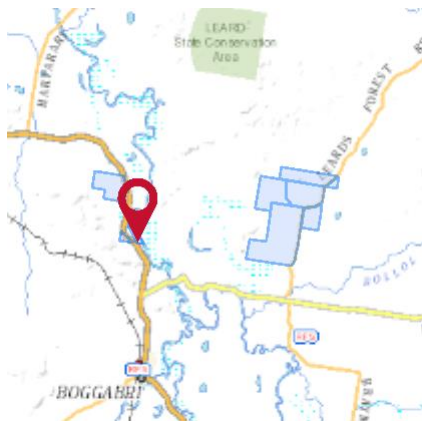
[wrm@wrmwater.com.au](mailto:wrm@wrmwater.com.au)  
[wrmwater.com.au](http://wrmwater.com.au)

ABN 96 107 404 544



# Property Report

306 THERRIBRI ROAD BOGGABRI 2382



## Property Details

|             |                                  |                |                |
|-------------|----------------------------------|----------------|----------------|
| Address:    | 306 THERRIBRI ROAD BOGGABRI 2382 |                |                |
| Lot/Section | 1/-/DP566122                     | 107/-/DP755470 | 12/-/DP754940  |
| /Plan No:   | 124/-/DP754926                   | 125/-/DP754926 | 127/-/DP754926 |
|             | 157/-/DP755475                   | 17/-/DP754940  | 18/-/DP754940  |
|             | 19/-/DP754940                    | 191/-/DP755470 | 202/-/DP755475 |
|             | 21/-/DP754940                    | 22/-/DP754940  | 23/-/DP754940  |
|             | 3/-/DP566122                     | 37/-/DP754940  | 44/-/DP754940  |
|             | 5/-/DP754940                     | 8/-/DP754940   | 85/-/DP755475  |
| Council:    | NARRABRI SHIRE COUNCIL           |                |                |

## Summary of planning controls

Planning controls held within the Planning Database are summarised below. The property may be affected by additional planning controls not outlined in this report. Please contact your council for more information.

|                              |                                                          |
|------------------------------|----------------------------------------------------------|
| Local Environmental Plans    | Narrabri Local Environmental Plan 2012 (pub. 21-12-2012) |
| Land Zoning                  | RU1 - Primary Production: (pub. 24-2-2023)               |
| Height Of Building           | NA                                                       |
| Floor Space Ratio            | NA                                                       |
| Minimum Lot Size             | 100 ha                                                   |
| Heritage                     | NA                                                       |
| Land Reservation Acquisition | NA                                                       |
| Foreshore Building Line      | NA                                                       |

## Detailed planning information

### State Environmental Planning Policies which apply to this property

State Environmental Planning Policies can specify planning controls for certain areas and/or types of development. They can also identify the development assessment system that applies and the type of environmental assessment that is required.

This report provides general information only and does not replace a Section 10.7 Certificate (formerly Section 149)





# Property Report

306 THERRIBRI ROAD BOGGABRI 2382

- State Environmental Planning Policy (Biodiversity and Conservation) 2021: Allowable Clearing Area (pub. 21-10-2022)
- State Environmental Planning Policy (Biodiversity and Conservation) 2021: Land Application (pub. 2-12-2021)
- State Environmental Planning Policy (Exempt and Complying Development Codes) 2008: Land Application (pub. 12-12-2008)
- State Environmental Planning Policy (Housing) 2021: Land Application (pub. 26-11-2021)
- State Environmental Planning Policy (Industry and Employment) 2021: Land Application (pub. 2-12-2021)
- State Environmental Planning Policy (Planning Systems) 2021: Land Application (pub. 2-12-2021)
- State Environmental Planning Policy (Primary Production) 2021: Land Application (pub. 2-12-2021)
- State Environmental Planning Policy (Resilience and Hazards) 2021: Land Application (pub. 2-12-2021)
- State Environmental Planning Policy (Resources and Energy) 2021: Land Application (pub. 2-12-2021)
- State Environmental Planning Policy (Sustainable Buildings) 2022: Land Application (pub. 29-8-2022)
- State Environmental Planning Policy (Transport and Infrastructure) 2021: Land Application (pub. 2-12-2021)
- State Environmental Planning Policy No 65—Design Quality of Residential Apartment Development: Land Application (pub. 26-7-2002)

## Other matters affecting the property

Information held in the Planning Database about other matters affecting the property appears below. The property may also be affected by additional planning controls not outlined in this report. Please speak to your council for more information

|                                      |                                                                                                                                                                                      |
|--------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1.5 m Buffer around Classified Roads | Classified Road Adjacent                                                                                                                                                             |
| Biodiversity Value (BV) Map          | Clearing native vegetation for a development on an area on the BV Map may require a Biodiversity Development Assessment Report. Consult your local council.                          |
| Bushfire Prone Land                  | Vegetation Buffer                                                                                                                                                                    |
| Land near Electrical Infrastructure  | This property may be located near electrical infrastructure and could be subject to requirements listed under ISEPP Clause 45. Please contact Essential Energy for more information. |
| Local Aboriginal Land Council        | RED CHIEF                                                                                                                                                                            |
| Regional Plan Boundary               | New England North West                                                                                                                                                               |

This report provides general information only and does not replace a Section 10.7 Certificate (formerly Section 149)

| SiteID    | SiteName                | Datum                     | Zone                                                                      | Easting | Northing | Context   | Site Status ** | SiteFeatures                                | SiteTypes      | Reports |
|-----------|-------------------------|---------------------------|---------------------------------------------------------------------------|---------|----------|-----------|----------------|---------------------------------------------|----------------|---------|
| 20-4-0017 | Nagero Creek;           | AGD                       | 56                                                                        | 225704  | 6608190  | Open site | Destroyed      | Artefact : -                                | Open Camp Site | 103378  |
|           | <a href="#">Contact</a> | <a href="#">Recorders</a> | Mrs.Angela Besant,Karen Flick                                             |         |          |           |                |                                             |                |         |
| 20-4-0388 | BCS 5                   | GDA                       | 56                                                                        | 226147  | 6608004  | Open site | Destroyed      | Artefact : 1                                |                | 103378  |
|           | <a href="#">Contact</a> | <a href="#">Recorders</a> | Mrs.Angela Besant,Insite Heritage Pty Ltd                                 |         |          |           |                |                                             |                |         |
| 20-4-0389 | BCS 6                   | GDA                       | 56                                                                        | 225719  | 6608229  | Open site | Destroyed      | Artefact : 1                                |                | 103378  |
|           | <a href="#">Contact</a> | <a href="#">Recorders</a> | Mrs.Angela Besant,Insite Heritage Pty Ltd                                 |         |          |           |                |                                             |                |         |
| 20-4-0392 | BCS 3                   | GDA                       | 56                                                                        | 225775  | 6607762  | Open site | Destroyed      | Artefact : 1                                |                | 103378  |
|           | <a href="#">Contact</a> | <a href="#">Recorders</a> | Mrs.Angela Besant,Insite Heritage Pty Ltd                                 |         |          |           |                |                                             |                |         |
| 20-4-0393 | BCS 4                   | GDA                       | 56                                                                        | 226222  | 6607532  | Open site | Destroyed      | Artefact : 1                                |                |         |
|           | <a href="#">Contact</a> | <a href="#">Recorders</a> | Mrs.Angela Besant,Insite Heritage Pty Ltd                                 |         |          |           |                |                                             |                |         |
| 20-4-0092 | NAS 1                   | GDA                       | 56                                                                        | 227537  | 6607675  | Open site | Destroyed      | Artefact : 4                                |                |         |
|           | <a href="#">Contact</a> | <a href="#">Recorders</a> | Mr.John Appleton,RPS Australia East Pty Ltd - Hamilton,Mrs.Tessa Boer-Mah |         |          |           |                |                                             |                |         |
| 20-4-0093 | NIS 01                  | GDA                       | 56                                                                        | 227537  | 6607675  | Open site | Destroyed      | Artefact : 1                                |                |         |
|           | <a href="#">Contact</a> | <a href="#">Recorders</a> | Mr.John Appleton,RPS Australia East Pty Ltd - Hamilton,Mrs.Tessa Boer-Mah |         |          |           |                |                                             |                |         |
| 20-4-0111 | BC-17                   | GDA                       | 56                                                                        | 227644  | 6608315  | Open site | Destroyed      | Artefact : 1                                |                |         |
|           | <a href="#">Contact</a> | <a href="#">Recorders</a> | Mr.Giles (dup ID#12832) Hamm,RPS Australia East Pty Ltd - Hamilton        |         |          |           |                |                                             |                |         |
| 20-4-0113 | BC-19                   | GDA                       | 56                                                                        | 227622  | 6608492  | Open site | Destroyed      | Artefact : 1                                |                |         |
|           | <a href="#">Contact</a> | <a href="#">Recorders</a> | Mr.Giles (dup ID#12832) Hamm,RPS Australia East Pty Ltd - Hamilton        |         |          |           |                |                                             |                |         |
| 20-4-0114 | BC-20                   | GDA                       | 56                                                                        | 227531  | 6608729  | Open site | Valid          | Artefact : 1                                |                |         |
|           | <a href="#">Contact</a> | <a href="#">Recorders</a> | Mr.Giles (dup ID#12832) Hamm                                              |         |          |           |                |                                             |                |         |
| 20-4-0115 | BC-21                   | GDA                       | 56                                                                        | 226251  | 6609073  | Open site | Valid          | Artefact : 1                                |                |         |
|           | <a href="#">Contact</a> | <a href="#">Recorders</a> | Mr.Giles (dup ID#12832) Hamm                                              |         |          |           |                |                                             |                |         |
| 20-4-0116 | BC-22                   | GDA                       | 56                                                                        | 227767  | 6608516  | Open site | Destroyed      | Artefact : 1                                |                | 103378  |
|           | <a href="#">Contact</a> | <a href="#">Recorders</a> | Mr.Giles (dup ID#12832) Hamm,RPS Australia East Pty Ltd - Hamilton        |         |          |           |                |                                             |                |         |
| 20-4-0117 | BC-23                   | GDA                       | 56                                                                        | 226605  | 6608460  | Open site | Not a Site     | Modified Tree<br>(Carved or Scarred) :<br>1 |                |         |
|           | <a href="#">Contact</a> | <a href="#">Recorders</a> | Mrs.Angela Besant,Insite Heritage Pty Ltd,Mr.Giles (dup ID#12832) Hamm    |         |          |           |                |                                             |                |         |
| 20-4-0121 | BC-27                   | GDA                       | 56                                                                        | 226238  | 6609120  | Open site | Valid          | Artefact : 1                                |                |         |
|           | <a href="#">Contact</a> | <a href="#">Recorders</a> | Mr.Giles (dup ID#12832) Hamm                                              |         |          |           |                |                                             |                |         |
| 20-4-0122 | BC-28                   | GDA                       | 56                                                                        | 226159  | 6609147  | Open site | Valid          | Artefact : 1                                |                |         |
|           | <a href="#">Contact</a> | <a href="#">Recorders</a> | Mr.Giles (dup ID#12832) Hamm                                              |         |          |           |                |                                             |                |         |
| 20-4-0123 | BC-29                   | GDA                       | 56                                                                        | 226090  | 6609164  | Open site | Valid          | Artefact : 1                                |                |         |
|           | <a href="#">Contact</a> | <a href="#">Recorders</a> | Mr.Giles (dup ID#12832) Hamm                                              |         |          |           |                |                                             |                |         |
| 20-4-0124 | BC30                    | GDA                       | 56                                                                        | 226018  | 6609174  | Open site | Valid          | Artefact : 1                                |                |         |
|           | <a href="#">Contact</a> | <a href="#">Recorders</a> | Mr.Giles (dup ID#12832) Hamm                                              |         |          |           |                |                                             |                |         |

| SiteID    | SiteName       | Datum  | Zone             | Easting                                        | Northing | Context   | Site Status **      | SiteFeatures                                | SiteTypes | Reports |
|-----------|----------------|--------|------------------|------------------------------------------------|----------|-----------|---------------------|---------------------------------------------|-----------|---------|
| 20-4-0125 | BC31           | GDA    | 56               | 225354                                         | 6609238  | Open site | Partially Destroyed | Artefact : 1                                |           | 103378  |
|           | <u>Contact</u> | Searle | <u>Recorders</u> | Mrs.Angela Besant,Mr.Giles (dup ID#12832) Hamm |          |           |                     | <u>Permits</u>                              |           |         |
| 20-4-0126 | BC32           | GDA    | 56               | 225147                                         | 6609354  | Open site | Valid               | Artefact : 1                                |           | 103378  |
|           | <u>Contact</u> | Searle | <u>Recorders</u> | Mr.Giles (dup ID#12832) Hamm                   |          |           |                     | <u>Permits</u>                              |           |         |
| 20-4-0127 | BC33           | GDA    | 56               | 225058                                         | 6609442  | Open site | Valid               | Artefact : 1                                |           | 103378  |
|           | <u>Contact</u> | Searle | <u>Recorders</u> | Mr.Giles (dup ID#12832) Hamm                   |          |           |                     | <u>Permits</u>                              |           |         |
| 20-4-0130 | BC37           | GDA    | 56               | 226785                                         | 6608396  | Open site | Not a Site          | Modified Tree<br>(Carved or Scarred) :<br>1 |           | 103378  |
|           | <u>Contact</u> | Searle | <u>Recorders</u> | Mr.Giles (dup ID#12832) Hamm,Ms.Taryn Gooley   |          |           |                     | <u>Permits</u>                              |           |         |
| 20-4-0131 | BC38           | GDA    | 56               | 226524                                         | 6608158  | Open site | Valid               | Artefact : 144                              |           |         |
|           | <u>Contact</u> | Searle | <u>Recorders</u> | Mr.Giles (dup ID#12832) Hamm                   |          |           |                     | <u>Permits</u>                              |           |         |
| 20-4-0132 | BC39           | GDA    | 56               | 226422                                         | 6608122  | Open site | Valid               | Artefact : 1                                |           |         |
|           | <u>Contact</u> | Searle | <u>Recorders</u> | Mr.Giles (dup ID#12832) Hamm                   |          |           |                     | <u>Permits</u>                              |           |         |
| 20-4-0133 | BC 40          | GDA    | 56               | 226468                                         | 6608332  | Open site | Valid               | Artefact : 10                               |           |         |
|           | <u>Contact</u> | Searle | <u>Recorders</u> | Mr.Giles (dup ID#12832) Hamm                   |          |           |                     | <u>Permits</u>                              |           |         |
| 20-4-0134 | BC 42          | GDA    | 56               | 226309                                         | 6608430  | Open site | Destroyed           | Artefact : 6                                |           | 103378  |
|           | <u>Contact</u> | Searle | <u>Recorders</u> | Mrs.Angela Besant,Mr.Giles (dup ID#12832) Hamm |          |           |                     | <u>Permits</u>                              |           |         |
| 20-4-0135 | BC 41          | GDA    | 56               | 226333                                         | 6608273  | Open site | Valid               | Artefact : 3                                |           |         |
|           | <u>Contact</u> | Searle | <u>Recorders</u> | Mr.Giles (dup ID#12832) Hamm                   |          |           |                     | <u>Permits</u>                              |           |         |
| 20-4-0136 | BC 43          | GDA    | 56               | 226155                                         | 6608455  | Open site | Destroyed           | Artefact : 15                               |           | 103378  |
|           | <u>Contact</u> | Searle | <u>Recorders</u> | Mrs.Angela Besant,Mr.Giles (dup ID#12832) Hamm |          |           |                     | <u>Permits</u>                              |           |         |
| 20-4-0137 | BC 44          | GDA    | 56               | 226186                                         | 6608185  | Open site | Destroyed           | Artefact : 4                                |           |         |
|           | <u>Contact</u> | Searle | <u>Recorders</u> | Mrs.Angela Besant,Mr.Giles (dup ID#12832) Hamm |          |           |                     | <u>Permits</u>                              |           |         |
| 20-4-0138 | BC 45          | GDA    | 56               | 226282                                         | 6608124  | Open site | Destroyed           | Artefact : 4                                |           |         |
|           | <u>Contact</u> | Searle | <u>Recorders</u> | Mrs.Angela Besant,Mr.Giles (dup ID#12832) Hamm |          |           |                     | <u>Permits</u>                              |           |         |
| 20-4-0139 | BC 46          | GDA    | 56               | 226098                                         | 6608743  | Open site | Partially Destroyed | Artefact : 28                               |           | 103378  |
|           | <u>Contact</u> | Searle | <u>Recorders</u> | Mrs.Angela Besant,Mr.Giles (dup ID#12832) Hamm |          |           |                     | <u>Permits</u>                              |           |         |
| 20-4-0140 | BC 47          | GDA    | 56               | 226157                                         | 6608862  | Open site | Destroyed           | Artefact : 3                                |           | 103378  |
|           | <u>Contact</u> | Searle | <u>Recorders</u> | Mrs.Angela Besant,Mr.Giles (dup ID#12832) Hamm |          |           |                     | <u>Permits</u>                              |           |         |
| 20-4-0141 | BC 48          | GDA    | 56               | 226223                                         | 6608938  | Open site | Valid               | Artefact : 3                                |           |         |
|           | <u>Contact</u> | Searle | <u>Recorders</u> | Mr.Giles (dup ID#12832) Hamm                   |          |           |                     | <u>Permits</u>                              |           |         |
| 20-4-0142 | BC 49          | GDA    | 56               | 226057                                         | 6608625  | Open site | Destroyed           | Artefact : 1                                |           | 103378  |
|           | <u>Contact</u> | Searle | <u>Recorders</u> | Mrs.Angela Besant,Mr.Giles (dup ID#12832) Hamm |          |           |                     | <u>Permits</u>                              |           |         |



| SiteID    | SiteName             | Datum  | Zone | Easting | Northing | Context   | Site Status **         | SiteFeatures                                     | SiteTypes        | Reports       |
|-----------|----------------------|--------|------|---------|----------|-----------|------------------------|--------------------------------------------------|------------------|---------------|
| 20-4-0143 | BC 50                | GDA    | 56   | 225982  | 6608482  | Open site | Not a Site             | Modified Tree<br>(Carved or Scarred) :<br>1      |                  | 103378        |
|           | <u>Contact</u>       | Searle |      |         |          |           |                        |                                                  | <u>Recorders</u> |               |
| 20-4-0144 | BC 51                | GDA    | 56   | 226179  | 6608523  | Open site | Valid                  | Modified Tree<br>(Carved or Scarred) :<br>1      |                  |               |
|           | <u>Contact</u>       | Searle |      |         |          |           |                        |                                                  | <u>Recorders</u> |               |
| 20-4-0145 | BC 52                | GDA    | 56   | 226306  | 6608432  | Open site | Destroyed              | Modified Tree<br>(Carved or Scarred) :<br>1      |                  | 103378        |
|           | <u>Contact</u>       | Searle |      |         |          |           |                        |                                                  | <u>Recorders</u> |               |
| 20-4-0146 | BC 53                | GDA    | 56   | 225786  | 6608877  | Open site | Valid                  | Artefact : 1                                     |                  |               |
|           | <u>Contact</u>       | Searle |      |         |          |           |                        |                                                  | <u>Recorders</u> |               |
| 20-4-0148 | BCHR1                | GDA    | 56   | 225485  | 6608430  | Open site | Valid                  | Artefact : 1                                     |                  |               |
|           | <u>Contact</u>       | Searle |      |         |          |           |                        |                                                  | <u>Recorders</u> |               |
| 20-4-0149 | BCHR2                | GDA    | 56   | 225368  | 6608222  | Open site | Valid                  | Artefact : 1                                     |                  |               |
|           | <u>Contact</u>       | Searle |      |         |          |           |                        |                                                  | <u>Recorders</u> |               |
| 20-4-0150 | BCHR3                | GDA    | 56   | 224793  | 6608318  | Open site | Valid                  | Artefact : 1                                     |                  |               |
|           | <u>Contact</u>       | Searle |      |         |          |           |                        |                                                  | <u>Recorders</u> |               |
| 20-4-0151 | BCHR4                | GDA    | 56   | 224630  | 6608316  | Open site | Valid                  | Artefact : 1                                     |                  |               |
|           | <u>Contact</u>       | Searle |      |         |          |           |                        |                                                  | <u>Recorders</u> |               |
| 20-4-0152 | BCHR5                | GDA    | 56   | 224530  | 6608290  | Open site | Valid                  | Artefact : 1                                     |                  |               |
|           | <u>Contact</u>       | Searle |      |         |          |           |                        |                                                  | <u>Recorders</u> |               |
| 20-4-0155 | BCHR6                | AGD    | 56   | 223161  | 6607947  | Open site | Valid                  | Artefact : 1                                     |                  |               |
|           | <u>Contact</u>       | Searle |      |         |          |           |                        |                                                  | <u>Recorders</u> |               |
| 20-4-0161 | NST 1                | AGD    | 56   | 227448  | 6606507  | Open site | Valid                  | Modified Tree<br>(Carved or Scarred) :<br>1      |                  |               |
|           | <u>Contact</u>       |        |      |         |          |           |                        |                                                  | <u>Recorders</u> |               |
| 20-4-0196 | Boggabri Coal Pad 1  | AGD    | 56   | 225915  | 6607271  | Open site | Not a Site             | Potential<br>Archaeological<br>Deposit (PAD) : 1 |                  |               |
|           | <u>Contact</u>       |        |      |         |          |           |                        |                                                  | <u>Recorders</u> |               |
| 20-4-0224 | LF NV 24, 51-61 & 63 | GDA    | 56   | 224946  | 6608068  | Open site | Partially<br>Destroyed | Artefact : 145                                   |                  | 101940,103378 |
|           | <u>Contact</u>       |        |      |         |          |           |                        |                                                  | <u>Recorders</u> |               |
| 20-4-0228 | LFNV 49, 50 & 62     | GDA    | 56   | 224896  | 6609111  | Open site | Valid                  | Artefact : 26                                    |                  | 101940,103378 |
|           | <u>Contact</u>       |        |      |         |          |           |                        |                                                  | <u>Recorders</u> |               |

| SiteID    | SiteName                                                             | Datum            | Zone                                                                             | Easting | Northing | Context     | Site Status **         | SiteFeatures                                                                                          | SiteTypes | Reports       |
|-----------|----------------------------------------------------------------------|------------------|----------------------------------------------------------------------------------|---------|----------|-------------|------------------------|-------------------------------------------------------------------------------------------------------|-----------|---------------|
| 20-4-0229 | LFNV 77, 78                                                          | GDA              | 56                                                                               | 223825  | 6608155  | Open site   | Destroyed              | Artefact : 10                                                                                         |           | 101940,103378 |
|           | <u>Contact</u>                                                       | <u>Recorders</u> | Mrs.Angela Besant,Mrs.Angela Besant                                              |         |          |             |                        | <u>Permits</u>                                                                                        |           |               |
| 20-4-0198 | Restriction applied. Please contact<br>ahims@environment.nsw.gov.au. |                  |                                                                                  |         |          | Open site   | Valid                  |                                                                                                       |           | 101906,103378 |
|           | <u>Contact</u>                                                       | <u>Recorders</u> | Mrs.Angela Besant                                                                |         |          |             |                        | <u>Permits</u>                                                                                        |           |               |
| 20-4-0199 | BCD 2                                                                | GDA              | 56                                                                               | 225900  | 6606697  | Open site   | Valid                  | Artefact : 2                                                                                          |           | 101906,103378 |
|           | <u>Contact</u>                                                       | <u>Recorders</u> | Mrs.Angela Besant                                                                |         |          |             |                        | <u>Permits</u>                                                                                        |           |               |
| 20-4-0200 | BCD 3                                                                | GDA              | 56                                                                               | 226322  | 6606222  | Open site   | Valid                  | Artefact : 1                                                                                          |           | 101906,103378 |
|           | <u>Contact</u>                                                       | <u>Recorders</u> | Mrs.Angela Besant                                                                |         |          |             |                        | <u>Permits</u>                                                                                        |           |               |
| 20-4-0347 | TCEP-ST-010                                                          | GDA              | 56                                                                               | 227984  | 6608219  | Open site   | Partially<br>Destroyed | Modified Tree<br>(Carved or Scarred) :<br>1                                                           |           | 103378        |
|           | <u>Contact</u>                                                       | <u>Recorders</u> | Kayandel Archaeological Services,RPS Australia East Pty Ltd - Hamilton,Mr.Warwic |         |          |             |                        | <u>Permits</u>                                                                                        |           |               |
| 20-4-0507 | Isolated Find Flake                                                  | GDA              | 56                                                                               | 226201  | 6609171  | Closed site | Valid                  | Artefact : -                                                                                          |           | 103378        |
|           | <u>Contact</u>                                                       | <u>Recorders</u> | Ms.Jane Delaney-John                                                             |         |          |             |                        | <u>Permits</u>                                                                                        |           |               |
| 20-4-0505 | Leard Stare Forest Grinding Stone Portable                           | GDA              | 56                                                                               | 226239  | 6609162  | Closed site | Valid                  | Aboriginal Resource<br>and Gathering : -,<br>Aboriginal Ceremony<br>and Dreaming : -,<br>Artefact : - |           | 103378        |
|           | <u>Contact</u>                                                       | <u>Recorders</u> | Ms.Jane Delaney-John                                                             |         |          |             |                        | <u>Permits</u>                                                                                        |           |               |
| 20-4-0474 | NV79                                                                 | GDA              | 56                                                                               | 224486  | 6608228  | Open site   | Valid                  | Artefact : 1                                                                                          |           | 103378        |
|           | <u>Contact</u>                                                       | <u>Recorders</u> | Mrs.Angela Besant,Insite Heritage Pty Ltd                                        |         |          |             |                        | <u>Permits</u>                                                                                        |           |               |
| 20-4-0510 | Leard Forest                                                         | GDA              | 56                                                                               | 226169  | 6609233  | Closed site | Valid                  | Artefact : -                                                                                          |           | 103378        |
|           | <u>Contact</u>                                                       | <u>Recorders</u> | Ms.Jane Delaney-John                                                             |         |          |             |                        | <u>Permits</u>                                                                                        |           |               |
| 20-4-0511 | Leard Forest Old Camp 3                                              | GDA              | 56                                                                               | 226178  | 6609239  | Closed site | Valid                  | Artefact : -                                                                                          |           | 103378        |
|           | <u>Contact</u>                                                       | <u>Recorders</u> | Ms.Jane Delaney-John                                                             |         |          |             |                        | <u>Permits</u>                                                                                        |           |               |
| 20-4-0512 | Leard Forest - Old Camp                                              | GDA              | 56                                                                               | 226200  | 6609177  | Closed site | Valid                  | Artefact : -                                                                                          |           | 103378        |
|           | <u>Contact</u>                                                       | <u>Recorders</u> | Ms.Jane Delaney-John                                                             |         |          |             |                        | <u>Permits</u>                                                                                        |           |               |
| 20-4-0565 | NV 84                                                                | GDA              | 56                                                                               | 226346  | 6608647  | Open site   | Valid                  | Artefact : -                                                                                          |           |               |
|           | <u>Contact</u>                                                       | <u>Recorders</u> | Mrs.Angela Besant                                                                |         |          |             |                        | <u>Permits</u>                                                                                        |           |               |
| 20-4-0566 | NV 85                                                                | GDA              | 56                                                                               | 226368  | 6608585  | Open site   | Valid                  | Artefact : -                                                                                          |           |               |
|           | <u>Contact</u>                                                       | <u>Recorders</u> | Mrs.Angela Besant                                                                |         |          |             |                        | <u>Permits</u>                                                                                        |           |               |
| 20-4-0570 | TC5/15                                                               | GDA              | 56                                                                               | 226251  | 6608783  | Open site   | Destroyed              | Artefact : -                                                                                          |           |               |
|           | <u>Contact</u>                                                       | <u>Recorders</u> | Ms.Taryn Gooley                                                                  |         |          |             |                        | <u>Permits</u>                                                                                        |           |               |
| 20-4-0571 | TC6/15                                                               | GDA              | 56                                                                               | 226722  | 6608998  | Open site   | Destroyed              | Artefact : -                                                                                          |           |               |

| SiteID    | SiteName                | Datum                     | Zone                                               | Easting | Northing | Context   | Site Status ** | SiteFeatures                                | SiteTypes | Reports |
|-----------|-------------------------|---------------------------|----------------------------------------------------|---------|----------|-----------|----------------|---------------------------------------------|-----------|---------|
|           | <a href="#">Contact</a> | <a href="#">Recorders</a> | Ms.Taryn Gooley                                    |         |          |           |                | <a href="#">Permits</a>                     |           |         |
| 20-4-0574 | TC9/15                  | GDA                       | 56                                                 | 226360  | 6608543  | Open site | Destroyed      | Artefact : -                                |           |         |
|           | <a href="#">Contact</a> | <a href="#">Recorders</a> | Ms.Taryn Gooley                                    |         |          |           |                | <a href="#">Permits</a>                     |           |         |
| 20-4-0526 | LFNV80                  | GDA                       | 56                                                 | 226282  | 6608635  | Open site | Valid          | Artefact : -                                |           | 103378  |
|           | <a href="#">Contact</a> | <a href="#">Recorders</a> | Mrs.Angela Besant                                  |         |          |           |                | <a href="#">Permits</a>                     |           |         |
| 20-4-0583 | BC30 (ST)               | GDA                       | 56                                                 | 226425  | 6608589  | Open site | Valid          | Modified Tree<br>(Carved or Scarred) :<br>- |           |         |
|           | <a href="#">Contact</a> | <a href="#">Recorders</a> | Mrs.Angela Besant                                  |         |          |           |                | <a href="#">Permits</a>                     |           |         |
| 20-4-0584 | TC2/14                  | GDA                       | 56                                                 | 226722  | 6608998  | Open site | Destroyed      | Artefact : -                                |           |         |
|           | <a href="#">Contact</a> | <a href="#">Recorders</a> | Mrs.Angela Besant,Ms.Taryn Gooley                  |         |          |           |                | <a href="#">Permits</a>                     |           |         |
| 20-4-0604 | VEP IA16                | GDA                       | 56                                                 | 225058  | 6606658  | Open site | Valid          | Artefact : -                                |           |         |
|           | <a href="#">Contact</a> | <a href="#">Recorders</a> | University of Queensland,Mr.Reiner Mantei          |         |          |           |                | <a href="#">Permits</a>                     |           |         |
| 20-4-0671 | VEP AS 13               | GDA                       | 56                                                 | 222194  | 6607364  | Open site | Valid          | Artefact : -                                |           |         |
|           | <a href="#">Contact</a> | <a href="#">Recorders</a> | University of Queensland,Ms.Jodie Crossman         |         |          |           |                | <a href="#">Permits</a>                     |           |         |
| 20-4-0663 | VEP IA17                | GDA                       | 56                                                 | 224758  | 6606874  | Open site | Valid          | Artefact : -                                |           |         |
|           | <a href="#">Contact</a> | <a href="#">Recorders</a> | University of Queensland,Mr.Reiner Mantei          |         |          |           |                | <a href="#">Permits</a>                     |           |         |
| 20-4-0740 | BC 20/17                | GDA                       | 56                                                 | 224570  | 6608561  | Open site | Valid          | Artefact : -                                |           |         |
|           | <a href="#">Contact</a> | <a href="#">Recorders</a> | Mrs.Angela Besant,Insite Heritage Pty Ltd          |         |          |           |                | <a href="#">Permits</a>                     |           |         |
| 20-4-0873 | Tarrawonga GG1          | GDA                       | 56                                                 | 227811  | 6607058  | Open site | Valid          | Grinding Groove : -                         |           |         |
|           | <a href="#">Contact</a> | <a href="#">Recorders</a> | Doctor.Matthew Whincop,Whincop Archaeology Pty Ltd |         |          |           |                | <a href="#">Permits</a>                     |           |         |
| 20-4-0925 | TPW A5S1                | GDA                       | 56                                                 | 222158  | 6607812  | Open site | Valid          | Artefact : -                                |           |         |
|           | <a href="#">Contact</a> | <a href="#">Recorders</a> | Mrs.Angela Besant,Insite Heritage Pty Ltd          |         |          |           |                | <a href="#">Permits</a>                     |           |         |
| 20-4-0926 | TPW A5 S3               | GDA                       | 56                                                 | 222197  | 6607169  | Open site | Valid          | Artefact : -                                |           |         |
|           | <a href="#">Contact</a> | <a href="#">Recorders</a> | Mrs.Angela Besant,Insite Heritage Pty Ltd          |         |          |           |                | <a href="#">Permits</a>                     |           |         |
| 20-4-0979 | Mod8_2/20               | GDA                       | 56                                                 | 226270  | 6609238  | Open site | Valid          | Hearth : -                                  |           |         |
|           | <a href="#">Contact</a> | <a href="#">Recorders</a> | Mrs.Angela Besant,Insite Heritage Pty Ltd          |         |          |           |                | <a href="#">Permits</a>                     |           |         |
| 20-4-0980 | Mod8_3/20 Cloned        | GDA                       | 56                                                 | 226691  | 6608744  | Open site | Valid          | Artefact : -                                |           |         |
|           | <a href="#">Contact</a> | <a href="#">Recorders</a> | Mrs.Angela Besant,Insite Heritage Pty Ltd          |         |          |           |                | <a href="#">Permits</a>                     |           |         |
| 20-4-0981 | Mod8_4/20               | GDA                       | 56                                                 | 226521  | 6608441  | Open site | Valid          | Modified Tree<br>(Carved or Scarred) :<br>- |           |         |
|           | <a href="#">Contact</a> | <a href="#">Recorders</a> | Mrs.Angela Besant,Insite Heritage Pty Ltd          |         |          |           |                | <a href="#">Permits</a>                     |           |         |
| 20-4-0982 | Mod8_5/20               | GDA                       | 56                                                 | 226349  | 6608568  | Open site | Valid          | Artefact : -                                |           |         |
|           | <a href="#">Contact</a> | <a href="#">Recorders</a> | Mrs.Angela Besant,Insite Heritage Pty Ltd          |         |          |           |                | <a href="#">Permits</a>                     |           |         |





# AHIMS Web Services (AWS)

## Extensive search - Site list report

Your Ref/PO Number : AU213008068.002

Client Service ID : 747640

| <u>SiteID</u> | <u>SiteName</u> | <u>Datum</u> | <u>Zone</u> | <u>Easting</u> | <u>Northing</u> | <u>Context</u> | <u>Site Status **</u> | <u>SiteFeatures</u> | <u>SiteTypes</u> | <u>Reports</u> |
|---------------|-----------------|--------------|-------------|----------------|-----------------|----------------|-----------------------|---------------------|------------------|----------------|
|---------------|-----------------|--------------|-------------|----------------|-----------------|----------------|-----------------------|---------------------|------------------|----------------|

### **\*\* Site Status**

**Valid** - The site has been recorded and accepted onto the system as valid

**Destroyed** - The site has been completely impacted or harmed usually as consequence of permit activity but sometimes also after natural events. There is nothing left of the site on the ground but proponents should proceed with caution.

**Partially Destroyed** - The site has been only partially impacted or harmed usually as consequence of permit activity but sometimes also after natural events. There might be parts or sections of the original site still present on the ground

**Not a site** - The site has been originally entered and accepted onto AHIMS as a valid site but after further investigations it was decided it is NOT an aboriginal site. Impact of this type of site does not require permit but Heritage NSW should be notified

Report generated by AHIMS Web Service on 24/01/2023 for Sarah Van Der Linde for the following area at Lat, Long From : -30.6495, 150.1009 - Lat, Long To : -30.6125, 150.1627. Number of Aboriginal sites and Aboriginal objects found is 77

This information is not guaranteed to be free from error omission. Heritage NSW and its employees disclaim liability for any act done or omission made on the information and consequences of such acts or omission.



Report

# State Environmental Planning Policy (Resilience and Hazards) – Screening Assessment

Merriown Solar Farm

Prepared for:

RPS Group

Prepared by:

Advitech Pty Limited

Job: AV-J-231034, Folder: F22867

Revision: 1 (Final) 23 October 2023

# Document Details

## State Environmental Planning Policy (Resilience and Hazards) – Screening Assessment

Filename: 22867 RPS Merriown Solar Farm SEPP H&OD Rev1.docx  
23 October 2023, Job: AV-J-231034, Folder: F22867, Revision: 1 (Final)

### Client

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Email: tait.worthington@advitech.com.au, Phone: 02 4924 5400

### History

| Date       | Revision | Comments                                    |
|------------|----------|---------------------------------------------|
| 19-09-2023 | 0        | Final Issue                                 |
| 23-10-2023 | 1        | Final Issue Incorporating Client Commentary |

### Endorsements

|                                              |                                                                                     |                                                                                                                           |            |
|----------------------------------------------|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------|------------|
| Prepared By:                                 |  | <b>Tait Worthington</b><br>Process Engineer<br>BE(Chem), GradIEAust                                                       | 23-10-2023 |
| Checked and<br>Authorised for<br>Release By: |  | <b>Dr Carl Fung</b><br>Lead Consultant – Process Engineering<br>PhD, BE(Env), MIEAust, CPEng, NER, RPEQ,<br>CAQP (Casanz) | 23-10-2023 |

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## Appendices

A: Project Location and Indicative Arrangements



# 1. Introduction

Advitech Pty Limited (Advitech) was engaged by RPS Group (RPS), on behalf of Idemitsu Renewable Developments Australian Pty Ltd (IRDA), to prepare a *State Environmental Planning Policy (Resilience and Hazards) – Chapter 3: Hazardous and Offensive Development* (SEPP H&OD) screening report for the Idemitsu Merriown Solar Farm, a photovoltaic (PV) solar generation facility with a DC coupled battery energy storage system (BESS), located in Boggabri NSW. The site is located at 333 Leards Forest Road, Boggabri NSW 2382, designated as Lot 21 DP 754940.

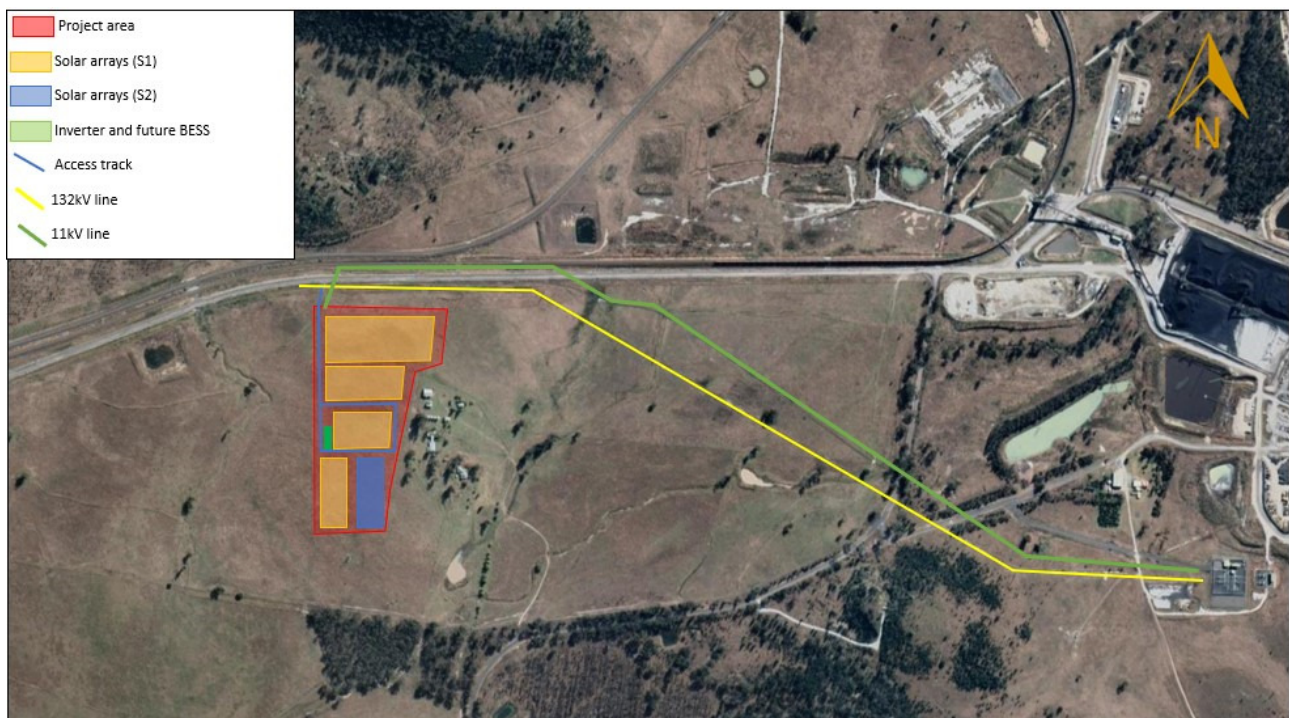
This report provides a review of the current hazardous chemicals information, together with the latest design layouts against current SEPP H&OD requirements and other applicable legislation, regulations, and guidelines.

It should be noted that this report was prepared by Advitech Pty Limited for RPS Group ('the customer') in accordance with the scope of work and specific requirements agreed between Advitech and the customer. This report was prepared with background information, terms of reference and assumptions agreed with the customer. The report is not intended for use by any other individual or organisation and as such, Advitech will not accept liability for use of the information contained in this report, other than that which was intended at the time of writing.

## 2. Background and Objectives

Idemitsu Renewable Developments Australia (IRDA) is the renewable energy development arm in Australia for the Japanese energy company Idemitsu Kosan. IRDA operates alongside its Australian mining operations arm (Idemitsu Australia). RPS has been engaged by IRDA to undertake design and development approval works for the proposed construction and installation of the 'Idemitsu Merriown Solar Farm' project. With IRDA progressing its renewable development operations, including a range of differing technologies such as solar, wind, pumped hydro, biomass, energy storage and green hydrogen, the Idemitsu Merriown Solar Farm continues Idemitsu's push for energy sustainability and self-sufficiency in its mining operations.

The Idemitsu Merriown Solar Farm project is located in Boggabri, NSW. The site is located adjacent to Idemitsu's Boggabri Coal Mine and is close to Tarrawonga and Maules Creek mines. **Figure 1** presents the location of the site in relation to Boggabri Coal Mine, and the closest neighbouring residential receptors.



**Figure 1: Site Location and Network Connections**

As presented in **Figure 1**, the following legend can be applied:

- Red – proposed project area;
- Orange and blue – PV arrays;
- Green (box) – inverter and future BESS installation area;
- Blue (line) – access track;
- Yellow – 132 kV line from substation; and
- Green (line) – 11 kV connection to the substation.

The aim of the project is to provide enough energy for all mining operations at Boggabri Coal Mine for the mine to be self-sufficient and run entirely off renewables during daytime operations. Additionally, the project may be capable of providing to the broader energy grid during periods of operational outage. The project will be constructed in two stages. Stage 1 will consist of the establishment of the five main array rows (approximate 11,900 PV modules), and the prospective Stage 2 would include an additional approximate 1,900 PV modules along with installation of a battery energy storage system (BESS).

The site is located within Narrabri Shire Local Government Area, within an area classified as RU1 – Primary Production (per the Narrabri Local Environmental Plan 2012 (DPE 2012)). The subject site lies approximately 17 km to the east of Baan Baa and 12 km to the northeast of Boggabri. A number of residential receptors lie within a 5 km radius from the proposed site, with the closest approximately 80 m to the east (Note: the closest property is currently unoccupied and owned by the Boggabri Coal Mine).

The Idemitsu Merriown Solar Farm project includes the following:

- Approximately 11,900 solar modules (Stage 1), with potential addition of approximately 1,900 solar modules (Stage 2). PV panels will be installed in rows running north to south;
- One central inverter station, tuned to operate to have a maximum output of 4.95 MW;
- A 11 kV / 50 Hz outdoor connection point kiosk, with the central inverter feeding into it;
- Potential future connection of a BESS solution;



- Security fence around the site's perimeter with an access gate installed at the location of the access track;
- Proposed stockpile and laydown area to the north of the development footprint, which will be later shifted to the proposed hardstand area; and
- Landscaping (outer side of security fence).

RPS Group, on behalf of IRDA, have required that a preliminary screening assessment be undertaken for the development, in accordance with SEPP H&OD, to determine if the required distances to protected places are met which ensure that the proposal does not cause undue risk or offence to the health and safety of people and the property within the surrounding area.

### 3. References

The analyses in this report were based on the following Australian Standards, codes and/or design references:

1. NSW Government Department of Planning and Environment (DPE) – *State Environmental Planning Policy (Resilience and Hazards)* December 2021.
2. NSW Government Department of Planning and Environment (DPE) – *Applying SEPP 33: Hazardous and Offensive Development* January 2011.
3. NSW Government Department of Planning and Environment (DPE) – Land Zoning Map – Sheet LZN\_004 (Narrabri Local Environmental Plan 2012) December 2012.
4. NSW Government – *Protection of the Environment Operations Act 1997 No 156* (POEO Act) February 2023.
5. NSW Government – *Work Health and Safety Regulation 2017* March 2023.
6. National Transport Commission – *Australian Code for the Transport of Dangerous Goods by Road and Rail* (ADG Code) Edition 7.8 April 2023.
7. Safe Work Australia – *Classifying Hazardous Chemicals National Guide* July 2020.
8. United Nations – *Globally Harmonized System of Classification and Labelling of Chemicals* (GHS) Seventh Revised Edition 2017
9. AS 1940:2017 – *The storage and handling of flammable and combustible liquids.*
10. AS 3780:2023 – *The storage and handling of corrosive substances.*
11. AS/NZS 4681:2000 – *The storage and handling of Class 9 (Miscellaneous) dangerous goods and articles.*
12. Q. Wang, P. Huang, P. Ping, Y. Du, K. Li and J. Sun – *Combustion behaviour of lithium iron phosphate battery induced external heat radiation* (Journal of Loss Prevention in the Process Industries, (2016), 1-9).
13. A.F Blum and R.T Long Jr – *Hazard Assessment of Lithium Ion Battery Energy Storage Systems* (NFPA Fire Protection Research Foundation, February 2016).
14. Hynynen J., Willstrand O., Blomqvist P., Andersson P. – *Analysis of combustion gases from large-scale electric vehicle fire tests* (Fire Safety Journal 139, 2023)

Note: Reference has been made to *Applying SEPP 33*, as of at the time of writing, no updated procedure has been put in place for *State Environmental Planning Policy (Resilience and Hazards) – Chapter 3: Hazardous and Offensive Developments*.



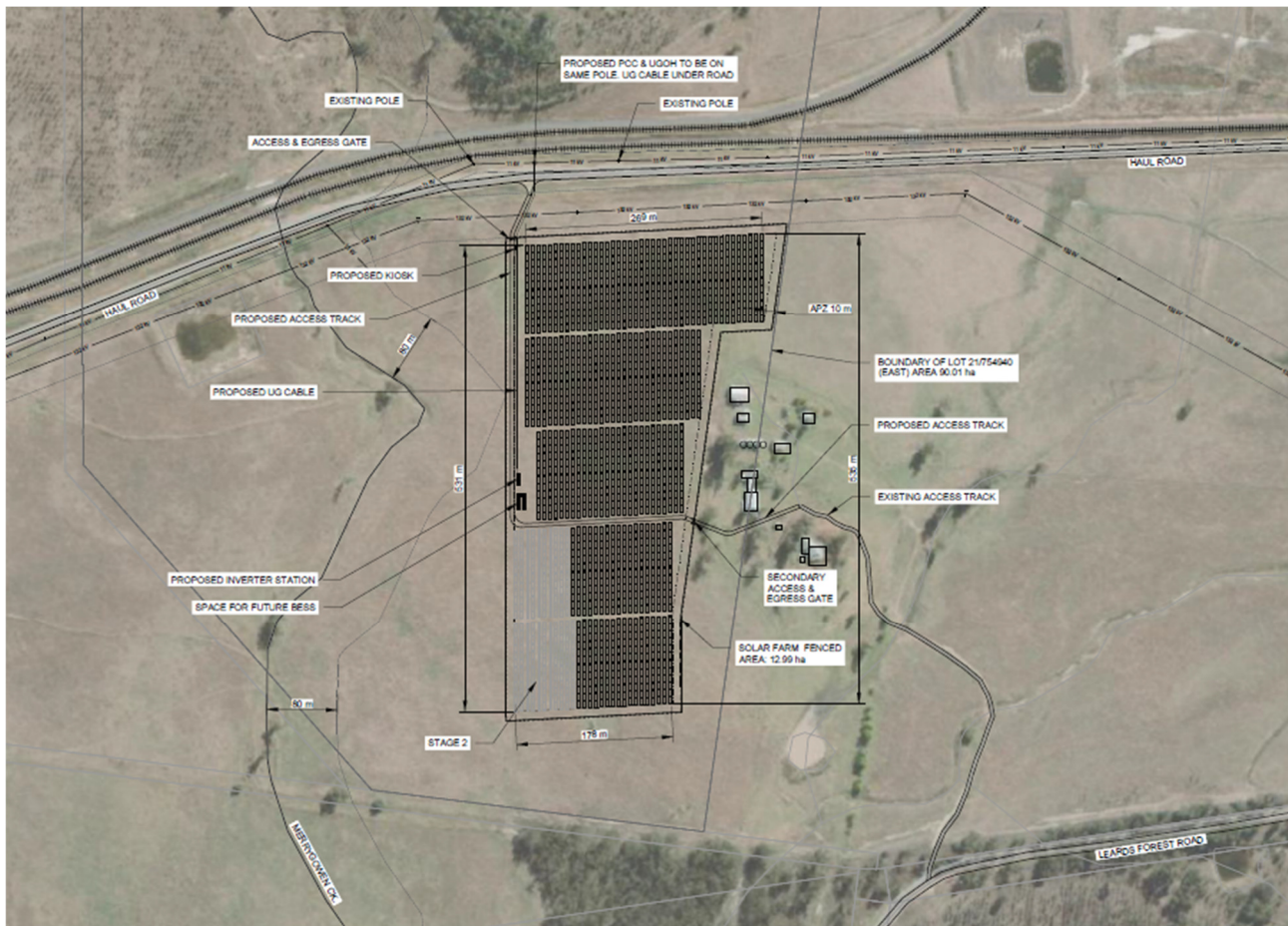
## 4. Site Analysis

### 4.1 Location

The proposed development is located rurally within the Narrabri Plains Shire Council area, approximately 12 km northeast of Boggabri. To the east of the proposed solar farm lies Boggabri Coal mine, with Leards State Forest to the north. The closest neighbouring receptor lies approximately 80 m from the facility boundary. This property is understood to be currently unoccupied and under the ownership of the Boggabri Coal Mine. Another receptor lies to the south, approximately 1.25 km away. Advitech understands that this receptor is a former Idemitsu employee.

Included in the development is the construction, installation of Solar PV panels and BESS units (alongside other associated site infrastructure), and connection to both the Boggabri Coal Mine network (Stage 1). Post completion of Stage 1, there is potential to connect to Essential Energies' network as part of Stage 2 (point of connection is about 10 km to the southwest from the site).

The 30 % Design is presented in **Figure 2**, which includes the approximate locations of individual PV panels, invertors, access tracks (both existing and proposed), as well as space for the proposed BESS installation. The drawing has also been included in **Appendix A**.



**Figure 2: Site Arrangement (as adapted from drawing no. 23043-G-2100)**



## 4.2 Assumptions

The following assumptions were used as the assessment basis:

- The location and indicative arrangement of the Solar PV panels, BESS units, inverters and other site associated infrastructure as provided by RPS is presented in **Figure 2** and **Appendix A**.
- Space has been allowed for the future installation of BESS units. The SEPP H&OD has been undertaken on the proposed location.
- Assessment of the BESS units have been undertaken on a generalised basis for two (2) potential battery technologies to be used on site. They are; Lithium Ion (Li-Ion) and Redox Flow batteries. Typical configurations of the two battery types have been reviewed and applied to the SEPP H&OD screening.
- Li-Ion batteries and battery storage units are generally classified as Dangerous Goods (DG) Class 9, and as such are exempt from risk screening under the Australian Dangerous Goods Code (ADG Code). They are also not included under Schedule 11 Hazardous Chemicals in the NSW Work Health and Safety Regulation (2017). Thus, traditional SEPP H&OD screening may not apply, and an adjusted methodology has been adapted and utilised in this study.
- Only materials deemed 'Dangerous Goods' (DGs) under the ADG Code have been listed under **Table 1** (presented in **Section 4.4.1**). Of note, these items are generally limited to the BESS units.

## 4.3 Assessment Bases

As well as items under **Section 4.2**, the following assessment bases are also employed:

- Applying SEPP H&OD also requires consideration of risks associated with a development, additional to that of the prescribed screening thresholds. A number of public incidents have occurred in Li-Ion BESS facilities in recent years, resulting in off-site impacts. As such, a brief hazard identification and proxy screening has been undertaken to determine if the development can be considered as 'potentially hazardous' or 'potentially offensive'.
- Advitech understands IRDA are considering two different types of battery technology for the energy storage at their Idemitsu Merriown Solar Farm. They are a Li-Ion type and a Redox Flow Type. Due to the significant differences (and hazards) associated with the two battery types, the SEPP H&OD screening assessment has reviewed each battery technology.
- Li-ion type BESS units contain components that can be deemed as 'Hazardous Chemicals' or 'Dangerous Goods', included the electrolyte, solvent and cosolvent. For a complete screening assessment, these components have been assessed under **Table 3**.

## 4.4 Proposed Development

### 4.4.1 Storage

RPS Group, on behalf of IRDA, have provided relevant safety data sheets (SDSs) for the two proposed BESS types. As the assessment has been undertaken on a 'generalised' basis, these SDSs were reviewed and combined with Advitech's working knowledge to form a typical configuration. The final design of the site is yet to be resolved; thus, the SEPP H&OD screening has been undertaken for the typical configuration of a Li-Ion battery and for a redox flow type. Advitech understands only one battery technology will be used on site.

**Table 1** presents the relevant DGs to be stored onsite (including the BESS units and respectively chemical stores), as per methodology prescribed within *Applying SEPP 33*.



**Table 1: Materials Classified as DGs to be Stored Onsite**

| Material <sup>1</sup>    | DG Class and Packing Group (PG) <sup>2</sup> | Max. Quantity to be Stored         | Threshold Quantities from <i>Applying SEPP 33</i> <sup>3</sup> | SEPP H&OD Triggered |
|--------------------------|----------------------------------------------|------------------------------------|----------------------------------------------------------------|---------------------|
| Electrolyte (Redox Flow) | 8 PG II                                      | 2,555.4 t electrolyte (~ 8 units)  | 25 t                                                           | Yes                 |
| Cells (Li-Ion)           | 9                                            | 86.1 t cells (~ 2 BESS containers) | -                                                              | No <sup>4</sup>     |

Notes:

<sup>1</sup>: Materials have been separated by battery technology (i.e., either if they are to be stored should the site utilise Li-Ion or Redox Flow).

<sup>2</sup>: Packing group (PG) has been assumed as the most hazardous PG for DGs to be stored within the same general area, as per guidance from *Applying SEPP 33*.

<sup>3</sup>: Reference has been made to *Applying SEPP 33*, as of at the time of writing, no updated procedure has been put in place for SEPP H&OD.

<sup>4</sup>: DG Class 9 is excluded from risk screening; further explanation can be found in Appendix 6 *Applying SEPP 33* (January 2011). As Class 9 materials are exempt, SEPP H&OD cannot be triggered.

As presented in **Table 1** above, the storage of Li-Ion cells does not have a corresponding screening threshold within *Applying SEPP 33*, as Li-Ion cells are classified as DG Class 9. Based on storage quantity alone, there is no number of Li-Ion cells that would trigger the screening thresholds of SEPP H&OD. Storage of the Redox Flow electrolyte on the other hand, significantly exceeds the screening thresholds.

*Applying SEPP 33* also requires consideration of risks associated with a development, in addition to the screening thresholds. There have been a number of public incidents associated with BESS facilities in recent years resulting in off-site impacts. A brief hazard identification and proxy screening assessment has been undertaken and is presented in the following sections to determine whether the development can be considered 'potentially hazardous' or 'potentially offensive'.

#### 4.4.2 Hazard Identification

For risk screening purposes, risks have been derived from relevant SDSs of the two proposed battery types and assessed alongside potential hazard scenarios. **Table 2** outlines some of the potential hazard scenarios or events that may arise from Li-Ion or Redox Flow battery products.

Should a Preliminary Hazard Analysis (PHA) be found to be required, a more detailed hazard identification will be undertaken and shall consider other materials, equipment, operations, and interactions that may occur at the proposed development.

**Table 2: Key Hazards associated with Li-Ion and Redox Flow Batteries**

| Battery Type | Hazardous Event                                  | Causes                                                                                                                                                   | Potential Consequences                                                                                                                                                                                                                                                                                                                                  |
|--------------|--------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Li-Ion       | Fire / explosion                                 | Individual cell or battery unit overheating due to external heat source or improper use / abuse (e.g., short circuit, external pressure, or deformation) | <ul style="list-style-type: none"> <li>Cell may spout vapourised or decomposed and combustible electrolyte fumes.</li> <li>Battery units may explode or cause burns.</li> <li>Hazardous decomposition products include hydrogen fluoride (HF), carbon monoxide (CO), carbon dioxide (CO<sub>2</sub>), lithium oxide fumes (Li<sub>2</sub>O).</li> </ul> |
|              | Toxic exposure                                   | Individual cell or battery unit overheating due to external heat source or improper use / abuse (e.g., short circuit, external pressure, or deformation) | <ul style="list-style-type: none"> <li>As above, it is likely that hazardous decomposition products may be produced (in event of a fire).</li> <li>Personal exposure may result in severe eye damage, or respiratory tract.</li> <li>Environmental release, resulting in air pollution event</li> </ul>                                                 |
| Redox Flow   | Electrolyte leakage / toxic exposure / corrosive | Cell overheating due to external heat sources or improper use / abuse (e.g., short circuit, external pressure, or deformation)                           | <ul style="list-style-type: none"> <li>Personal exposure may result in severe skin burns and eye damage, or respiratory and/or damage to gastro / respiratory tract if ingested.</li> <li>Environmental release resulting in land and water pollution event.</li> </ul>                                                                                 |

Some of the potential hazards associated with BESS units are consistent with flammable, toxic and/or corrosive materials, not just with DG Class 9 materials. It is Advitech's opinion that the substances with the batteries contribute to the hazards present. Therefore, Advitech has completed a brief review of the quantities of battery components which would be considered a 'Hazardous Chemical' (HC) or a 'Dangerous Good' (DG) if they were to be stored outside the battery units. This review has only been undertaken on the Li-ion units, as the Redox Flow units are classified as DG Class 8.

The review encapsulates quantities of materials which would be considered potentially hazardous or materials that meet SafeWork Australia (SWA) manifest threshold quantities. Importantly, battery components are either chemically or physically bound and/or contained within the battery cell and may not present the same hazards as that of a separate store of the same substances.

**Table 3: HC and DG Classification of Li-ion BESS unit component materials**

| Substance <sup>1,2</sup>                                                     | UN No. | DG Class and PG | GHS Classification           | Max Quantity to be Stored                   | Schedule 11 (Manifest) Threshold Quantities | Screening Method from <i>Applying SEPP 33</i> | Threshold Quantities from <i>Applying SEPP 33</i> <sup>3,4</sup> |
|------------------------------------------------------------------------------|--------|-----------------|------------------------------|---------------------------------------------|---------------------------------------------|-----------------------------------------------|------------------------------------------------------------------|
| Electrolyte<br>7.5 % (wt/wt) cell <sup>5</sup>                               | 1161   | 3 PG II         | H225                         | 6,037 L <sup>6</sup><br>6.46 t <sup>7</sup> | 2,500 L                                     | Heat radiation impact (distance)              | Other – 4.5 m <sup>8</sup><br>Sensitive – 8.0 m <sup>8</sup>     |
| Cosolvent<br>7.5 % (wt/wt) cell <sup>5</sup>                                 | 3272   | 3 PG II         | H225<br>H315                 | 6,395 L <sup>6</sup><br>6.46 t <sup>7</sup> | 2,500 L                                     | Heat radiation impact (distance)              | Other – 4.5 m <sup>8</sup><br>Sensitive – 8.0 m <sup>8</sup>     |
| Solvent<br>7.5 % (wt/wt) cell <sup>5</sup>                                   | 2366   | 3 PG III        | H226                         | 6,625 L <sup>6</sup><br>6.46 t <sup>7</sup> | 10,000 L                                    | Heat radiation impact (distance)              | Other – 4.5 m <sup>8</sup><br>Sensitive – 8.0 m <sup>8</sup>     |
| Electrolyte (Lithium hexafluorophosphate)<br>2.5 % (wt/wt) cell <sup>5</sup> | 2923   | 8 PG II         | H311<br>H314<br>H302<br>H372 | 2,153 kg<br>2.15 t <sup>7</sup>             | 2,500 kg or L                               | Quantity                                      | 25 t                                                             |

Notes:

<sup>1</sup>: Typical substances have been applied. Generally, components classified as hazardous or dangerous are contained within the electrolyte (corrosive and/or flammable elements).

<sup>2</sup>: In order to utilise the ingredients of the Li-ion cells as an example of hazardous material to be stored on site, further material SDSs were reviewed and the United Nations (UN) no., DG Class and PG, GHS Classifications and Manifest quantities. It should be noted that whilst contained within the battery cell, they do not exist as individual components. For example, the electrolyte in combination with the cosolvent, solvent and li-ion salt form a paste like substance.

<sup>3</sup>: The screening thresholds from *Applying SEPP 33* have been reapplied to the total storage capacity of the proposed development. This has been used as a comparative measure, as stated within **Table 1**, DG Class 9 materials do not trigger a risk screening.

<sup>4</sup>: From *Applying SEPP 33*, 'sensitive' refers to residential or other more sensitive land users. 'Other' applies to all other land users (e.g., commercial, or industrial).

<sup>5</sup>: Approximate weight (wt) % of the components has been applied. With a typical cell, a range for the composition is given.

<sup>6</sup>: Litres (L) has been provided for a direct comparison to the manifest quantities for flammable liquids. As individual quantities of flammable liquids (i.e., 3 PG II) have exceeded the relevant manifest thresholds, there is no need for a combination quantity to be applied.

<sup>7</sup>: Total amount in tonnes (t) is based on the wt % of the cell and the total quantity of the cells to be stored on site (presented in **Table 1**).

<sup>8</sup>: The total quantity of DG Class 3 (PG II and PG III) has been summed to determine the distance for potential heat radiation impacts from the storage of Flammable Liquids. For a total of ~ 20 t it is considered potentially hazards to sensitive receptors within 8 m and/or potentially hazardous to other receptors within 5 m.





As previously stated in **Table 1**, the Li-ion units are classified as DG Class 9 (Miscellaneous) and as such are exempt from risk assessment. However, due to potential hazards that are associated with Li-ion units (listed under **Table 2**), along with review of some typical SDSs for Li-ion units, a brief review was undertaken with respect to manifest threshold quantities.

From **Table 3**, the highly flammable components of the cell (i.e., electrolyte and cosolvent) do exceed their respective manifest threshold quantities. When the substances were re-applied to the thresholds from *Applying SEPP 33*, the following was determined:

- The storage of flammable material (DG Class 3 PG II and PG III) can be considered potentially hazardous if there are sensitive users within 8.0 m of the stores and/or if there are other users within 4.5 m of the stores. The closest offsite unoccupied receptor is approximately 400 m away from the BESS area and the closest occupied receptor is 1.7 km from the BESS area. It is unlikely that sensitive or other users would be within the required separation distance; and
- The storage of corrosive material (DG Class 8) is below the screening threshold.

The flammable component of the Li-ion batteries makes up the largest percentage (~ 22.5 % wt/wt in a typical cell). Li-ion batteries combust in a vastly different manner to that of a liquid fuel. Within publicly available literature, experimentation has been undertaken to determine how Li-ion cells combust. Results have found that there are several stages of jet fire and a stable, long-lasting combustion but no explosion (Wang et al 2016).

Should a fire event occur within a Li-ion BESS unit, there is potential for off-gases to be emitted. The off gases are high toxic and can cause significant risk to people both on and off site. A further brief study of potential impacts from a toxic release was also undertaken for the Li-Ion units.

#### 4.4.3 Impact of a Fire Event – Toxic Plume

From review of potential hazards associated with Li-Ion batteries, alongside review of other hazard assessments undertaken for similar BESS facilities, it was found thermal runaway to be of significant consequence to site and neighbouring receptors. The thermal runaway hazard is largely independent of the overall site installed kWh of the BESS unit. Current, scrutiny is largely focused on one BESS container being involved in a thermal scenario before corrective actions and/or emergency services prevent fire spreading to adjoining BESS containers. Once a fire scenario occurs and is established, it is almost impossible to contain the fire to individual modules within the container.

In the event of a fire, the electrolyte of a Li-ion battery will decompose, creating harmful toxic emissions. The electrolyte of a Li-ion battery typically contains lithium hexafluorophosphate (LiPF<sub>6</sub>) or other Li-salts containing fluorine. Decomposition of the electrolyte to fluoride binders include harmful emissions of hydrogen fluoride (HF).

For the screening assessment, a conservative Level 1 air quality plume assessment was undertaken using current NSW Environmental Protection Agency (EPA) methodology. The Level 1 air quality plume assessment assumed the following factors:

- Single Li-ion BESS container as a basis;
- Installed kWh of a single container was utilised;
- The single container is assumed to be completely engulfed in fire;
- A generic meteorological dataset, running through various wind speeds and atmospheric stability possibilities was applied; and
- Each container has the potential to produce up to 89 kg per hour of Hydrogen Fluoride (HF), equating to approximately 20 g/s emission rate (over a 1-hour period).

From the Level 1 air quality assessment, it was determined that for the capacity of Li-ion unit to be installed on-site, a thermal runaway fire event has the potential to result in unacceptable on-site consequences, and may have potential to risk to human life offsite within a radius of 200 m. Note: this is a conservative estimate for approximate radius based on the 30 parts per million (ppm) 'Immediately Dangerous to Life and Health Limits' (IDLH).



The closest neighbouring residential receptor is located just outside the eastern boundary of the site (approximately 270 m from the proposed BESS installation). It is understood that the residence is currently unoccupied, and mine owned. Considering the relative distance to the receptor, emission from a thermal event is not expected to be an issue. Advitech recommends that additional assessments be undertaken to determine the potential impact to all receptors (both mine personnel and members of public) within the conservative vicinity of 200 – 250 m of the proposed battery units.

It should be noted, the redox flow battery has not been assessed in the same manner (i.e., breakdown of component materials and the impact of a fire causing a toxic release). This is due to the redox flow battery has already triggered the SEPP H&OD screening thresholds, and as such can already be deemed 'potentially hazardous'. Furthermore, the inherent design of the redox flow battery will make it unlikely for fire to develop.

## 5. Impact to Proposed Development

### 5.1 State Environmental Planning Policy (Resilience and Hazards) – Chapter 3: Hazardous and Offensive Developments

Further consideration to the screening results must be undertaken to determine whether SEPP H&OD applies to the proposed development. This includes resolving whether the proposed development is considered a 'potentially hazardous industry', either by way of inventory or through transport thresholds, and concluding whether the proposed development is or has cause to be considered 'potentially offensive'.

#### 5.1.1 Potentially Hazardous Industry

The objective of *State Environmental Planning Policy (Resilience and Hazards) – Chapter 3: Hazardous and Offensive Developments* (SEPP H&OD) is to link the permissibility of a proposal to its safety and pollution control performance. It aims to ensure that the merits of the proposal are properly assessed in relation to offsite risk and offence. SEPP H&OD applies to any proposals which fall under the definition of 'potentially hazardous industry'.

SEPP H&OD define 'potentially hazardous industry' as:

*A development for the purposes of an industry which, if the development were to operate without employing any measures to reduce or minimise its impact in the locality or on the existing or likely future development on other land, would pose a significant risk in relation to the locality:*

- *To human health, life, or property;*
- *To the biophysical environment.*

*And includes a hazardous industry and a hazardous storage establishment.*

If a development falls within the definition of a 'potentially hazardous industry', then the proponent must prepare, or cause to be prepared, a Preliminary Hazard Analysis (PHA). SEPP H&OD provides the definition of a 'potentially hazardous industry' as a site which holds quantities of dangerous goods in excess of the screening threshold levels prescribed within the NSW Department of Planning document entitled '*Applying SEPP 33*' (January 2011). Note, at the time of writing, there have been no changes to encapsulate *Applying SEPP 33* under the new SEPP arrangements (i.e., SEPP Resilience and Hazards). As such, *Applying SEPP 33* has been referred to.

#### 5.1.1.1 Storage Screening Threshold

##### *Li-ion batteries*

Li-ion batteries are classified as DG Class 9. As such are exempt from risk screening under the SEPP H&OD screening thresholds. With consideration to hazards associated with Li-ion batteries, the typical composition of the cell was split and reassessed against manifest threshold quantities and SEPP H&OD thresholds. The highly flammable components (i.e., electrolyte and cosolvent) exceeded the manifest quantities. When re-assessed against the SEPP H&OD thresholds, it was considered unlikely for a sensitive or other users would be between 5-8 m of the proposed battery storage location.



Note: the distance is to be taken with respect to potential offsite land uses. *Applying SEPP 33* defines 'sensitive' uses as residential or other more sensitive land uses and 'other' applying to all other land uses (e.g., commercial or industrial).

A further brief air quality impact assessment was undertaken to determine whether there would be significant off-site impacts to classify the development as 'potentially hazardous', as presented under **Section 5.1.1.2**.

#### *Redox Flow batteries*

Electrolyte contained within the redox flow batteries is classified as DG Class 8. The storage of redox flow batteries does exceed the screening thresholds prescribed within *Applying SEPP 33*. As such, should the development utilise redox flow type batteries on site, the development has cause to be classified as 'potentially hazardous' and a PHA must be prepared.

#### *5.1.1.2 Other Considerations (BESS Specific)*

A brief Level 1 air quality assessment was undertaken to quantify potential impacts from a 'thermal runaway fire event leading to a toxic off-gas' scenario. From the assessment undertaken, there is potential risk to human life extending to an approximate radius of 200 m. The closest receptor is a currently unoccupied mine owned property located 270 m from the BESS. Based on the conservative screening approach, the emission from a thermal event is not expected to be an issue with consideration to the closest receptor.

#### *5.1.1.3 Transport Screening Thresholds*

A development may also be considered as 'potentially hazardous' if the Transport Screening thresholds are exceeded for vehicular movements to and from the site. The transport screening thresholds for DG Class 8 and Class 9 materials from *Applying SEPP 33* have been reproduced and compared against the movements for the development in **Table 4**.

For the purposes of comparison, it has been assumed that a significant quantity of DGs delivered to the site during the construction and/or commissioning phase of the project. For a Redox flow battery type, there may be a requirement to have additional electrolyte delivered during the operation of the site. The approximate movements for the development were estimated from similar facilities (i.e., Solar Farms with battery energy storage capabilities).

**Table 4: Transportation Screening Thresholds (adapted from *Applying SEPP 33*)**

| Class | Approx. Movements for Development <sup>1</sup> |             | Vehicle Movements |             | Minimum quantity per load (t) <sup>2</sup> |         |
|-------|------------------------------------------------|-------------|-------------------|-------------|--------------------------------------------|---------|
|       | Cumulative Annual                              | Peak Weekly | Cumulative Annual | Peak Weekly | Bulk                                       | Package |
| 8     | 120                                            | 30          | > 500             | > 30        | 2                                          | 5       |
| 9     | 60                                             | 20          | > 1000            | > 60        | No limit                                   | -       |

Notes:

<sup>1</sup>: Based on information provided by RPS. Values taken and maximum in range for estimation purposes. Additional estimation used for assumption detailed above.

<sup>2</sup>: If the quantities are below this level, the potential risk is unlikely to be significant unless the number of traffic movements is high.

Li-ion and Redox Flow batteries are both classified as a 'Dangerous Good' under the ADG Code, care must be taken when handling and transporting the units to and from the site. As presented in **Table 4**, the cumulative annual and peak weekly transport of DG Class 8 and DG Class 9 materials are well below their respective screening thresholds. As such, it is unlikely that the potential risk associated with transport to be significant.





### 5.1.2 Potentially Offensive Industry

SEPP H&OD would also apply where a development is considered a 'potentially offensive industry', which is defined as follows:

***Potentially Offensive Industry** means a development for the purposes of industry which, if the development were to operate without employing any measures (including, for example, isolation from existing or likely future development on other land) to reduce or minimise its impact in the locality or on the existing likely future development on other land, would emit a polluting discharge (including, for example, noise) in a manner which would have a significant adverse impact in the locality or on the existing or likely future development on other land, and includes an offensive industry and an offensive storage establishment.*

In deciding if a proposal is a 'potentially offensive industry', it is necessary to consider whether, in the absence of safeguards, the proposal would emit a polluting discharge which would cause a significant level of offence. Generally, a development may be classified as 'potentially offensive' where, either:

- A licence is required under pollution control legislation; or
- Where no such licence is required, the proposal has the potential to cause offence having regard to the sensitivity of the surrounding environment.

The proposed development lies in close vicinity to Leards Forest Road and an access road for the Boggabri Coal Mine (as presented in **Appendix A**). There are several receptors located within vicinity of the proposed development, one just off the eastern boundary approximately 80 m from the boundary and another 1.25 km to the southwest of the site. Both are mined owned, with the closest property to be permanently uninhabited. In the case of a catastrophic event (i.e., thermal runaway leading to a battery container fire), there is potential for Li-ion BESS units to produce highly toxic gases (e.g., hydrogen fluoride). Some recently documented Li-ion large scale battery fires have burned for considerable lengths of time, with authorities recommending the public to remain indoors.

Comparatively, there is limited knowledge of potential fire (and off gassing) hazards known about the Redox flow type batteries. They are much more likely to represent a corrosive electrolyte leakage hazard rather than a fire hazard.

Due to the location of the proposed development, consideration to zoning and a review of how the batteries will be stored, it is unlikely for the proposed development to be deemed a 'potentially hazardous industry'. From review of Schedule 1 Scheduled Activities under the *Protection of the Environment Act* (POEO Act 1997), neither battery storage nor solar electricity generation are considered and as such do not require a licence under relevant pollution control legislation. There is potential to cause offense to sensitive receptors with the storage of Li-ion batteries should there be a significant event. Further assessment may be required to determine impacts of other potential emissions of polluting discharges (i.e., noise, odour, air emissions etc).

## 5.2 Outcomes

Li-ion batteries are classified as DG Class 9, and as such do not require a risk screening. Redox flow batteries are classified as DG Class 8 (based on electrolyte quantities). The screening thresholds only form a part of the SEPP H&OD screening assessment. Further consideration to some of the potential hazardous involved with the storing of Li-ion and/or Redox flow battery types were also assessed. This assessment led to a brief review of the components of the batteries and a brief impact assessment based on toxic emissions.

### 5.2.1 Li-ion Batteries

It was determined that the flammable components of the Li-ion battery type did exceed the manifest thresholds from Schedule 11 of Work Health and Safety Regulation. Re-assessing the components against the screening thresholds from *Applying SEPP 33*, it was found to be unlikely for receptors (sensitive or otherwise) to be present within the required separation distances.



Based on the findings of the impact assessment, should a significant thermal runaway or an exterior fire, there is potential for the batteries to release toxic HF gas. From a Level 1 air quality assessment, there is potential to impact receptors up to 200 m away. With consideration to the distance to sensitive offsite receptors, it is unlikely the storage or impacts from potential events affect neighbours in the vicinity. As such, a PHA does not need to be prepared.

#### 5.2.2 Redox Flow Batteries

The Redox flow the battery was found to exceed both the manifest threshold and the screening thresholds. Based on the quantity of corrosive material alone (electrolyte), selection of Redox flow battery for the proposed development can be considered 'potentially hazardous'. Therefore a PHA has cause to be prepared and would be required should the development utilise Redox flow type batteries.

## 6. Conclusions

Advitech was engaged by RPS Group, on behalf of IRDA, to prepare a SEPP H&OD screening report in accordance with an EIS for the construction and operation of a solar photovoltaic (PV) generation facility and associated battery storage system in Boggabri NSW.

Based on the supplied information reviewed, it is Advitech's professional opinion that a PHA be undertaken should the proposed development utilise a Redox flow type battery, based on the reasoning provided throughout the report.

Were the proposed development to utilise Li-ion type batteries, though there are significant risks associated with LI-ion units, a PHA does not need to be undertaken. Advitech does recommend undertaking further assessments be undertaken to determine and quantify impact to receptors.

This report has been prepared on the basis of information supplied by RPS Group, on behalf IRDA, and relies on the assessment of Hazardous Chemicals (HCs) and Dangerous Goods (DGs) present within the associated battery types, as presented in **Section 4.4**, along with the locations of the proposed BESS units as shown in **Appendix A**.



# Appendix A

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## Project Location and Indicative Arrangements



# BOGGABRI SOLAR FARM

## 30% DESIGN

ADDRESS:  
LEARDS FOREST ROAD  
BOGGABRI  
NSW 2382



DEVELOPED BY:  
IDEMITSU RENEWABLE DEVELOPMENTS AUSTRALIA

| Sheet List Table |                          |
|------------------|--------------------------|
| Sheet Number     | Sheet Title              |
| G-0100           | TITLE                    |
| G-0400           | LOCATION PLAN            |
| G-2100           | GENERAL ARRANGEMENT PLAN |
| E-1100           | AC SLD                   |



RENEWABLES

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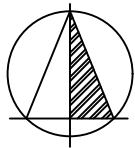
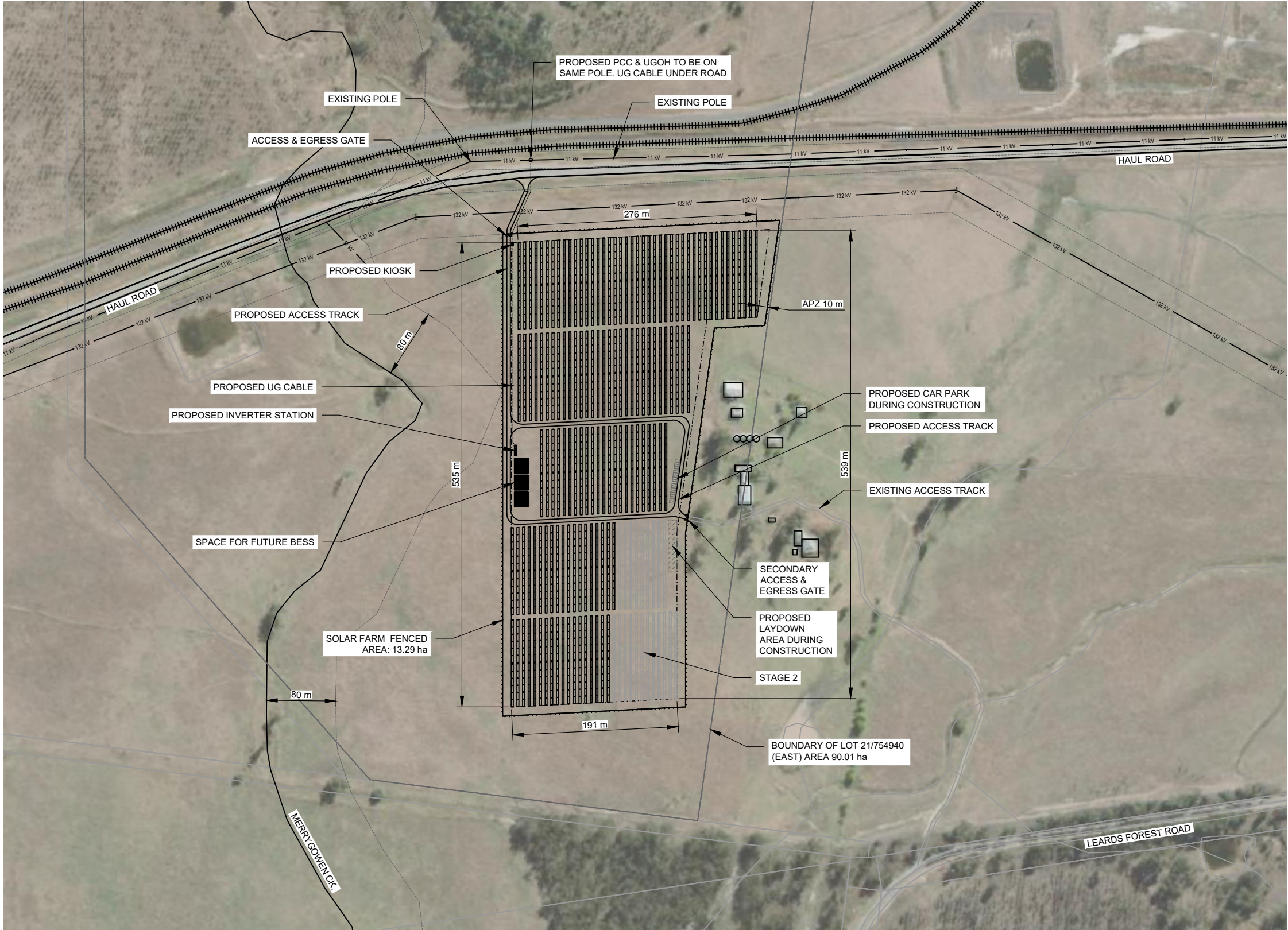
| NO. | STAGE                            | DSN  | DWN  | CHKD | APPR | DATE       |
|-----|----------------------------------|------|------|------|------|------------|
| 1   | 30% DESIGN                       | ISC  | MJB  | ISC  | LF   | 15/08/2023 |
| 2   | OH WIRES ADDED                   | ISC  | MJB  | ISC  | LF   | 28/08/2023 |
| 3   | SECURITY FENCE FOOTPRINT UPDATED | ISC  | MJB  | ISC  | ISC  | 04/10/2023 |
| 4   | ----                             | ---- | ---- | ---- | ---- | ----       |
| 5   | ----                             | ---- | ---- | ---- | ---- | ----       |
| 6   | ----                             | ---- | ---- | ---- | ---- | ----       |

[illegible]

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+61 2 6257 3511

|                                                                                                                   |     |      |     |                                       |                                           |            |          |
|-------------------------------------------------------------------------------------------------------------------|-----|------|-----|---------------------------------------|-------------------------------------------|------------|----------|
| DSN                                                                                                               | ISC | DWN  | MJB | DRG TITLE<br><br><b>LOCATION PLAN</b> |                                           |            |          |
| CHKD                                                                                                              | ISC | APPR | ISC |                                       |                                           |            |          |
| DO NOT SCALE                                                                                                      |     |      |     |                                       |                                           |            |          |
| ALL MEASUREMENTS IN mm<br>UNLESS OTHERWISE STATED.                                                                |     |      |     | PROJECT                               | BOGGABRI SOLAR FARM                       | SCALE      | AS NOTED |
| THIS DOCUMENT MAY ONLY BE<br>USED BY CLIENTS OF ITP OR<br>THOSE WHO HAVE RECEIVED<br>EXPRESS PERMISSION FROM ITP. |     |      |     | CLIENT                                | IDEMITSU RENEWABLE DEVELOPMENTS AUSTRALIA | SHEET SIZE | A3       |
|                                                                                                                   |     |      |     | ADDRESS                               | LEARDS FOREST ROAD<br>BOGGABRI, NSW 2382  | ORIG. DATE | 2/8/23   |
|                                                                                                                   |     |      |     |                                       |                                           | REV. DATE  | 4/10/23  |
| THE USE OF THIS DRAWING<br>SHALL NOT EXTEND BEYOND THE<br>PURPOSE FOR WHICH IT WAS<br>ORIGINALLY PREPARED.        |     |      |     | DRG NO.                               | <b>23043-G-0400</b>                       | REV NO.    | <b>3</b> |





### SITE INFORMATION

|             |                                        |
|-------------|----------------------------------------|
| LOT / DP    | 21/754940                              |
| ADDRESS     | LEARDS FOREST ROAD, BOGGABRI, NSW 2382 |
| LGA         | NARRABRI SHIRE COUNCIL                 |
| LAT / LONG  | -30.626901 / 150.122058                |
| LOT AREA    | 90.01 ha                               |
| FENCED AREA | 13.29 ha                               |
| NSP         | TRANSGRID                              |

### PROJECT INFORMATION

|                        |                                          |
|------------------------|------------------------------------------|
| DC CAPACITY            | 6.528 MW (STAGE 1)<br>1.023 MW (STAGE 2) |
| INVERTERS              | 4.95 MW                                  |
| TRACKER SPACING (N-S)  | MIN. 6.0 m                               |
| ARRAY PITCH            | 6.5 m                                    |
| CONNECTION VOLTAGE     | 11 kV                                    |
| CONNECTION FEEDER      | TRANSGRID                                |
| CONNECTION SUBSTATION  | TRANSGRID                                |
| SECURITY FENCE SETBACK | MIN. 3 m FROM OPTION BOUNDARY            |
| ARRAY SETBACK          | MIN. 10 m FROM SECURITY FENCE            |
| ACCESS PATH WIDTH      | 4 m                                      |

## 1 GENERAL ARRANGEMENT PLAN

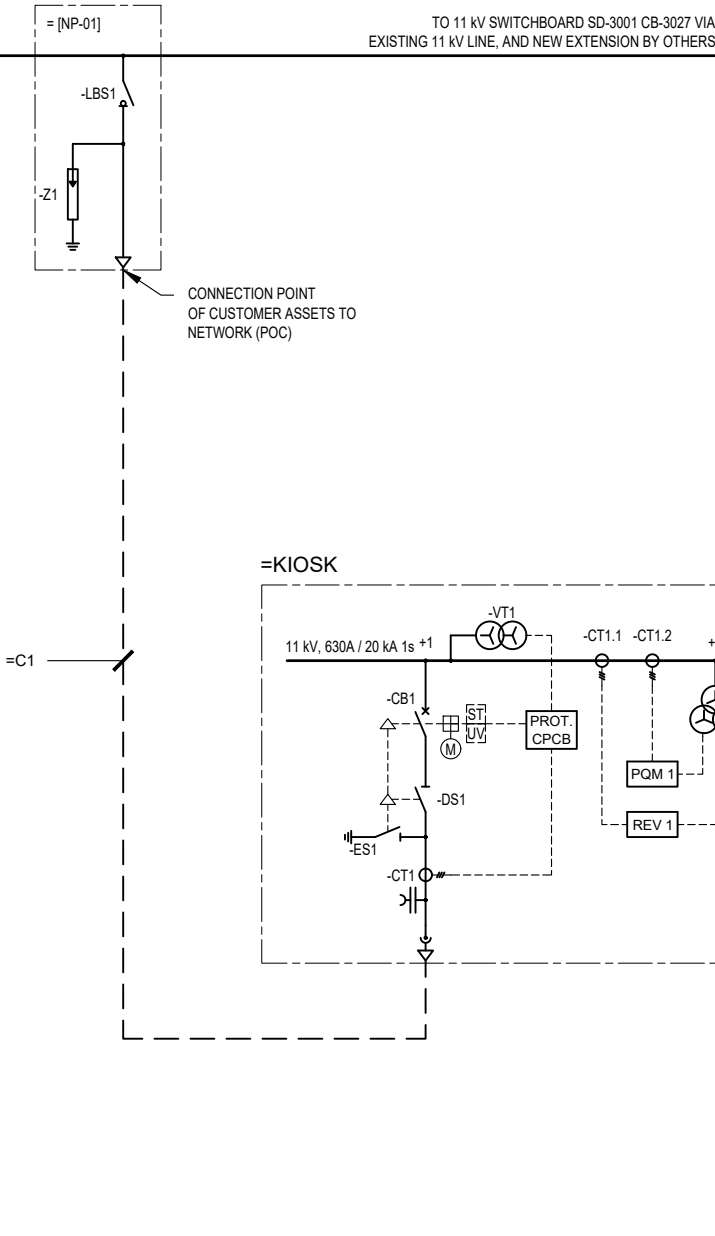
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30% DESIGN

|              |  |                                     |      |      |      |      |            |       |                                                                                                                                                                                                                              |            |  |                                                                                                                   |  |           |  |                                           |  |              |  |          |  |
|--------------|--|-------------------------------------|------|------|------|------|------------|-------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|--|-------------------------------------------------------------------------------------------------------------------|--|-----------|--|-------------------------------------------|--|--------------|--|----------|--|
| NO.          |  | STAGE                               | DSN  | DWN  | CHKD | APPR | DATE       | NOTES | <div><div>info@itpau.com.au<br/>itpau.com.au<br/>+61 2 6257 3511</div><div>PO Box 6217<br/>O'Connor, ACT 2602<br/>AUSTRALIA</div></div> | DSN    ISC |  | DWN    MJB                                                                                                        |  | DRG TITLE |  | GENERAL ARRANGEMENT PLAN                  |  |              |  |          |  |
| CHKD         |  | ISC                                 |      | APPR |      | ISC  |            |       |                                                                                                                                                                                                                              |            |  |                                                                                                                   |  |           |  |                                           |  |              |  |          |  |
| DO NOT SCALE |  |                                     |      |      |      |      |            |       |                                                                                                                                                                                                                              |            |  |                                                                                                                   |  |           |  |                                           |  |              |  |          |  |
| 1            |  | 30% DESIGN                          | ISC  | MJB  | ISC  | LF   | 15/08/2023 |       |                                                                                                                                                                                                                              |            |  | ALL MEASUREMENTS IN mm<br>UNLESS OTHERWISE STATED.                                                                |  | PROJECT   |  | BOGGABRI SOLAR FARM                       |  | SCALE        |  | AS NOTED |  |
| 2            |  | SITE FOOTPRINT OPTIMISED            | ISC  | MJB  | ISC  | LF   | 28/08/2023 |       |                                                                                                                                                                                                                              |            |  | THIS DOCUMENT MAY ONLY BE<br>USED BY CLIENTS OF ITP OR<br>THOSE WHO HAVE RECEIVED<br>EXPRESS PERMISSION FROM ITP. |  | CLIENT    |  | IDEMITSU RENEWABLE DEVELOPMENTS AUSTRALIA |  | SHEET SIZE   |  | A3       |  |
| 3            |  | VANADIUM REDOX FLOW BATTERIES ADDED | ISC  | MJB  | ISC  | ISC  | 04/10/2023 |       |                                                                                                                                                                                                                              |            |  |                                                                                                                   |  | ADDRESS   |  | LEARDS FOREST ROAD<br>BOGGABRI, NSW 2382  |  | ORIG. DATE   |  | 2/8/23   |  |
| 4            |  | ----                                | ---- | ---- | ---- | ---- | ----       |       |                                                                                                                                                                                                                              |            |  |                                                                                                                   |  |           |  |                                           |  | REV. DATE    |  | 4/10/23  |  |
| 5            |  | ----                                | ---- | ---- | ---- | ---- | ----       |       |                                                                                                                                                                                                                              |            |  |                                                                                                                   |  |           |  |                                           |  |              |  |          |  |
| 6            |  | ----                                | ---- | ---- | ---- | ---- | ----       |       |                                                                                                                                                                                                                              |            |  |                                                                                                                   |  |           |  | DRG NO.                                   |  | 23043-G-2100 |  |          |  |
|              |  |                                     |      |      |      |      |            |       |                                                                                                                                                                                                                              |            |  |                                                                                                                   |  |           |  | REV NO.                                   |  | 3            |  |          |  |



BATTERY LIMIT OF  
SOLAR FARM WORKS



| INSTRUMENT TRANSFORMER SCHEDULE |       |       |      |                       |        |       |               |
|---------------------------------|-------|-------|------|-----------------------|--------|-------|---------------|
| Area                            | Panel | ID    | Core | Ratio                 | Burden | Class | Functions     |
| =KIOSK                          |       | -CT1  | 1    | 200/1 A               | 5 VA   | 0.5   | REVENUE METER |
|                                 |       | -CT1  | 2    | 200/1 A               | 5 VA   | 0.5   | PQM           |
|                                 |       | -VT1  | 1    | (11000/V3)/(110/V3) V | 50 VA  | 0.5M  | REVENUE METER |
|                                 |       | -VT1  | 2    | (11000/V3)/(110/V3) V | 50 VA  | 0.5M  | PQM           |
|                                 | +ACR1 | -CT1  | 1    |                       |        | 5P    | PROT. CPCB    |
|                                 |       | -CVT1 | 1    |                       |        | 5P    | PROT. CPCB    |
|                                 |       | -CVT2 | 1    |                       |        | 5P    | PROT. CPCB    |

| TRANSFORMER SCHEDULE |       |    |                               |                   |           |         |              |
|----------------------|-------|----|-------------------------------|-------------------|-----------|---------|--------------|
| Area                 | Plant | ID | Primary (kV) / Secondary (kV) | Rated Power (kVA) | Impedance | Cooling | Vector Group |
| =PCS                 | +TX1  |    | 11 / 0.550                    | 5000              | 8%        | ONAN    | Dy11         |
|                      | +TX2  |    | 0.550 / 0.400                 | 20                |           |         | Dyn5         |

| PROTECTION RELAY SCHEDULE |                        |        |                                                                |  |
|---------------------------|------------------------|--------|----------------------------------------------------------------|--|
| Type                      | Description            | Device | Functions                                                      |  |
| PROT. CPCB                | Grid Protection Relay  | TBC    | 50P, 50N, 50SEF/N, 51P, 51N, 50BF, 27S, 27P, 59P, 81O/U/R, 78V |  |
| PROT. TX                  | Transformer Protection |        | 26, 63                                                         |  |
| PROT. INV                 | Inverter Protection    |        | 27P, 59P, 81O/U/R, AIP, 50, 51                                 |  |

| SWITCHGEAR SCHEDULE |       |                |             |            |        |          |
|---------------------|-------|----------------|-------------|------------|--------|----------|
| Area                | Plant | ID             | Vm (kV)     | Vd/Vp (kV) | Ir (A) | Isk (kA) |
| =KIOSK              |       | +ACR1, -CB1    | 15.5        | 50/110     | 630    | 16       |
| =PCS                | +INV1 | -LVCB1, -LVCB2 | 600 V (AC)  | n/a        | 2000   |          |
|                     | +INV2 | -DCCB1, -DCCB2 | 1500 V (DC) | n/a        |        |          |

| CABLE & CONDUCTOR SCHEDULE |            |             |               |
|----------------------------|------------|-------------|---------------|
| Area                       | Length (m) | Type        | Specification |
| =C1                        | 110        | UNDERGROUND | TBC           |
| =C2                        | 265        | UNDERGROUND | TBC           |

| INVERTER SCHEDULE |       |             |         |                   |
|-------------------|-------|-------------|---------|-------------------|
| Area              | Plant | Description | ID      | Rated Power (MVA) |
| =PCS              | +INV1 | TBC         | -INV1.1 | 4.950             |

# 1 ELECTRICAL AC SLD

SCALE: NTS

30% DESIGN

|     |  |                                                 |      |      |      |      |            |                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                      |                                                                                                          |     |      |     |                |                                                                                       |  |  |            |          |
|-----|--|-------------------------------------------------|------|------|------|------|------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------|-----|------|-----|----------------|---------------------------------------------------------------------------------------|--|--|------------|----------|
| NO. |  | STAGE                                           | DSN  | DWN  | CHKD | APPR | DATE       | NOTES<br><br>1. PCC IS BASED ON THE LATEST GENERAL ARRANGEMENT LAYOUT (23043-G-2100).<br><br>Vm: RATED MAXIMUM VOLTAGE<br>Vd: RATED SHORT-DURATION POWER-FREQUENCY WITHSTAND VOLTAGE<br>Vp: RATED LIGHTNING WITHSTAND VOLTAGE<br>Ir: RATED CONTINUOUS CURRENT<br>Isk: RATED SHORT-DURATION WITHSTAND CURRENT | <div><p>info@itpau.com.au<br/>itpau.com.au<br/>+61 2 6257 3511</p><p>PO Box 6217<br/>O'Connor, ACT 2602<br/>AUSTRALIA</p></div> | DSN                                                                                                      | ISC | DWN  | MJB | DRG TITLE      |                                                                                       |  |  |            |          |
| 1   |  | 30% DESIGN                                      | ISC  | NAL  | ISC  | LF   | 15/08/2023 |                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                      | CHKD                                                                                                     | ISC | APPR | LF  | AC SLD         |                                                                                       |  |  |            |          |
| 2   |  | OGOH PCC ADDED, KIOSK REPLACED, PCS S/B REMOVED | ISC  | MJB  | ISC  | LF   | 28/08/2023 |                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                      | DO NOT SCALE                                                                                             |     |      |     | ----           |                                                                                       |  |  |            |          |
| 3   |  | ----                                            | ---- | ---- | ---- | ---- | ----       |                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                      | ALL MEASUREMENTS IN mm UNLESS OTHERWISE STATED.                                                          |     |      |     | PROJECT        | BOGGABRI SOLAR FARM                                                                   |  |  | SCALE      | AS NOTED |
| 4   |  | ----                                            | ---- | ---- | ---- | ---- | ----       |                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                      | THIS DOCUMENT MAY ONLY BE USED BY CLIENTS OF ITP OR THOSE WHO HAVE RECEIVED EXPRESS PERMISSION FROM ITP. |     |      |     | CLIENT ADDRESS | IDEMITSU RENEWABLE DEVELOPMENTS AUSTRALIA<br>LEARDS FOREST ROAD<br>BOGGABRI, NSW 2382 |  |  | SHEET SIZE | A3       |
| 5   |  | ----                                            | ---- | ---- | ---- | ---- | ----       |                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                      | THE USE OF THIS DRAWING SHALL NOT EXTEND BEYOND THE PURPOSE FOR WHICH IT WAS ORIGINALLY PREPARED.        |     |      |     |                |                                                                                       |  |  | ORIG. DATE | 10/5/22  |
| 6   |  | ----                                            | ---- | ---- | ---- | ---- | ----       |                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                      |                                                                                                          |     |      |     | DRG NO.        | 23043-E-1100                                                                          |  |  | REV. DATE  | 25/8/23  |
|     |  |                                                 |      |      |      |      |            |                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                      |                                                                                                          |     |      |     |                |                                                                                       |  |  | REV NO.    | 2        |



## **MERRIOWN SOLAR FARM**

### **GLINT AND GLARE ASSESSMENT REPORT FINAL ISSUE**

**Prepared For  
Idemitsu Renewable Developments Australia**

**October 2023**



Prepared By Environmental Ethos  
for Idemitsu Renewable Developments Australia

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## EXECUTIVE SUMMARY

The proposed Merriown Solar Farm comprises of the installation and operation of a 4.95MW solar farm, located approximately 1 kilometres (km) west of Boggabri Coal Mine and 10km to the north east of Boggabri. The primary purpose of the Project is to supply behind-the-meter energy to the Boggabri Coal Mine.

The structure of the solar farm will be a single axis horizontal tracking system with PV arrays running north/south. The PV arrays will be a maximum height of 1.8 metres to centroid.

This glint and glare impact assessment utilised the Solar Glare Hazard Analysis Tool (SGHAT 2023C) in conjunction with a viewshed analysis, to undertake the glare modelling which is the basis for the impact assessment methodology.

The glint and glare assessment has been undertaken with reference to the NSW Government's Large-scale Solar Energy Design Guidelines (2022), including assessment of the following:

- All residential receivers with 3km of the proposed solar arrays with line of sight to the Project;
- All roads and rail lines within 1km of the proposed solar array; and
- All air traffic control towers and take off/landing approaches to any runway or landing strip within 5km of the proposed solar array.

Based on the assumptions and parameters of this desktop assessment, the following results were identified:

- The SGHAT modelling identified no glare is geometrically possible affecting rural dwellings within 3km of the Project, therefore no impact is likely.
- The SGHAT modelling identified no glare is geometrically possible affecting local roads and the rail line spur within 1km of the Project, therefore no impact is likely.
- The assessment identified no aviation facilities within 5km of the Project.

Management and mitigation measures recommended in this assessment include:

The Project Environmental Management Plan (EMP) is to detail glare management measures including:

- Tracking and backtracking operational procedures required to avoid glare impacts to sensitive receptors, including operating the system with a minimum limit of 5 degree resting (stow) angle.
- Glare hazard monitoring program and process for managing complaints, including rectification if required.

## 1. INTRODUCTION

This report has been prepared by Environmental Ethos on behalf of Idemitsu Renewable Developments Australia (IRDA) to assess the potential solar glint and glare impact of the proposed Merriown Solar Farm (the Project), located on Lot 21/DP754940, west of Boggabri Coal Mine, NSW. The Project comprises of the installation and operation of a solar farm with a generating capacity up to 4.95MW. The primary purpose of the Project is to supply behind-the-meter energy to the Boggabri Coal Mine. Generation beyond the mines consumption will be spilled, with a connection agreement to be considered with Essential Energy as part of Stage 2.

The Project covers an area of approximately 12 hectares. The structure of the solar farm will be a single axis horizontal tracking system with PV arrays running north/south.

This glint and glare assessment has been undertaken in accordance with the requirements of NSW Government Large-Scale Solar Energy Guideline, August 2022 (NSW Guidelines), including assessment of the following:

- All residential receivers with 3km of the proposed solar arrays with line of sight to the Project;
- All roads and rail lines within 1km of the proposed solar array; and
- All air traffic control towers and take off/landing approaches to any runway or landing strip within 5km of the proposed solar array.

### 1.1. Location

The Project site is located approximately 10 kilometres (km) north east of Boggabri, within the Narrabri Local Government Area, *refer Figure 1*. Boggabri Coal Mine is located approximately 1.5km to the east of the site.



*Figure 1. Location Plan*



The site is zoned RU1 Primary Production and is currently used for grazing. Surrounding land uses include grazing, forestry and mining.

A coal rail spur line is located approximately 120m to the north of the Project site.

No aviation facilities were identified within a 5km radius of the Project site.

## 2. SCOPE OF THE ASSESSMENT

The scope of this Glint and Glare Impact Assessment includes the following:

- Description of the methodology used to undertake the study;
- Assessment of the baseline conditions;
- Description of the elements of the Project with the potential to influence glare including size, height, angle and rotation of PV modules, and tracking system operation;
- Identification of the viewshed and potential visibility of the Project;
- Desktop mapping of potential glare at the location of sensitive receptors within the viewshed, based on Solar Glare Hazard Analysis and viewshed analysis;
- Assessment of the potential glare hazard affecting sensitive receptors during operation of the Project; and
- Recommendation for mitigation measures to avoid, mitigate, or manage potential impacts.

## 3. METHODOLOGY

The methodology used in this assessment is consistent with the requirements of the NSW Guidelines *Appendix C – Glint and Glare Assessment*, and is outlined below.

### 3.1. Glint and Glare Definitions

Glint and glare refers to the human experience of reflected light.

This study utilises the Solar Glare Hazard Analysis Tool (SGHAT revision 2023C) software developed in the USA to address policy adherence required for the 2013 U.S. Federal Aviation Administration (FAA) Interim Policy 78 FR 63276. The FAA definitions of glint and glare are as follows:

*“Reflectivity refers to light that is reflected off surfaces. The potential effects of reflectivity are glint (a momentary flash of bright light) and glare (a continuous source of bright light). These two effects are referred to hereinafter as “glare,” which can cause a brief loss of vision, also known as flash blindness.”<sup>1</sup>*

This definition of glint and glare is consistent with the NSW Guidelines definition:

*“Glint (a momentary flash of light) and glare (a continuous, excessive brightness)”.*

---

<sup>1</sup> Federal Aviation Administration, Version 1.1 April 2018, Technical Guidance for Evaluating Selected Solar Technologies on Airports

For the purpose of this study the term 'glare' is used in reference to both glint and glare resulting from direct solar reflectivity from PV modules, measurable in duration over minutes (1 minute intervals throughout the year).

### 3.2. Solar glare Assessment Parameters

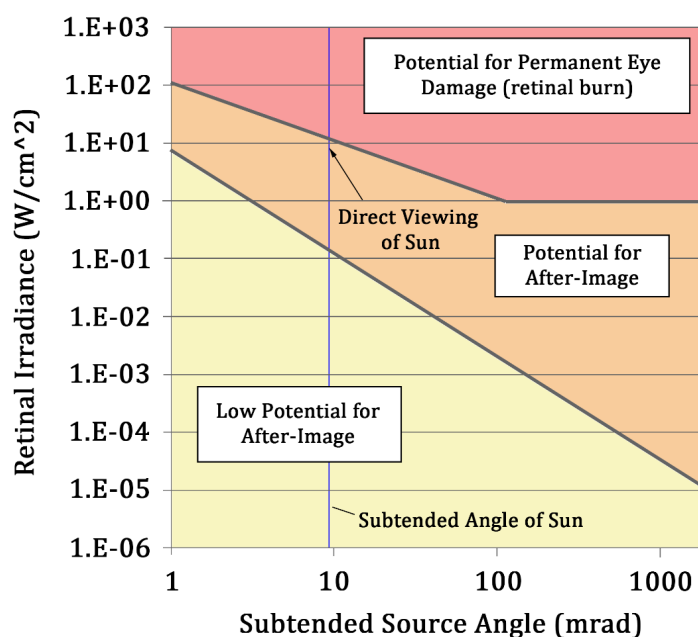
Solar glare assessment modelling for solar farms is based on the following factors:

- the tilt, orientation, and optical properties of the PV modules in the solar array;
- sun position over time, taking into account geographic location;
- the location of sensitive receivers (dwellings, roads, rail, and aviation facilities); and
- Screening potential of surrounding topography, vegetation and buildings.

### 3.3. Glare Intensity Categories

The potential hazard from solar glare is a function of retinal irradiance (power of electromagnetic radiation per unit area produced by the sun) and the subtended angle (size, distance, and geometry) of the glare source.<sup>2</sup>

Glare can be broadly classified into three categories: low potential for after-image (referred to as "Green Glare" in SGHAT), potential for after-image (referred to as "Yellow Glare" in SGHAT), and potential for permanent eye damage (referred to as "Red Glare" in SGHAT), *Figure 2* illustrates the glare intensity categories used in this study.



*Figure 2. Ocular impacts and Hazard Ranges<sup>3</sup>*

The amount of light reflected from a PV module depends on the amount of sunlight hitting the surface, as well as the surface reflectivity. The amount of sunlight interacting with the PV module will vary

<sup>2</sup> HO, C.K., C.M. Ghanbari, and R.B. Diver, 2011, Methodology to Assess Potential Glint and Glare hazards from Concentrated Solar Power Plants

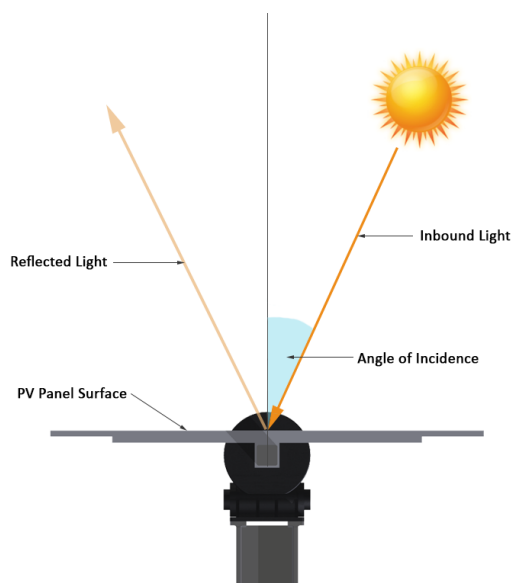
<sup>3</sup> Source: Solar Glare Hazard Analysis Tool (SGHAT) Presentation (2013)  
[https://share.sandia.gov/phlux/static/references/glint-glare/SGHAT\\_Ho.pdf](https://share.sandia.gov/phlux/static/references/glint-glare/SGHAT_Ho.pdf)

based on geographic location, time of year, cloud cover, and PV module orientation.  $1000\text{W/m}^2$  is generally used in most counties as an estimate of the solar energy interacting with a PV module when no other information is available. This study modelled scenarios using  $2000\text{ W/m}^2$  in order to cover potentially higher solar energy levels in Australia as compared to other parts of the world<sup>4</sup>. Flash blindness for a period of 4-12 seconds (i.e. time to recovery of vision) occurs when  $7\text{-}11\text{ W/m}^2$  (or  $650\text{-}1,100\text{ lumens/m}^2$ ) reaches the eye<sup>5</sup>.

### 3.4. Reflection and Angle of Incidence

PV modules are designed to maximise the absorption of solar energy and therefore minimise the extent of solar energy reflected. PV modules have low levels of reflectivity between 0.03 and 0.20 depending on the specific materials, anti-reflective coatings, and angle of incidence.<sup>6</sup>

The higher reflectivity values of 0.20, that is 20% of incident light being reflected, can occur when the angle of incidence is greater than  $50^\circ$ . *Figure 3 and 4* show the relationship between increased angles of incidence and increased levels of reflected light. Where the angle of incidence remains below  $50^\circ$  the amount of reflected light remains below 10%. The angle of incidence is particularly relevant to specular reflection (light reflection from a smooth surface). Diffuse reflection (light reflection from a rough surface or scattered light reflection) may also occur in PV modules, however diffuse reflection is significantly less intense than specular reflection.



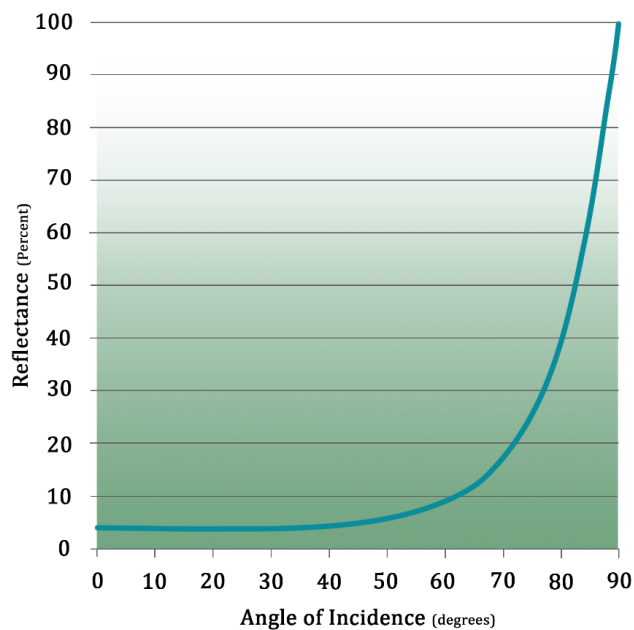
*Figure 3. Angle of Incidence Relative to PV Panel Surface*

<sup>4</sup> Global Solar Atlas 2.0, Solar resource data: Solargis

<sup>5</sup> Sandia National Laboratory, SGHAT Technical Manual

<sup>6</sup> Ho, C. 2013 *Relieving a Glare Problem*





*Figure 4. Angles of Incidence and Increased Levels of Reflected Light (Glass (n-1.5))*

In a fixed PV solar array, the angle of incidence varies as the sun moves across the sky, that is the angle of incidence are at their lowest around noon where the sun is directly overhead, and increase in the early mornings and late evenings as the incidence angles increase. If the PV array is mounted on a tracking system, this variation is reduced because the panel is rotated to remain perpendicular to the sun. Therefore a PV modular array using a tracking system has less potential to cause glare whilst it tracks the sun. *Figure 5* illustrates a PV module mounted horizontal single axis tracking system following the east to west path of the sun.

A single axis tracking system has a fixed maximum angle of rotation, once the tracking mechanism reaches this maximum angle, the PV modules position relative to the sun becomes fixed and therefore the angle of incidence increases and the potential for glare increases. Some tracking systems utilise 'backtracking' to avoid PV modules over-shadowing each other. During the backtracking procedure (early morning and late afternoon) the tracking system begins to rotate away from the sun to reduce shadow casting to adjoining PV panels, *refer Figure 6*. During the backtracking phase, higher angles of incidence will occur in comparison to the tracking phase, and this may increase the potential for glare.

Tracking systems operate from a set resting angle, resting angles define the final angle at the beginning and end of the backtracking cycle. Generally resting angles range between 0 and 30 degrees, depending on the type of system used and the site requirements. A slight angle (5 degrees) is commonly used to allow rain and dew to sheet off the panels, some systems use higher angles in more extreme climatic conditions. Shallow resting angles increase the angle of incidence between the sun and PV model, therefore the shallower the angle the more likely glare may occur.

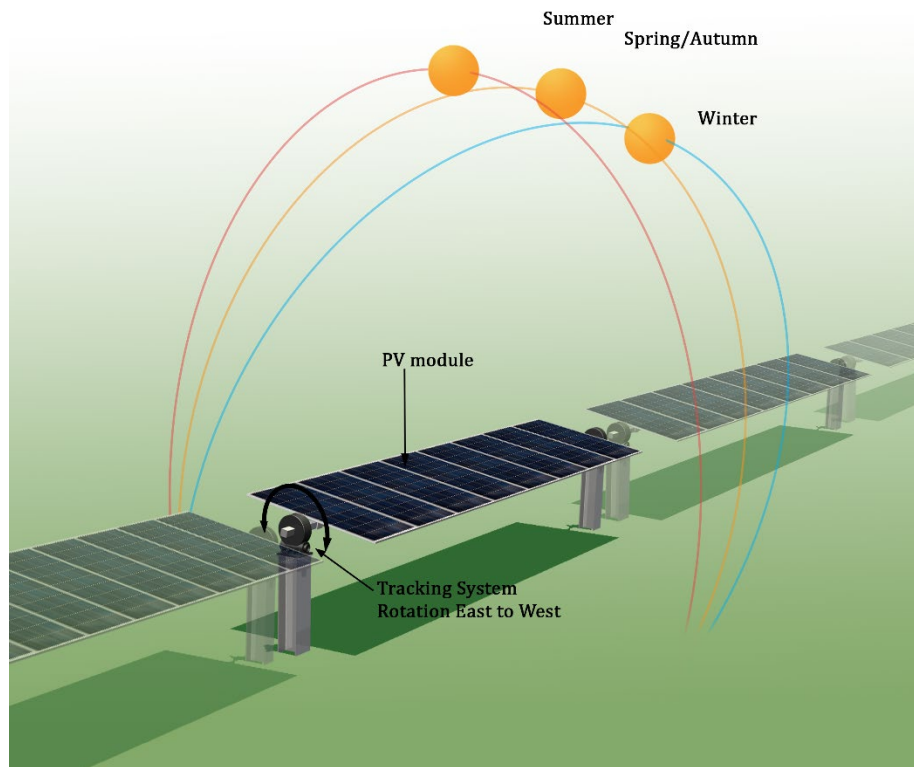


Figure 5. Diagrammatic illustration of sun position relative to PV module mounted on a horizontal single axis tracking system.

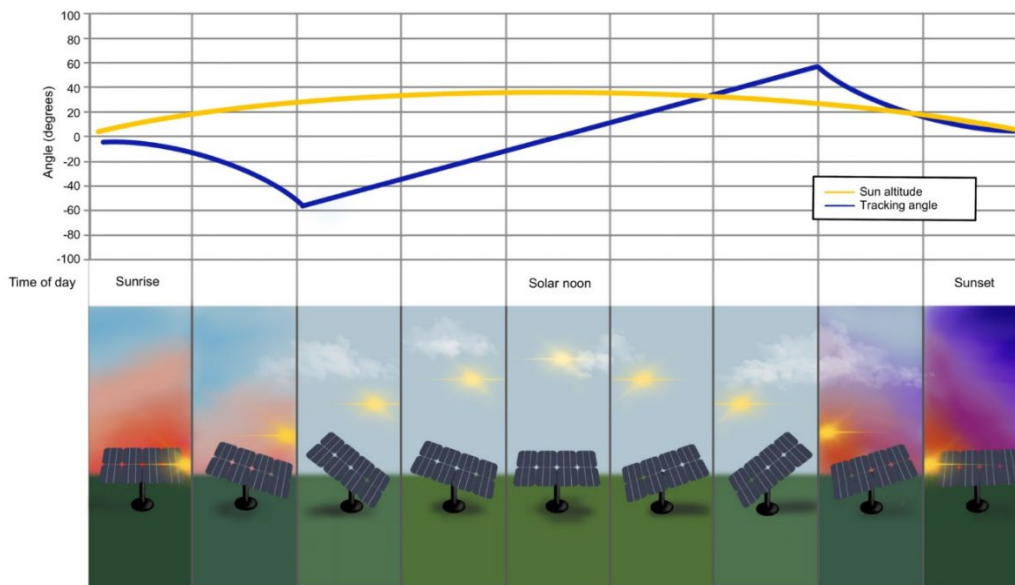


Figure 6. Diagrammatic illustration of a backtracking procedure for a horizontal single axis tracking system. (Source: ForgeSolar).

### 3.5. Viewshed Analysis

A desktop viewshed analysis was undertaken using ArcGIS 3D modelling. The extent of visibility of the proposed solar farm was assessed relative to the location of sensitive receptors (dwellings, roads, etc.) The desktop viewshed analysis is based on topography only and does not take into consideration existing vegetation.

### 3.6. Solar Glare Hazard Analysis

This assessment has utilised the Solar Glare Hazard Analysis Tool (SGHAT 2023C) co-developed by Sandi National Laboratory<sup>7</sup> and ForgeSolar (Sim Industries) (referred to as GlareGauge) to assess potential glare utilising latitude and longitudinal coordinates, elevation, sun position, and vector calculations. The PV module orientation, reflectance environment and ocular factors are also considered by the software. If potential glare is identified by the model, the tool calculates the retinal irradiance and subtended angle (size/distance) of the glare source to predict potential ocular hazards according to the glare intensity categories (refer *Section 3.3*).

The sun position algorithm used by SGHAT calculates the sun position in two forms: first as a unit vector extending from the Cartesian origin toward the sun, and second as azimuthal and altitudinal angles. The algorithm enables determination of the sun position at one (1) minute intervals throughout the year.

The SGHAT is a high level tool and does not take into consideration the following factors:

- Gaps between PV modules; and
- Atmospheric conditions.

Updated SGHAT analysis now includes the ability to include 'obstructions' in the modelling (such as vegetation and buildings). This feature was not used as part of this assessment since detailed information on the screening height and density of existing vegetation was not available at the time of the assessment.

SGHAT is the industry standard modelling tool for solar glare assessment based on geometrical analysis measured in minutes over annual and daily durations.

#### **Backtracking**

A single axis horizontal tracking system can be programed to operate a 'backtracking' procedure (*refer section 3.4*). Backtracking algorithms are becoming increasingly sophisticated with each system optimised dependent on individual project parameters including; distance between panels, width of each panel, incidence angle of the sun, field slope angle, and local weather (wind loading).

SGHAT software includes a backtracking feature which can be used to simulate various backtracking strategies. SGHAT also provides tracking data and plots, detailing the range of rotation over time. Whilst the backtracking feature simulates a generic operation based on the models parameters, the software may deviate from real-world backtracking behaviour due to a specific project system design, environmental conditions, and other factors. However, the backtracking feature does provide an understanding of potential glare implications of operating a backtracking procedure.

---

<sup>7</sup> [https://share.sandia.gov/phlux/static/references/glnt-glare/SGHAT\\_Technical\\_Reference-v5.pdf](https://share.sandia.gov/phlux/static/references/glnt-glare/SGHAT_Technical_Reference-v5.pdf)

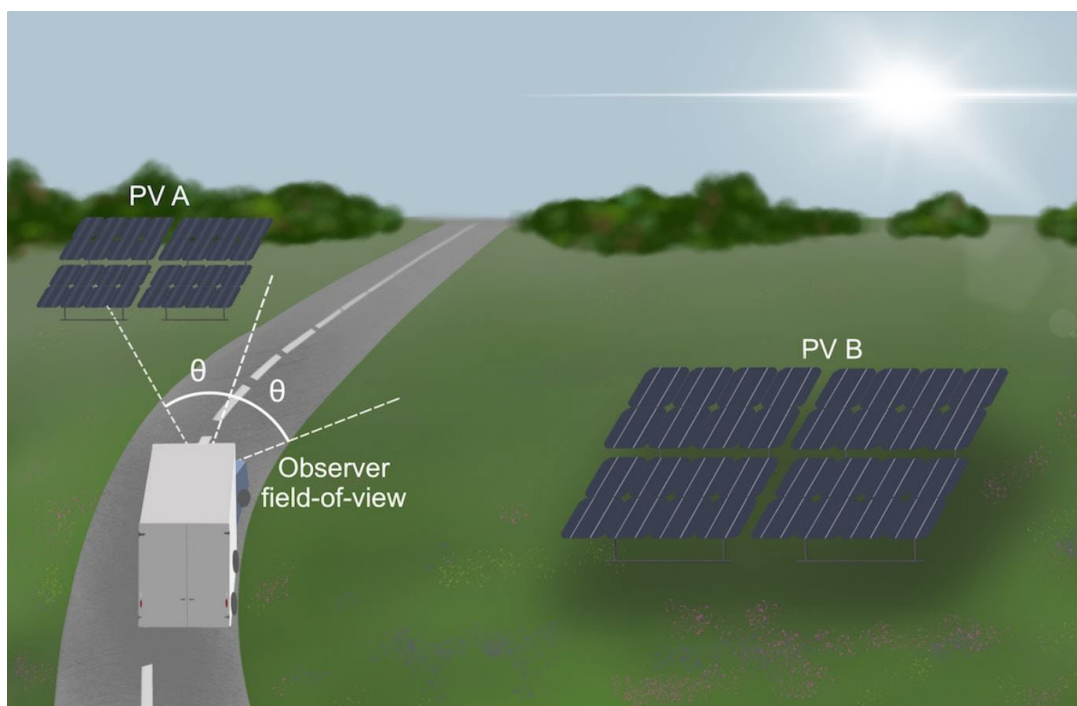


### Observation Point Receptor (OP)

In SGHAT modelling the Observation Point receptor ("OP") simulates an observer at a single, discrete location, defined by a latitude, longitude, elevation, and height above ground. OPs generally define the location of a residential receiver (dwelling) and are subscribed a unique number in the modelling. In addition, an OP can be marked to represent an Air Traffic Control Tower ("ATCT") for aviation purposes.

### Route Parameters

The assessment of potential glare impacts to route receptors, people travelling along roads and rail, includes the parameters of direction of travel (single or both directions) and field-of-view (FOV). FOV defines the left and right field-of-view of observers traveling along a route. A view angle of 90° means the observer has a field-of-view of 90° to their left and right, i.e. a total FOV of 180°, refer *Figure 7*.



*Figure 7. Diagrammatic illustration of Observer Field of View relative to PV array (source: ForgeSolar).*

FAA research has identified 'impairment ratings' based on simulations of glare at various angles and duration, and the effect on a pilot's ability to fly a plane<sup>8</sup>. The research identified impairment was highest when the glare source was within a FOV of 25° or less. The impact of glare fell below 'slight impairment' rating when the glare source was at an angle of 50° from the direction of travel. When the glare source was located at an angle of 90° the impairment rating reduced further.

SGHAT default parameter for FOV is 50°, this assessment used an FOV of 90°, representing a conservative assessment of potential glare hazard to drivers using roads and rail network within the vicinity of the solar farm.

<sup>8</sup> [https://www.faa.gov/data\\_research/research/med\\_humanfacs/oamtechreports/2010s/media/201512.pdf](https://www.faa.gov/data_research/research/med_humanfacs/oamtechreports/2010s/media/201512.pdf)

### 3.7. Hazard Assessment

Once the potential for solar glare has been identified through the viewshed analysis and SGHAT, which is based on topography only, an assessment of the likelihood of glare hazard occurring is undertaken, taking into consideration existing mitigating factors such as existing vegetation, buildings, and minor topographic variations outside the parameters of the modelling. Embedded mitigation measures, such as proposed vegetation screens to be undertaken as part of the Project, are also considered to identify residual glare potential.

Where required, additional mitigation measures, beyond those previously considered as part of the Project, are included in the Hazard and Offensive Development Assessment which recommends additional mitigation measures to avoid, reduce or manage the identified risks.

### 3.8. Limitations to the assessment

This desktop assessment is based on a geometric analysis of potential glare using SGHAT software modelling. The parameters of the modelling are based on the default values within the software. Where these values have been altered (generally increased), this has been noted in the assessment.

The assessment considers potential impacts of solar glare under normal operational procedures, potential impacts during construction and non-operational events have not been assessed.

Field tests has not been undertaken as part of the assessment, therefore the modelling is reliant on the algorithms contained in the software.

SGHAT software is used under license to Sims Industries d/b/a ForgeSolar, refer to assumptions and limitations listed in the data output (Appendices) and for further information refer to [www.forgesolar.com/help/](http://www.forgesolar.com/help/).

Environmental Ethos does not verify the accuracy of the SGHAT software modelling. Responsibility and accountability for the accuracy of the SGHAT software (GlareGauge) resides with Sims Industries d/b/a ForgeSolar.

## 4. EXISTING CONDITIONS

The baseline is a statement of the characteristics which currently exist in the Project area. The baseline glare condition assessment takes into consideration the following:

- Characteristics of the environment that may affect the potential for glare;
- Land use and human modifications to the landscape such as roads, buildings and existing infrastructure which may influence glare and sensitivity to glare.

### 4.1. Baseline Conditions

The Project covers an area of slightly undulating grazing land with limited existing native vegetation.

Land use surrounding the site includes grazing, forestry and coal mining. Boggabri township is located approximately 10km to the south west of the site. There are a small number of rural homesteads in the area.

Infrastructure elements within the landscape include Boggabri coal mine and associated facilities, local roads, the rail spur line, a substation, and powerlines.

There are no existing features in the landscape with the potential to contribute to glare.

#### 4.2. Atmospheric Conditions

Atmospheric conditions such as cloud cover, dust and haze will impact light reflection, however these factors have not been accounted for in this glare assessment. The Bureau of Meteorology statistics for Barraba 53km north east of the Project site (the closest BOM records for cloud cover statistics) recorded 94.6 cloudy days per year (mean number over the period 1966 to 2010)<sup>9</sup>. Cloudy days mainly occur in the winter months between May and July. Since atmospheric conditions have not been factored into this assessment modelling, statistically the glare potential represents a conservative assessment.

### 5. PROJECT DESCRIPTION

The general layout of the Project is as shown in *Figure 8*. The main elements of the solar farm with the potential to influence glare are the tilt, orientation, and optical properties of the PV modules in the solar array, and the rotational capabilities of the system. Whilst specific products are yet to be determined for the Project, the general technical properties of the main elements influencing glare are described below.

#### 5.1. PV modules

Reflectance values for the PV modules were based on the default values for smooth glass with anti-reflective coating contained in SGHAT, and vary dependent on the sun/module incidence angle (refer *Figure 9*).

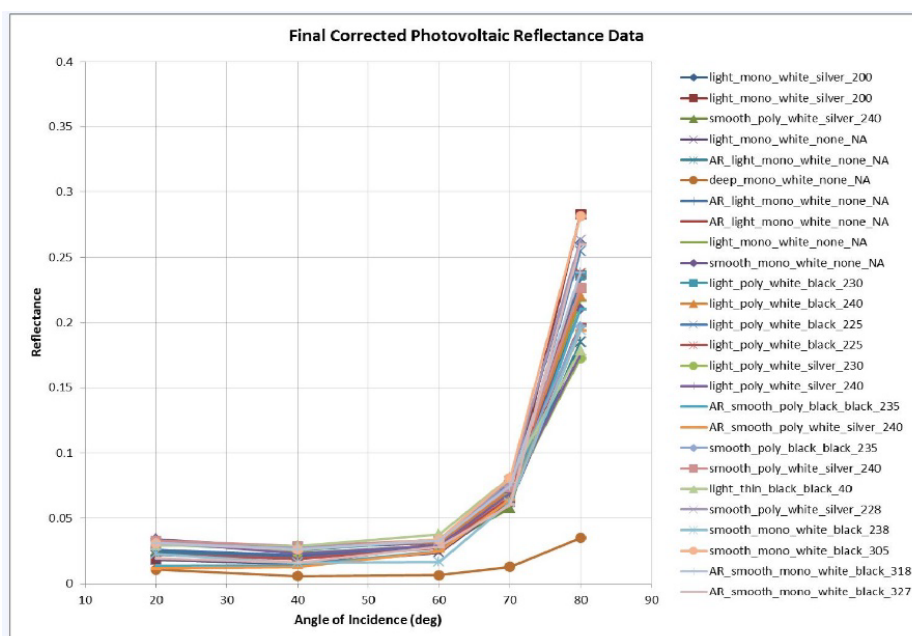


Figure 9. Photovoltaic Reflectance Data (Source Yellowhair<sup>10</sup>)

<sup>9</sup> [http://www.bom.gov.au/climate/averages/tables/cw\\_054003.shtml](http://www.bom.gov.au/climate/averages/tables/cw_054003.shtml)

<sup>10</sup> Yellowhair, J. and C.K. Ho. "Assessment of Photovoltaic Surface Texturing on Transmittance Effects and Glint/Glare Impacts". *ASME 2015 9th International Conference on Energy Sustainability collocated with the ASME 2015 Power Conference*





**SITE INFORMATION**

|             |                                        |
|-------------|----------------------------------------|
| LOT / DP    | 21/754940                              |
| ADDRESS     | LEARDS FOREST ROAD, BOGGABRI, NSW 2382 |
| LGA         | NARRABRI SHIRE COUNCIL                 |
| LAT / LONG  | -30.626901 / 150.122058                |
| LOT AREA    | 90.01 ha                               |
| FENCED AREA | 13.29 ha                               |
| NSP         | TRANSGRID                              |

**PROJECT INFORMATION**

|                        |                                          |
|------------------------|------------------------------------------|
| DC CAPACITY            | 6.528 MW (STAGE 1)<br>1.023 MW (STAGE 2) |
| INVERTERS              | 4.95 MW                                  |
| TRACKER SPACING (N-S)  | MIN. 6.0 m                               |
| ARRAY PITCH            | 6.5 m                                    |
| CONNECTION VOLTAGE     | 11 kV                                    |
| CONNECTION FEEDER      | TRANSGRID                                |
| CONNECTION SUBSTATION  | TRANSGRID                                |
| SECURITY FENCE SETBACK | MIN. 3 m FROM OPTION BOUNDARY            |
| ARRAY SETBACK          | MIN. 10 m FROM SECURITY FENCE            |
| ACCESS PATH WIDTH      | 4 m                                      |

SOURCE: itp RENEWABLES  
GENERAL ARRANGEMENTS PLAN  
23043-G-2100  
REV. 3  
DATE 04/10/23

PROJECT NO. 22024  
CREATED BY: SC  
DATE: 17 10 2023  
VERSION: **B**

**MERRIOWN SOLAR PROJECT**

GLINT AND GLARE IMPACT  
ASSESSMENT

**PROJECT LAYOUT  
PLAN**

FIGURE  
**8.0**

## 5.2. Horizontal single axis tracking system

The Project will use a horizontal single axis tracking system aligned north-south, with a maximum rotation range of 120° (+/- 60°). The zenith tilt angle of the panels was assumed to be set at zero, that is, the panels are not tilted on a north-south alignment but remain horizontal along the plane of the tracker.

The height of the PV tracking system will depend on the final design, the current proposal is a maximum height to centroid of 1.8m and maximum height at full rotation 2.8m.

The configuration of the tracking system rows vary slightly dependent on the type of system used, generally rows are approximately 6.5 metres apart.

## 5.3. Associated infrastructure

In addition to the PV arrays, the Project will also include a solar inverter, future Battery Energy Storage System, and perimeter fencing. These elements do not generally create specular reflection as they comprise of non-reflective surfaces typically found in the built environment.

# 6. DESKTOP GLARE ASSESSMENT

The aim of the desktop glare assessment is to identify if any sensitive receptors have the potential to be impacted by glare. The software modelling systems used in the desktop assessment include viewshed modelling to identify the location of sensitive receptors with line of sight to the Project, and the SGHAT to identify the potential and ocular significance of glare.

## 6.1. Viewshed Analysis

The results of the viewshed analysis (based on topography) are shown in *Figure 10*.

The Digital Elevation Model (DEM) for the viewshed modelling was set as 'Finest' (> 10 m). The viewshed analysis focussed on potential visibility of the Project within 3km of the site.

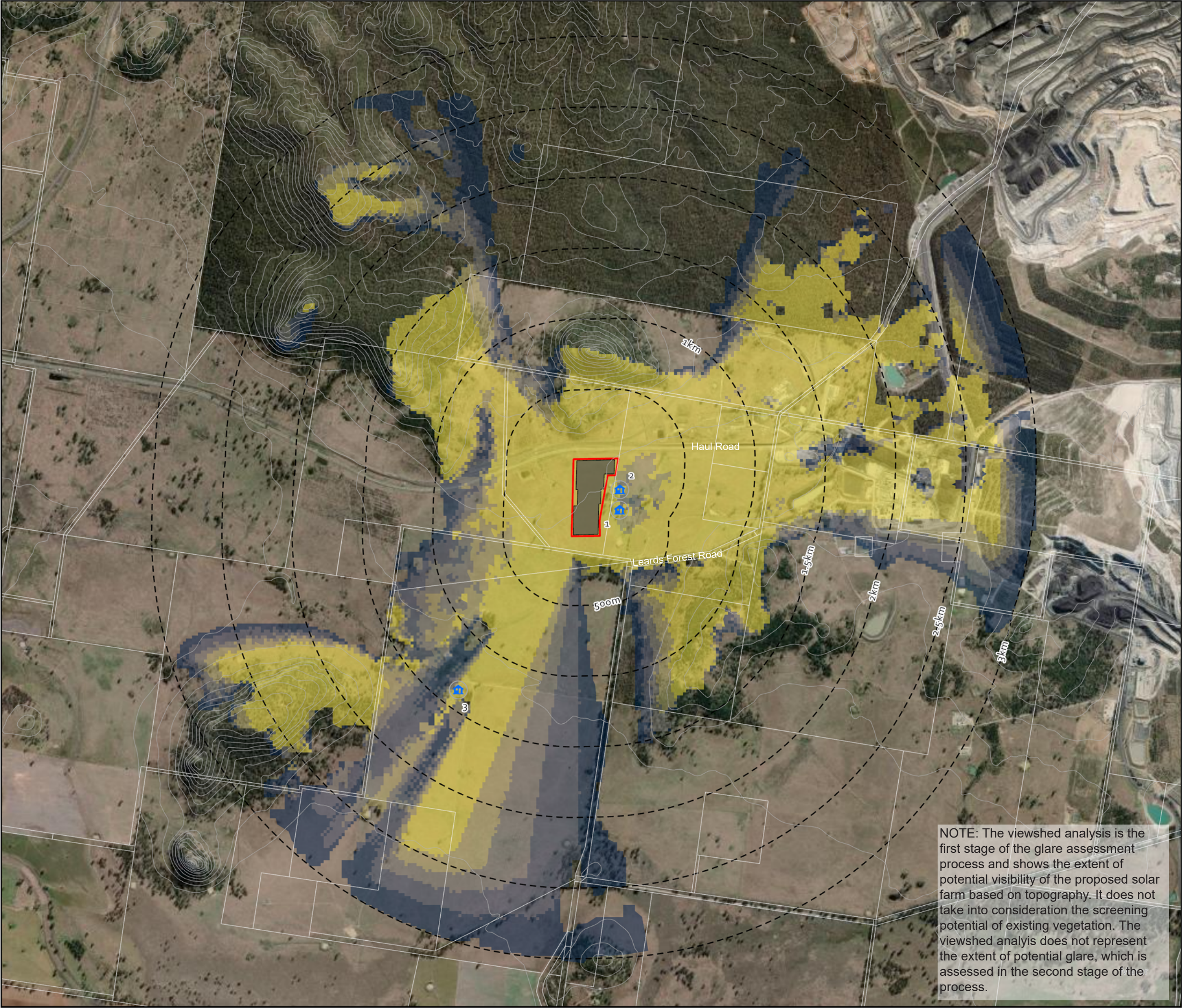
Contour and DEM information for the site shows the Project site is located within a slightly undulating valley with steep hills and ridges to the north, and smaller hills and isolated pinnacles to the south, east, and south west.

The viewshed analysis shows the surrounding hills block visibility of the Project resulting in a limited viewshed.

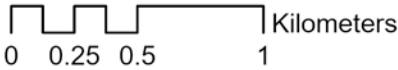
3 rural dwellings were identified within a 3km radius as having potential line-of-sight to the Project, two dwellings are located on the lot immediately adjoining the Project site. The location of the dwellings are shown in *Figure 10*, the numbering of the dwelling locations are consistent with the observation points (OP) in the glare modelling.

Two roads were identified within 1km radius of the Project including Leards Forest Road and Boggabri coal mine haul road. The coal mine rail spur line is also within the Project viewshed.





DATUM GDA 1994,  
PROJECTION MGA ZONE 56



SCALE 1:30,000 @ A3

Legend

- SITE BOUNDARY
- PV MODULE AREA
- DISTANCE FROM SOLAR FARM
- DWELLINGS
- EXTENT OF VISIBILITY\*
- LESS VISIBLE
- MORE VISIBLE

\*(Analysis based on Digital Terrain Model)

\*RURAL DWELLING LOCATIONS BASED  
ON DESKTOP ASSESSMENT  
GROUND-TRUTHING EXCLUDED

PROJECT No. 22024  
CREATED BY: SC  
DATE: 12 09 2023  
VERSION: A

MERRIOWN SOLAR PROJECT

GLINT AND GLARE ASSESSMENT

VIEWSHED ANALYSIS

FIGURE  
10.0



## 6.2. Solar Glare Hazard Analysis

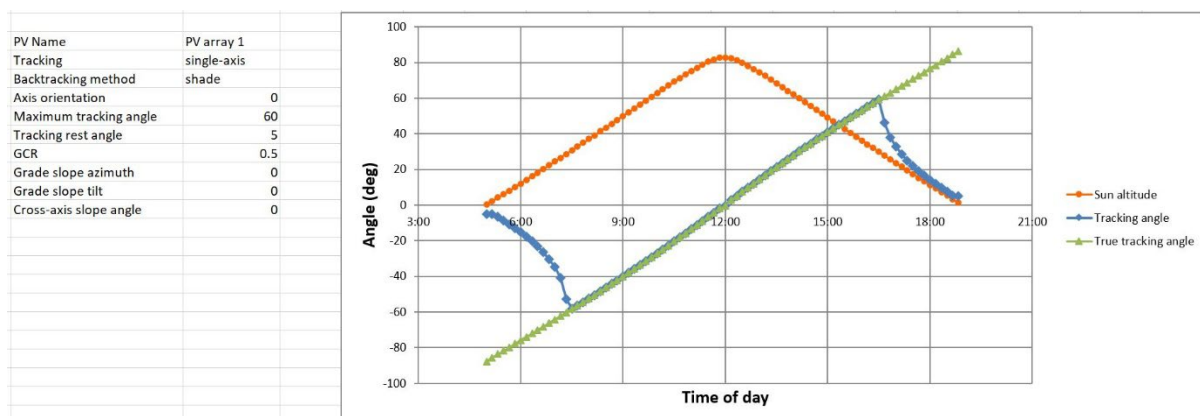
The parameters used in the SGHAT model are detailed in *Table 1*.

*Table 1. Input data for SGHAT Analysis – Single Axis Tracking System*

| SGHAT Model Parameters                   | Values                                          |
|------------------------------------------|-------------------------------------------------|
| Time Zone                                | UTC +10                                         |
| Axis Tracking                            | Horizontal Single Axis                          |
| Backtracking                             | Shade (flat land)                               |
| Tilt of tracking axis                    | 0 (Parallel to ground)                          |
| Orientation of tracking axis             | 0                                               |
| Offset angle of module                   | 0                                               |
| Module Surface material                  | Smooth glass with anti-reflective coating (ARC) |
| Maximum tracking angle                   | 60 degrees                                      |
| Resting (Stowing) angle                  | 5 degrees                                       |
| Reflectivity                             | Vary with sun                                   |
| Correlate slope error with surface type? | Yes                                             |
| Slope error                              | 8.43 mrad                                       |
| Height of panels above ground (maximum)  | 1.8m to centroid                                |

SGHAT modelling includes tracking and backtracking operations based on generic parameters. The maximum rotation angle of the tracking system was set at  $\pm 60^\circ$  and the minimum resting angle was set at  $5^\circ$  (being the fixed angle at which the backtracking process starts and finishes during daylight hours).

The general alignment of the rotation angle over time is plotted in the Component Data File. An outline of the typical rotation angles for the model's tracking/backtracking data for summer and winter solstice is outlined in *Figures 11 and 12*.



*Figure 11. Tracking/backtracking angle per time slot – mid summer*

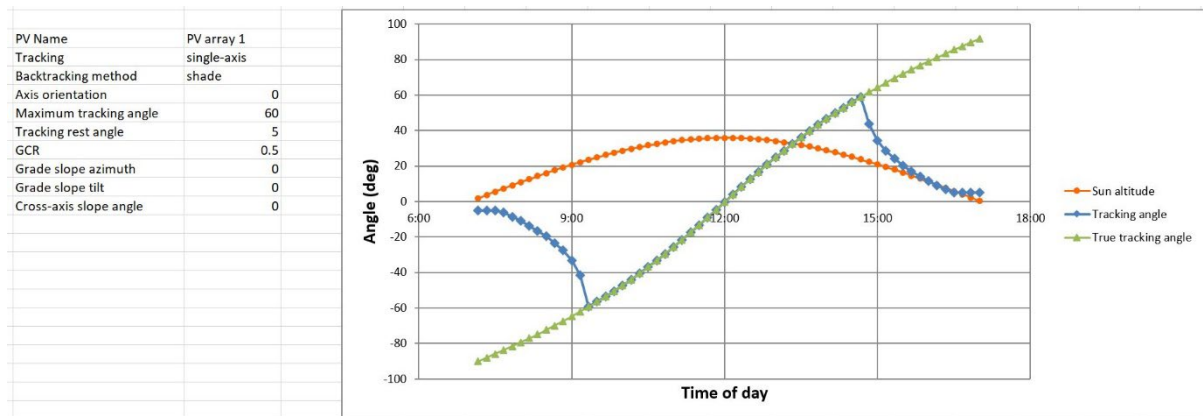


Figure 12. Tracking/backtracking angle per time slot – mid winter

### 6.3. Solar Glare Hazard Analysis Tool (SGHAT) Results

The assessment outcomes for the SGHAT modelling are detailed in *Appendix A*, and outlined in *Table 2*.

All observation point locations and numbers shown in *Figure 10* are consistent with the glare modelling results provided in the appendix and detailed in *Table 2*.

Table 2. SGHAT Assessment Results – Horizontal Single Axis Tracking System

| Sensitive Receptor                              | Glare Potential |
|-------------------------------------------------|-----------------|
| Observation Points OP1 to OP3 – Rural dwellings | No Glare        |
| Leards Forest Road                              | No Glare        |
| Mine Haul Roads 1 and 2                         | No Glare        |
| Rail Line Spur                                  | No Glare        |

The SGHAT modelling identifies that under normal operation of the solar farm, based on the model parameters, no glare hazard is geometrically possible, refer *Appendix A*.

## 7. MANAGEMENT AND MITIGATION MEASURES

The SGHAT modelling identified that under normal operation of the solar farm tracking system, with a backtracking operation and minimum limit of 5 degree resting angle, no additional mitigation measures are required to manage the potential impacts of glare on receivers.

The Project Environmental Management Plan (EMP) is to detail glare management measures including:

- Tracking and backtracking operational procedures required to avoid glare impacts to sensitive receptors, including operating the system with a minimum limit of 5 degree resting (stow) angle.
- Glare hazard monitoring program and process for managing complaints, including rectification if required.

## 8. SUMMARY

In summary, based on the assumptions and parameters of this desktop assessment, the following results were identified:

- The SGHAT modelling identified no glare is geometrically possible affecting rural dwellings within 3km of the Project, therefore no impact is likely.
- The SGHAT modelling identified no glare is geometrically possible affecting local roads and the rail line spur within 1km of the Project, therefore no impact is likely.
- The assessment identified no aviation facilities within 5km of the Project.



## APPENDIX A:

### SOLAR GLARE HAZARD ANALYSIS RESULTS

# FORGESOLAR GLARE ANALYSIS

Project: **Merriown Solar Farm**

Site configuration: **Merriown Solar Farm v2**

Created 12 Sep, 2023

Updated 12 Sep, 2023

Time-step 1 minute

Timezone offset UTC10

Minimum sun altitude 0.0 deg

DNI peaks at 2,000.0 W/m<sup>2</sup>

Category 5 MW to 10 MW

Site ID 100013.16779

Ocular transmission coefficient 0.5

Pupil diameter 0.002 m

Eye focal length 0.017 m

Sun subtended angle 9.3 mrad

PV analysis methodology V2



## Summary of Results No glare predicted

| PV Array   | Tilt<br>°      | Orient<br>°    | Annual Green Glare |     | Annual Yellow Glare |     | Energy<br>kWh |
|------------|----------------|----------------|--------------------|-----|---------------------|-----|---------------|
|            |                |                | min                | hr  | min                 | hr  |               |
| PV array 1 | SA<br>tracking | SA<br>tracking | 0                  | 0.0 | 0                   | 0.0 | -             |

*Total glare received by each receptor; may include duplicate times of glare from multiple reflective surfaces.*

| Receptor           | Annual Green Glare |     | Annual Yellow Glare |     |
|--------------------|--------------------|-----|---------------------|-----|
|                    | min                | hr  | min                 | hr  |
| Leards Forest Road | 0                  | 0.0 | 0                   | 0.0 |
| Mine Access Road 1 | 0                  | 0.0 | 0                   | 0.0 |
| Mine Access Road 2 | 0                  | 0.0 | 0                   | 0.0 |
| Rail Line Spur     | 0                  | 0.0 | 0                   | 0.0 |
| OP 1               | 0                  | 0.0 | 0                   | 0.0 |
| OP 2               | 0                  | 0.0 | 0                   | 0.0 |
| OP 3               | 0                  | 0.0 | 0                   | 0.0 |

# Component Data

## PV Arrays

**Name:** PV array 1

**Axis tracking:** Single-axis rotation

**Backtracking:** Shade

**Tracking axis orientation:** 0.0°

**Max tracking angle:** 60.0°

**Resting angle:** 5.0°

**Ground Coverage Ratio:** 0.5

**Rated power:** -

**Panel material:** Smooth glass with AR coating

**Reflectivity:** Vary with sun

**Slope error:** correlate with material



| Vertex | Latitude (°) | Longitude (°) | Ground elevation (m) | Height above ground (m) | Total elevation (m) |
|--------|--------------|---------------|----------------------|-------------------------|---------------------|
| 1      | -30.627193   | 150.124793    | 264.85               | 1.80                    | 266.65              |
| 2      | -30.628084   | 150.124787    | 263.05               | 1.80                    | 264.85              |
| 3      | -30.628074   | 150.124053    | 263.65               | 1.80                    | 265.45              |
| 4      | -30.629038   | 150.124031    | 263.78               | 1.80                    | 265.58              |
| 5      | -30.629038   | 150.123806    | 263.85               | 1.80                    | 265.65              |
| 6      | -30.629983   | 150.123787    | 264.47               | 1.80                    | 266.27              |
| 7      | -30.629983   | 150.123686    | 264.33               | 1.80                    | 266.13              |
| 8      | -30.631954   | 150.123613    | 260.30               | 1.80                    | 262.10              |
| 9      | -30.631956   | 150.121735    | 262.60               | 1.80                    | 264.40              |
| 10     | -30.630101   | 150.121783    | 264.47               | 1.80                    | 266.27              |
| 11     | -30.630107   | 150.122052    | 264.67               | 1.80                    | 266.47              |
| 12     | -30.629065   | 150.122084    | 266.65               | 1.80                    | 268.45              |
| 13     | -30.629067   | 150.121944    | 266.83               | 1.80                    | 268.63              |
| 14     | -30.627250   | 150.121971    | 267.87               | 1.80                    | 269.67              |



## Route Receptors

**Name:** Leards Forest Road

**Path type:** Two-way

**Observer view angle:** 90.0°



| Vertex | Latitude (°) | Longitude (°) | Ground elevation (m) | Height above ground (m) | Total elevation (m) |
|--------|--------------|---------------|----------------------|-------------------------|---------------------|
| 1      | -30.649001   | 150.123141    | 254.50               | 2.40                    | 256.90              |
| 2      | -30.642115   | 150.124342    | 257.64               | 2.40                    | 260.04              |
| 3      | -30.637093   | 150.125179    | 261.64               | 2.40                    | 264.04              |
| 4      | -30.635116   | 150.125535    | 264.26               | 2.40                    | 266.66              |
| 5      | -30.634470   | 150.125825    | 264.04               | 2.40                    | 266.44              |
| 6      | -30.634017   | 150.126275    | 263.26               | 2.40                    | 265.66              |
| 7      | -30.633796   | 150.126683    | 262.01               | 2.40                    | 264.41              |
| 8      | -30.633630   | 150.127305    | 262.02               | 2.40                    | 264.42              |
| 9      | -30.633408   | 150.129290    | 268.03               | 2.40                    | 270.43              |
| 10     | -30.633224   | 150.130899    | 267.55               | 2.40                    | 269.95              |
| 11     | -30.633067   | 150.131897    | 269.36               | 2.40                    | 271.76              |
| 12     | -30.632651   | 150.132981    | 274.06               | 2.40                    | 276.46              |
| 13     | -30.632282   | 150.133839    | 278.22               | 2.40                    | 280.62              |
| 14     | -30.631732   | 150.134740    | 278.52               | 2.40                    | 280.92              |
| 15     | -30.631215   | 150.135298    | 275.42               | 2.40                    | 277.82              |
| 16     | -30.630439   | 150.135620    | 271.12               | 2.40                    | 273.52              |
| 17     | -30.628787   | 150.135985    | 266.85               | 2.40                    | 269.25              |
| 18     | -30.627531   | 150.136231    | 268.16               | 2.40                    | 270.56              |
| 19     | -30.626405   | 150.136468    | 268.92               | 2.40                    | 271.32              |

**Name:** Mine Access Road 1  
**Path type:** Two-way  
**Observer view angle:** 90.0°



| Vertex | Latitude (°) | Longitude (°) | Ground elevation (m) | Height above ground (m) | Total elevation (m) |
|--------|--------------|---------------|----------------------|-------------------------|---------------------|
| 1      | -30.623375   | 150.095310    | 245.46               | 2.40                    | 247.86              |
| 2      | -30.626883   | 150.103078    | 253.83               | 2.40                    | 256.23              |
| 3      | -30.628416   | 150.106876    | 255.87               | 2.40                    | 258.27              |
| 4      | -30.628859   | 150.108528    | 260.39               | 2.40                    | 262.79              |
| 5      | -30.629136   | 150.110652    | 263.12               | 2.40                    | 265.52              |
| 6      | -30.628951   | 150.112777    | 267.21               | 2.40                    | 269.61              |
| 7      | -30.628286   | 150.115201    | 267.43               | 2.40                    | 269.83              |
| 8      | -30.627308   | 150.118098    | 270.83               | 2.40                    | 273.23              |
| 9      | -30.626791   | 150.119772    | 271.77               | 2.40                    | 274.17              |
| 10     | -30.626551   | 150.121338    | 270.66               | 2.40                    | 273.06              |
| 11     | -30.626458   | 150.122969    | 267.97               | 2.40                    | 270.37              |
| 12     | -30.626458   | 150.125651    | 265.67               | 2.40                    | 268.07              |
| 13     | -30.626292   | 150.132410    | 265.23               | 2.40                    | 267.63              |
| 14     | -30.626329   | 150.136294    | 268.65               | 2.40                    | 271.05              |
| 15     | -30.626274   | 150.138376    | 268.60               | 2.40                    | 271.00              |

**Name:** Mine Access Road 2  
**Path type:** Two-way  
**Observer view angle:** 90.0°



| Vertex | Latitude (°) | Longitude (°) | Ground elevation (m) | Height above ground (m) | Total elevation (m) |
|--------|--------------|---------------|----------------------|-------------------------|---------------------|
| 1      | -30.626237   | 150.138023    | 268.03               | 2.40                    | 270.43              |
| 2      | -30.625628   | 150.138892    | 269.52               | 2.40                    | 271.92              |
| 3      | -30.624917   | 150.139814    | 272.00               | 2.40                    | 274.40              |
| 4      | -30.624474   | 150.140050    | 272.26               | 2.40                    | 274.66              |
| 5      | -30.622590   | 150.140555    | 272.63               | 2.40                    | 275.03              |
| 6      | -30.621824   | 150.140748    | 274.48               | 2.40                    | 276.88              |
| 7      | -30.621528   | 150.140962    | 274.84               | 2.40                    | 277.24              |
| 8      | -30.620753   | 150.142250    | 276.40               | 2.40                    | 278.80              |
| 9      | -30.619848   | 150.143516    | 282.28               | 2.40                    | 284.68              |
| 10     | -30.619349   | 150.144202    | 285.56               | 2.40                    | 287.96              |



**Name:** Rail Line Spur  
**Path type:** Two-way  
**Observer view angle:** 50.0°



| Vertex | Latitude (°) | Longitude (°) | Ground elevation (m) | Height above ground (m) | Total elevation (m) |
|--------|--------------|---------------|----------------------|-------------------------|---------------------|
| 1      | -30.623468   | 150.096678    | 250.18               | 3.00                    | 253.18              |
| 2      | -30.627751   | 150.106591    | 256.03               | 3.00                    | 259.03              |
| 3      | -30.628725   | 150.110271    | 263.60               | 3.00                    | 266.60              |
| 4      | -30.628760   | 150.111907    | 268.24               | 3.00                    | 271.24              |
| 5      | -30.627793   | 150.115646    | 268.82               | 3.00                    | 271.82              |
| 6      | -30.626884   | 150.118607    | 271.35               | 3.00                    | 274.35              |
| 7      | -30.626307   | 150.121037    | 272.17               | 3.00                    | 275.17              |
| 8      | -30.626214   | 150.123403    | 269.08               | 3.00                    | 272.08              |
| 9      | -30.626108   | 150.136310    | 268.35               | 3.00                    | 271.35              |
| 10     | -30.625757   | 150.137984    | 267.29               | 3.00                    | 270.29              |
| 11     | -30.624372   | 150.139228    | 271.97               | 3.00                    | 274.97              |
| 12     | -30.622674   | 150.139748    | 271.50               | 3.00                    | 274.50              |
| 13     | -30.620901   | 150.139099    | 274.15               | 3.00                    | 277.15              |
| 14     | -30.619534   | 150.137469    | 279.35               | 3.00                    | 282.35              |
| 15     | -30.619124   | 150.135543    | 279.51               | 3.00                    | 282.51              |
| 16     | -30.619470   | 150.133665    | 278.33               | 3.00                    | 281.33              |
| 17     | -30.620389   | 150.132313    | 275.30               | 3.00                    | 278.30              |
| 18     | -30.624732   | 150.127662    | 269.88               | 3.00                    | 272.88              |
| 19     | -30.625651   | 150.126048    | 267.41               | 3.00                    | 270.41              |
| 20     | -30.625979   | 150.124530    | 269.46               | 3.00                    | 272.46              |
| 21     | -30.626071   | 150.121182    | 273.64               | 3.00                    | 276.64              |
| 22     | -30.626468   | 150.119278    | 271.09               | 3.00                    | 274.09              |
| 23     | -30.627539   | 150.115888    | 269.52               | 3.00                    | 272.52              |
| 24     | -30.628287   | 150.112857    | 271.45               | 3.00                    | 274.45              |
| 25     | -30.628647   | 150.111263    | 266.13               | 3.00                    | 269.13              |
| 26     | -30.628379   | 150.109059    | 261.48               | 3.00                    | 264.48              |

## Discrete Observation Point Receptors

| Name | ID | Latitude (°) | Longitude (°) | Elevation (m) | Height (m) |
|------|----|--------------|---------------|---------------|------------|
| OP 1 | 1  | -30.630373   | 150.125214    | 263.38        | 1.50       |
| OP 2 | 2  | -30.629057   | 150.125209    | 263.80        | 1.50       |
| OP 3 | 3  | -30.641849   | 150.113206    | 256.09        | 1.50       |

# Glare Analysis Results

## Summary of Results No glare predicted

| PV Array   | Tilt        | Orient      | Annual Green Glare |     | Annual Yellow Glare |     | Energy |
|------------|-------------|-------------|--------------------|-----|---------------------|-----|--------|
|            | °           | °           | min                | hr  | min                 | hr  | kWh    |
| PV array 1 | SA tracking | SA tracking | 0                  | 0.0 | 0                   | 0.0 | -      |

*Total glare received by each receptor; may include duplicate times of glare from multiple reflective surfaces.*

| Receptor           | Annual Green Glare |     | Annual Yellow Glare |     |
|--------------------|--------------------|-----|---------------------|-----|
|                    | min                | hr  | min                 | hr  |
| Leards Forest Road | 0                  | 0.0 | 0                   | 0.0 |
| Mine Access Road 1 | 0                  | 0.0 | 0                   | 0.0 |
| Mine Access Road 2 | 0                  | 0.0 | 0                   | 0.0 |
| Rail Line Spur     | 0                  | 0.0 | 0                   | 0.0 |
| OP 1               | 0                  | 0.0 | 0                   | 0.0 |
| OP 2               | 0                  | 0.0 | 0                   | 0.0 |
| OP 3               | 0                  | 0.0 | 0                   | 0.0 |

## PV: PV array 1 no glare found

*Receptor results ordered by category of glare*

| Receptor           | Annual Green Glare |     | Annual Yellow Glare |     |
|--------------------|--------------------|-----|---------------------|-----|
|                    | min                | hr  | min                 | hr  |
| Leards Forest Road | 0                  | 0.0 | 0                   | 0.0 |
| Mine Access Road 1 | 0                  | 0.0 | 0                   | 0.0 |
| Mine Access Road 2 | 0                  | 0.0 | 0                   | 0.0 |
| Rail Line Spur     | 0                  | 0.0 | 0                   | 0.0 |
| OP 1               | 0                  | 0.0 | 0                   | 0.0 |
| OP 2               | 0                  | 0.0 | 0                   | 0.0 |
| OP 3               | 0                  | 0.0 | 0                   | 0.0 |

## PV array 1 and Route: Leards Forest Road

No glare found

## PV array 1 and Route: Mine Access Road 1

No glare found

## **PV array 1 and Route: Mine Access Road 2**

No glare found

## **PV array 1 and Route: Rail Line Spur**

No glare found

## **PV array 1 and OP 1**

No glare found

## **PV array 1 and OP 2**

No glare found

## **PV array 1 and OP 3**

No glare found



# Assumptions

---

"Green" glare is glare with low potential to cause an after-image (flash blindness) when observed prior to a typical blink response time.

"Yellow" glare is glare with potential to cause an after-image (flash blindness) when observed prior to a typical blink response time.

Times associated with glare are denoted in Standard time. For Daylight Savings, add one hour.

The algorithm does not rigorously represent the detailed geometry of a system; detailed features such as gaps between modules, variable height of the PV array, and support structures may impact actual glare results. However, we have validated our models against several systems, including a PV array causing glare to the air-traffic control tower at Manchester-Boston Regional Airport and several sites in Albuquerque, and the tool accurately predicted the occurrence and intensity of glare at different times and days of the year.

Several V1 calculations utilize the PV array centroid, rather than the actual glare spot location, due to algorithm limitations. This may affect results for large PV footprints. Additional analyses of array sub-sections can provide additional information on expected glare. This primarily affects V1 analyses of path receptors.

Random number computations are utilized by various steps of the annual hazard analysis algorithm. Predicted minutes of glare can vary between runs as a result. This limitation primarily affects analyses of Observation Point receptors, including ATCTs. Note that the SGHAT/ ForgeSolar methodology has always relied on an analytical, qualitative approach to accurately determine the overall hazard (i.e. green vs. yellow) of expected glare on an annual basis.

The analysis does not automatically consider obstacles (either man-made or natural) between the observation points and the prescribed solar installation that may obstruct observed glare, such as trees, hills, buildings, etc.

The subtended source angle (glare spot size) is constrained by the PV array footprint size. Partitioning large arrays into smaller sections will reduce the maximum potential subtended angle, potentially impacting results if actual glare spots are larger than the sub-array size. Additional analyses of the combined area of adjacent sub-arrays can provide more information on potential glare hazards. (See previous point on related limitations.)

The variable direct normal irradiance (DNI) feature (if selected) scales the user-prescribed peak DNI using a typical clear-day irradiance profile. This profile has a lower DNI in the mornings and evenings and a maximum at solar noon. The scaling uses a clear-day irradiance profile based on a normalized time relative to sunrise, solar noon, and sunset, which are prescribed by a sun-position algorithm and the latitude and longitude obtained from Google maps. The actual DNI on any given day can be affected by cloud cover, atmospheric attenuation, and other environmental factors.

The ocular hazard predicted by the tool depends on a number of environmental, optical, and human factors, which can be uncertain. We provide input fields and typical ranges of values for these factors so that the user can vary these parameters to see if they have an impact on the results. The speed of SGHAT allows expedited sensitivity and parametric analyses.

The system output calculation is a DNI-based approximation that assumes clear, sunny skies year-round. It should not be used in place of more rigorous modeling methods.

Hazard zone boundaries shown in the Glare Hazard plot are an approximation and visual aid based on aggregated research data. Actual ocular impact outcomes encompass a continuous, not discrete, spectrum.

Glare locations displayed on receptor plots are approximate. Actual glare-spot locations may differ.

Refer to the Help page at [www.forgesolar.com/help/](http://www.forgesolar.com/help/) for assumptions and limitations not listed here.

Default glare analysis parameters and observer eye characteristics (for reference only):

- Analysis time interval: 1 minute
- Ocular transmission coefficient: 0.5
- Pupil diameter: 0.002 meters
- Eye focal length: 0.017 meters
- Sun subtended angle: 9.3 milliradians

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# STATEMENT OF ENVIRONMENTAL EFFECTS

## Merriown Solar Farm



AU213008068

1

15 November 2023

## REPORT

### Document status

| Version | Purpose of document | Authored by | Reviewed by   | Approved by   | Review date |
|---------|---------------------|-------------|---------------|---------------|-------------|
| 1       | Final               | Tam Durney  | Arie Krossman | Simon Pollock | 15/11/2023  |

### Approval for issue

Simon Pollock



15 November 2023

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# 1 INTRODUCTION

This Statement of Environmental Effects (SEE) has been prepared by RPS AAP Consulting Pty Ltd on behalf of Boggabri Coal Mine (the proponent) to support a Development Application (DA) for electricity generating works in the form of a solar farm (the proposed development) at 333 Leards Forest Road, Boggabri NSW (Lot 21 DP754940).

The proposed development includes:

- Photovoltaic (PV) modules making up a 4.95MWac solar farm;
- Internal access roads;
- Security fencing with barbed wire and access gates;
- Hardstand area;
- Inverters ;
- Car parking space;
- High voltage (HV) cabling connecting to privately operated 11kV transmission line;
- Future capacity for a lithium-ion/vanadium flow battery energy storage system (BESS).

This SEE has been prepared to assess the development against relevant legislation and planning controls in accordance with Section 4.15(1) of the *Environmental Planning & Assessment Act*, as well as the *Narrabri Local Environmental Plan 2012* and Narrabri Shire Council's relevant Development Control Plan, *DCP – Industrial Development Code*.

## 1.1 Project Context

Idemitsu Renewables (the developer) is the renewable energy development branch of Idemitsu Kosan in Australia. It is responsible for the development of the solar farm proposed by Boggabri Coal Operations Pty Ltd. Idemitsu Renewables operates alongside the company's mining operations arm Idemitsu Australia.

Idemitsu Renewables has been developing renewable energy and hydrogen projects in Australia since 2019. The Merriown Solar Farm development will join a portfolio that includes a large scale renewable developments across solar and pumped hydro in Muswellbrook, NSW; as well as a large scale green hydrogen development in Abbot Point, North Queensland.

The desired outcome of the Merriown Solar Farm is to provide energy for Boggabri Coal Mine's operations to become fully self-sufficient, running solely on renewable energy during daytime mining operations. This outcome would contribute to Idemitsu's decarbonisation commitments of a 46% reduction in carbon emissions by 2030 (compared to 2013 levels), and net zero by 2050 across the global business. Studies are underway to allow excess energy generated by Merriown Solar Farm to be provided to the local electricity grid system for external use, further contributing to Australia's net zero emissions goal.

## 1.2 The Applicant

Boggabri Coal Mine is an open-cut coal operation which has been contributing to the community and regional economy since 2006. The mine supports a workforce of about 600 employees and contractors. Most of our workers and their families live locally and are part of the community.

Coal is processed through a recently completed coal handling and preparation plant before being transported to the Port of Newcastle for international export. The mine produces up to 7 million tonnes per annum (mtpa) of saleable coal with a current approved mine life to 2033.

Boggabri Coal Operations Pty Ltd is the entity created by the shareholders in the Boggabri Coal Mine to operate the Mine. Ownership is split at 80% Idemitsu Australia (through its subsidiary company, Boggabri Coal Pty Ltd), 10% Chugoku Electric Power Australia Resources Pty Ltd and 10% NS Boggabri Pty Limited.

The applicant's details are provided below.

**Table 1–1 Applicant’s details**

| Identifier   | Details                                                                                               |
|--------------|-------------------------------------------------------------------------------------------------------|
| Organisation | Boggabri Coal Operations Pty Ltd                                                                      |
| ABN          | 76 600 191 455                                                                                        |
| Address      | Corporate: Level 9/175 Eagle St, Brisbane City QLD 4000<br>Local: Leards Forest Rd, Boggabri NSW 2382 |
| Phone        | 02 6743 4775                                                                                          |

### 1.3 Pre-DA Consultation

A Pre-DA meeting was held with Narrabri Shire Council on the 17<sup>th</sup> of January 2023 with representatives from Idemitsu Renewables, Boggabri Coal Operation and RPS. A presentation was made to Council, covering the development’s context, area, and potential development constraints.

Narrabri Shire Council stated that they had no immediate issues with the design of the development and circulated the presentation slide deck prepared by RPS and Idemitsu Renewables to the elected councillors to make them aware of the proposed development.

### 1.4 Supporting Documentation

The following documentation has been provided to support this SEE:

- Appendix A Concept plans;
- Appendix B Glint and Glare Assessment;
- Appendix C AHIMS search;
- Appendix D Property report;
- Appendix E Hazard risk assessment;
- Appendix F Capital Investment Value.

## 2 SITE CONTEXT

### 2.1 Location and surrounds

The project site is located at 333 Leards Forest Road, Boggabri NSW, legally referred to as Lot21/DP754940, with a total size of 90.1ha, and known locally as Merriown. The physical components of the proposed development will occupy approximately 13ha of land located in the south-western corner of the lot (the site).

The site's surroundings mostly consist of primary production land, coal mining sites and State Forest. The area is sparsely populated and the site is relatively flat, consisting of disturbed grassland.

The proposed solar farm is bounded by Merrygowen Creek to the west and mine-owned land with vacant residential buildings to the east. The site is located approximately 1.3km west of Boggabri Coal Mine. The site borders the Maules Creek coal mine access road to the north, which cuts the lot in an east to west orientation.

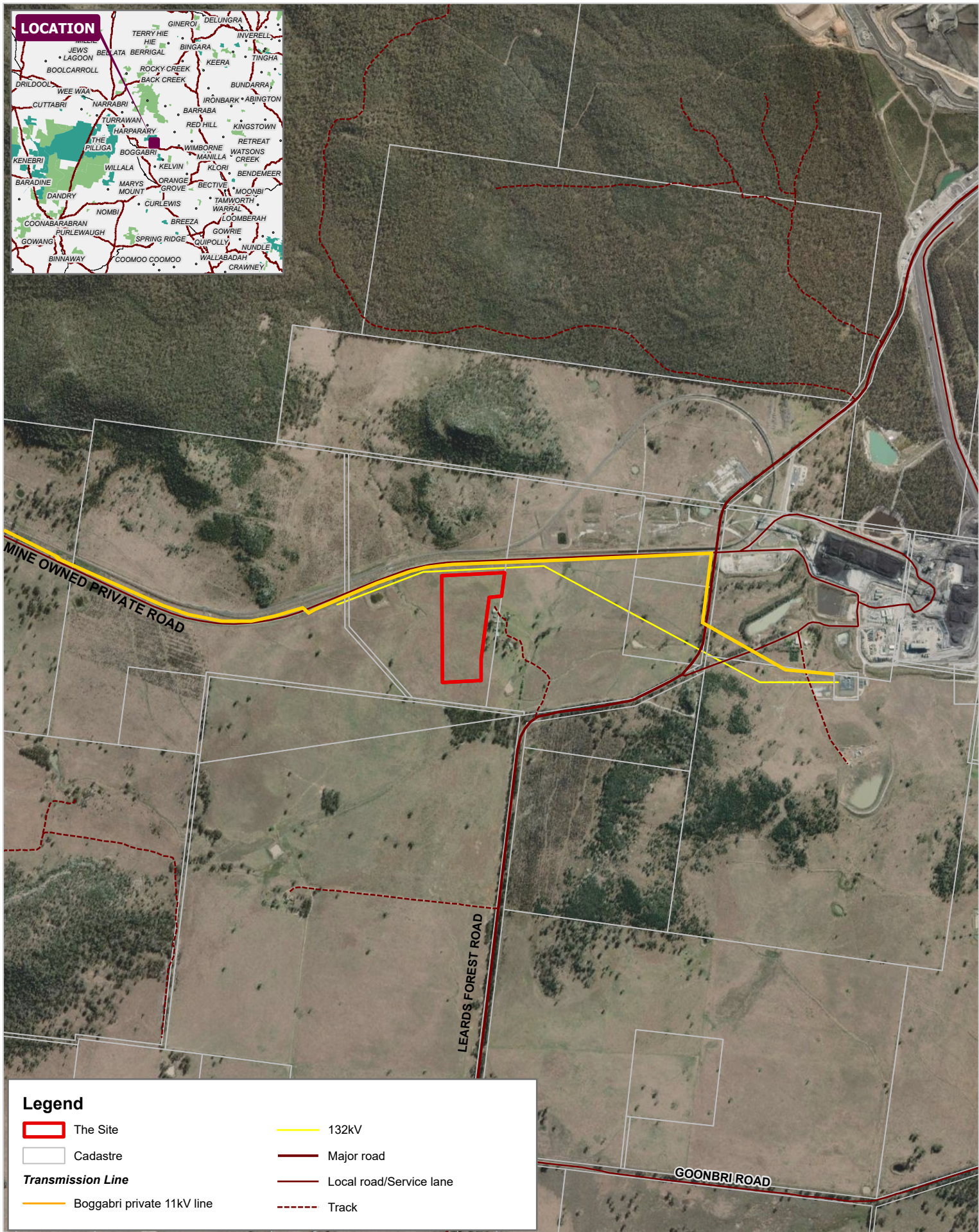
The north-western corner of the legal lot borders Leard State Forest, which is considered bushfire prone land by Narrabri Shire Council, with a vegetation buffer overlapping with the lot boundary. This is located over a kilometre to the north-west of the site. The closest town to the site, Boggabri, lies approximately 10.4km south-west.

The site exists on RU1 Primary Production zoned land. All land surrounding the lot is also RU1 Primary Production, bar the RU3 Forestry land making up Leards State Forest to the North.









CLIENT: Idemitsu  
 PROJ: AU213008068  
 LOCATION: Boggabri Solar Farm

**DATA SOURCES**  
 Client, RPS, NSWSS, Esri, HERE, Garmin, FAO, NOAA, USGS, Maxar

**MAP: Fig 2-2 Site Location**  
**VERSION: A**  
**DATE EXPORTED: 31/08/2023**  
**TECHNICIAN: Natalie Wood**

0 200 400 600 800 1,000 m  
 SCALE: 1:25,000  
 A4 SIZE / Projection: GDA2020 MGA Zone 56



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## 2.2 The site

An existing privately owned 11kV transmission line (owned by the Boggabri Coal) borders the broader site and runs from the high voltage substation at Boggabri Coal Mine to the Essential Energy network approximately 5km NNW of the town of Boggabri.

In the context of the proposal, the transmission line runs between Boggabri Coal mine's haul access road and the existing rail line. As such, a small connection line running underground through to the northern side of the Mine haul road is required to connect to the broader grid electricity system. This ensures an efficient energy supply and minimises impacts.

The north-western edge of Lot 21 is mapped as bush fire prone land (vegetation buffer) land and could be considered a constraint on the proposed development due to the vegetation buffer of the neighbouring lot (Lot 38 DP 1211027) overlapping the northern edge of the larger lot. However, the solar farm will be located a minimum of 1km to the south of the bushfire hazard. This provides a significant separation between the proposed development and the mapped bushfire risk. This matter is further explored in Section 5.1.

There are a number of Aboriginal heritage sites both on the project site and within a 200m buffer. To date, only five (5) finds have been located on the project site and further investigations are being progressed in the preparation of an Aboriginal Cultural Heritage Assessment Report (ACHAR). The proponent is currently reviewing the potential for impacts to Aboriginal Heritage sites during development and this is occurring concurrently to the assessment of this application. This matter is further discussed in Section 5.7.

## 2.3 Suitability

The project site is zoned RU1 – Primary Production and 'Electricity Generating Works' and are permitted with consent under *State Environmental Planning Policy (SEPP) 2021 (Transport and Infrastructure)*.

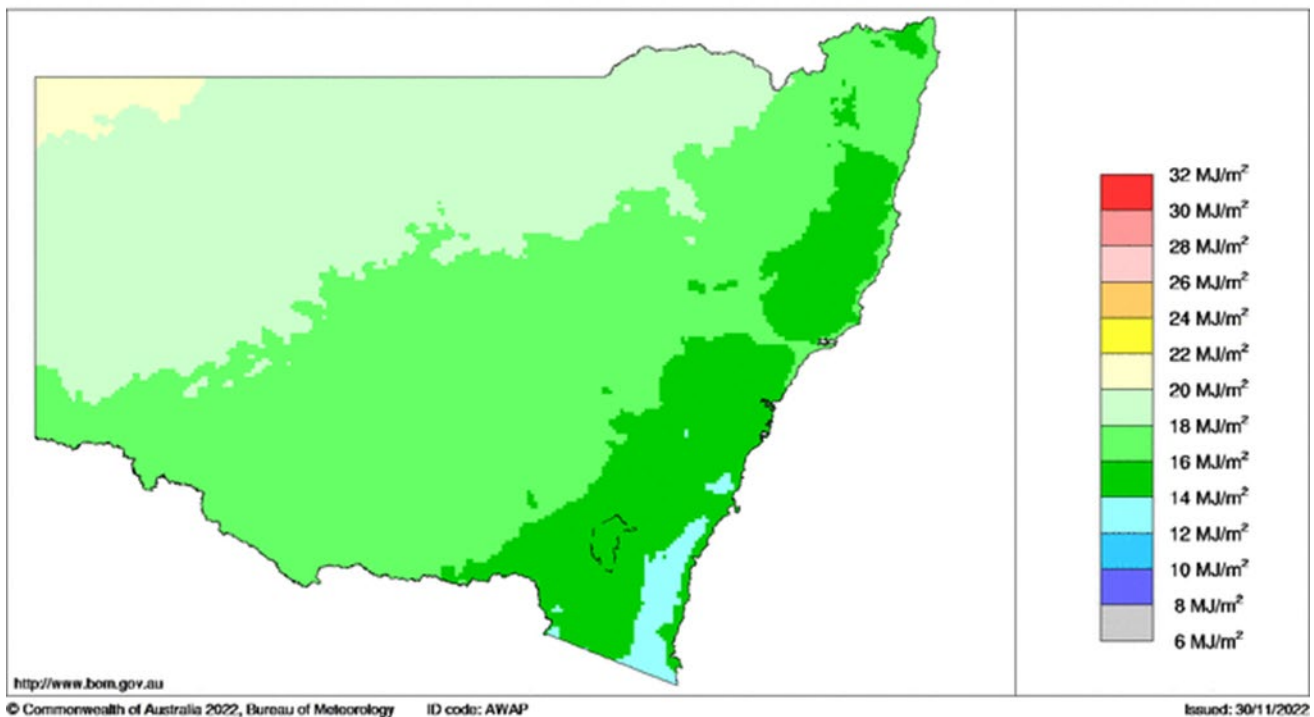
The proposed site for development has been selected due to its proximity to the Boggabri Coal Mine, which its energy production will primarily support. The site exists on land owned by the proponent, with no residential land nearby. The existing electricity transmission infrastructure on-site allows for connection to Essential Energy's grid network with minimal interruption or environmental impact in Stage 2.

The Bureau of Meteorology (BoM) runs a computer model which produces estimates of the total amount of solar radiation that reaches the earth's surface in a day called 'daily global solar exposure'. For each location on the surface of the earth, an energy budget calculation is made using hourly visible radiation information i.e. radiances from the current operational geostationary meteorological satellite. Typical values for solar exposure range from 1 to 35MJ/m<sup>2</sup> (megajoules per square metre) in Australia. The values are usually highest in clear sun conditions during the summer, and lowest during winter or very cloudy days.

**Figure 2–3** below shows average daily solar exposure for New South Wales within the 12-month period between the 1 December 2021 to 30 November 2022.



Australian Bureau of Meteorology



**Figure 2–3 Global Solar Exposure Daily Averages 01/12/2021 to 30/11/2022**

Based on BoM computer model estimates, the site would have received approximately 16-18MJ/m²/day in the observed 12-month period.

## 3 PROPOSED DEVELOPMENT

### 3.1 Description

Merriown Solar Farm is a proposed behind-the-meter solar electricity generation facility with a potential capacity of 4.95MWac connecting through via a new buried 11kV high voltage cable into an existing 11kV transmission line, which is privately owned by the proponent. This overhead connection would transmit the generated electricity to the existing 11kV substation at Boggabri Coal Mine. The electricity would be used to power daytime operations at Boggabri Coal Mine in a self-sufficient manner, with the central inverter spilling any excess generation in Stage 1. In Stage 2, excess generation may be exported into the Essential Energy or TransGrid network via a new grid connection.

The PV generation facility will consist of five PV array rows once fully constructed, connected via an underground 11kV cable feeding into the inverter station and then into an 11kV connection-point kiosk at the north of the site. Each array block will be capable of supporting the connection of a Direct Current (DC) coupled Battery Energy Storage System (BESS) to provide for arbitrage, load capacity and load shifting capabilities in Stage 2 of the proposed development. Array blocks will comprise of the following elements:

- PV Modules mounted on a Single Axis Tracking mounting system;
- DC String cables connecting the PV modules to DC combiner boxes;
- Underground DC feeder cables connecting combiner boxes to the central inverter, and
- Underground 11kV feeder cable connecting the central inverter to the 11kV connection-point kiosk.

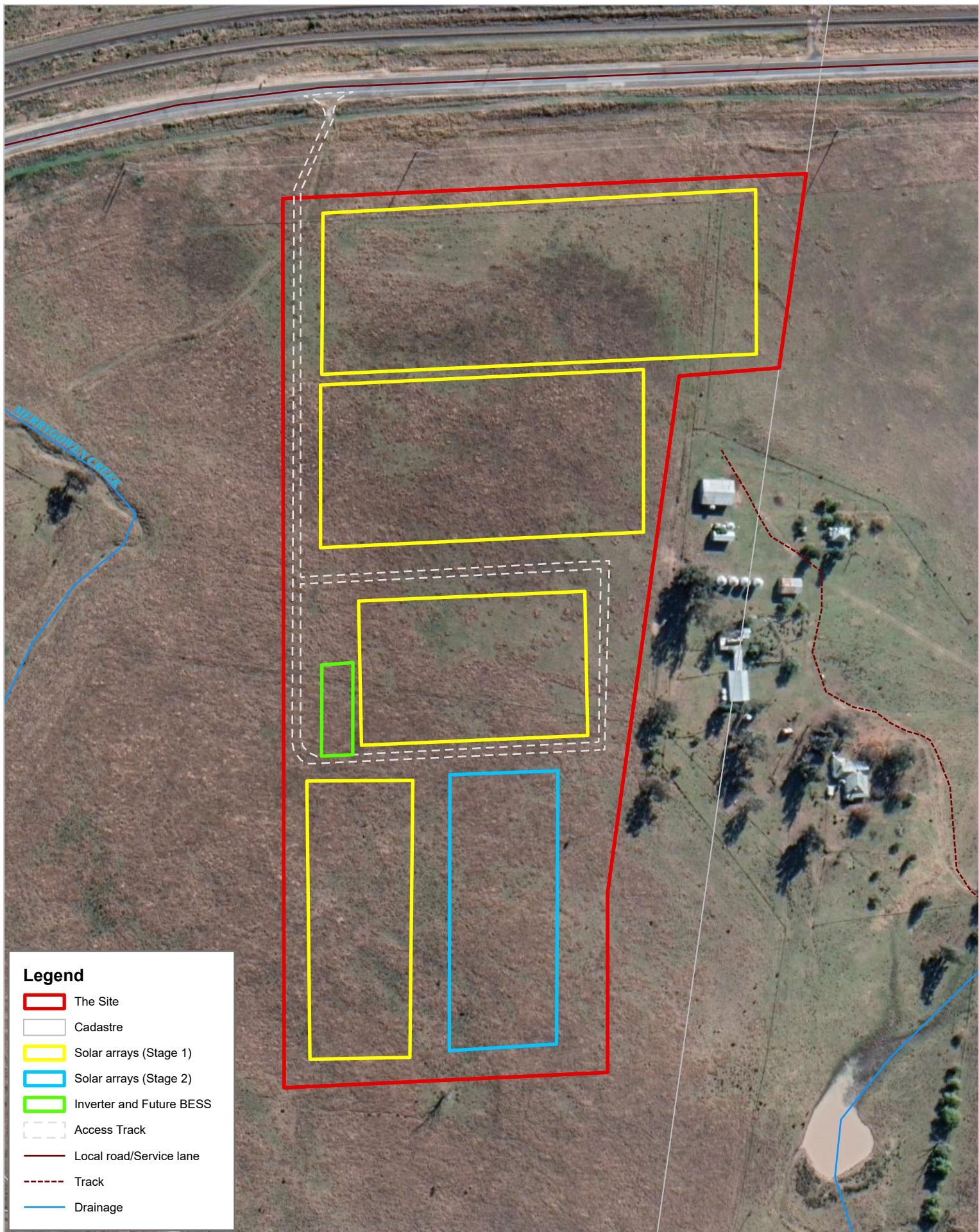
The proposed development will be constructed in two stages. Stage 1 will consist of the establishment of the five main array rows (approx. 11,200 PV modules). If the development were to progress to Stage 2, an additional 21 single axis trackers (approx. 1,750 PV modules) would be added to the two lower array rows, along with a BESS in the future. The onsite BESS will either comprise a 2.5MW/5MWh lithium battery or a 1.5MW/12MWh vanadium redox flow battery. The BESS will be located to the west of the middle array block, next to the inverter station and along the access track.

Site access will be achieved through an existing site access along the mine haul road to the north and a secondary access from the existing track leading from the unoccupied mine-owned residence to the east. A four-metre-wide access track will then be formed running along the western edge of the arrays, before turning east to connect the two accesses. This will be utilised for 19.5m trucks during construction. The secondary access is only to be used in case of emergencies by light vehicles and will not have consistent traffic during construction or operation.

A 2.3m high fence will surround the site perimeter, consisting of a 1.8m chain link fence and three spools of barbed wire in accordance with AS1725.1-2010. The arrays will be setback a minimum of 10m from any given point of the fence line to achieve a 10m Asset Protection Zone (APZ).

A layout of the Detailed Site Plan is provided in Figure 3–1 below.





## MERRIOWN SOLAR FARM PROPOSED SITE LAYOUT

## FIGURE 3-1



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## 3.2 Construction

The proposed development for Merriown Solar Farm consists of the following works:

- Site establishment works, including designation of site access, laying of compound and stockpile areas, and erection of construction fencing;
- Forming of gravel access and laydown;
- Site levelling and grading where required;
- Trenching for electrical infrastructure and footings for solar panel array racks;
- Establishment of solar panel array racking and laying of site's electrical wiring;
- Establishment of slab for future BESS;
- Assembly of inverter infrastructure;
- Connection of inverter to 11kV power line north of the site;
- Fixing of solar panels to racking;
- Erection of chain link security fencing and gates, and
- Provision of room for a car parking space and through site road loop.

The proposed works for Stage 2 would consist of the following:

- Placement of BESS onsite and connection to substation and electrical connections, and
- Installation of additional solar panels, inclusive of electrical infrastructure, footings, array racking and wiring required.

Construction of Stage 1 is anticipated to be completed over a 30-week period. An initial eight-week program will commence at construction notice to proceed to prepare the Site and complete cable trenching. There will then be a non-activity period of approximately six weeks while long lead items arrive at Site. From this point, an 18-week period will commence, with testing and commissioning being completed over a 6-week period. Construction period is dependent on weather conditions and overlap with public holidays.

### 3.2.1 Panels

Merriown Solar Farm will utilise a single axis tracking system for the PV modules. The configuration will be the industry standard for trackers, with 1P (1 in portrait) configuration. Panels are expected to be a size of 2278 x 1134 mm. Mounting will be achieved through steel posts driven to roughly 1.5m below ground level, with supports attached to support the weight of the panels. A general clearance of 300mm – 800mm will be utilised to allow for grass and weed maintenance of the site throughout its operational life.

### 3.2.2 Inverters

One central inverter with string combiners is proposed for the development and will be tuned to operate to have a maximum output of 4.95MW<sub>ac</sub> at 11kV<sub>ac</sub>.

### 3.2.3 Substation

The solar farm's substation on site will consist of an 11kV/50Hz outdoor connection point kiosk, with the central inverter feeding into it. There will also be an 11kV/11kV earthing transformer and neutral earthing resistor connected in parallel as a requirement to meet electrical compliance for Mine site supply. The solar farm substation will be linked via an underground feeder cable onto the existing 11kV overhead line, sending electricity generated to the Boggabri Coal Mine 11kV substation, which will then allow distribution into the mine's electrical infrastructure.

### **3.2.4 Battery storage**

The solar farm is considering future connection of a DC Coupled BESS solution. The BESS solutions would consist of integrated self-contained battery blocks. Depending on the outcome of the BESS feasibility study and business case, the facility may utilise a lithium-ion or vanadium battery solution. The site plans are based on a vanadium battery solution which requires a larger footprint than a lithium-ion battery solution.

### **3.2.5 Security fencing**

A security fence with barbed wire will fence the site's perimeter, being 1.8m in height with three rows of barbed wire affixed on top for a total height of 2.3m. The fence will be fixed by engineered embedded concrete foundations. Access gates will be installed at the location of access tracks.

### **3.2.6 Construction hours**

Construction hours for the proposed development are as follows:

- Monday-Sunday 7am-6pm;
- No work on public holidays.

### **3.2.7 Stockpile and laydown area**

During Stage 1 there will be a stockpile and laydown area located in the northern portion of the site. This will enable ease of access for trucks and employees without unnecessarily interfering with the construction footprint.

During Stage 2, a new laydown area and carpark will be created further south, to facilitate the new proposed development area. The stockpile area in the north will still be utilised for Stage 2.





### Legend

- The Site
- Laydown
- Carpark
- Cadastre
- Access Track
- Major road
- Local road/Service lane
- Track
- Drainage

## STOCKPILE AND LAYDOWN AREA STAGING

**CLIENT:** Idemitsu  
**PROJ:** AU213008068  
**LOCATION:** Marriown Solar Farm

**DATA SOURCES**  
 Client, RPS, NSWSS, Google, Esri, HERE, Garmin, FAO, NOAA, USGS

**MAP:** Fig 3-2 Stockpile1  
**VERSION:** B  
**DATE EXPORTED:** 15/11/2023  
**TECHNICIAN:** Natalie.Wood

0 20 40 60 80 100 120 140 160 180  
 m

SCALE 1:5,000  
 A4 SIZE / Projection: GDA2020 MGA Zone 56



## FIGURE 3-2



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### **3.2.8 Vehicle movements**

Construction is expected to take place over a period of 24 weeks, of which 18 weeks are considered 'active construction' where works are taking place. Materials will be delivered in either containers or on side curtain trailers. There is expected to be about 50 x 12.2m containers, or equivalent trailer, deliveries for materials, along with an additional 270 equivalent deliveries for fill and surfacing materials over the course of the construction period. Much of material delivery for infrastructure and civil works is expected at the start of the construction period, with up to eight deliveries in a single day and a peak of 30 deliveries within a week. Average deliveries across the active construction period are roughly 15 deliveries a week.

Worker vehicle traffic is expected to be an average of 10 vehicles (20 trips) per day, up to a peak of 25 vehicles (50 trips) per day. Overall, delivery and worker traffic are not expected to significantly impact the operation of local roads due to current usage and maximum capacity able to easily accommodate the number of trips. Additionally, the primary access will be off the mine's private haul road, which will be able to accommodate the construction-related traffic.

### **3.2.9 Employment**

Workforce numbers are expected to peak at around 50 employees, with the average workforce being around 20 full-time employees over the course of 18 weeks of active construction.

## **3.3 Operation**

### **3.3.1 Operational hours**

The development is proposed to operate 24 hours, 7 days a week.

### **3.3.2 Vehicle movements**

Vehicle movements to and from the site are expected to be up to two times per day during the operational life of the proposed development from the primary access track, and only in the case of emergency from the secondary access track.

### **3.3.3 Employment**

During operation, the proposed development is expected to have 1-2 local subcontractors for the general care and maintenance of the site. The site will generally be unmanned and operated remotely. A technician will attend the site when required for technical maintenance activities. All operation activities will be managed by the Electrical Maintenance team at Boggabri Coal Operations.

## **3.4 Earthworks**

Proposed earthworks on the site will primarily consist of levelling, piling for footings, formation of access roads and construction of a hard stand area. These works would be minor in scope and be limited in the total increase in impervious surface area.

## **3.5 Site access**

The subject site will be accessed via the proponent-owned mine access road on the northern boundary of the site. An internal access track is proposed to be developed, building upon the existing access to the property. This track will be accessed via the turnoff shown in Figure 3–3.







## 4 APPLICABLE LEGISLATION AND PLANNING CONTROLS

### 4.1 Commonwealth legislation

#### 4.1.1 Environmental Protection and Biodiversity Conservation Act 1999

The Commonwealth of Australia's *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act), in conjunction with the Commonwealth's *Environmental Protection and Biodiversity Conservation Regulations 2000*, are the basis for the determination of national environmental protection and conservation within Australian jurisdictions.

The proposed DA will not impact on any areas that are considered to be of national environmental significance.

### 4.2 State legislation

#### 4.2.1 Environmental Planning and Assessment Act 1979

The *Environmental Planning & Assessment Act 1979* (EP&A Act) establishes the planning and approvals process in NSW. The EP&A Act provides for the making of Environmental Planning Instruments (EPIs), including Local Environmental Plans (LEPs) and State Environmental Planning Policies (SEPPs), which set out requirements for specific localities and/or types of development. The applicable EPIs and the Regulations made under the EP&A Act determine the relevant planning approval pathway and the associated environmental assessment requirements for proposed development activities.

##### 4.2.1.1 Section 4.15 – Evaluation

In order to conduct an assessment of a development application a consent authority must ensure that Section 4.15 of the EP&A Act is satisfied:

*(1) Matters for consideration – general. In determining a development application, a consent authority is to take into consideration such of the following matters as are of relevance to the development the subject of the development application:*

- a. the provisions of:*
  - i. any environmental planning instrument, and*
  - ii. any proposed instrument that is or has been the subject of public consultation under this Act and that has been notified to the consent authority (unless the Planning Secretary has notified the consent authority that the making of the proposed instrument has been deferred indefinitely or has not been approved), and*
  - iii. any development control plan, and*
    - iiia. any planning agreement that has been entered into under section 7.4, or any draft planning agreement that a developer has offered to enter into under section 7.4, and*
  - iv. the regulations (to the extent that they prescribe matters for the purposes of this paragraph), and*
  - v. repealed*
- b. the likely impacts of that development, including environmental impacts on both the natural and built environments, and social and economic impacts in the locality,*
- c. the suitability of the site for the development,*
- d. any submissions made in accordance with this Act or the regulations,*
- e. the public interest.*



#### 4.2.1.2 Section 4.46 – Integrated development

In order for a development application to be approved, it must be determined whether the works require concurrence from various authorities. The proposed development is not considered integrated development for the following reasons:

- *Coal Mine Subsidence Compensation Act 2017*: the works are not within a mine subsidence district.
- *Fisheries Management Act 1994*: the development does not involve natural waterways or the carrying out of dredging, reclamation, or aquaculture.
- *Heritage Act 1977*: the development will not impact on a heritage item-discussed in Section 4.2.5.
- *Mining Act 1992*: the development is not for the granting of a mining lease.
- *National Parks and Wildlife Act 1974*: the development is not expected to impact of Aboriginal artefacts-discussed in Section 4.2.3.
- *Petroleum (Onshore) Act 1991*: the development is not for the granting of a petroleum production lease.
- *Protection of the Environment Operations Act 1997*: refer to Section 4.2.6.
- *Roads Act 1993*: no public or classified roads will be physically affected by the development. Increased traffic does not trigger integrated development.
- *Rural Fires Act 1997*: the development does not require referral under Section 100B. Refer to Section 5.1 for justification.
- *Water Management Act 2000*: the development does not require an activity approval under the Act.

#### 4.2.2 Biodiversity Conservation Act 2016

The proposed development is subject to assessment against the *Biodiversity Conservation Act 2016* (BC Act) and its regulation (2017). Part 7.3 of the BC Act sets out the test for determining whether a proposed development or activity is likely to significantly affect threatened species, communities, or their habitats:

- Harm any animal that is of, or is part of, a threatened species, population or ecological community;
- Remove any plant that is of, or is part of, a threatened species, population or ecological community;
- Damage critical habitat; and
- Damage habitat of a threatened species, population, or ecological community.

No threatened ecological communities or any listed flora or fauna were identified on site. The site is heavily disturbed grassland with minimal presence of biodiverse vegetation on the area to be utilised for the development.

#### 4.2.3 National Parks and Wildlife Act 1974

The *National Parks and Wildlife Act 1974* (NPW Act) conserves places, objects, and features of significance to Aboriginal people. It is an offence under the NPW Act to:

- Harm or desecrate an object that the person knows is an Aboriginal object except in accordance with an Aboriginal Heritage Impact Permit (AHIP); and
- Harm or desecrate Aboriginal objects and Aboriginal places except in accordance with an AHIP or where the person can show they exercised due diligence to reasonably determine that no Aboriginal object will be harmed.

A search of the Aboriginal Heritage Information Management System (AHIMS) was undertaken on 13 February 2023, which indicated that there were nine registered sites or places of Aboriginal significance situated within a 200m radius of the site. Initial fieldwork has identified only five (5) finds and it is not expected to find additional items of significance. Accordingly, an ACHAR is being finalised in consultation with Registered Aboriginal Parties (RAPs) and will be provided to Council once completed to inform the final assessment of the development application.

#### 4.2.4 Contaminated Land Management Act 1997

The *Contaminated Land Management Act 1997* (CLM Act) is administered by the NSW Environment Protection Authority (EPA) and local councils. It provides a regime for investigating, and, where appropriate, remediating land affected by contamination which represents a significant risk of harm to human health or the environment. The CLM Act specifies responsibilities for managing contaminated land and the role of the EPA in the assessment of contamination and the supervision of the investigation, remediation, and management of contaminated sites.

It is unlikely that the proposed development will impact on any contaminated land due to the nature of the site as an active agricultural field. Current and previous agricultural activities on the site may have involved the use of pesticides and other contaminants, however these are unlikely to pose a risk of harm to human health due to the site's proposed use as electricity generating works with no inhabitable structures. If works uncover a need for remediation, then the principal construction contractor of the proposed activity will need to undertake site investigations, in accordance with the NSW EPA Guidelines. All contamination incidents or suspected contamination incidents will be notified to the EPA. There were no signs of significant spills of oils or hazardous liquids during the site inspection undertaken as a component of this SEE.

#### 4.2.5 Heritage Act 1977

The *Heritage Act 1977* is concerned with the protection of scheduled heritage items, sites, and relics. It is administered by the NSW Heritage Office. It is an offence under the *Heritage Act 1977* to disturb any relics. Relics, as defined in the *Heritage Act 1977*, means any deposit, artefact, object, or material evidence that:

- Relates to the settlement of the areas that comprises New South Wales, not being Aboriginal settlement, and
- Is of State or local heritage significance.

The proposed works are not located in a heritage conservation area and are not located near any local or State heritage items. The nearest heritage item to the site is the local heritage item of 'Midkin Homestead' (Listing No. I004) located approximately 1.8km from the site. While the terrain between the project site and Midkin Homestead is relatively flat, a significant amount of tree cover and vegetation obscures direct line of sight. Consequently, it is unlikely that the proposed development will impact on any heritage items. Notwithstanding this, however, an unexpected finds protocol should be developed and implemented in should it eventuate that any potential items of heritage significance are uncovered during works.

#### 4.2.6 Protection of the Environment Operations Act 1997

One of the aims of the Protection of *Environment Operations Act 1997* (PoEO Act) is to reduce risks to human health and prevent the degradation of the environment using mechanisms that promote the following:

- Pollution prevention and cleaner production;
- The reduction to harmless levels of the discharge of substances likely to cause harm to the environment;
- The elimination of harmful wastes;
- The reduction in the use of materials and the re-use, recovery, or recycling of materials;
- The making of progressive environmental improvement, including the reduction of pollution at source;
- The monitoring and reporting of environmental quality on a regular basis.

The proposed works are not a scheduled activity pursuant to Schedule 1 of the PoEO Act.

## 4.3 State Environmental Planning Policies (SEPPs)

### 4.3.1 State Environmental Planning Policy (Resilience and Hazards) 2021

The recently consolidated *State Environmental Planning Policy (Resilience and Hazards) 2021* (Resilience and Hazards SEPP) is the new legislative instrument for development involving coastal management, hazardous and offensive development, and the remediation of land.

Chapter 3 of the *State Environmental Planning Policy (Resilience and Hazards) 2021* dictates that no development should be undertaken without investigation and appropriate action into the remediation of land, in order to improve the health of the natural and human environment. Hence, consent authorities must not grant approval unless it has assessed if the land is contaminated, and, if it is, that the land is suitable (or will be suitable after remediation) for its proposed use. Commentary on contamination for the proposed development can be found in Section 5.3 of this report.

### 4.3.2 State Environmental Planning Policy (Biodiversity and Conservation) 2021

The *State Environmental Planning Policy (Biodiversity and Conservation) 2021* (Biodiversity and Conservation SEPP) is the recently consolidated planning instrument that dictates the legislative planning frameworks around vegetation in non-rural areas, koala habitat protection, bushland in urban areas, canal estate development and key river and drinking water catchments.

The proposed development will not impact any of the above criteria.

### 4.3.3 State Environmental Planning Policy (Planning Systems) 2021

The *State Environmental Planning Policy (Planning Systems) 2021* (Planning Systems SEPP) is the comprehensive state planning instrument that forms the legislative controls, guidelines, and definitions for State and Regional development, Aboriginal land, and Concurrences and consents.

Chapter 2 of the Planning Systems SEPP defines the parameters for development being considered State Significant Development (SSD). Section 2.6 of the SEPP dictates that development specified under Schedule 1 or 2 of the Planning Systems SEPP constitutes SSD. Under Schedule 1(20), development for the purposes of electricity generation is SSD if it:

- a. has a capital investment value of more than \$30 million, or
- b. has a capital investment value of more than \$10 million and is located in an environmentally sensitive area of State significance.

As the proposed development has an estimated CIV of \$25,345,425 excluding GST, which does not exceed \$30 million, and is not located in an environmentally sensitive area of State significance, it is not considered State Significant Development. The CIV report is contained in Appendix F.

However, under Section 2.19 of the Planning Systems SEPP, development of a type listed in Schedule 6 of the SEPP is considered Regionally Significant Development (RSD), which makes the relevant Regional Planning Panel the consent authority for the proposed development. In accordance with Schedule 6(5), as the development is private infrastructure in the form of electricity generating works with a CIV over \$5 million, it constitutes RSD. This means that the Regional Planning Panel, the Northern Regional Planning Panel (NRPP) will be the determining authority.



#### 4.3.4 State Environmental Planning Policy (Transport and Infrastructure) 2021

The *State Environmental Planning Policy (Transport and Infrastructure) 2021* (Transport and Infrastructure SEPP) is the overarching planning framework for the development and associated works of infrastructure, educational establishments, childcare facilities, major infrastructure corridors, and the three ports of Port Botany, Port Kembla, and Port Newcastle.

Chapter 2 of the Transport and Infrastructure SEPP deals with the permissibility and planning pathways for a range of infrastructure and transport related projects around NSW. Under Division 4 of this chapter, the proposed development is described as electricity generating works, which is defined as follows:

##### 2.35 Definitions

*In this Division—*

*electricity generating works means a building or place used for the following purposes, but does not include a solar energy system—*

- c. making or generating electricity,**
- d. electricity storage.**

Section 2.36 of the Division indicates that electricity generating works are development permitted with consent under the following parameters-

*(1) Development for the purpose of electricity generating works may be carried out by any person with consent on the following land—*

- a. in the case of electricity generating works comprising a building or place used for the purpose of making or generating electricity using waves, tides or aquatic thermal as the relevant fuel source—on any land,**
- b. in any other case—any land in a prescribed non-residential zone.**

The project site is zoned as RU1 Primary Production, which is a prescribed non-residential zone, meaning the proposed development is permissible with consent.

Section 2.48, Subdivision 2 of Division 5, Chapter 2 dictates the determination of development applications that affect an electricity transmission or distribution network. According to Section 2.48 (1)(b)(i) and (1)(d), as the proposed development has works that require connection to overhead power lines and involves the placement of power lines underground (internally on the site), referral to the electricity supply authority, in this case Essential Energy, is required during the assessment period.

Under Section 2.122 of the Transport and Infrastructure SEPP, development that triggers over 50 vehicle movements per hour triggers traffic-generating development and requires referral to Transport for NSW. As the site will not exceed 50 vehicle movements to and from the site per hour during construction or operation referral is not required in this instance.

## 4.4 Local planning policies

### 4.4.1 Narrabri Local Environmental Plan 2012

The *Narrabri Local Environmental Plan 2012* (NLEP 2012) provides the local environmental planning provisions for land within the Narrabri LGA, in accordance with the relevant standard environmental planning instrument under Section 3.20 of the EP&A Act. The proposed development is consistent with the aims of the plan under Section 1.2 of the NLEP 2012 which encourages the management, development and conservation of environmental, economic and social resources of the LGA. The following provides commentary on parts of the NLEP 2012 that are relevant to the proposed development.

### **Part 2 Permitted or prohibited development**

#### Clause 2.3 Zone objectives and land use table

(1) *The Land Use Table at the end of this Part specifies for each zone—*

- (a) the objectives for development, and*
- (b) development that may be carried out without development consent, and*
- (c) development that may be carried out only with development consent, and*
- (d) development that is prohibited.*

(2) *The consent authority must have regard to the objectives for development in a zone when determining a development application in respect of land within the zone.*

(3) *In the Land Use Table at the end of this Part—*

- (a) a reference to a type of building or other thing is a reference to development for the purposes of that type of building or other thing, and*
- (b) a reference to a type of building or other thing does not include (despite any definition in this Plan) a reference to a type of building or other thing referred to separately in the Land Use Table in relation to the same zone.*

(4) *This clause is subject to the other provisions of this Plan.*

The objectives of RU1 Primary Production land are as follows:

- *To encourage sustainable primary industry production by maintaining and enhancing the natural resource base.*
- *To encourage diversity in primary industry enterprises and systems appropriate for the area.*
- *To minimise the fragmentation and alienation of resource lands.*
- *To minimise conflict between land uses within this zone and land uses within adjoining zones.*
- *To allow for non-agricultural land uses that will not restrict the use of other land for agricultural purposes.*

The proposed development meets the objectives of an RU1 Land Zone because:

- Provides a new primary industry production, encouraging diversity in primary industry enterprises in the local area.
- Appropriate, legislation-compliant land use within the zone.

It is noted that electricity generating works is not a permissible land use under the NLEP, however Section 2.36 of the Transport and Infrastructure SEPP enables the development of electricity generating works on RU1 land. Consequently, the NLEP is superseded, and the proposed development is permitted with consent.

### **Part 5 Miscellaneous provisions**

#### Clause 5.10 Heritage Conservation

As development consent is required, an ACHAR is currently being completed to address heritage values present at the project site.

#### 5.21 Flood Planning

The project site is not located on flood prone land and is therefore unlikely to be impacted in the event of flooding. Flooding is addressed further in Section 5.6.2.

### **Part 6 Additional local provisions**

#### 6.1 Earthworks

Proposed earthworks on the site will largely be minor in scope and be limited in the total increase in impervious surface area. Earthworks are further addressed in Section 3.5.

#### **4.4.2 Narrabri Development Control Plan – Industrial Development Code**

*The Narrabri DCP - Industrial Development Code* sets general guidelines, development requirements and controls for industrial development within the Narrabri Shire. The following chapters of the Industrial Development Code apply:

##### 4.1.1 Development Generally

The proponent is submitting a Statement of Environmental Effects, satisfying this requirement of the DCP.

##### 4.4 Security Fencing

Security fencing will be visually unobtrusive.

##### 4.5.3 Local Constraints

Impacts and mitigation measures for matters including flooding, land fill, geotechnical hazards and other constraints are detailed in Section 5 of this report.

##### 4.8.1 General Requirements

Parking and service areas for the development will be within the requirements of the *Narrabri Shire Parking Code*.

##### 4.8.2 Access and Road Construction Requirements

The access drive will be greater than six metres in width.

#### **4.5 Environmental Planning and Assessment Regulation 2021**

The proposed development does not contravene any section within the EP&A Regulation 2021.

#### **4.6 Planning agreements**

There is no relevant planning agreement pertaining to the site.



## 5 ASSESSMENT OF IMPACTS

### 5.1 Bushfire

#### 5.1.1 Existing environment

The site is zoned as vegetation buffer land, bordering bush fire prone land approximately 1.0km to the NW.

According to the Rural Fire Service's *Planning for Bush Fire Protection 2019* (PBP) the development would be classified as a Class 10 structure under section 8.3.5 wind and solar farms.

Approval from the Rural Fire Service (RFS) would not be required under Section 100B of the *Rural Fires Act 1997* as the proposed use does not fulfil the definition of a Special Fire Protection Purpose (SFPP). However, regard has been given for the PBP 2 and any building construction standards. The development is assumed to be defined as a special consideration structure (solar and wind farms) under the NCC and Planning for Bushfire Protection 2019. As such, the site does not require a Bushfire Impact Assessment.

#### 5.1.2 Proposed mitigation measures

The following measures are proposed to mitigate potential bushfire impacts for the project site:

- Bushfire Emergency Management and Operations Plan to be prepared as a condition of consent, anticipated to contain the following measures:
  - Management of specific work tasks that should not be carried out during total fire bans, i.e. no hot works, or works with the potential to generate sparks or other forms of ignition;
  - Identification, specification, and location of fire-suppression equipment, access, and water in line with RFS and Council requirements;
  - Appropriate storage and maintenance of fuels and other flammable materials;
  - Appropriate bush fire emergency management planning.
- Installation of 10m APZ for the structures and associated buildings/structures;
- The APZ will be maintained to the standard of an Inner Protection Area (IPA) for the life of the development.

### 5.2 Waste

#### 5.2.1 Existing environment

There are two NSW EPA licensed landfill facilities in the vicinity of the project site.

Gunnedah Waste Management Facility is the closest land fill, located 51.5km to the SSE of the site. The facility is open seven days a week from 8am – 5pm, excluding News Years Day, Anzac Day, Good Friday and Christmas Day.

Narrabri Landfill is located 68km to the NW of the site. It is also open from 8am – 5pm daily, with the same exceptions.

During works, the nearby waste management facilities will accept the following types of waste.

- General waste disposal;
- Green waste disposal;
- Scrap metal and concrete recycling;
- Recycling drop-off;
- Oil waste disposal;
- Household hazardous waste disposal;

- Recycling chemical containers;
- Asbestos disposal;
- Tyre disposal;
- Compost and mulch.

### 5.2.2 Assessment

The NSW EPA governs waste management in accordance with the following legislation, regulations and guidelines:

- *Protection of the Environment Operations Act 1997*;
- *Protection of the Environment Operations (Waste) Regulations 2005*;
- *Waste Avoidance and Resource Recovery (WARR) Act 2001*;
- Waste Classification Guidelines (EPA, 2014).

#### Waste sources

Waste generated during the construction phase would be similar to that produced from any major construction site including a large volume of packaging materials such as cardboard, wood pallets, and plastics. Due to the flat topography of the site, waste generated from earthmoving activities is anticipated to be minimal. Any 'cut' on-site will be reused on-site where possible. During operations, the generation of waste will be minimal and predominately related to maintenance of equipment and on-going staff activities. Some green waste may be generated from maintaining safe grass heights on the solar farm site. Opportunities for cattle to graze on land surrounding the security fence to reduce green waste and mowing requirements will be investigated. However, cattle will not be permitted inside the solar farm boundary at any time. This green waste management strategy would be low impact due to the site's history as cattle-grazed pasture. All waste produced will be classified in accordance with EPA's Waste Classification Guidelines. The six waste classification categories under these guidelines are:

- Special waste;
- Liquid waste;
- Hazardous waste;
- Restricted solid waste;
- General solid waste (putrescible);
- General solid waste (non-putrescible).

Waste sources anticipated to be generated during construction and operation of the proposed development, and their classification, are listed in Table 5–1 below. The quantities of each waste stream will be available post detailed design of the development in accordance with requirements of *Waste Avoidance and Resource Recovery Act 2001*.

**Table 5–1 Expected development waste types and classifications**

| Waste type / source                                                | Reuse, Recycle / Dispose | Classification                        |
|--------------------------------------------------------------------|--------------------------|---------------------------------------|
| <b>Construction</b>                                                |                          |                                       |
| Soil or excavated material                                         | Reuse                    | General solid waste (non-putrescible) |
| Cleared vegetation                                                 | Dispose                  | General solid waste (non-putrescible) |
| Packaging materials, cardboard, wood pallets, plastic              | Recycle                  | General solid waste (non-putrescible) |
| General waste                                                      | Dispose                  | General solid waste (non-putrescible) |
| Concrete waste                                                     | Dispose / Recycle        | General solid waste (non-putrescible) |
| Scrap metal and cabling materials (i.e., steel, aluminium, copper) | Dispose / Recycle        | General solid waste (non-putrescible) |

| Waste type / source                        | Reuse, Recycle / Dispose | Classification                        |
|--------------------------------------------|--------------------------|---------------------------------------|
| Oils, solvents, fuels, and other chemicals | Dispose                  | Liquid waste                          |
| <b>Operation</b>                           |                          |                                       |
| Food scraps and organic matter             | Dispose                  | General solid waste (putrescible)     |
| Domestic waste                             | Dispose                  | General solid waste (non-putrescible) |
| Timber & general packaging                 | Dispose / Recycle        | General solid waste (non-putrescible) |
| Cable off cuts (Electrical Repairs)        | Dispose / Recycle        | General solid waste (non-putrescible) |
| Metals (copper, aluminium, steel)          | Dispose / Recycle        | General solid waste (non-putrescible) |
| Paper and Cardboard                        | Dispose / Recycle        | General solid waste (non-putrescible) |
| Plastics (PET)                             | Dispose / Recycle        | General solid waste (non-putrescible) |
| Oils, solvents, fuels and other chemicals  | Dispose                  | Liquid waste                          |
| Sewage                                     | Dispose                  | General solid waste (non-putrescible) |

Waste generation will be greatest during the decommissioning phase of the proposed development. However, solar PV recycling methods and initiatives are rapidly developing in Australia with research indicating ~89% of materials are potentially recoverable from solar panels. It is anticipated that recycling markets for solar PVs, large scale batteries and associated equipment will continue to emerge and improve over the life of the proposed development. Measures detailing the reuse, recycling and disposal of waste materials at the end-of-life of the proposed development will be detailed in a Decommissioning Management Plan. Potential impacts from poor management of waste include:

- Increased waste going to landfill;
- Increased resource use due to missed opportunities to reuse and recycle;
- Land and water pollution either from poorly managed landfills or incorrectly stored and handled waste;
- Negative impacts on human and animal health as a result of land and water pollution.

### 5.2.3 Proposed mitigation measures

Waste generated by the proposed development will be managed in accordance with the waste management hierarchy that underpins the objectives of the WARR Act. This is:

- Avoidance including action to reduce the amount of waste generated;
- Resource recovery including re-use, recycling, reprocessing and energy recovery;
- Disposal including management of all disposal option in the most environmentally responsible manner.

Waste separation and segregation will be promoted on site with dedicated bins provided for recyclable materials. Where waste cannot be avoided, reused or recycled it will be classified and disposed of at licenced waste management facilities. A Waste Management Plan will be developed prior to the construction of the development which will detail:

- The quantities and classification of all waste streams;
- Types and location of on-site recycling facilities;
- Location of nearby waste facilities permitted to accept waste;
- Requirements for transportation and tracking of waste;
- Responsibility for recycling, re-use and disposal;
- Incident reporting procedures.



## 5.3 Contamination

### 5.3.1 Existing environment

The project site is currently used as cleared mine buffer land and has historically been grazed by cattle since the clearing of vegetation for this current use. Due to recent intense volumes of rainfall, cattle grazing on the site has now ceased. Historical and anecdotal evidence indicates that the site has not been used for indiscriminate disposal of waste or other potentially hazardous materials or dip sites.

Chemicals such as organic pesticides and herbicides are typically utilised as part of normal farming practices. These chemicals are generally unstable and biodegrade over time. Potential chemical residue levels on site would likely be at low levels if present at all. The half-life of glyphosate, one of the more commonly used chemical herbicides in NSW, is between 3 days and 19 weeks depending on water conditions.

### 5.3.2 Assessment

A search of the NSW EPA contaminated land public record was undertaken for contaminated sites within the Narrabri LGA on 20 February 2023. One recorded site was returned for the LGA, which is located over 40km from the project site. This contaminated site is unlikely to be impacted by the activity. The online list of NSW contaminated sites notified to the EPA was also searched on 20 February 2023. The list of notified sites contain land that has been notified to the EPA as being potentially contaminated. The list states whether the land is regulated under the CLM Act. The investigation revealed no contaminated sites in the suburb of Boggabri had recently been notified to the EPA.

Desktop site analysis and site inspection indicated that the property has been utilised primarily for cattle grazing and as vacant mine buffer land. Chemicals such as organic pesticides and herbicides are utilised for farming procedures such as weed control. It should be noted that minor residues of these chemicals have the potential to remain in soil for up to 18 months after application.

There were no spillages or ground staining noted on the site during the site inspection that would produce concerning levels of these or other residues that may impact on the proposed land use or present a risk to the adjoining land, including local flora, fauna, and surface water. No current or historical cattle dip sites or sheep spray yards were noted on the property. Overall, the risk for potential existing contamination on site is considered low. The potential for impact to surrounding receptors or the environment of low-level soil residues is also considered minor during construction and operation with minimal earthworks required during construction.

The results of this assessment indicate that contamination issues on the site should not impact the potential to construct and operate the proposed solar farm. The development does not consist of any habitable building and will not be for regular human use, and as such no further contamination assessment is proposed.

### 5.3.3 Proposed mitigation measures

A Spill and Contamination Response Plan would be developed as part of the overall CEMP to prevent contaminants affecting adjacent surrounding environments. The plan would include measures to:

- Respond to the discovery of existing contaminants at the site (e.g. pesticide containers or asbestos), including stop work protocols and remediation and disposal requirements;
- Requirement to notify the EPA for incidents that cause material harm to the environment (refer s147-153 of the POEO Act);
- Manage the storage of any potential contaminants onsite;
- Mitigate the effects of soil contamination by fuels or other chemicals (including emergency response and the EPA notification procedures and remediation);
- Ensure that machinery is visually inspected upon arrival at site and appears in a clean, washed condition, free of fluid leaks;

- Prevent contaminants affecting adjacent pastures, dams, water courses and native vegetation;
- Monitor and maintain spill equipment;
- Induct and train all site staff.

Unexpected finds procedure would also be prepared as part of the CEMP and outline the procedure for managing unexpected finds of physical or chemical contamination on the site during construction.

Treatment, handling, and disposal methods for contamination, when encountered, will be done in accordance with EPA Guidelines.

All potentially contaminated soil excavated must be stockpiled in a secure area and be assessed and classified in accordance with the *Waste Classification Guidelines* (EPA, 2014) before being transported from the site for disposal at an appropriately licensed waste facility.

## 5.4 Traffic and access

### 5.4.1 Existing environment

The project site is located 9.4km off the Kamilaroi Highway on a privately owned mine access road and is used only by mine workers and visitors. The road is co-owned by the proponent and Whitehaven Coal up to the intersection (near the Whitehaven security check point) where the road splits into a direct access road for each mine and managed independently.

The mining access road which will be used to access the site does not experience traffic near its capacity. A physical site inspection revealed the access road is in a good, safe condition.

### 5.4.2 Assessment

#### Traffic

The majority of traffic movements associated with the development will occur during the construction of the solar farm (approximate 24-week period) with the delivery of panels and prefabricated structural supports. Following construction an additional six-week period will be required for testing and commissioning. Deliveries during construction works would be expected to be within rigid and articulated vehicles and will utilise the existing Boggabri Coal Mine access road that has been designed to safely accommodate heavy vehicles. These deliveries will primarily be loaded from Sydney and transported via approved roads suitable for heavy vehicles. Where possible deliveries will be from local suppliers will be sought i.e., within Gunnedah, Narrabri, Boggabri and surrounds.

Traffic movements generated during operation would include a single, light vehicle movement associated with maintenance inspections and specific regular maintenance work which would be short term and infrequent.

On average, the Merriown Solar Farm is expected to generate an average of 20 employee vehicle trips a day, up to a peak of 50 trips a day. There will be 50 deliveries for materials from Heavy Rigid Vehicles (HRV), along with an additional 270 deliveries for fill over the 24-week construction period.

In real terms, HRV deliveries will peak at 8 deliveries in a single day, with a maximum of 30 deliveries in a single week. Weekly HRV deliveries will average 15 a week.

Overall, delivery and worker traffic are not expected to significantly impact the operation of any nearby roads due to current usage rates and the maximum capacity of the road being able to easily accommodate the number of trips required.

The surrounding road network has sufficient capacity to cater for the projected construction traffic with capacity to spare for future development in the area. It is noted that construction traffic is temporary in nature and will be managed through a CEMP going forward.

The existing condition of the surrounding road network in particular at the time of this assessment, in particular the mine-owned access road, are suitable to cater for the short-term heavy vehicle increase required during the construction phase. The local and state road network would be suitable to cater for the expected construction traffic associated with the development.

No over-mass or over-dimensional vehicle delivery will be required.

### **Access and Internal Circulation**

The proposed vehicular access to the site will be provided via an internal private road off the existing mine access road to the north of the site. Vehicles will enter from the mine access road, turning onto the proposed internal access road. Vehicles access and traffic circulation proposed is shown in Figure 3–3.

The mine access road is currently utilised by large heavy vehicles for mine related haulage and would be suitable for heavy construction traffic. There is a cleared and levelled section present off the road on the northern boundary of the project site, currently used for site access. This will have a gravel layer placed atop to allow for HRV access to site.

The Narrabri DCP – Parking Code sets out the relevant on-site car parking rates for land uses within the Narrabri LGA. No gross floor area is proposed as part of the development.

As no DCP rate is provided specifically for a solar farm, the parking rate for Industry will be used for this development. Due to the low number of staff required to operate a solar farm, the car parking provision with the lowest car parking spaces to site area ratio was chosen. This guideline is the 'Warehouses' category, which recommends 1 space per 300 square metres of gross leasable floor area.

As no buildings are proposed on site and only 1 employee is likely to be engaged in the day-to-day operation of the solar farm, more than a single car parking space on site would not be considered necessary for the operation of the development.

Construction parking demand has also been considered with potential for up to 20 employees projected. A total of 10 car parking spaces are proposed with additional space afforded for potential onsite overflow if required. The car parking area is to comply with the requirements of Australian Standard AS2890.1-2004 Parking Facilities – Part 1: Off-street car parking. This means parking spaces on site will be required to be 2.4 m x 5.4 m with aisle widths of 5.8 metres.

### **5.4.3 Proposed mitigation measures**

The intended site construction hours are between 7am to 6pm Monday to Sunday, with no works on Public Holidays. The peak hourly traffic volumes are expected in the early morning and late afternoon hours and will be avoided where possible during construction.

A Traffic Management Plan will be prepared as part of the CEMP prior to construction works occurring.

The Traffic Management Plan should include measures to manage access and traffic flow controls during the works, and outline areas for parking of site vehicles during the construction phase. As part of the overall CEMP notification should be provided to adjacent residents of the upcoming site works and potential short-term traffic impacts.

## **5.5 Landscape and visual**

### **5.5.1 Existing environment**

The project site lies approximately 10kms out of the town of Boggabri and has previously been cleared and is heavily disturbed due to grazing. The project site consists of open, slightly undulating grassland and is located within a slightly undulating valley with steep hills and ridges to the north, and smaller hills and isolated pinnacles to the south, east, and south west.



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The project site is in the vicinity of a number of large, open cut coal mines, approximately 2km from Boggabri Coal Mine and associated facilities, as well as two local roads, the rail spur line, a substation and powerlines. There are two dwellings directly adjacent to the east of site and another approximately two kilometres south-west of site. The Leards State Forest provides a vegetation barrier to the northern sector of Leards Forest Road providing a reasonable visual barrier for the site from traffic utilising the road, whilst Haul Road is without a vegetation barrier.

A selection of images showing the character of the project site is provided in Plate 5-1 to Plate 5-6.



**Plate 5-1      View of Project site facing west**





**Plate 5-2** Corner of Project site facing east



**Plate 5-3** View of powerlines and mountain range to the north





**Plate 5-4**      **Creek line along western property boundary**



**Plate 5-5**      **View north-east of project area**





**Plate 5-6** Small tree and stag along fence line along southern boundary

### 5.5.2 Assessment

The desktop analysis, supported by the site inspection conducted by RPS concludes that the proposed development is unlikely to have glare and significant visual related impacts on surrounding rural dwellings within three kilometres of the proposed development, along with local roads and rail line spur within one kilometre of the proposed development. The assessment identified a lack of aviation facilities within five kilometres of the proposed development and therefore no impact is anticipated on aviation facilities. This is attributed to the proposed solar PV panels being mounted on solar trackers which results in minimal potential for horizontal reflectivity to occur as light is generally reflected upwards.

The project site is located at a great enough distance from the Boggabri township and any residential or recreational areas to minimise visual obtrusion. Trees along Leards Forest Road provide a visual barrier to the site, although mine workers travelling in and out of Boggabri Coal Mine via the access road may be minorly visually impacted. As such it's considered the proposed development would likely have minor visual impact rating on the existing landscape character and values of the site in its local context.

As part of the Landscape and Visual assessment a Glint and Glare Assessment has been completed by Environmental Ethos to support the proposed development. Glint and glare resulting from external lighting associated with the proposed development will comply with AS/NZS 4282:2019 – Control of the Obtrusive Effects of Outdoor Lighting, including the minimisation of light spill. Due to the use of high-quality solar tracking systems and site buffer distances to surrounding receivers and transport networks, potential for glint and glare along with visual impacts are deemed to be minor. Further details relating to Glint and Glare are provided in the following section and Appendix B.

### 5.5.3 Proposed mitigation measures

#### 5.5.3.1 Glint and glare

Glint and Glare Assessment has been completed by Environmental Ethos utilised the Solar Glare Hazard Analysis Tool (SGHAT 2023C) in conjunction with a viewshed analysis, to undertake the glare modelling which is the basis for the impact assessment methodology.

The glint and glare assessment has been undertaken with reference to the NSW Government's Largescale Solar Energy Design Guidelines (2022), including assessment of the following:

- All residential receivers with 3km of the proposed solar arrays with line of sight to the proposed development;
- All roads and rail lines within 1km of the proposed solar array; and
- All air traffic control towers and take off/landing approaches to any runway or landing strip within 5km of the proposed solar array.

Based on the assumptions and parameters of this desktop assessment, the following results were identified:

- The SGHAT modelling identified no glare is geometrically possible affecting rural dwellings within 3km of the proposed development, therefore no impact is likely;
- The SGHAT modelling identified no glare is geometrically possible affecting local roads and the rail line spur within 1km of the Project, therefore no impact is likely;
- The assessment identified no aviation facilities within 5km of the proposed development.

The desktop analysis concluded that with a backtracking operation and minimum limit of a five-degree resting angle there are no additional mitigation measures required due to the unlikely impact on sensitive receivers.

The proposed development's Environmental Management Plan will incorporate the following management measures:

- Tracking and backtracking operational procedures required to avoid glare impacts to sensitive receptors, including operating the system with a minimum limit of five degree resting (stow) angle.
- A zero degree stow angle will be allowed in cases where inclement weather occurs to prevent damage to arrays.
- Glare hazard monitoring program and process for managing complaints, including rectification if required.

#### 5.5.3.2 Visual amenity

The viewshed analysis shows the surrounding hills block visibility of the proposed development resulting in a limited viewshed, determining that plantings are not deemed necessary to reduce the visual prominence of the solar farm from the roadside and limit its glint and glare effects.

In addition, all external lighting associated with the proposed development will comply with AS/NZS 4282:2019 – Control of the Obtrusive Effects of Outdoor Lighting, including the minimisation of light spill.

### 5.6 Stormwater, soil, and erosion control

#### 5.6.1 Existing environment

The project site for Merriown Solar Farm covers approximately 50% of the lot. The site generally from north to south at a slope ~2%. During rainfall events, surface runoff from the site would sheet flow towards the southern and southwestern boundary towards Merrygowen Creek and exit the site.

The project site borders Merrygowen Creek to the West. The township of Boggabri experiences an average annual rainfall of 593.3mm, with summer months experiences significantly higher average rainfall levels.

Appropriate drainage would be established during earthworks to avoid extra sedimentation entering the creek in rainfall events. Considering average rainfall statistics, it is unlikely that the development would impact Merrygowen Creek via stormwater, soil or erosion in the long term.

## **5.6.2 Assessment**

### **Water Quantity / Peak flows**

Stormwater runoff which falls on each solar array will discharge directly to the ground where the natural flow regime will be maintained. As the solar arrays are relatively small in size and the pervious surfaces below and infiltration regime is not significantly altered from existing conditions. Therefore, it is not expected that the arrays will have an impact on peak stormwater runoffs from the Site.

### **Water Quality**

#### **Construction**

The primary risk to water quality during construction will occur as a result of ground disturbance during earthworks and other site activities (e.g. installation of PV modules). There is potential that these works will lead to exposure of soils and potential erosion and mobilisation of sediment into receiving watercourses.

Contamination of surface water as a result of accidental spillage of materials such as fuel, lubricants, herbicides and other chemicals used to support construction activities could also adversely impact water quality. It is proposed that spill kits be available on-site during construction and used according to manufacturer's specifications if spillage does occur. Although Merrygowen Creek is within close proximity to the western border of the site (approximately 80m), potential impacts to water quality are considered minor and manageable with proposed management measures in place, further details of which are provided in Section 5.6.3. The exact project siting has been chosen to minimise any potential impact as far as possible.

#### **Operation**

The generation of pollutants on the arrays is expected to be windblown dust only. The interaction of rainfall with the solar array is unlikely to lead to water quality impacts as runoff will infiltrate back into the same pervious area under the panels.

The pollutants expected to be generated from the proposed ancillary structures and hardstand areas, and how they are expected to be managed onsite are contained below:

- Battery cell surfaces – Pollutants typically generated from these types of sources include dust and sediments from windblown sources as well as small insects. Collected runoff will be treated via discharge to the impervious areas on site with existing vegetation filtering runoff of sediment and small gross pollutants;
- Runoff from gravel hardstand roads and pads – Pollutants typically generated from these types of sources include a small amount of hydrocarbons, sediment, and associated nutrients from car exhaust and tyre wear. Runoff containing these pollutants will be managed on site via the treatment of runoff in table drains and infiltration across other large pervious areas.

Due to the small size of pollutant generating areas and the minor use of the facility by vehicles during operation, it is expected that the impact on water quality due to the facility will be insignificant. As such dedicated water quality measures are not proposed as part of the development of the site.

#### **Surface water traversing the site**

The site generally slopes towards the south-east, at a 0-2% gradient. Due to the extremely flat nature of the Site, there are no identified concentrated flow paths. The surrounding irrigation channels appear to collect most of the concentrated flow in and around the Site, and connecting to Merrygowen Creek. The proposed development will maintain this regime, with internal roads either being designed as sheet flow or run off from the internal roads being collected by roadside swales.



### **Flooding**

The site is located in the Namoi River Basin catchment area at an elevation of approximately 265m. The site is not located on flood prone land and is therefore unlikely to be impacted in the event of flooding.

Earthworks, hardstand areas and internal access roads proposed will be generally on grade with adjacent swales cut in to avoid large scale fill of the site that could change flow regime. This will result in minimal restriction to overland flow paths and impacts upstream and downstream of the site. Regional flooding is not expected to be a constraint on this development.

### **5.6.3 Proposed mitigation measures**

The development is expected to be of low impact to water quality or flood risk. While the area experiences typically low levels of rainfall, and earthworks are expected to include minor flattening and drainage works. It's recommended to utilise coir logs or sediment fencing to prevent material from leaving site and during drainage works.

## **5.7 Aboriginal and non-Aboriginal heritage**

### **5.7.1 Existing environment**

The project site is located within the Narrabri Shire and within the Red Chief Local Aboriginal Land Council (LALC) boundary. Background research included a review of previous studies and database searches on the Aboriginal archaeological and historical context of the study area and surrounds.

As per the AHIMS search conducted on 13 February 2023, nine Aboriginal sites have been recorded within 200m of the project site. A search of the NSW State Heritage Inventory on 30 June 2023 showed no state significant heritage sites within the lot.

### **5.7.2 Assessment**

In accordance with the Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales, it has been identified that further studies are required. Presently an ACHAR is being developed by OzArk to address heritage aspects.

### **5.7.3 Proposed mitigation measures**

Proposed mitigations measures will be detailed following provision of the ACHAR.

## **5.8 Biodiversity**

### **5.8.1 Existing environment**

A desktop analysis of the site was undertaken using the following resources on 15 February 2023:

- Office of Environment and Heritage (OEH) Atlas of NSW Wildlife database for records of threatened species and endangered ecological communities which have been recorded within a 10km radius (locality) of the project site;
- Department of the Environment and Energy (DoEE) Protected Matters Search Tool for Matters of National Environmental Significance (MNES) listed under the EPBC Act within a 10 km radius from the site;
- NSW Vegetation Information System (VIS) vegetation classification database;
- NSW Biodiversity Values Map and Threshold Tool;
- NSW Sharing and Enabling Environmental Data (SEED) portal (NSW Government).

The project site is currently covered by disturbed pasture with minimal vegetation and biodiversity.

There is one Protected matter within 10km of the site. This Protected Area – Terrestrial, is part of Leards State Forest, known as the Leard State Forest Conservation Area National Park. The project site is approximately 6km from the protected area and is unlikely to impact the protected matter in any way.

There are no mapped Plant Community Types (PCTs) within the proposed site area. It is notable that there are two PCTs adjacent to the southern boundary. These are PCT 592 – Western Slopes Dry Sclerophyll Forests and PCT 101 – Brigalow Clay Plain Woodlands, shown in Figure 5–1 below. The development is unlikely to impact these PCT's in any way.

The project site is not considered land of high biodiversity value according to the NSW Biodiversity Values Map (BV). The BV map identifies land with high biodiversity value as defined by clause 7.3(3) of the *Biodiversity Conservation Regulation 2017*. The Biodiversity Offsets Scheme applies to all clearing of native vegetation and other biodiversity impacts prescribed by the regulation on land identified on the map.





## 5.8.2 Assessment

The proposed development will be undertaken within currently managed cleared land and land to which cropping is currently undertaken. The proposed development will not require the removal of any trees or native vegetation.

The proposed development will not impact surrounding BV mapped land and is not expected that any EPBC listed species, ecological communities, migratory species, or important habitat for such species would be identified within the project site.

## 5.8.3 Proposed mitigation measures

No native vegetation is proposed to be cleared as a part of the development, as the area of the project site is used as crop land. No further biodiversity assessment is proposed as a part of the development.

Following the establishment of the proposed development, suitable vegetation ground coverings are expected to be re-established on site to manage dust generation. Weed management and control will be included as part of the standard operation procedures of the facility during both construction and operation.

## 5.9 Noise

### 5.9.1 Existing environment

The project site is currently vacant and is not generating any additional noise to the surrounding area. The surrounding area experiences cumulative noise pollution due to operations at three open cut coal mines in close proximity and rail operations and general road traffic noise. Boggabri Coal Mine possesses a fleet of 101 heavy vehicles according to its 2021 Annual Review, shown below.

**Table 5–2 Mobile plant and equipment at Boggabri Coal Mine**

| Equipment         | Number in fleet |
|-------------------|-----------------|
| Haul trucks       | 49              |
| Excavators        | 12              |
| Front end loaders | 2               |
| Dozers            | 19              |
| Graders           | 4               |
| Water carts       | 5               |
| Service trucks    | 5               |
| Drills            | 5               |
| <b>Total</b>      | <b>101</b>      |

These vehicles are used for activities such as drilling, blasting, excavation, extraction and haulage. These operations have established the acoustic amenity of the area.

The construction of Merriown Solar Farm will involve large machinery such as cranes for delivery and installation of the inverters and batteries but will no longer be required once the site is operational. No large machinery will be active on the site once the solar farm is in operation. The solar farm will generate minor noise emissions from inverter/transformer stations and battery enclosures. The section of the property which is not used for solar energy harvesting will remain vacant.

## 5.9.2 Assessment

### 5.9.2.1 Construction

The main source of construction noise would be from machinery associated with the works. These impacts would be short term and would include associated traffic movements. Works are likely to include the use of rigid tipper trucks, cranes, excavators, and portable hand tools. The noise generated by the construction equipment will be consistent with other construction noise sources expected on private construction sites.

Assumptions around typical Sound Power Levels (SWL) of plant and equipment for the likely equipment to be used at the site has been obtained from *AS2436-2010 Guide to noise and vibration control on construction, demolition and maintenance sites*. This is the usual standard for the assessment, management, and mitigation of noise impacts from construction works. It is noted that plant and equipment vary in their sound output due to a variety of factors, notably age and size, which may impact on the final noise received at sensitive receivers, though this is not expected to vary greatly. Sound pressure level mid points at 10m are determined by a general but varied reduction in SWL from a variety of local factors, including typical levels of ground and obstruction absorption, atmospheric pressures, weather, and terrain. These all serve to disrupt and mitigate the sound power levels felt at receivers.

**Table 5–3 Typical SWL of Plant and Equipment for Construction Sites**

| Plant and equipment   | Sound power levels (SWL)<br>LwA dB ref: 10-12 W |                       | Sound pressure levels<br>LpA (mid-point) dB at 10m |
|-----------------------|-------------------------------------------------|-----------------------|----------------------------------------------------|
|                       | Common SWL<br>range                             | Midpoint SWL<br>range |                                                    |
| Compactor             | 110-115                                         | 113                   | 85                                                 |
| Compressor (silenced) | 93-110                                          | 101                   | 73                                                 |
| Excavator             | 97-117                                          | 107                   | 79                                                 |
| Forklift              | 100-110                                         | 105                   | 78                                                 |
| Front end loader      | 110-115                                         | 113                   | 85                                                 |
| Generator (diesel)    | 84-113                                          | 99                    | 71                                                 |
| Hand tools (electric) | 95-110                                          | 102                   | 74                                                 |
| Loader                | 99-111                                          | 105                   | 77                                                 |
| Truck (>20 tonne)     | 105-110                                         | 107                   | 79                                                 |
| Truck (water cart)    | 106-108                                         | 107                   | 79                                                 |
| Vehicle (4WD)         | 100-111                                         | 106                   | 78                                                 |
| Welder                | 100-110                                         | 105                   | 77                                                 |

Source: AS2436-2010

From these criteria the effect on sensitive receivers is able to be calculated through the procedure provided by the *NSW Noise Policy for Industry 2017*, which dictates that a project is intruding into local amenity when it exceeds a 5dB increase in rated baseline background noise levels (35dB during daytime (7am-6pm), and 30dB during evening and night (6pm-7am)). This is then used to provide the baseline for the following equation provided by the EPA's *Noise Guide for Local Government*:

$$L_2 = L_1 - 20\text{Log}(d_1/d_2)$$

Where:  $d_1$  = distance (m) between source and receiver

$d_2$  = distance (m) at which Sound Pressure ( $L_{pa}$ ) measured

$L_2$  = sound pressure level at the distance  $d_1$  from the source

$L_1$  = sound pressure at distance  $d_2$  from the source

The nearest receiver is owned by Boggabri Coal Mine located approximately 1,500m to the SW of the site boundary. Boggabri Coal Mine intermittently uses the house as “worker accommodation”, as a result exceedances at this location need not be applied. However, in consideration of loudest plant/equipment being a compactor at 85dB, the following calculation is yielded for the “worker accommodation” and for the nearest “sensitive receiver” approximately 3,400m south of the site boundary:

$$\text{(Worker accommodation) } L_2 = 85 - 20\text{Log}(1,500/1)$$

$$L_2 = 21.5 \text{ dB}$$

$$\text{(Sensitive receiver) } L_2 = 85 - 20\text{Log}(3,500/1)$$

$$L_2 = 14 \text{ dB}$$

The criteria for noise intrusion of the proposed development is 40dB during day time hours. The threshold will therefore not be exceeded during works, even in the case that a compactor is used.

As construction activities will not occur during the evening or night time period, no noise impacts are anticipated. Additionally, the calculation is based on a ‘Free-field’, which broadly means where sound is measured or predicted in the absence of any reflection (other than the ground). However, due to various factors including undulating topography further from the project site which would hinder off-site noise transmission, the values presented in Table 5–5 are only indicative and actual noise levels at the receiver are expected to be either not measurable or indistinguishable from other background noise. Including distant mining noise and noise from the rail corridor, it’s considered that any noise generated from site would be negligible. Noise from site would only add to the existing noise environment and not exceed the noise threshold.

### 5.9.2.2 Operation

Table 5–5 provides the indicative sound power levels from operational plant equipment at the site.

**Table 5–4 Sound Power Levels from Operational**

| Equipment                    | LAeqSWL (dB(A)) |
|------------------------------|-----------------|
| SMA MV Power Station 2800-S2 | 80.5 dB         |
| Redox FLOW BESS              | 80 dB           |

The nearest receiver is owned by Boggabri Coal Mine located approximately 1,500m to the SW of the site boundary. Boggabri Coal Mine intermittently uses the house as worker accommodation, as a result exceedances at this location need not be applied. However, in consideration of loudest plant/equipment being the SMA MV Power Station 2800-S2 at 80.5dB, the following calculation is yielded for the “worker accommodation” and for the nearest “sensitive receiver” approximately 3,400m south of the site boundary:

$$\text{(Worker accommodation) } L_2 = 80.5 - 20\text{Log}(1,500/1)$$

$$L_2 = 17 \text{ dB}$$

$$\text{(Sensitive receiver) } L_2 = 80.5 - 20\text{Log}(1,500/1)$$

$$L_2 = 9.6 \text{ dB}$$

With the acceptable noise threshold being 40dB during the day, and 35dB during the evening and night, sound power levels is far below the intrusion level and as such does not trigger further assessment or mitigation.

### 5.9.3 Proposed mitigation measures

Noise intrusion from the development is expected to be minimal, with predicted construction and operation noise levels well under the threshold. There are no proposed mitigation measures for construction or operation due to the low noise impact of the development.



## 5.10 Hazards

### 5.10.1 Assessment

Advitech Pty Limited (Advitech) was engaged to prepare a response to *State Development Planning Policy (Resilience and Hazards) – Chapter 3: Hazardous and Offensive Development* (SEPP H&OD) screening report for the proposed development and is contained in Appendix E.

The report provides a review of the current hazardous chemicals information, together with the latest design layouts, against current SEPP Hazardous and Offensive Development requirements and other applicable legislation, regulations and guidelines. The proposed development will utilise Redox Flow type Battery Energy Storage Systems (BESS) for their energy storage needs.

Advitech reviewed several safety data sheets (SDSs) for the Redox flow type BESS units provided by Idemitsu Renewables. As the assessment has been undertaken on a generalised basis, the SDSs were reviewed, and a 'typical' composition has been utilised. Final design has yet to be resolved, as such the SEPP H&OD screening has been undertaken on both a flow type and lithium-ion type battery unit.

The objective of State Environmental Planning Policy (Resilience and Hazards) – Chapter 3: Hazardous and Offensive Development (SEPP H&OD) is to link the permissibility of an industrial proposal to its safety and pollution control performance. It aims to ensure that the merits of proposals are properly assessed in relation to offsite risk and offence before being determined. SEPP H&OD applies to any proposals which fall under the definition of 'potentially hazardous industry'.

SEPP H&OD defines 'potentially hazardous industry' as:

- A development for the purposes of an industry which, if the development were to operate without employing any measures to reduce or minimise its impact in the locality or on the existing or likely future development on other land, would pose a significant risk in relation to the locality;
  - To human health, life, or property; or
  - To the biophysical environment.
- And includes a hazardous industry and a hazardous storage establishment.

If a development falls within the definition of a 'potentially hazardous industry', then the proponent, must prepare, or cause to be prepared, a Preliminary Hazard Analysis (PHA). SEPP H&OD provides the definition of a 'potentially hazardous industry' as a site which holds quantities of dangerous goods in excess of the screening threshold levels prescribed within the NSW Department of Planning document entitled 'Applying SEPP 33' (January 2011). Note, at the time of writing, there have been no changes to encapsulate Applying SEPP 33 under the new SEPP (SEPP H&OD). As such, Applying SEPP 33 has been referred to.

Based on the initial screening assessment, the screening thresholds do not apply to a redox flow type system, and can be classified as DG Class 9 under the ADG Code, and as such does not require a risk screening. The screening thresholds only form a part of the SEPP H&OD screening. Further consideration to some of the potential hazardous involved with the storing of Redox Flow battery types was also assessed. This assessment led to a brief review of the components of the battery and a brief impact assessment.

The Redox Flow type battery was found to exceed both the manifest threshold and the screening thresholds, when re-assessed. Based on the quantity of corrosive material alone (electrolyte), the proposed development can be considered as 'potentially hazardous'. Thus, a PHA has cause to be prepared and would be required should the development progress to Stage 2.

As long as vehicle movements carrying DG Class 9 materials are below the relevant transport screening thresholds, as presented in Appendix D, the potential risk from transport is unlikely to be significant.

With respect to the locality, location of neighbouring receptors, consideration to zoning and review of how the batteries are to be stored, it is unlikely for the proposed development to be deemed a 'potentially offensive industry'. Should there be a thermal runaway event from the Li-ion batteries, there may be potential to cause offense to sensitive receptors. Further assessment may be required to determine impacts or other potential emissions following finalisation of the design.

### **5.10.2 Proposed mitigation measures**

Due to low risk levels presented by technological hazards for Stage 1 of the development, there are no associated mitigation measures proposed. Should the development progress to Stage 2, hazard assessment will be undertaken as required.

Based on the supplied information reviewed, it is Advitech's professional opinion that a PHA be undertaken should the proposed development utilise a Redox-Flow type battery, based on the reasoning provided in the screening report contained in Appendix E.

## **5.11 Socio-economic**

### **5.11.1 Existing environment**

The closest town to the proposed development site, Boggabri, is home to 1,201 people with a median age of 43 according to the 2021 census. The majority of the town's inhabitants are active in the workforce with 70.3% working over 35 hours per week. Boggabri has 27 unemployed residents, making up 5.3% of the population.

The township of Boggabri forms part of the Narrabri Shire Local Government Area. The Narrabri LGA has 12,703 residents with a median age of 40. 66.2% of the Narrabri population work 35 hours or more per week with a 4.1% unemployment rate.

### **5.11.2 Assessment**

Merriown Solar Farm is expected to have a small positive increase in the socioeconomic conditions of the locality of the Narrabri LGA. The development will result in the creation of approximately 20 jobs during the construction phase of development. There is then expected to be one job created during operation of the solar farm, as well as the employment of contractors for regularly scheduled maintenance of the site.

The Narrabri LGA will experience positive socioeconomic impacts from development contributions relating to the proposed development. These contributions are paid to Council and can be used to improve public roads, amenities, etc.

Once operational, Boggabri Coal will complete a study to investigate the techno-commercial viability of connecting the solar farm to the broader electricity network, allowing for excess electricity generated to flow back to the grid and contribute to powering homes in the Narrabri LGA. Depending on the amount of electricity generated at Merriown Solar Farm, this has potential to slightly reduce electricity prices, resulting in a positive socioeconomic impact.

### **5.11.3 Proposed enhancement measures**

The following enhancement measure is proposed as part of the development to ensure positive impacts on the socioeconomic status of the LGA:

- Local workforce will be procured where and when possible, to improve local socioeconomic outcomes and avoid additional stressors on local accommodation;.
- Where a local workforce can't be secured, temporary accommodation at Civeo will be utilised for the temporary workforce.

## 6 SUMMARY ASSESSMENT OF ENVIRONMENTAL EFFECTS

### 6.1 Site suitability

#### 6.1.1 Section 4.15(1)(a) – Statutory planning considerations

In determining the DA, the consent authority is required to consider those relevant matters listed in Section 4.15(1) of the EP&A Act. Each of the relevant matters is addressed below:

Section 4.15 (1)(a) requires the consent authority to take into consideration:

*“(a) the provisions of—*

*(i) any environmental planning instrument, and*

*(ii) any proposed instrument that is or has been the subject of public consultation under this Act and that has been notified to the consent authority (unless the Planning Secretary has notified the consent authority that the making of the proposed instrument has been deferred indefinitely or has not been approved), and*

*(iii) any development control plan, and*

*(iiia) any planning agreement that has been entered into under section 7.4, or any draft planning agreement that a developer has offered to enter into under section 7.4, and*

*(iv) the regulations (to the extent that they prescribe matters for the purposes of this paragraph),*

*that apply to the land to which the development application relates,”*

These matters are addressed in Section 4 and 5 of this SEE and below:

The proposed development is permitted with the consent by virtue of Clause 2.3 of the MPLEP 2011 and is consistent with the provisions and objectives of the MPLEP 2011 and the guidelines within the MPDCP 2013

#### 6.1.2 Section 4.15(1)(b) – Environmental, social, and economic impacts

Section 4.15 (1)(b) requires the consent authority to consider:

*“(b) the likely impacts of that development, including environmental impacts on both the natural and built environments, and social and economic impacts in the locality.”*

##### 6.1.2.1 Impacts on the natural environment

The proposed development has been considered in the context of the natural environment. It is not anticipated that the proposed development will have any adverse impact on the existing natural environment, noting that the site is already significantly transformed from its natural state.

##### 6.1.2.2 Impacts on the built environment

The proposed development is to be co-located with the historical agricultural use on the project site, within a rural area. The proposed solar farm will have little irreversible impact on the already transformed agricultural land and will be a compatible use with the surrounding agricultural land and electricity generating infrastructure. Impacts on the built environment are minimal and would not be considered negative.



### 6.1.2.3 Social and economic impacts

The development of Merriown Solar Farm would have positive social and economic effects in the locality of Boggabri and the broader Narrabri Shire LGA. The increase in green energy potentially provided to the grid in future, as well as job creation and development contributions far outweigh any unlikely negative social or economic effects. These aspects are expanded upon in Section 5.11.

### 6.1.3 Section 4.15(1)(c) – The suitability of the site

Section 4.15 (1)(c) requires the consent authority to consider:

*“(c) the suitability of the site for the development.”*

The suitability of the site for the proposed development is examined in Sections 6.1.3, 6.1.4 and 6.1.5 of this SEE. The site will continue to have access to all existing services, with connection to privately owned lines to enable power supply to Boggabri Coal Mine in the first instance, and potentially back to the grid in future. All factors considered; the site is eminently suitable for the proposed development.

### 6.1.4 Section 4.15(1)(d) – Submissions

Section 4.15 (1)(d) requires the consent authority to consider:

*“(d) any submissions made in accordance with this Act or the regulations.”*

Any relevant representations will need to be considered by Council in the determination of the development application.

### 6.1.5 Section 4.15(1)(e) – Public interest

Section 4.15 (1)(e) requires the consent authority to consider:

*“(e) the public interest.”*

The public interest is best served by the orderly and economic use of land for purposes permissible under the relevant planning regime and predominantly in accordance with the prevailing planning controls. The development is a permissible form of development compatible with the local land use and is therefore considered to be in the public interest.

## 7 CONCLUSIONS

This Statement of Environmental Effects prepared by RPS AAP Consulting on behalf of Idemitsu Renewables to support the proposed development for a 4.95MWac solar farm, associated Battery Storage System and transmission line, dubbed 'Merriown Solar Farm', is suitable for approval. The development has been assessed as compliant with legislative requirements, will not adversely affect the environment or the local or regional socio-economic situation, and is in the public interest both short and long term.

The inclusions of an PV electricity generating plant of 4.95MWac, gravel access roads around and outside the solar farm area, a chain link fence and earthworks for future expansion, all ensure the proposed development's long-term viability in providing electricity in a growing energy market that is quickly shifting to demanding cleaner, more sustainable energy sources.

This SEE has been prepared to assess the development against relevant legislation and planning controls in accordance with Section 4.15(1) of the Environmental Planning & Assessment Act, including the Narrabri LEP 2012 and the Narrabri Shire Council's DCP.

We are of the opinion the development warrants approval, subject to reasonable conditions for the following reasons:

- The solar farm project is well located away from sensitive receptors and is not expected to have any material 'off-site' impacts;
- The development will provide employment opportunities in the region;
- The proposed development can utilise the existing (private) 11kV transmission line to provide electricity to meet the needs of the mining operations. It may also be able to deliver excess electricity to the broader grid in future, providing benefits to both the mine operations and the community in the form of renewable energy;
- The private mine access road will be the primary access to Boggabri Mine, utilising this road will ensure there is no impacts on local traffic. Leards Forest Road will only be utilised as emergency access.
- The site is located more than 1.0km from the nearest mapped bushfire risk. If required, a bushfire Emergency Management and Operations Plan can be prepared to ensure an appropriate management of bushfire risk;
- There is no flooding that will impact on the site and suitable measures can be put in place to manage the limited additional stormwater flows arising for the increase in impervious area;
- Acoustic assessments have confirmed the proposed BESS will not generate noise levels that are considered to be intrusive and therefore no mitigation measures are required;
- There have been limited cultural heritage finds on the site. An ACHAR is currently being prepared and will be provided to Council to inform the final decision on the proposed development; and
- The hazard assessment has focused on the proposed BESS and indicates the risk is potentially hazardous. However, a condition requiring a Potential Hazard Assessment be completed and mitigation measures imposed once the preferred form of BESS is procured.

## 8 REFERENCES

Australian Standard (AS) 2436: 2010 *Guide to noise and vibration control on construction, demolition and maintenance sites*.

Bureau of Meteorology/CSRIO - State of the Climate 2014 Report.

Bureau of Meteorology - *Monthly Rainfall 2023*.

Landcom - Managing Urban Stormwater: Soils and construction - Volume 1 (Blue Book), 2004.

NSW EPA Local government air quality toolkit – Module 3 Module 3: Guidelines for managing air pollution.

NSW EPA Contaminated Land Register

NSW EPA (2014). *Waste Classification Guidelines – Part 1: Classification of waste*.

NSW EPA (2009). *Interim Construction Noise Guideline*.

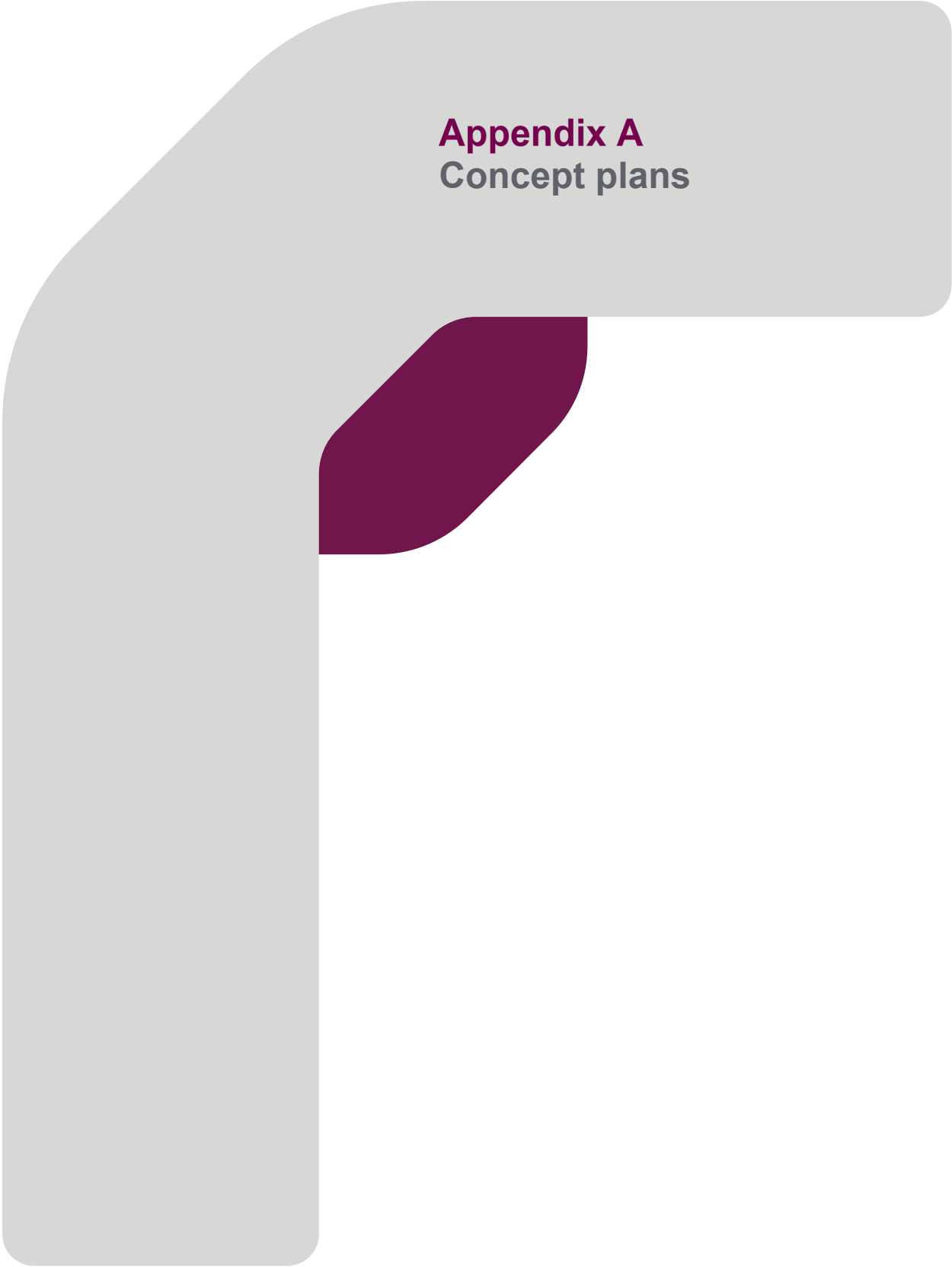
NSW EPA (2020). *Draft Construction Noise Guideline*.

NSW ePlanning Portal.

NSW Rural Fire Service 2019 – Planning for Bush Fire Protection - A guide for councils, planners, fire authorities and developers November 2019.

Wisconsin Department of Natural Resources – *Glyphosate Chemical Fact Sheet*



A large, light grey abstract shape with rounded corners and a diagonal cutout. The cutout is filled with a maroon color. The text 'Appendix A' and 'Concept plans' is positioned within the grey area.

## Appendix A

### Concept plans

# BOGGABRI SOLAR FARM

## 30% DESIGN

ADDRESS:  
LEARDS FOREST ROAD  
BOGGABRI  
NSW 2382



DEVELOPED BY:  
IDEMITSU RENEWABLE DEVELOPMENTS AUSTRALIA

| Sheet List Table |                          |
|------------------|--------------------------|
| Sheet Number     | Sheet Title              |
| G-0100           | TITLE                    |
| G-0400           | LOCATION PLAN            |
| G-2100           | GENERAL ARRANGEMENT PLAN |
| E-1100           | AC SLD                   |



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| NO. | STAGE                            | DSN  | DWN  | CHKD | APPR | DATE       |
|-----|----------------------------------|------|------|------|------|------------|
| 1   | 30% DESIGN                       | ISC  | MJB  | ISC  | LF   | 15/08/2023 |
| 2   | OH WIRES ADDED                   | ISC  | MJB  | ISC  | LF   | 28/08/2023 |
| 3   | SECURITY FENCE FOOTPRINT UPDATED | ISC  | MJB  | ISC  | ISC  | 04/10/2023 |
| 4   | ----                             | ---- | ---- | ---- | ---- | ----       |
| 5   | ----                             | ---- | ---- | ---- | ---- | ----       |
| 6   | ----                             | ---- | ---- | ---- | ---- | ----       |

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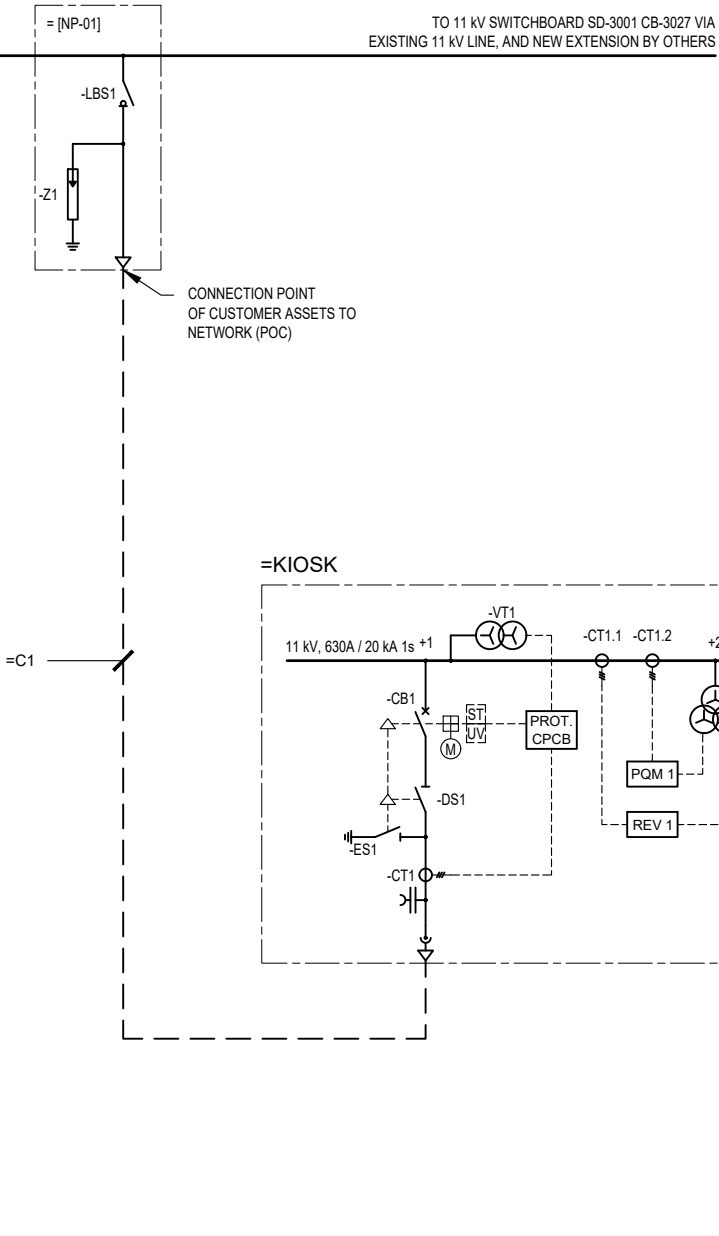
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|                                                                                                                   |     |      |     |                                       |                                           |            |          |
|-------------------------------------------------------------------------------------------------------------------|-----|------|-----|---------------------------------------|-------------------------------------------|------------|----------|
| DSN                                                                                                               | ISC | DWN  | MJB | DRG TITLE<br><br><b>LOCATION PLAN</b> |                                           |            |          |
| CHKD                                                                                                              | ISC | APPR | ISC |                                       |                                           |            |          |
| DO NOT SCALE                                                                                                      |     |      |     |                                       |                                           |            |          |
| ALL MEASUREMENTS IN mm<br>UNLESS OTHERWISE STATED.                                                                |     |      |     | PROJECT                               | BOGGABRI SOLAR FARM                       | SCALE      | AS NOTED |
| THIS DOCUMENT MAY ONLY BE<br>USED BY CLIENTS OF ITP OR<br>THOSE WHO HAVE RECEIVED<br>EXPRESS PERMISSION FROM ITP. |     |      |     | CLIENT                                | IDEMITSU RENEWABLE DEVELOPMENTS AUSTRALIA | SHEET SIZE | A3       |
|                                                                                                                   |     |      |     | ADDRESS                               | LEARDS FOREST ROAD<br>BOGGABRI, NSW 2382  | ORIG. DATE | 2/8/23   |
|                                                                                                                   |     |      |     |                                       |                                           | REV. DATE  | 4/10/23  |
| THE USE OF THIS DRAWING<br>SHALL NOT EXTEND BEYOND THE<br>PURPOSE FOR WHICH IT WAS<br>ORIGINALLY PREPARED.        |     |      |     | DRG NO.                               | <b>23043-G-0400</b>                       | REV NO.    | <b>3</b> |





BATTERY LIMIT OF  
SOLAR FARM WORKS



| INSTRUMENT TRANSFORMER SCHEDULE |       |       |      |                       |        |       |               |
|---------------------------------|-------|-------|------|-----------------------|--------|-------|---------------|
| Area                            | Panel | ID    | Core | Ratio                 | Burden | Class | Functions     |
| =KIOSK                          |       | -CT1  | 1    | 200/1 A               | 5 VA   | 0.5   | REVENUE METER |
|                                 |       | -CT1  | 2    | 200/1 A               | 5 VA   | 0.5   | PQM           |
|                                 |       | -VT1  | 1    | (11000/V3)/(110/V3) V | 50 VA  | 0.5M  | REVENUE METER |
|                                 |       | -VT1  | 2    | (11000/V3)/(110/V3) V | 50 VA  | 0.5M  | PQM           |
|                                 | +ACR1 | -CT1  | 1    |                       |        | 5P    | PROT. CPCB    |
|                                 |       | -CVT1 | 1    |                       |        | 5P    | PROT. CPCB    |
|                                 |       | -CVT2 | 1    |                       |        | 5P    | PROT. CPCB    |

| TRANSFORMER SCHEDULE |       |    |                               |                   |           |         |              |
|----------------------|-------|----|-------------------------------|-------------------|-----------|---------|--------------|
| Area                 | Plant | ID | Primary (kV) / Secondary (kV) | Rated Power (kVA) | Impedance | Cooling | Vector Group |
| =PCS                 | +TX1  |    | 11 / 0.550                    | 5000              | 8%        | ONAN    | Dy11         |
|                      | +TX2  |    | 0.550 / 0.400                 | 20                |           |         | Dyn5         |

| PROTECTION RELAY SCHEDULE |                        |        |                                                                |  |
|---------------------------|------------------------|--------|----------------------------------------------------------------|--|
| Type                      | Description            | Device | Functions                                                      |  |
| PROT. CPCB                | Grid Protection Relay  | TBC    | 50P, 50N, 50SEF/N, 51P, 51N, 50BF, 27S, 27P, 59P, 81O/U/R, 78V |  |
| PROT. TX                  | Transformer Protection |        | 26, 63                                                         |  |
| PROT. INV                 | Inverter Protection    |        | 27P, 59P, 81O/U/R, AIP, 50, 51                                 |  |

| SWITCHGEAR SCHEDULE |       |                |             |            |        |          |
|---------------------|-------|----------------|-------------|------------|--------|----------|
| Area                | Plant | ID             | Vm (kV)     | Vd/Vp (kV) | Ir (A) | Isk (kA) |
| =KIOSK              |       | +ACR1, -CB1    | 15.5        | 50/110     | 630    | 16       |
| =PCS                | +INV1 | -LVCB1, -LVCB2 | 600 V (AC)  | n/a        | 2000   |          |
|                     | +INV2 | -DCCB1, -DCCB2 | 1500 V (DC) | n/a        |        |          |

| CABLE & CONDUCTOR SCHEDULE |            |             |               |
|----------------------------|------------|-------------|---------------|
| Area                       | Length (m) | Type        | Specification |
| =C1                        | 110        | UNDERGROUND | TBC           |
| =C2                        | 265        | UNDERGROUND | TBC           |

| INVERTER SCHEDULE |       |             |         |                   |
|-------------------|-------|-------------|---------|-------------------|
| Area              | Plant | Description | ID      | Rated Power (MVA) |
| =PCS              | +INV1 | TBC         | -INV1.1 | 4.950             |

# 1 ELECTRICAL AC SLD

SCALE: NTS

30% DESIGN

| NO. |                                                 | STAGE | DSN  | DWN  | CHKD | APPR | DATE                                                                                                     | NOTES | <div><div></div><div>RENEWABLES</div><div><div>info@itpau.com.au</div><div>itpau.com.au</div><div>+61 2 6257 3511</div></div><div><div>PO Box 6217</div><div>O'Connor, ACT 2602</div><div>AUSTRALIA</div></div></div> | DSN          | ISC                | DWN                                       | MJB        | DRG TITLE                   |  |  |       |          |
|-----|-------------------------------------------------|-------|------|------|------|------|----------------------------------------------------------------------------------------------------------|-------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|--------------------|-------------------------------------------|------------|-----------------------------|--|--|-------|----------|
| 1   | 30% DESIGN                                      |       | ISC  | NAL  | ISC  | LF   | 15/08/2023                                                                                               |       |                                                                                                                                                                                                                                                                                                            | CHKD         | ISC                | APPR                                      | LF         | AC SLD                      |  |  |       |          |
| 2   | OGOH PCC ADDED, KIOSK REPLACED, PCS S/B REMOVED |       | ISC  | MJB  | ISC  | LF   | 28/08/2023                                                                                               |       |                                                                                                                                                                                                                                                                                                            | DO NOT SCALE |                    |                                           |            | PROJECT BOGGABRI SOLAR FARM |  |  | SCALE | AS NOTED |
| 3   | ----                                            |       | ---- | ---- | ---- | ---- | ALL MEASUREMENTS IN mm UNLESS OTHERWISE STATED.                                                          |       |                                                                                                                                                                                                                                                                                                            |              | SHEET SIZE         | A3                                        |            |                             |  |  |       |          |
| 4   | ----                                            |       | ---- | ---- | ---- | ---- | THIS DOCUMENT MAY ONLY BE USED BY CLIENTS OF ITP OR THOSE WHO HAVE RECEIVED EXPRESS PERMISSION FROM ITP. |       |                                                                                                                                                                                                                                                                                                            |              | CLIENT ADDRESS     | IDEMITSU RENEWABLE DEVELOPMENTS AUSTRALIA | ORIG. DATE | 10/5/22                     |  |  |       |          |
| 5   | ----                                            |       | ---- | ---- | ---- | ---- | THE USE OF THIS DRAWING SHALL NOT EXTEND BEYOND THE PURPOSE FOR WHICH IT WAS ORIGINALLY PREPARED.        |       |                                                                                                                                                                                                                                                                                                            |              | BOGGABRI, NSW 2382 | REV. DATE                                 | 25/8/23    |                             |  |  |       |          |
| 6   | ----                                            |       | ---- | ---- | ---- | ---- |                                                                                                          |       |                                                                                                                                                                                                                                                                                                            |              | DRG NO.            | 23043-E-1100                              | REV NO.    | 2                           |  |  |       |          |



## **Appendix B**

### **Glint and Glare Assessment**





## **MERRIOWN SOLAR FARM**

### **GLINT AND GLARE ASSESSMENT REPORT FINAL ISSUE**

**Prepared For  
Idemitsu Renewable Developments Australia**

**October 2023**



Prepared By Environmental Ethos  
for Idemitsu Renewable Developments Australia

REF NO. 22024

FINAL ISSUE: 17/10/2023

Cover Image: Studio-fi

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## EXECUTIVE SUMMARY

The proposed Merriown Solar Farm comprises of the installation and operation of a 4.95MW solar farm, located approximately 1 kilometres (km) west of Boggabri Coal Mine and 10km to the north east of Boggabri. The primary purpose of the Project is to supply behind-the-meter energy to the Boggabri Coal Mine.

The structure of the solar farm will be a single axis horizontal tracking system with PV arrays running north/south. The PV arrays will be a maximum height of 1.8 metres to centroid.

This glint and glare impact assessment utilised the Solar Glare Hazard Analysis Tool (SGHAT 2023C) in conjunction with a viewshed analysis, to undertake the glare modelling which is the basis for the impact assessment methodology.

The glint and glare assessment has been undertaken with reference to the NSW Government's Large-scale Solar Energy Design Guidelines (2022), including assessment of the following:

- All residential receivers with 3km of the proposed solar arrays with line of sight to the Project;
- All roads and rail lines within 1km of the proposed solar array; and
- All air traffic control towers and take off/landing approaches to any runway or landing strip within 5km of the proposed solar array.

Based on the assumptions and parameters of this desktop assessment, the following results were identified:

- The SGHAT modelling identified no glare is geometrically possible affecting rural dwellings within 3km of the Project, therefore no impact is likely.
- The SGHAT modelling identified no glare is geometrically possible affecting local roads and the rail line spur within 1km of the Project, therefore no impact is likely.
- The assessment identified no aviation facilities within 5km of the Project.

Management and mitigation measures recommended in this assessment include:

The Project Environmental Management Plan (EMP) is to detail glare management measures including:

- Tracking and backtracking operational procedures required to avoid glare impacts to sensitive receptors, including operating the system with a minimum limit of 5 degree resting (stow) angle.
- Glare hazard monitoring program and process for managing complaints, including rectification if required.

## 1. INTRODUCTION

This report has been prepared by Environmental Ethos on behalf of Idemitsu Renewable Developments Australia (IRDA) to assess the potential solar glint and glare impact of the proposed Merriown Solar Farm (the Project), located on Lot 21/DP754940, west of Boggabri Coal Mine, NSW. The Project comprises of the installation and operation of a solar farm with a generating capacity up to 4.95MW. The primary purpose of the Project is to supply behind-the-meter energy to the Boggabri Coal Mine. Generation beyond the mines consumption will be spilled, with a connection agreement to be considered with Essential Energy as part of Stage 2.

The Project covers an area of approximately 12 hectares. The structure of the solar farm will be a single axis horizontal tracking system with PV arrays running north/south.

This glint and glare assessment has been undertaken in accordance with the requirements of NSW Government Large-Scale Solar Energy Guideline, August 2022 (NSW Guidelines), including assessment of the following:

- All residential receivers with 3km of the proposed solar arrays with line of sight to the Project;
- All roads and rail lines within 1km of the proposed solar array; and
- All air traffic control towers and take off/landing approaches to any runway or landing strip within 5km of the proposed solar array.

### 1.1. Location

The Project site is located approximately 10 kilometres (km) north east of Boggabri, within the Narrabri Local Government Area, *refer Figure 1*. Boggabri Coal Mine is located approximately 1.5km to the east of the site.



Figure 1. Location Plan

The site is zoned RU1 Primary Production and is currently used for grazing. Surrounding land uses include grazing, forestry and mining.

A coal rail spur line is located approximately 120m to the north of the Project site.

No aviation facilities were identified within a 5km radius of the Project site.

## 2. SCOPE OF THE ASSESSMENT

The scope of this Glint and Glare Impact Assessment includes the following:

- Description of the methodology used to undertake the study;
- Assessment of the baseline conditions;
- Description of the elements of the Project with the potential to influence glare including size, height, angle and rotation of PV modules, and tracking system operation;
- Identification of the viewshed and potential visibility of the Project;
- Desktop mapping of potential glare at the location of sensitive receptors within the viewshed, based on Solar Glare Hazard Analysis and viewshed analysis;
- Assessment of the potential glare hazard affecting sensitive receptors during operation of the Project; and
- Recommendation for mitigation measures to avoid, mitigate, or manage potential impacts.

## 3. METHODOLOGY

The methodology used in this assessment is consistent with the requirements of the NSW Guidelines *Appendix C – Glint and Glare Assessment*, and is outlined below.

### 3.1. Glint and Glare Definitions

Glint and glare refers to the human experience of reflected light.

This study utilises the Solar Glare Hazard Analysis Tool (SGHAT revision 2023C) software developed in the USA to address policy adherence required for the 2013 U.S. Federal Aviation Administration (FAA) Interim Policy 78 FR 63276. The FAA definitions of glint and glare are as follows:

*“Reflectivity refers to light that is reflected off surfaces. The potential effects of reflectivity are glint (a momentary flash of bright light) and glare (a continuous source of bright light). These two effects are referred to hereinafter as “glare,” which can cause a brief loss of vision, also known as flash blindness.”<sup>1</sup>*

This definition of glint and glare is consistent with the NSW Guidelines definition:

*“Glint (a momentary flash of light) and glare (a continuous, excessive brightness)”.*

---

<sup>1</sup> Federal Aviation Administration, Version 1.1 April 2018, Technical Guidance for Evaluating Selected Solar Technologies on Airports



For the purpose of this study the term 'glare' is used in reference to both glint and glare resulting from direct solar reflectivity from PV modules, measurable in duration over minutes (1 minute intervals throughout the year).

### 3.2. Solar glare Assessment Parameters

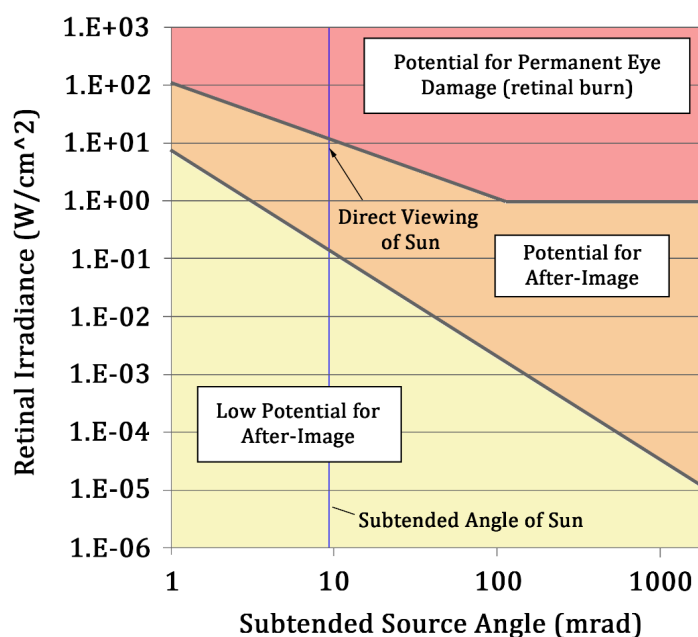
Solar glare assessment modelling for solar farms is based on the following factors:

- the tilt, orientation, and optical properties of the PV modules in the solar array;
- sun position over time, taking into account geographic location;
- the location of sensitive receivers (dwellings, roads, rail, and aviation facilities); and
- Screening potential of surrounding topography, vegetation and buildings.

### 3.3. Glare Intensity Categories

The potential hazard from solar glare is a function of retinal irradiance (power of electromagnetic radiation per unit area produced by the sun) and the subtended angle (size, distance, and geometry) of the glare source.<sup>2</sup>

Glare can be broadly classified into three categories: low potential for after-image (referred to as "Green Glare" in SGHAT), potential for after-image (referred to as "Yellow Glare" in SGHAT), and potential for permanent eye damage (referred to as "Red Glare" in SGHAT), *Figure 2* illustrates the glare intensity categories used in this study.



*Figure 2. Ocular impacts and Hazard Ranges<sup>3</sup>*

The amount of light reflected from a PV module depends on the amount of sunlight hitting the surface, as well as the surface reflectivity. The amount of sunlight interacting with the PV module will vary

<sup>2</sup> HO, C.K., C.M. Ghanbari, and R.B. Diver, 2011, Methodology to Assess Potential Glint and Glare hazards from Concentrated Solar Power Plants

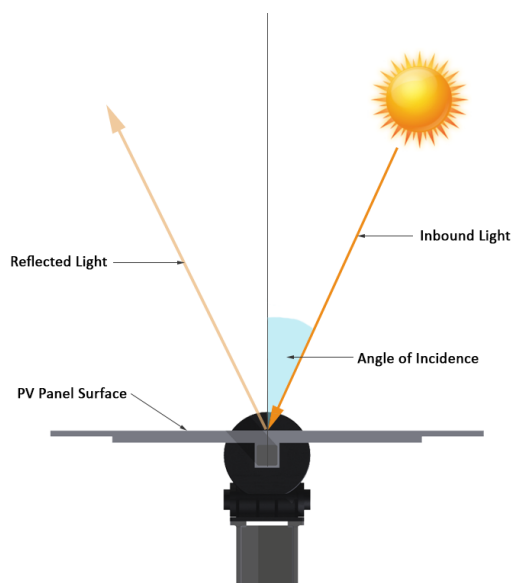
<sup>3</sup> Source: Solar Glare Hazard Analysis Tool (SGHAT) Presentation (2013)  
[https://share.sandia.gov/phlux/static/references/glint-glare/SGHAT\\_Ho.pdf](https://share.sandia.gov/phlux/static/references/glint-glare/SGHAT_Ho.pdf)

based on geographic location, time of year, cloud cover, and PV module orientation.  $1000\text{W/m}^2$  is generally used in most counties as an estimate of the solar energy interacting with a PV module when no other information is available. This study modelled scenarios using  $2000\text{ W/m}^2$  in order to cover potentially higher solar energy levels in Australia as compared to other parts of the world<sup>4</sup>. Flash blindness for a period of 4-12 seconds (i.e. time to recovery of vision) occurs when  $7\text{-}11\text{ W/m}^2$  (or  $650\text{-}1,100\text{ lumens/m}^2$ ) reaches the eye<sup>5</sup>.

### 3.4. Reflection and Angle of Incidence

PV modules are designed to maximise the absorption of solar energy and therefore minimise the extent of solar energy reflected. PV modules have low levels of reflectivity between 0.03 and 0.20 depending on the specific materials, anti-reflective coatings, and angle of incidence.<sup>6</sup>

The higher reflectivity values of 0.20, that is 20% of incident light being reflected, can occur when the angle of incidence is greater than  $50^\circ$ . *Figure 3 and 4* show the relationship between increased angles of incidence and increased levels of reflected light. Where the angle of incidence remains below  $50^\circ$  the amount of reflected light remains below 10%. The angle of incidence is particularly relevant to specular reflection (light reflection from a smooth surface). Diffuse reflection (light reflection from a rough surface or scattered light reflection) may also occur in PV modules, however diffuse reflection is significantly less intense than specular reflection.

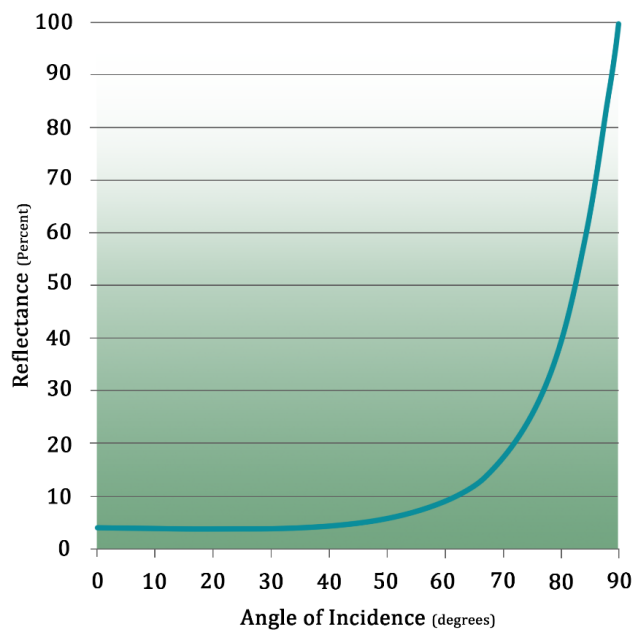


*Figure 3. Angle of Incidence Relative to PV Panel Surface*

<sup>4</sup> Global Solar Atlas 2.0, Solar resource data: Solargis

<sup>5</sup> Sandia National Laboratory, SGHAT Technical Manual

<sup>6</sup> Ho, C. 2013 *Relieving a Glare Problem*



*Figure 4. Angles of Incidence and Increased Levels of Reflected Light (Glass (n-1.5))*

In a fixed PV solar array, the angle of incidence varies as the sun moves across the sky, that is the angle of incidence are at their lowest around noon where the sun is directly overhead, and increase in the early mornings and late evenings as the incidence angles increase. If the PV array is mounted on a tracking system, this variation is reduced because the panel is rotated to remain perpendicular to the sun. Therefore a PV modular array using a tracking system has less potential to cause glare whilst it tracks the sun. *Figure 5* illustrates a PV module mounted horizontal single axis tracking system following the east to west path of the sun.

A single axis tracking system has a fixed maximum angle of rotation, once the tracking mechanism reaches this maximum angle, the PV modules position relative to the sun becomes fixed and therefore the angle of incidence increases and the potential for glare increases. Some tracking systems utilise 'backtracking' to avoid PV modules over-shadowing each other. During the backtracking procedure (early morning and late afternoon) the tracking system begins to rotate away from the sun to reduce shadow casting to adjoining PV panels, *refer Figure 6*. During the backtracking phase, higher angles of incidence will occur in comparison to the tracking phase, and this may increase the potential for glare.

Tracking systems operate from a set resting angle, resting angles define the final angle at the beginning and end of the backtracking cycle. Generally resting angles range between 0 and 30 degrees, depending on the type of system used and the site requirements. A slight angle (5 degrees) is commonly used to allow rain and dew to sheet off the panels, some systems use higher angles in more extreme climatic conditions. Shallow resting angles increase the angle of incidence between the sun and PV model, therefore the shallower the angle the more likely glare may occur.



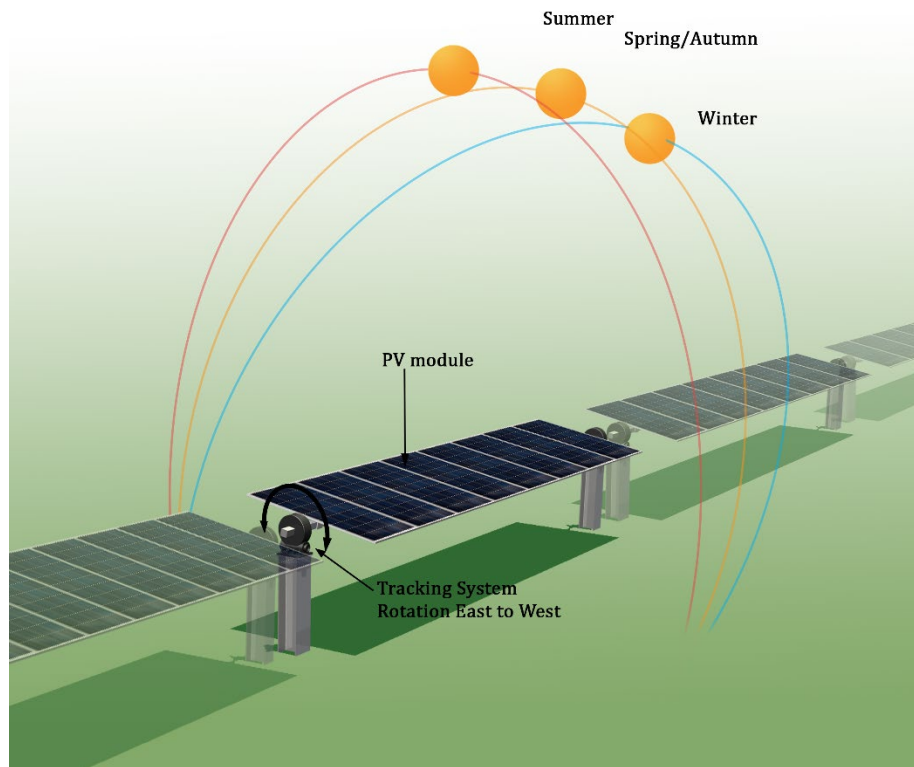


Figure 5. Diagrammatic illustration of sun position relative to PV module mounted on a horizontal single axis tracking system.

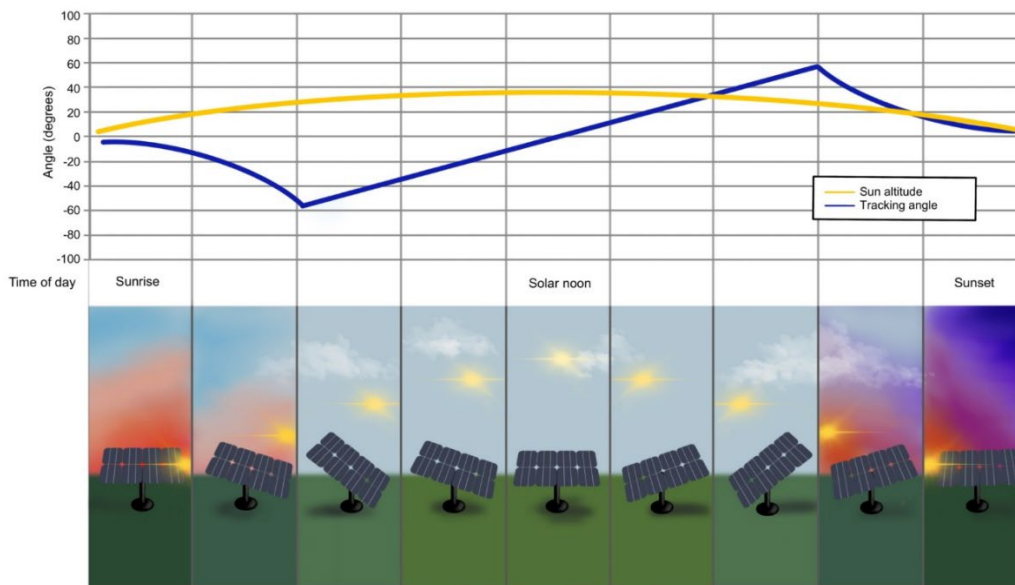


Figure 6. Diagrammatic illustration of a backtracking procedure for a horizontal single axis tracking system. (Source: ForgeSolar).

### 3.5. Viewshed Analysis

A desktop viewshed analysis was undertaken using ArcGIS 3D modelling. The extent of visibility of the proposed solar farm was assessed relative to the location of sensitive receptors (dwellings, roads, etc.) The desktop viewshed analysis is based on topography only and does not take into consideration existing vegetation.

### 3.6. Solar Glare Hazard Analysis

This assessment has utilised the Solar Glare Hazard Analysis Tool (SGHAT 2023C) co-developed by Sandi National Laboratory<sup>7</sup> and ForgeSolar (Sim Industries) (referred to as GlareGauge) to assess potential glare utilising latitude and longitudinal coordinates, elevation, sun position, and vector calculations. The PV module orientation, reflectance environment and ocular factors are also considered by the software. If potential glare is identified by the model, the tool calculates the retinal irradiance and subtended angle (size/distance) of the glare source to predict potential ocular hazards according to the glare intensity categories (refer *Section 3.3*).

The sun position algorithm used by SGHAT calculates the sun position in two forms: first as a unit vector extending from the Cartesian origin toward the sun, and second as azimuthal and altitudinal angles. The algorithm enables determination of the sun position at one (1) minute intervals throughout the year.

The SGHAT is a high level tool and does not take into consideration the following factors:

- Gaps between PV modules; and
- Atmospheric conditions.

Updated SGHAT analysis now includes the ability to include 'obstructions' in the modelling (such as vegetation and buildings). This feature was not used as part of this assessment since detailed information on the screening height and density of existing vegetation was not available at the time of the assessment.

SGHAT is the industry standard modelling tool for solar glare assessment based on geometrical analysis measured in minutes over annual and daily durations.

#### **Backtracking**

A single axis horizontal tracking system can be programed to operate a 'backtracking' procedure (*refer section 3.4*). Backtracking algorithms are becoming increasingly sophisticated with each system optimised dependent on individual project parameters including; distance between panels, width of each panel, incidence angle of the sun, field slope angle, and local weather (wind loading).

SGHAT software includes a backtracking feature which can be used to simulate various backtracking strategies. SGHAT also provides tracking data and plots, detailing the range of rotation over time. Whilst the backtracking feature simulates a generic operation based on the models parameters, the software may deviate from real-world backtracking behaviour due to a specific project system design, environmental conditions, and other factors. However, the backtracking feature does provide an understanding of potential glare implications of operating a backtracking procedure.

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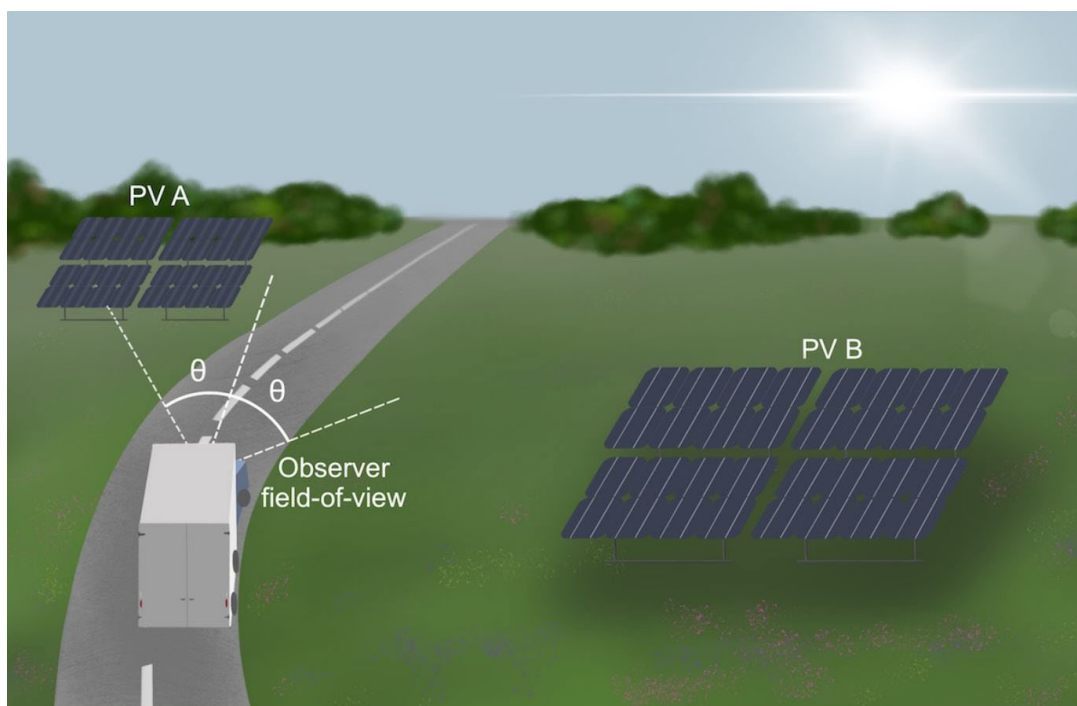
<sup>7</sup> [https://share.sandia.gov/phlux/static/references/glnt-glare/SGHAT\\_Technical\\_Reference-v5.pdf](https://share.sandia.gov/phlux/static/references/glnt-glare/SGHAT_Technical_Reference-v5.pdf)

### Observation Point Receptor (OP)

In SGHAT modelling the Observation Point receptor ("OP") simulates an observer at a single, discrete location, defined by a latitude, longitude, elevation, and height above ground. OPs generally define the location of a residential receiver (dwelling) and are subscribed a unique number in the modelling. In addition, an OP can be marked to represent an Air Traffic Control Tower ("ATCT") for aviation purposes.

### Route Parameters

The assessment of potential glare impacts to route receptors, people travelling along roads and rail, includes the parameters of direction of travel (single or both directions) and field-of-view (FOV). FOV defines the left and right field-of-view of observers traveling along a route. A view angle of 90° means the observer has a field-of-view of 90° to their left and right, i.e. a total FOV of 180°, refer *Figure 7*.



*Figure 7. Diagrammatic illustration of Observer Field of View relative to PV array (source: ForgeSolar).*

FAA research has identified 'impairment ratings' based on simulations of glare at various angles and duration, and the effect on a pilot's ability to fly a plane<sup>8</sup>. The research identified impairment was highest when the glare source was within a FOV of 25° or less. The impact of glare fell below 'slight impairment' rating when the glare source was at an angle of 50° from the direction of travel. When the glare source was located at an angle of 90° the impairment rating reduced further.

SGHAT default parameter for FOV is 50°, this assessment used an FOV of 90°, representing a conservative assessment of potential glare hazard to drivers using roads and rail network within the vicinity of the solar farm.

<sup>8</sup> [https://www.faa.gov/data\\_research/research/med\\_humanfacs/oamtechreports/2010s/media/201512.pdf](https://www.faa.gov/data_research/research/med_humanfacs/oamtechreports/2010s/media/201512.pdf)



### 3.7. Hazard Assessment

Once the potential for solar glare has been identified through the viewshed analysis and SGHAT, which is based on topography only, an assessment of the likelihood of glare hazard occurring is undertaken, taking into consideration existing mitigating factors such as existing vegetation, buildings, and minor topographic variations outside the parameters of the modelling. Embedded mitigation measures, such as proposed vegetation screens to be undertaken as part of the Project, are also considered to identify residual glare potential.

Where required, additional mitigation measures, beyond those previously considered as part of the Project, are included in the Hazard and Offensive Development Assessment which recommends additional mitigation measures to avoid, reduce or manage the identified risks.

### 3.8. Limitations to the assessment

This desktop assessment is based on a geometric analysis of potential glare using SGHAT software modelling. The parameters of the modelling are based on the default values within the software. Where these values have been altered (generally increased), this has been noted in the assessment.

The assessment considers potential impacts of solar glare under normal operational procedures, potential impacts during construction and non-operational events have not been assessed.

Field tests has not been undertaken as part of the assessment, therefore the modelling is reliant on the algorithms contained in the software.

SGHAT software is used under license to Sims Industries d/b/a ForgeSolar, refer to assumptions and limitations listed in the data output (Appendices) and for further information refer to [www.forgesolar.com/help/](http://www.forgesolar.com/help/).

Environmental Ethos does not verify the accuracy of the SGHAT software modelling. Responsibility and accountability for the accuracy of the SGHAT software (GlareGauge) resides with Sims Industries d/b/a ForgeSolar.

## 4. EXISTING CONDITIONS

The baseline is a statement of the characteristics which currently exist in the Project area. The baseline glare condition assessment takes into consideration the following:

- Characteristics of the environment that may affect the potential for glare;
- Land use and human modifications to the landscape such as roads, buildings and existing infrastructure which may influence glare and sensitivity to glare.

### 4.1. Baseline Conditions

The Project covers an area of slightly undulating grazing land with limited existing native vegetation.

Land use surrounding the site includes grazing, forestry and coal mining. Boggabri township is located approximately 10km to the south west of the site. There are a small number of rural homesteads in the area.

Infrastructure elements within the landscape include Boggabri coal mine and associated facilities, local roads, the rail spur line, a substation, and powerlines.

There are no existing features in the landscape with the potential to contribute to glare.

#### 4.2. Atmospheric Conditions

Atmospheric conditions such as cloud cover, dust and haze will impact light reflection, however these factors have not been accounted for in this glare assessment. The Bureau of Meteorology statistics for Barraba 53km north east of the Project site (the closest BOM records for cloud cover statistics) recorded 94.6 cloudy days per year (mean number over the period 1966 to 2010)<sup>9</sup>. Cloudy days mainly occur in the winter months between May and July. Since atmospheric conditions have not been factored into this assessment modelling, statistically the glare potential represents a conservative assessment.

### 5. PROJECT DESCRIPTION

The general layout of the Project is as shown in *Figure 8*. The main elements of the solar farm with the potential to influence glare are the tilt, orientation, and optical properties of the PV modules in the solar array, and the rotational capabilities of the system. Whilst specific products are yet to be determined for the Project, the general technical properties of the main elements influencing glare are described below.

#### 5.1. PV modules

Reflectance values for the PV modules were based on the default values for smooth glass with anti-reflective coating contained in SGHAT, and vary dependent on the sun/module incidence angle (refer *Figure 9*).

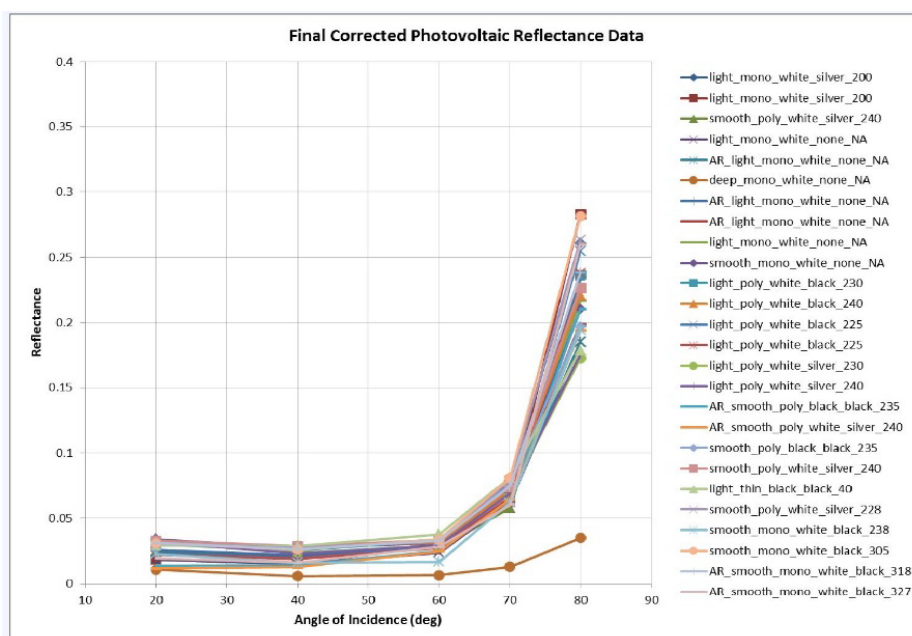


Figure 9. Photovoltaic Reflectance Data (Source Yellowhair<sup>10</sup>)

<sup>9</sup> [http://www.bom.gov.au/climate/averages/tables/cw\\_054003.shtml](http://www.bom.gov.au/climate/averages/tables/cw_054003.shtml)

<sup>10</sup> Yellowhair, J. and C.K. Ho. "Assessment of Photovoltaic Surface Texturing on Transmittance Effects and Glint/Glare Impacts". ASME 2015 9th International Conference on Energy Sustainability collocated with the ASME 2015 Power Conference





| SITE INFORMATION |                                           |
|------------------|-------------------------------------------|
| LOT / DP         | 21/754940                                 |
| ADDRESS          | LEARDS FOREST ROAD, BOGGABRI, NSW<br>2382 |
| LGA              | NARRABRI SHIRE COUNCIL                    |
| LAT / LONG       | -30.626901 / 150.122058                   |
| LOT AREA         | 90.01 ha                                  |
| FENCED AREA      | 13.29 ha                                  |
| NSP              | TRANSGRID                                 |

| PROJECT INFORMATION    |                                          |
|------------------------|------------------------------------------|
| DC CAPACITY            | 6.528 MW (STAGE 1)<br>1.023 MW (STAGE 2) |
| INVERTERS              | 4.95 MW                                  |
| TRACKER SPACING (N-S)  | MIN. 6.0 m                               |
| ARRAY PITCH            | 6.5 m                                    |
| CONNECTION VOLTAGE     | 11 kV                                    |
| CONNECTION FEEDER      | TRANSGRID                                |
| CONNECTION SUBSTATION  | TRANSGRID                                |
| SECURITY FENCE SETBACK | MIN. 3 m FROM OPTION BOUNDARY            |
| ARRAY SETBACK          | MIN. 10 m FROM SECURITY FENCE            |
| ACCESS PATH WIDTH      | 4 m                                      |

SOURCE: itp RENEWABLES  
GENERAL ARRANGEMENTS PLAN  
23043-G-2100  
REV. 3  
DATE 04/10/23

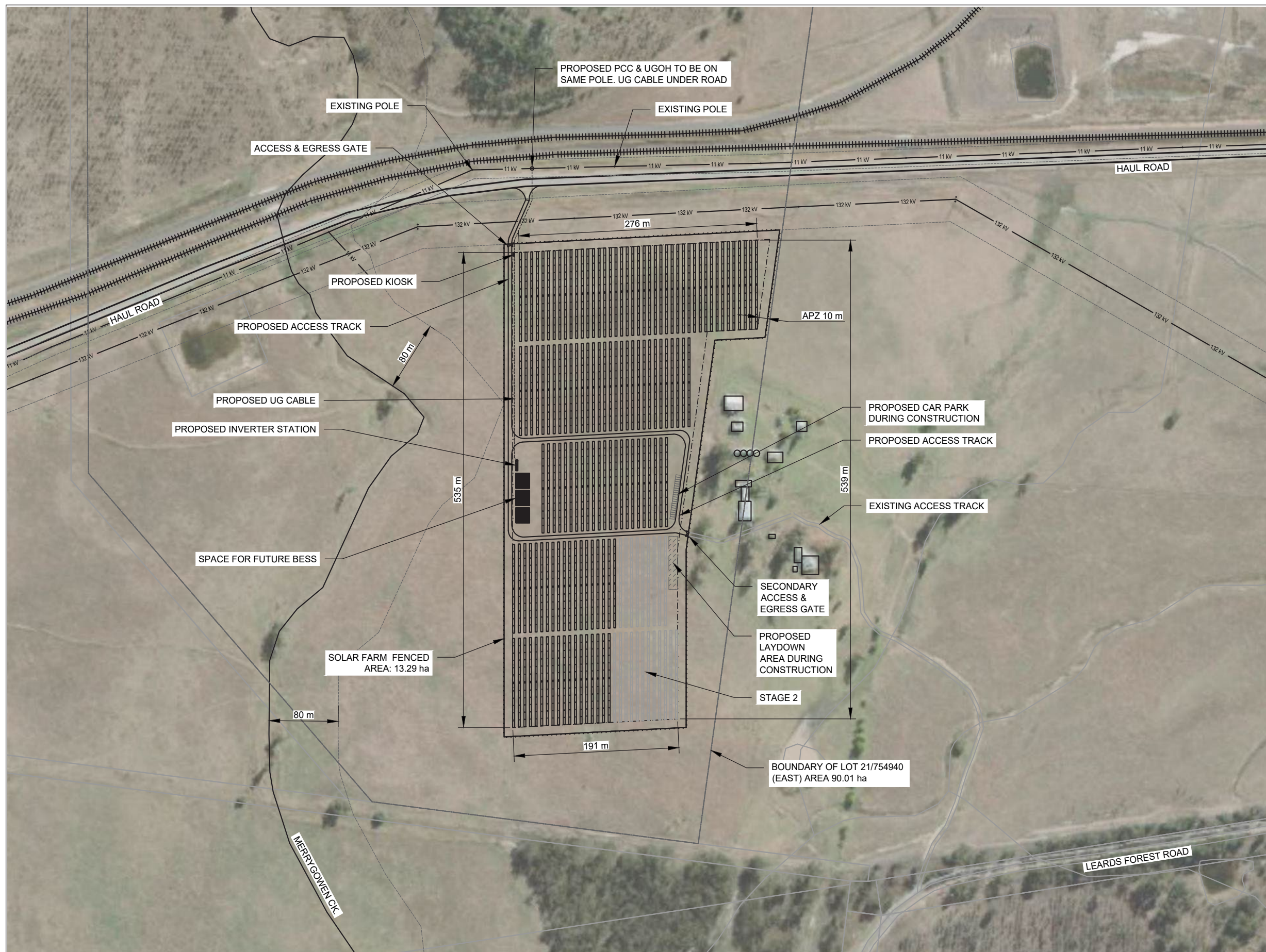
|                   |            |
|-------------------|------------|
| PROJECT NO. 22024 |            |
| CREATED BY: SC    |            |
| DATE: 17 10 2023  | VERSION: B |

**MERRIOWN SOLAR PROJECT**

## GLINT AND GLARE IMPACT ASSESSMENT

## PROJECT LAYOUT PLAN

**FIGURE**  
**8.0**





## 5.2. Horizontal single axis tracking system

The Project will use a horizontal single axis tracking system aligned north-south, with a maximum rotation range of 120° (+/- 60°). The zenith tilt angle of the panels was assumed to be set at zero, that is, the panels are not tilted on a north-south alignment but remain horizontal along the plane of the tracker.

The height of the PV tracking system will depend on the final design, the current proposal is a maximum height to centroid of 1.8m and maximum height at full rotation 2.8m.

The configuration of the tracking system rows vary slightly dependent on the type of system used, generally rows are approximately 6.5 metres apart.

## 5.3. Associated infrastructure

In addition to the PV arrays, the Project will also include a solar inverter, future Battery Energy Storage System, and perimeter fencing. These elements do not generally create specular reflection as they comprise of non-reflective surfaces typically found in the built environment.

# 6. DESKTOP GLARE ASSESSMENT

The aim of the desktop glare assessment is to identify if any sensitive receptors have the potential to be impacted by glare. The software modelling systems used in the desktop assessment include viewshed modelling to identify the location of sensitive receptors with line of sight to the Project, and the SGHAT to identify the potential and ocular significance of glare.

## 6.1. Viewshed Analysis

The results of the viewshed analysis (based on topography) are shown in *Figure 10*.

The Digital Elevation Model (DEM) for the viewshed modelling was set as 'Finest' (> 10 m). The viewshed analysis focussed on potential visibility of the Project within 3km of the site.

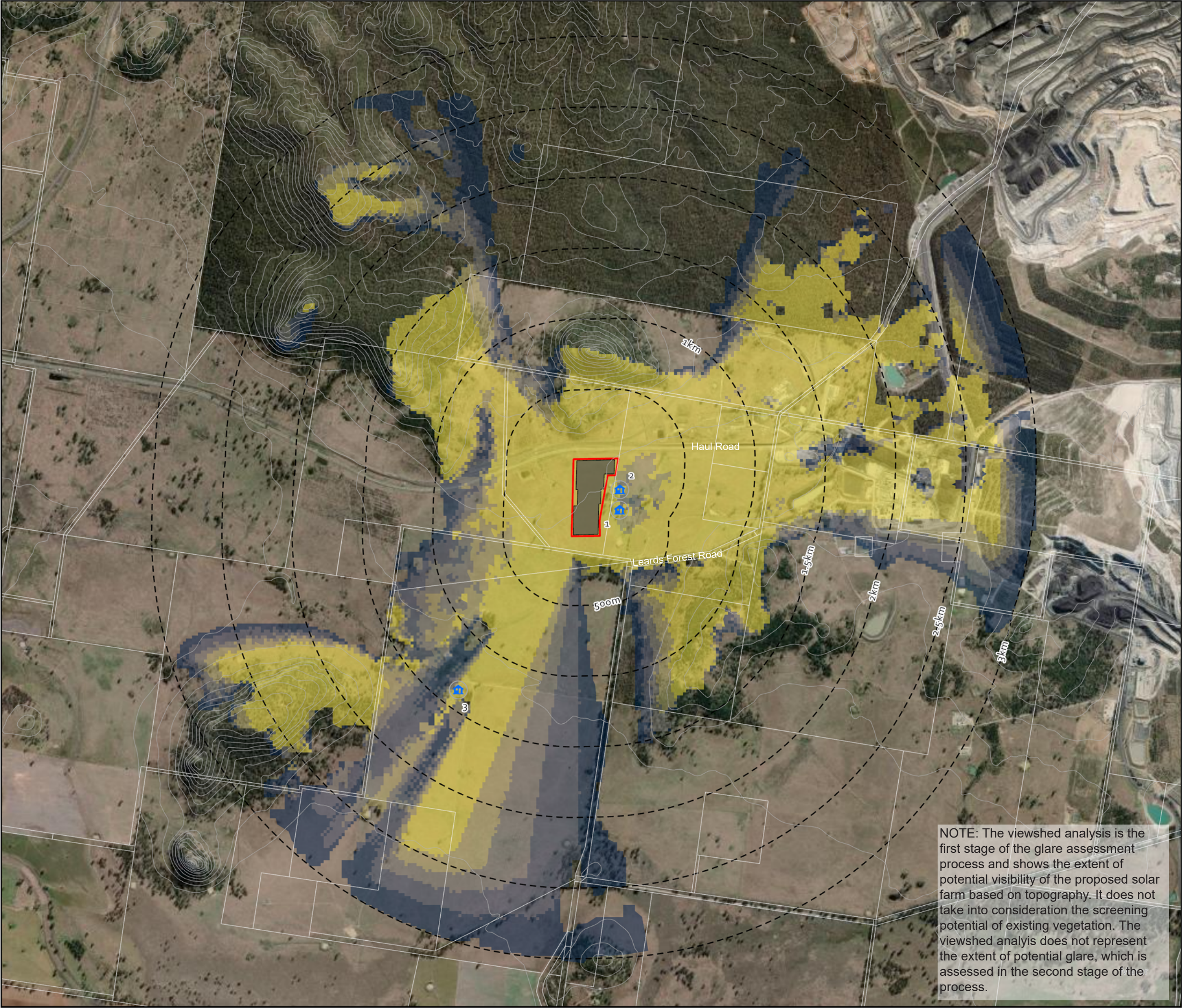
Contour and DEM information for the site shows the Project site is located within a slightly undulating valley with steep hills and ridges to the north, and smaller hills and isolated pinnacles to the south, east, and south west.

The viewshed analysis shows the surrounding hills block visibility of the Project resulting in a limited viewshed.

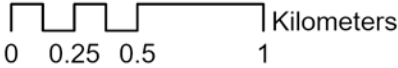
3 rural dwellings were identified within a 3km radius as having potential line-of-sight to the Project, two dwellings are located on the lot immediately adjoining the Project site. The location of the dwellings are shown in *Figure 10*, the numbering of the dwelling locations are consistent with the observation points (OP) in the glare modelling.

Two roads were identified within 1km radius of the Project including Leards Forest Road and Boggabri coal mine haul road. The coal mine rail spur line is also within the Project viewshed.





DATUM GDA 1994,  
PROJECTION MGA ZONE 56



SCALE 1:30,000 @ A3

Legend

- SITE BOUNDARY
- PV MODULE AREA
- DISTANCE FROM SOLAR FARM
- DWELLINGS
- EXTENT OF VISIBILITY\*
- LESS VISIBLE
- MORE VISIBLE

\*(Analysis based on Digital Terrain Model)

\*RURAL DWELLING LOCATIONS BASED  
ON DESKTOP ASSESSMENT  
GROUND-TRUTHING EXCLUDED

PROJECT No. 22024  
CREATED BY: SC  
DATE: 12 09 2023  
VERSION: A

MERRIOWN SOLAR PROJECT

GLINT AND GLARE ASSESSMENT

VIEWSHED ANALYSIS

FIGURE  
10.0



## 6.2. Solar Glare Hazard Analysis

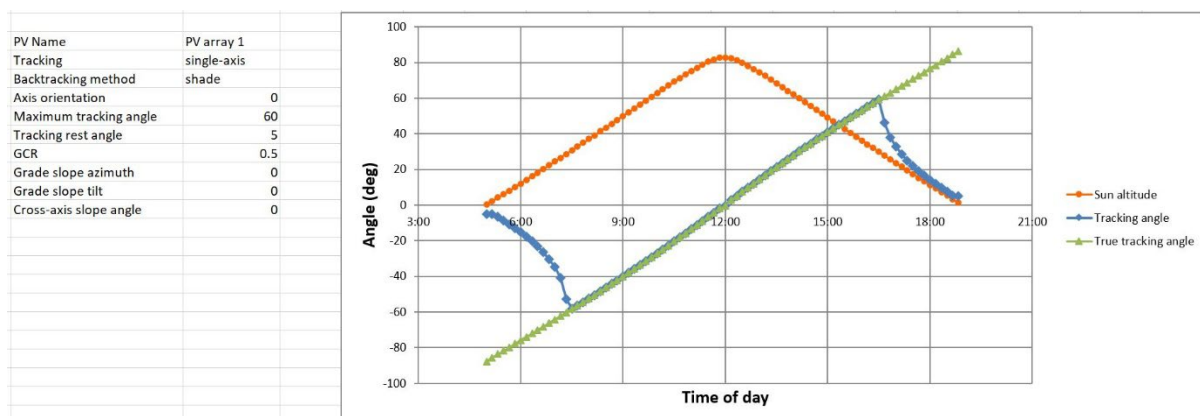
The parameters used in the SGHAT model are detailed in *Table 1*.

*Table 1. Input data for SGHAT Analysis – Single Axis Tracking System*

| SGHAT Model Parameters                   | Values                                          |
|------------------------------------------|-------------------------------------------------|
| Time Zone                                | UTC +10                                         |
| Axis Tracking                            | Horizontal Single Axis                          |
| Backtracking                             | Shade (flat land)                               |
| Tilt of tracking axis                    | 0 (Parallel to ground)                          |
| Orientation of tracking axis             | 0                                               |
| Offset angle of module                   | 0                                               |
| Module Surface material                  | Smooth glass with anti-reflective coating (ARC) |
| Maximum tracking angle                   | 60 degrees                                      |
| Resting (Stowing) angle                  | 5 degrees                                       |
| Reflectivity                             | Vary with sun                                   |
| Correlate slope error with surface type? | Yes                                             |
| Slope error                              | 8.43 mrad                                       |
| Height of panels above ground (maximum)  | 1.8m to centroid                                |

SGHAT modelling includes tracking and backtracking operations based on generic parameters. The maximum rotation angle of the tracking system was set at  $\pm 60^\circ$  and the minimum resting angle was set at  $5^\circ$  (being the fixed angle at which the backtracking process starts and finishes during daylight hours).

The general alignment of the rotation angle over time is plotted in the Component Data File. An outline of the typical rotation angles for the model's tracking/backtracking data for summer and winter solstice is outlined in *Figures 11 and 12*.



*Figure 11. Tracking/backtracking angle per time slot – mid summer*



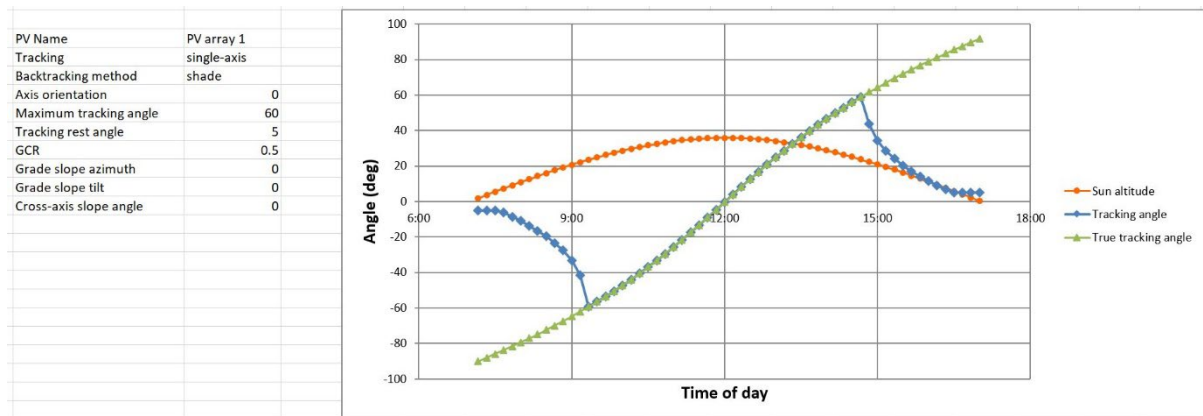


Figure 12. Tracking/backtracking angle per time slot – mid winter

### 6.3. Solar Glare Hazard Analysis Tool (SGHAT) Results

The assessment outcomes for the SGHAT modelling are detailed in *Appendix A*, and outlined in *Table 2*.

All observation point locations and numbers shown in *Figure 10* are consistent with the glare modelling results provided in the appendix and detailed in *Table 2*.

Table 2. SGHAT Assessment Results – Horizontal Single Axis Tracking System

| Sensitive Receptor                              | Glare Potential |
|-------------------------------------------------|-----------------|
| Observation Points OP1 to OP3 – Rural dwellings | No Glare        |
| Leards Forest Road                              | No Glare        |
| Mine Haul Roads 1 and 2                         | No Glare        |
| Rail Line Spur                                  | No Glare        |

The SGHAT modelling identifies that under normal operation of the solar farm, based on the model parameters, no glare hazard is geometrically possible, refer *Appendix A*.

## 7. MANAGEMENT AND MITIGATION MEASURES

The SGHAT modelling identified that under normal operation of the solar farm tracking system, with a backtracking operation and minimum limit of 5 degree resting angle, no additional mitigation measures are required to manage the potential impacts of glare on receivers.

The Project Environmental Management Plan (EMP) is to detail glare management measures including:

- Tracking and backtracking operational procedures required to avoid glare impacts to sensitive receptors, including operating the system with a minimum limit of 5 degree resting (stow) angle.
- Glare hazard monitoring program and process for managing complaints, including rectification if required.

## 8. SUMMARY

In summary, based on the assumptions and parameters of this desktop assessment, the following results were identified:

- The SGHAT modelling identified no glare is geometrically possible affecting rural dwellings within 3km of the Project, therefore no impact is likely.
- The SGHAT modelling identified no glare is geometrically possible affecting local roads and the rail line spur within 1km of the Project, therefore no impact is likely.
- The assessment identified no aviation facilities within 5km of the Project.

## APPENDIX A:

### SOLAR GLARE HAZARD ANALYSIS RESULTS



# FORGESOLAR GLARE ANALYSIS

Project: **Merriown Solar Farm**

Site configuration: **Merriown Solar Farm v2**

Created 12 Sep, 2023

Updated 12 Sep, 2023

Time-step 1 minute

Timezone offset UTC10

Minimum sun altitude 0.0 deg

DNI peaks at 2,000.0 W/m<sup>2</sup>

Category 5 MW to 10 MW

Site ID 100013.16779

Ocular transmission coefficient 0.5

Pupil diameter 0.002 m

Eye focal length 0.017 m

Sun subtended angle 9.3 mrad

PV analysis methodology V2



## Summary of Results No glare predicted

| PV Array   | Tilt<br>°      | Orient<br>°    | Annual Green Glare |     | Annual Yellow Glare |     | Energy<br>kWh |
|------------|----------------|----------------|--------------------|-----|---------------------|-----|---------------|
|            |                |                | min                | hr  | min                 | hr  |               |
| PV array 1 | SA<br>tracking | SA<br>tracking | 0                  | 0.0 | 0                   | 0.0 | -             |

*Total glare received by each receptor; may include duplicate times of glare from multiple reflective surfaces.*

| Receptor           | Annual Green Glare |     | Annual Yellow Glare |     |
|--------------------|--------------------|-----|---------------------|-----|
|                    | min                | hr  | min                 | hr  |
| Leards Forest Road | 0                  | 0.0 | 0                   | 0.0 |
| Mine Access Road 1 | 0                  | 0.0 | 0                   | 0.0 |
| Mine Access Road 2 | 0                  | 0.0 | 0                   | 0.0 |
| Rail Line Spur     | 0                  | 0.0 | 0                   | 0.0 |
| OP 1               | 0                  | 0.0 | 0                   | 0.0 |
| OP 2               | 0                  | 0.0 | 0                   | 0.0 |
| OP 3               | 0                  | 0.0 | 0                   | 0.0 |

# Component Data

## PV Arrays

**Name:** PV array 1  
**Axis tracking:** Single-axis rotation  
**Backtracking:** Shade  
**Tracking axis orientation:** 0.0°  
**Max tracking angle:** 60.0°  
**Resting angle:** 5.0°  
**Ground Coverage Ratio:** 0.5  
**Rated power:** -  
**Panel material:** Smooth glass with AR coating  
**Reflectivity:** Vary with sun  
**Slope error:** correlate with material



| Vertex | Latitude (°) | Longitude (°) | Ground elevation (m) | Height above ground (m) | Total elevation (m) |
|--------|--------------|---------------|----------------------|-------------------------|---------------------|
| 1      | -30.627193   | 150.124793    | 264.85               | 1.80                    | 266.65              |
| 2      | -30.628084   | 150.124787    | 263.05               | 1.80                    | 264.85              |
| 3      | -30.628074   | 150.124053    | 263.65               | 1.80                    | 265.45              |
| 4      | -30.629038   | 150.124031    | 263.78               | 1.80                    | 265.58              |
| 5      | -30.629038   | 150.123806    | 263.85               | 1.80                    | 265.65              |
| 6      | -30.629983   | 150.123787    | 264.47               | 1.80                    | 266.27              |
| 7      | -30.629983   | 150.123686    | 264.33               | 1.80                    | 266.13              |
| 8      | -30.631954   | 150.123613    | 260.30               | 1.80                    | 262.10              |
| 9      | -30.631956   | 150.121735    | 262.60               | 1.80                    | 264.40              |
| 10     | -30.630101   | 150.121783    | 264.47               | 1.80                    | 266.27              |
| 11     | -30.630107   | 150.122052    | 264.67               | 1.80                    | 266.47              |
| 12     | -30.629065   | 150.122084    | 266.65               | 1.80                    | 268.45              |
| 13     | -30.629067   | 150.121944    | 266.83               | 1.80                    | 268.63              |
| 14     | -30.627250   | 150.121971    | 267.87               | 1.80                    | 269.67              |

## Route Receptors

**Name:** Leards Forest Road

**Path type:** Two-way

**Observer view angle:** 90.0°



| Vertex | Latitude (°) | Longitude (°) | Ground elevation (m) | Height above ground (m) | Total elevation (m) |
|--------|--------------|---------------|----------------------|-------------------------|---------------------|
| 1      | -30.649001   | 150.123141    | 254.50               | 2.40                    | 256.90              |
| 2      | -30.642115   | 150.124342    | 257.64               | 2.40                    | 260.04              |
| 3      | -30.637093   | 150.125179    | 261.64               | 2.40                    | 264.04              |
| 4      | -30.635116   | 150.125535    | 264.26               | 2.40                    | 266.66              |
| 5      | -30.634470   | 150.125825    | 264.04               | 2.40                    | 266.44              |
| 6      | -30.634017   | 150.126275    | 263.26               | 2.40                    | 265.66              |
| 7      | -30.633796   | 150.126683    | 262.01               | 2.40                    | 264.41              |
| 8      | -30.633630   | 150.127305    | 262.02               | 2.40                    | 264.42              |
| 9      | -30.633408   | 150.129290    | 268.03               | 2.40                    | 270.43              |
| 10     | -30.633224   | 150.130899    | 267.55               | 2.40                    | 269.95              |
| 11     | -30.633067   | 150.131897    | 269.36               | 2.40                    | 271.76              |
| 12     | -30.632651   | 150.132981    | 274.06               | 2.40                    | 276.46              |
| 13     | -30.632282   | 150.133839    | 278.22               | 2.40                    | 280.62              |
| 14     | -30.631732   | 150.134740    | 278.52               | 2.40                    | 280.92              |
| 15     | -30.631215   | 150.135298    | 275.42               | 2.40                    | 277.82              |
| 16     | -30.630439   | 150.135620    | 271.12               | 2.40                    | 273.52              |
| 17     | -30.628787   | 150.135985    | 266.85               | 2.40                    | 269.25              |
| 18     | -30.627531   | 150.136231    | 268.16               | 2.40                    | 270.56              |
| 19     | -30.626405   | 150.136468    | 268.92               | 2.40                    | 271.32              |



**Name:** Mine Access Road 1  
**Path type:** Two-way  
**Observer view angle:** 90.0°



| Vertex | Latitude (°) | Longitude (°) | Ground elevation (m) | Height above ground (m) | Total elevation (m) |
|--------|--------------|---------------|----------------------|-------------------------|---------------------|
| 1      | -30.623375   | 150.095310    | 245.46               | 2.40                    | 247.86              |
| 2      | -30.626883   | 150.103078    | 253.83               | 2.40                    | 256.23              |
| 3      | -30.628416   | 150.106876    | 255.87               | 2.40                    | 258.27              |
| 4      | -30.628859   | 150.108528    | 260.39               | 2.40                    | 262.79              |
| 5      | -30.629136   | 150.110652    | 263.12               | 2.40                    | 265.52              |
| 6      | -30.628951   | 150.112777    | 267.21               | 2.40                    | 269.61              |
| 7      | -30.628286   | 150.115201    | 267.43               | 2.40                    | 269.83              |
| 8      | -30.627308   | 150.118098    | 270.83               | 2.40                    | 273.23              |
| 9      | -30.626791   | 150.119772    | 271.77               | 2.40                    | 274.17              |
| 10     | -30.626551   | 150.121338    | 270.66               | 2.40                    | 273.06              |
| 11     | -30.626458   | 150.122969    | 267.97               | 2.40                    | 270.37              |
| 12     | -30.626458   | 150.125651    | 265.67               | 2.40                    | 268.07              |
| 13     | -30.626292   | 150.132410    | 265.23               | 2.40                    | 267.63              |
| 14     | -30.626329   | 150.136294    | 268.65               | 2.40                    | 271.05              |
| 15     | -30.626274   | 150.138376    | 268.60               | 2.40                    | 271.00              |

**Name:** Mine Access Road 2  
**Path type:** Two-way  
**Observer view angle:** 90.0°



| Vertex | Latitude (°) | Longitude (°) | Ground elevation (m) | Height above ground (m) | Total elevation (m) |
|--------|--------------|---------------|----------------------|-------------------------|---------------------|
| 1      | -30.626237   | 150.138023    | 268.03               | 2.40                    | 270.43              |
| 2      | -30.625628   | 150.138892    | 269.52               | 2.40                    | 271.92              |
| 3      | -30.624917   | 150.139814    | 272.00               | 2.40                    | 274.40              |
| 4      | -30.624474   | 150.140050    | 272.26               | 2.40                    | 274.66              |
| 5      | -30.622590   | 150.140555    | 272.63               | 2.40                    | 275.03              |
| 6      | -30.621824   | 150.140748    | 274.48               | 2.40                    | 276.88              |
| 7      | -30.621528   | 150.140962    | 274.84               | 2.40                    | 277.24              |
| 8      | -30.620753   | 150.142250    | 276.40               | 2.40                    | 278.80              |
| 9      | -30.619848   | 150.143516    | 282.28               | 2.40                    | 284.68              |
| 10     | -30.619349   | 150.144202    | 285.56               | 2.40                    | 287.96              |

**Name:** Rail Line Spur  
**Path type:** Two-way  
**Observer view angle:** 50.0°



| Vertex | Latitude (°) | Longitude (°) | Ground elevation (m) | Height above ground (m) | Total elevation (m) |
|--------|--------------|---------------|----------------------|-------------------------|---------------------|
| 1      | -30.623468   | 150.096678    | 250.18               | 3.00                    | 253.18              |
| 2      | -30.627751   | 150.106591    | 256.03               | 3.00                    | 259.03              |
| 3      | -30.628725   | 150.110271    | 263.60               | 3.00                    | 266.60              |
| 4      | -30.628760   | 150.111907    | 268.24               | 3.00                    | 271.24              |
| 5      | -30.627793   | 150.115646    | 268.82               | 3.00                    | 271.82              |
| 6      | -30.626884   | 150.118607    | 271.35               | 3.00                    | 274.35              |
| 7      | -30.626307   | 150.121037    | 272.17               | 3.00                    | 275.17              |
| 8      | -30.626214   | 150.123403    | 269.08               | 3.00                    | 272.08              |
| 9      | -30.626108   | 150.136310    | 268.35               | 3.00                    | 271.35              |
| 10     | -30.625757   | 150.137984    | 267.29               | 3.00                    | 270.29              |
| 11     | -30.624372   | 150.139228    | 271.97               | 3.00                    | 274.97              |
| 12     | -30.622674   | 150.139748    | 271.50               | 3.00                    | 274.50              |
| 13     | -30.620901   | 150.139099    | 274.15               | 3.00                    | 277.15              |
| 14     | -30.619534   | 150.137469    | 279.35               | 3.00                    | 282.35              |
| 15     | -30.619124   | 150.135543    | 279.51               | 3.00                    | 282.51              |
| 16     | -30.619470   | 150.133665    | 278.33               | 3.00                    | 281.33              |
| 17     | -30.620389   | 150.132313    | 275.30               | 3.00                    | 278.30              |
| 18     | -30.624732   | 150.127662    | 269.88               | 3.00                    | 272.88              |
| 19     | -30.625651   | 150.126048    | 267.41               | 3.00                    | 270.41              |
| 20     | -30.625979   | 150.124530    | 269.46               | 3.00                    | 272.46              |
| 21     | -30.626071   | 150.121182    | 273.64               | 3.00                    | 276.64              |
| 22     | -30.626468   | 150.119278    | 271.09               | 3.00                    | 274.09              |
| 23     | -30.627539   | 150.115888    | 269.52               | 3.00                    | 272.52              |
| 24     | -30.628287   | 150.112857    | 271.45               | 3.00                    | 274.45              |
| 25     | -30.628647   | 150.111263    | 266.13               | 3.00                    | 269.13              |
| 26     | -30.628379   | 150.109059    | 261.48               | 3.00                    | 264.48              |

## Discrete Observation Point Receptors

| Name | ID | Latitude (°) | Longitude (°) | Elevation (m) | Height (m) |
|------|----|--------------|---------------|---------------|------------|
| OP 1 | 1  | -30.630373   | 150.125214    | 263.38        | 1.50       |
| OP 2 | 2  | -30.629057   | 150.125209    | 263.80        | 1.50       |
| OP 3 | 3  | -30.641849   | 150.113206    | 256.09        | 1.50       |



# Glare Analysis Results

## Summary of Results No glare predicted

| PV Array   | Tilt        | Orient      | Annual Green Glare |     | Annual Yellow Glare |     | Energy |
|------------|-------------|-------------|--------------------|-----|---------------------|-----|--------|
|            | °           | °           | min                | hr  | min                 | hr  | kWh    |
| PV array 1 | SA tracking | SA tracking | 0                  | 0.0 | 0                   | 0.0 | -      |

*Total glare received by each receptor; may include duplicate times of glare from multiple reflective surfaces.*

| Receptor           | Annual Green Glare |     | Annual Yellow Glare |     |
|--------------------|--------------------|-----|---------------------|-----|
|                    | min                | hr  | min                 | hr  |
| Leards Forest Road | 0                  | 0.0 | 0                   | 0.0 |
| Mine Access Road 1 | 0                  | 0.0 | 0                   | 0.0 |
| Mine Access Road 2 | 0                  | 0.0 | 0                   | 0.0 |
| Rail Line Spur     | 0                  | 0.0 | 0                   | 0.0 |
| OP 1               | 0                  | 0.0 | 0                   | 0.0 |
| OP 2               | 0                  | 0.0 | 0                   | 0.0 |
| OP 3               | 0                  | 0.0 | 0                   | 0.0 |

## PV: PV array 1 no glare found

*Receptor results ordered by category of glare*

| Receptor           | Annual Green Glare |     | Annual Yellow Glare |     |
|--------------------|--------------------|-----|---------------------|-----|
|                    | min                | hr  | min                 | hr  |
| Leards Forest Road | 0                  | 0.0 | 0                   | 0.0 |
| Mine Access Road 1 | 0                  | 0.0 | 0                   | 0.0 |
| Mine Access Road 2 | 0                  | 0.0 | 0                   | 0.0 |
| Rail Line Spur     | 0                  | 0.0 | 0                   | 0.0 |
| OP 1               | 0                  | 0.0 | 0                   | 0.0 |
| OP 2               | 0                  | 0.0 | 0                   | 0.0 |
| OP 3               | 0                  | 0.0 | 0                   | 0.0 |

## PV array 1 and Route: Leards Forest Road

No glare found

## PV array 1 and Route: Mine Access Road 1

No glare found

## **PV array 1 and Route: Mine Access Road 2**

No glare found

## **PV array 1 and Route: Rail Line Spur**

No glare found

## **PV array 1 and OP 1**

No glare found

## **PV array 1 and OP 2**

No glare found

## **PV array 1 and OP 3**

No glare found

# Assumptions

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"Green" glare is glare with low potential to cause an after-image (flash blindness) when observed prior to a typical blink response time.

"Yellow" glare is glare with potential to cause an after-image (flash blindness) when observed prior to a typical blink response time.

Times associated with glare are denoted in Standard time. For Daylight Savings, add one hour.

The algorithm does not rigorously represent the detailed geometry of a system; detailed features such as gaps between modules, variable height of the PV array, and support structures may impact actual glare results. However, we have validated our models against several systems, including a PV array causing glare to the air-traffic control tower at Manchester-Boston Regional Airport and several sites in Albuquerque, and the tool accurately predicted the occurrence and intensity of glare at different times and days of the year.

Several V1 calculations utilize the PV array centroid, rather than the actual glare spot location, due to algorithm limitations. This may affect results for large PV footprints. Additional analyses of array sub-sections can provide additional information on expected glare. This primarily affects V1 analyses of path receptors.

Random number computations are utilized by various steps of the annual hazard analysis algorithm. Predicted minutes of glare can vary between runs as a result. This limitation primarily affects analyses of Observation Point receptors, including ATCTs. Note that the SGHAT/ ForgeSolar methodology has always relied on an analytical, qualitative approach to accurately determine the overall hazard (i.e. green vs. yellow) of expected glare on an annual basis.

The analysis does not automatically consider obstacles (either man-made or natural) between the observation points and the prescribed solar installation that may obstruct observed glare, such as trees, hills, buildings, etc.

The subtended source angle (glare spot size) is constrained by the PV array footprint size. Partitioning large arrays into smaller sections will reduce the maximum potential subtended angle, potentially impacting results if actual glare spots are larger than the sub-array size. Additional analyses of the combined area of adjacent sub-arrays can provide more information on potential glare hazards. (See previous point on related limitations.)

The variable direct normal irradiance (DNI) feature (if selected) scales the user-prescribed peak DNI using a typical clear-day irradiance profile. This profile has a lower DNI in the mornings and evenings and a maximum at solar noon. The scaling uses a clear-day irradiance profile based on a normalized time relative to sunrise, solar noon, and sunset, which are prescribed by a sun-position algorithm and the latitude and longitude obtained from Google maps. The actual DNI on any given day can be affected by cloud cover, atmospheric attenuation, and other environmental factors.

The ocular hazard predicted by the tool depends on a number of environmental, optical, and human factors, which can be uncertain. We provide input fields and typical ranges of values for these factors so that the user can vary these parameters to see if they have an impact on the results. The speed of SGHAT allows expedited sensitivity and parametric analyses.

The system output calculation is a DNI-based approximation that assumes clear, sunny skies year-round. It should not be used in place of more rigorous modeling methods.

Hazard zone boundaries shown in the Glare Hazard plot are an approximation and visual aid based on aggregated research data. Actual ocular impact outcomes encompass a continuous, not discrete, spectrum.

Glare locations displayed on receptor plots are approximate. Actual glare-spot locations may differ.

Refer to the Help page at [www.forgesolar.com/help/](http://www.forgesolar.com/help/) for assumptions and limitations not listed here.

Default glare analysis parameters and observer eye characteristics (for reference only):

- Analysis time interval: 1 minute
- Ocular transmission coefficient: 0.5
- Pupil diameter: 0.002 meters
- Eye focal length: 0.017 meters
- Sun subtended angle: 9.3 milliradians

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A large, light grey abstract shape with rounded corners and a maroon-colored cutout on its right side. The cutout is a rounded rectangle with a diagonal line through it, creating a sense of depth or a shadow.

## Appendix C AHIMS search

Luke Wiggins

Date: 13 February 2023

67 Everton Street

Hamilton New South Wales 2303

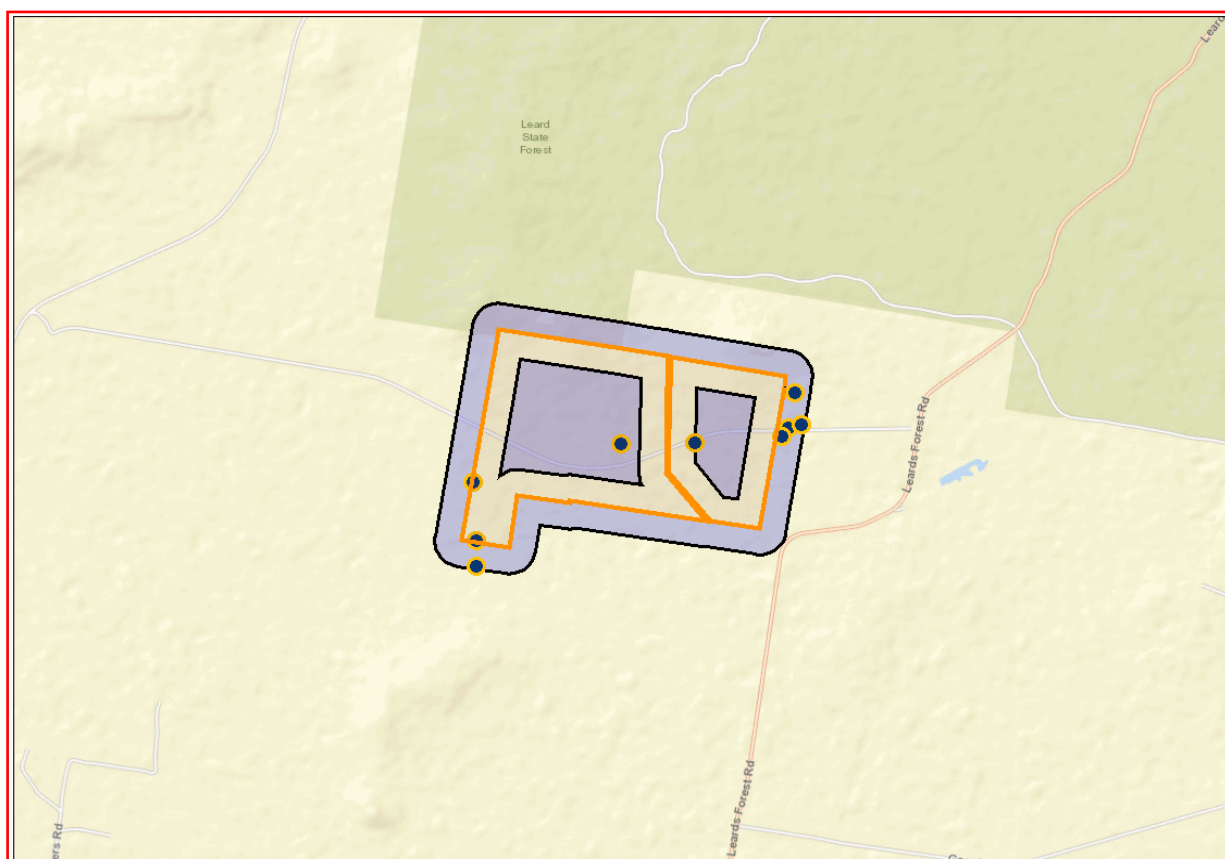
Attention: Luke Wiggins

Email: luke.wiggins@rpsgroup.com.au

Dear Sir or Madam:

**AHIMS Web Service search for the following area at Lot : 21, DP:DP754940, Section : - with a Buffer of 200 meters, conducted by Luke Wiggins on 13 February 2023.**

The context area of your search is shown in the map below. Please note that the map does not accurately display the exact boundaries of the search as defined in the paragraph above. The map is to be used for general reference purposes only.



A search of Heritage NSW AHIMS Web Services (Aboriginal Heritage Information Management System) has shown that:

|   |                                                                       |
|---|-----------------------------------------------------------------------|
| 9 | Aboriginal sites are recorded in or near the above location.          |
| 0 | Aboriginal places have been declared in or near the above location. * |

**If your search shows Aboriginal sites or places what should you do?**

- You must do an extensive search if AHIMS has shown that there are Aboriginal sites or places recorded in the search area.
- If you are checking AHIMS as a part of your due diligence, refer to the next steps of the Due Diligence Code of practice.
- You can get further information about Aboriginal places by looking at the gazettal notice that declared it. Aboriginal places gazetted after 2001 are available on the [NSW Government Gazette \(https://www.legislation.nsw.gov.au/gazette\)](https://www.legislation.nsw.gov.au/gazette) website. Gazettal notices published prior to 2001 can be obtained from Heritage NSW upon request

**Important information about your AHIMS search**

- The information derived from the AHIMS search is only to be used for the purpose for which it was requested. It is not to be made available to the public.
- AHIMS records information about Aboriginal sites that have been provided to Heritage NSW and Aboriginal places that have been declared by the Minister;
- Information recorded on AHIMS may vary in its accuracy and may not be up to date. Location details are recorded as grid references and it is important to note that there may be errors or omissions in these recordings,
- Some parts of New South Wales have not been investigated in detail and there may be fewer records of Aboriginal sites in those areas. These areas may contain Aboriginal sites which are not recorded on AHIMS.
- Aboriginal objects are protected under the National Parks and Wildlife Act 1974 even if they are not recorded as a site on AHIMS.
- This search can form part of your due diligence and remains valid for 12 months.



| SiteID    | SiteName                | Datum                     | Zone | Easting                                                                   | Northing | Context   | Site Status ** | SiteFeatures                                | SiteTypes      | Reports |
|-----------|-------------------------|---------------------------|------|---------------------------------------------------------------------------|----------|-----------|----------------|---------------------------------------------|----------------|---------|
| 20-4-0017 | Nagero Creek;           | AGD                       | 56   | 225704                                                                    | 6608190  | Open site | Destroyed      | Artefact : -                                | Open Camp Site | 103378  |
|           | <a href="#">Contact</a> | <a href="#">Recorders</a> |      | Mrs.Angela Besant,Karen Flick                                             |          |           |                | <a href="#">Permits</a>                     |                |         |
| 20-4-0388 | BCS 5                   | GDA                       | 56   | 226147                                                                    | 6608004  | Open site | Destroyed      | Artefact : 1                                |                | 103378  |
|           | <a href="#">Contact</a> | <a href="#">Recorders</a> |      | Mrs.Angela Besant,Insite Heritage Pty Ltd                                 |          |           |                | <a href="#">Permits</a>                     |                |         |
| 20-4-0389 | BCS 6                   | GDA                       | 56   | 225719                                                                    | 6608229  | Open site | Destroyed      | Artefact : 1                                |                | 103378  |
|           | <a href="#">Contact</a> | <a href="#">Recorders</a> |      | Mrs.Angela Besant,Insite Heritage Pty Ltd                                 |          |           |                | <a href="#">Permits</a>                     |                |         |
| 20-4-0392 | BCS 3                   | GDA                       | 56   | 225775                                                                    | 6607762  | Open site | Destroyed      | Artefact : 1                                |                | 103378  |
|           | <a href="#">Contact</a> | <a href="#">Recorders</a> |      | Mrs.Angela Besant,Insite Heritage Pty Ltd                                 |          |           |                | <a href="#">Permits</a>                     |                |         |
| 20-4-0393 | BCS 4                   | GDA                       | 56   | 226222                                                                    | 6607532  | Open site | Destroyed      | Artefact : 1                                |                |         |
|           | <a href="#">Contact</a> | <a href="#">Recorders</a> |      | Mrs.Angela Besant,Insite Heritage Pty Ltd                                 |          |           |                | <a href="#">Permits</a>                     |                |         |
| 20-4-0092 | NAS 1                   | GDA                       | 56   | 227537                                                                    | 6607675  | Open site | Destroyed      | Artefact : 4                                |                |         |
|           | <a href="#">Contact</a> | <a href="#">Recorders</a> |      | Mr.John Appleton,RPS Australia East Pty Ltd - Hamilton,Mrs.Tessa Boer-Mah |          |           |                | <a href="#">Permits</a>                     | 2312           |         |
| 20-4-0093 | NIS 01                  | GDA                       | 56   | 227537                                                                    | 6607675  | Open site | Destroyed      | Artefact : 1                                |                |         |
|           | <a href="#">Contact</a> | <a href="#">Recorders</a> |      | Mr.John Appleton,RPS Australia East Pty Ltd - Hamilton,Mrs.Tessa Boer-Mah |          |           |                | <a href="#">Permits</a>                     | 2312           |         |
| 20-4-0111 | BC-17                   | GDA                       | 56   | 227644                                                                    | 6608315  | Open site | Destroyed      | Artefact : 1                                |                |         |
|           | <a href="#">Contact</a> | <a href="#">Recorders</a> |      | Mr.Giles (dup ID#12832) Hamm,RPS Australia East Pty Ltd - Hamilton        |          |           |                | <a href="#">Permits</a>                     |                |         |
| 20-4-0113 | BC-19                   | GDA                       | 56   | 227622                                                                    | 6608492  | Open site | Destroyed      | Artefact : 1                                |                |         |
|           | <a href="#">Contact</a> | <a href="#">Recorders</a> |      | Mr.Giles (dup ID#12832) Hamm,RPS Australia East Pty Ltd - Hamilton        |          |           |                | <a href="#">Permits</a>                     |                |         |
| 20-4-0114 | BC-20                   | GDA                       | 56   | 227531                                                                    | 6608729  | Open site | Valid          | Artefact : 1                                |                |         |
|           | <a href="#">Contact</a> | <a href="#">Recorders</a> |      | Mr.Giles (dup ID#12832) Hamm                                              |          |           |                | <a href="#">Permits</a>                     |                |         |
| 20-4-0115 | BC-21                   | GDA                       | 56   | 226251                                                                    | 6609073  | Open site | Valid          | Artefact : 1                                |                |         |
|           | <a href="#">Contact</a> | <a href="#">Recorders</a> |      | Mr.Giles (dup ID#12832) Hamm                                              |          |           |                | <a href="#">Permits</a>                     |                |         |
| 20-4-0116 | BC-22                   | GDA                       | 56   | 227767                                                                    | 6608516  | Open site | Destroyed      | Artefact : 1                                |                | 103378  |
|           | <a href="#">Contact</a> | <a href="#">Recorders</a> |      | Mr.Giles (dup ID#12832) Hamm,RPS Australia East Pty Ltd - Hamilton        |          |           |                | <a href="#">Permits</a>                     |                |         |
| 20-4-0117 | BC-23                   | GDA                       | 56   | 226605                                                                    | 6608460  | Open site | Not a Site     | Modified Tree<br>(Carved or Scarred) :<br>1 |                |         |
|           | <a href="#">Contact</a> | <a href="#">Recorders</a> |      | Mrs.Angela Besant,Insite Heritage Pty Ltd,Mr.Giles (dup ID#12832) Hamm    |          |           |                | <a href="#">Permits</a>                     |                |         |
| 20-4-0121 | BC-27                   | GDA                       | 56   | 226238                                                                    | 6609120  | Open site | Valid          | Artefact : 1                                |                |         |
|           | <a href="#">Contact</a> | <a href="#">Recorders</a> |      | Mr.Giles (dup ID#12832) Hamm                                              |          |           |                | <a href="#">Permits</a>                     |                |         |
| 20-4-0122 | BC-28                   | GDA                       | 56   | 226159                                                                    | 6609147  | Open site | Valid          | Artefact : 1                                |                |         |
|           | <a href="#">Contact</a> | <a href="#">Recorders</a> |      | Mr.Giles (dup ID#12832) Hamm                                              |          |           |                | <a href="#">Permits</a>                     |                |         |
| 20-4-0123 | BC-29                   | GDA                       | 56   | 226090                                                                    | 6609164  | Open site | Valid          | Artefact : 1                                |                |         |
|           | <a href="#">Contact</a> | <a href="#">Recorders</a> |      | Mr.Giles (dup ID#12832) Hamm                                              |          |           |                | <a href="#">Permits</a>                     |                |         |
| 20-4-0124 | BC30                    | GDA                       | 56   | 226018                                                                    | 6609174  | Open site | Valid          | Artefact : 1                                |                |         |
|           | <a href="#">Contact</a> | <a href="#">Recorders</a> |      | Mr.Giles (dup ID#12832) Hamm                                              |          |           |                | <a href="#">Permits</a>                     |                |         |

| SiteID    | SiteName       | Datum  | Zone             | Easting                                        | Northing | Context   | Site Status **      | SiteFeatures                                | SiteTypes | Reports |
|-----------|----------------|--------|------------------|------------------------------------------------|----------|-----------|---------------------|---------------------------------------------|-----------|---------|
| 20-4-0125 | BC31           | GDA    | 56               | 225354                                         | 6609238  | Open site | Partially Destroyed | Artefact : 1                                |           | 103378  |
|           | <u>Contact</u> | Searle | <u>Recorders</u> | Mrs.Angela Besant,Mr.Giles (dup ID#12832) Hamm |          |           |                     | <u>Permits</u>                              |           |         |
| 20-4-0126 | BC32           | GDA    | 56               | 225147                                         | 6609354  | Open site | Valid               | Artefact : 1                                |           | 103378  |
|           | <u>Contact</u> | Searle | <u>Recorders</u> | Mr.Giles (dup ID#12832) Hamm                   |          |           |                     | <u>Permits</u>                              |           |         |
| 20-4-0127 | BC33           | GDA    | 56               | 225058                                         | 6609442  | Open site | Valid               | Artefact : 1                                |           | 103378  |
|           | <u>Contact</u> | Searle | <u>Recorders</u> | Mr.Giles (dup ID#12832) Hamm                   |          |           |                     | <u>Permits</u>                              |           |         |
| 20-4-0130 | BC37           | GDA    | 56               | 226785                                         | 6608396  | Open site | Not a Site          | Modified Tree<br>(Carved or Scarred) :<br>1 |           | 103378  |
|           | <u>Contact</u> | Searle | <u>Recorders</u> | Mr.Giles (dup ID#12832) Hamm,Ms.Taryn Gooley   |          |           |                     | <u>Permits</u>                              |           |         |
| 20-4-0131 | BC38           | GDA    | 56               | 226524                                         | 6608158  | Open site | Valid               | Artefact : 144                              |           |         |
|           | <u>Contact</u> | Searle | <u>Recorders</u> | Mr.Giles (dup ID#12832) Hamm                   |          |           |                     | <u>Permits</u>                              |           |         |
| 20-4-0132 | BC39           | GDA    | 56               | 226422                                         | 6608122  | Open site | Valid               | Artefact : 1                                |           |         |
|           | <u>Contact</u> | Searle | <u>Recorders</u> | Mr.Giles (dup ID#12832) Hamm                   |          |           |                     | <u>Permits</u>                              |           |         |
| 20-4-0133 | BC 40          | GDA    | 56               | 226468                                         | 6608332  | Open site | Valid               | Artefact : 10                               |           |         |
|           | <u>Contact</u> | Searle | <u>Recorders</u> | Mr.Giles (dup ID#12832) Hamm                   |          |           |                     | <u>Permits</u>                              |           |         |
| 20-4-0134 | BC 42          | GDA    | 56               | 226309                                         | 6608430  | Open site | Destroyed           | Artefact : 6                                |           | 103378  |
|           | <u>Contact</u> | Searle | <u>Recorders</u> | Mrs.Angela Besant,Mr.Giles (dup ID#12832) Hamm |          |           |                     | <u>Permits</u>                              |           |         |
| 20-4-0135 | BC 41          | GDA    | 56               | 226333                                         | 6608273  | Open site | Valid               | Artefact : 3                                |           |         |
|           | <u>Contact</u> | Searle | <u>Recorders</u> | Mr.Giles (dup ID#12832) Hamm                   |          |           |                     | <u>Permits</u>                              |           |         |
| 20-4-0136 | BC 43          | GDA    | 56               | 226155                                         | 6608455  | Open site | Destroyed           | Artefact : 15                               |           | 103378  |
|           | <u>Contact</u> | Searle | <u>Recorders</u> | Mrs.Angela Besant,Mr.Giles (dup ID#12832) Hamm |          |           |                     | <u>Permits</u>                              |           |         |
| 20-4-0137 | BC 44          | GDA    | 56               | 226186                                         | 6608185  | Open site | Destroyed           | Artefact : 4                                |           |         |
|           | <u>Contact</u> | Searle | <u>Recorders</u> | Mrs.Angela Besant,Mr.Giles (dup ID#12832) Hamm |          |           |                     | <u>Permits</u>                              |           |         |
| 20-4-0138 | BC 45          | GDA    | 56               | 226282                                         | 6608124  | Open site | Destroyed           | Artefact : 4                                |           |         |
|           | <u>Contact</u> | Searle | <u>Recorders</u> | Mrs.Angela Besant,Mr.Giles (dup ID#12832) Hamm |          |           |                     | <u>Permits</u>                              |           |         |
| 20-4-0139 | BC 46          | GDA    | 56               | 226098                                         | 6608743  | Open site | Partially Destroyed | Artefact : 28                               |           | 103378  |
|           | <u>Contact</u> | Searle | <u>Recorders</u> | Mrs.Angela Besant,Mr.Giles (dup ID#12832) Hamm |          |           |                     | <u>Permits</u>                              |           |         |
| 20-4-0140 | BC 47          | GDA    | 56               | 226157                                         | 6608862  | Open site | Destroyed           | Artefact : 3                                |           | 103378  |
|           | <u>Contact</u> | Searle | <u>Recorders</u> | Mrs.Angela Besant,Mr.Giles (dup ID#12832) Hamm |          |           |                     | <u>Permits</u>                              |           |         |
| 20-4-0141 | BC 48          | GDA    | 56               | 226223                                         | 6608938  | Open site | Valid               | Artefact : 3                                |           |         |
|           | <u>Contact</u> | Searle | <u>Recorders</u> | Mr.Giles (dup ID#12832) Hamm                   |          |           |                     | <u>Permits</u>                              |           |         |
| 20-4-0142 | BC 49          | GDA    | 56               | 226057                                         | 6608625  | Open site | Destroyed           | Artefact : 1                                |           | 103378  |
|           | <u>Contact</u> | Searle | <u>Recorders</u> | Mrs.Angela Besant,Mr.Giles (dup ID#12832) Hamm |          |           |                     | <u>Permits</u>                              |           |         |

| SiteID    | SiteName             | Datum                                                | Zone | Easting | Northing | Context   | Site Status **         | SiteFeatures                                     | SiteTypes | Reports       |
|-----------|----------------------|------------------------------------------------------|------|---------|----------|-----------|------------------------|--------------------------------------------------|-----------|---------------|
| 20-4-0143 | BC 50                | GDA                                                  | 56   | 225982  | 6608482  | Open site | Not a Site             | Modified Tree<br>(Carved or Scarred) :<br>1      |           | 103378        |
|           | <b>Contact</b>       | Searle                                               |      |         |          |           |                        |                                                  |           |               |
|           | <b>Recorders</b>     | Mr.Giles (dup ID#12832) Hamm                         |      |         |          |           |                        | <b>Permits</b>                                   |           |               |
| 20-4-0144 | BC 51                | GDA                                                  | 56   | 226179  | 6608523  | Open site | Valid                  | Modified Tree<br>(Carved or Scarred) :<br>1      |           |               |
|           | <b>Contact</b>       | Searle                                               |      |         |          |           |                        |                                                  |           |               |
|           | <b>Recorders</b>     | Insite Heritage Pty Ltd,Mr.Giles (dup ID#12832) Hamm |      |         |          |           |                        | <b>Permits</b>                                   |           |               |
| 20-4-0145 | BC 52                | GDA                                                  | 56   | 226306  | 6608432  | Open site | Destroyed              | Modified Tree<br>(Carved or Scarred) :<br>1      |           | 103378        |
|           | <b>Contact</b>       | Searle                                               |      |         |          |           |                        |                                                  |           |               |
|           | <b>Recorders</b>     | Mr.Giles (dup ID#12832) Hamm,Ms.Taryn Gooley         |      |         |          |           |                        | <b>Permits</b>                                   |           |               |
| 20-4-0146 | BC 53                | GDA                                                  | 56   | 225786  | 6608877  | Open site | Valid                  | Artefact : 1                                     |           |               |
|           | <b>Contact</b>       | Searle                                               |      |         |          |           |                        |                                                  |           |               |
|           | <b>Recorders</b>     | Mr.Giles (dup ID#12832) Hamm                         |      |         |          |           |                        | <b>Permits</b>                                   |           |               |
| 20-4-0148 | BCHR1                | GDA                                                  | 56   | 225485  | 6608430  | Open site | Valid                  | Artefact : 1                                     |           |               |
|           | <b>Contact</b>       | Searle                                               |      |         |          |           |                        |                                                  |           |               |
|           | <b>Recorders</b>     | Mr.Giles (dup ID#12832) Hamm                         |      |         |          |           |                        | <b>Permits</b>                                   |           |               |
| 20-4-0149 | BCHR2                | GDA                                                  | 56   | 225368  | 6608222  | Open site | Valid                  | Artefact : 1                                     |           |               |
|           | <b>Contact</b>       | Searle                                               |      |         |          |           |                        |                                                  |           |               |
|           | <b>Recorders</b>     | Mr.Giles (dup ID#12832) Hamm                         |      |         |          |           |                        | <b>Permits</b>                                   |           |               |
| 20-4-0150 | BCHR3                | GDA                                                  | 56   | 224793  | 6608318  | Open site | Valid                  | Artefact : 1                                     |           |               |
|           | <b>Contact</b>       | Searle                                               |      |         |          |           |                        |                                                  |           |               |
|           | <b>Recorders</b>     | Mr.Giles (dup ID#12832) Hamm                         |      |         |          |           |                        | <b>Permits</b>                                   |           |               |
| 20-4-0151 | BCHR4                | GDA                                                  | 56   | 224630  | 6608316  | Open site | Valid                  | Artefact : 1                                     |           |               |
|           | <b>Contact</b>       | Searle                                               |      |         |          |           |                        |                                                  |           |               |
|           | <b>Recorders</b>     | Mr.Giles (dup ID#12832) Hamm                         |      |         |          |           |                        | <b>Permits</b>                                   |           |               |
| 20-4-0152 | BCHR5                | GDA                                                  | 56   | 224530  | 6608290  | Open site | Valid                  | Artefact : 1                                     |           |               |
|           | <b>Contact</b>       | Searle                                               |      |         |          |           |                        |                                                  |           |               |
|           | <b>Recorders</b>     | Mr.Giles (dup ID#12832) Hamm                         |      |         |          |           |                        | <b>Permits</b>                                   |           |               |
| 20-4-0155 | BCHR6                | AGD                                                  | 56   | 223161  | 6607947  | Open site | Valid                  | Artefact : 1                                     |           |               |
|           | <b>Contact</b>       | Searle                                               |      |         |          |           |                        |                                                  |           |               |
|           | <b>Recorders</b>     | Archaeological Risk Assessment Services (ARAS)       |      |         |          |           |                        | <b>Permits</b>                                   |           |               |
| 20-4-0161 | NST 1                | AGD                                                  | 56   | 227448  | 6606507  | Open site | Valid                  | Modified Tree<br>(Carved or Scarred) :<br>1      |           |               |
|           | <b>Contact</b>       |                                                      |      |         |          |           |                        |                                                  |           |               |
|           | <b>Recorders</b>     | Mr.John Appleton                                     |      |         |          |           |                        | <b>Permits</b>                                   |           |               |
| 20-4-0196 | Boggabri Coal Pad 1  | AGD                                                  | 56   | 225915  | 6607271  | Open site | Not a Site             | Potential<br>Archaeological<br>Deposit (PAD) : 1 |           |               |
|           | <b>Contact</b>       |                                                      |      |         |          |           |                        |                                                  |           |               |
|           | <b>Recorders</b>     | Mrs.Angela Besant                                    |      |         |          |           |                        | <b>Permits</b>                                   |           |               |
| 20-4-0224 | LF NV 24, 51-61 & 63 | GDA                                                  | 56   | 224946  | 6608068  | Open site | Partially<br>Destroyed | Artefact : 145                                   |           | 101940,103378 |
|           | <b>Contact</b>       |                                                      |      |         |          |           |                        |                                                  |           |               |
|           | <b>Recorders</b>     | Mrs.Angela Besant,Mrs.Angela Besant                  |      |         |          |           |                        | <b>Permits</b>                                   |           |               |
| 20-4-0228 | LFNV 49, 50 & 62     | GDA                                                  | 56   | 224896  | 6609111  | Open site | Valid                  | Artefact : 26                                    |           | 101940,103378 |
|           | <b>Contact</b>       |                                                      |      |         |          |           |                        |                                                  |           |               |
|           | <b>Recorders</b>     | Mrs.Angela Besant                                    |      |         |          |           |                        | <b>Permits</b>                                   |           |               |



| SiteID    | SiteName                                                             | Datum            | Zone                                                                             | Easting | Northing | Context     | Site Status **         | SiteFeatures                                                                                          | SiteTypes | Reports       |
|-----------|----------------------------------------------------------------------|------------------|----------------------------------------------------------------------------------|---------|----------|-------------|------------------------|-------------------------------------------------------------------------------------------------------|-----------|---------------|
| 20-4-0229 | LFNV 77, 78                                                          | GDA              | 56                                                                               | 223825  | 6608155  | Open site   | Destroyed              | Artefact : 10                                                                                         |           | 101940,103378 |
|           | <u>Contact</u>                                                       | <u>Recorders</u> | Mrs.Angela Besant,Mrs.Angela Besant                                              |         |          |             |                        | <u>Permits</u>                                                                                        |           |               |
| 20-4-0198 | Restriction applied. Please contact<br>ahims@environment.nsw.gov.au. |                  |                                                                                  |         |          | Open site   | Valid                  |                                                                                                       |           | 101906,103378 |
|           | <u>Contact</u>                                                       | <u>Recorders</u> | Mrs.Angela Besant                                                                |         |          |             |                        | <u>Permits</u>                                                                                        |           |               |
| 20-4-0199 | BCD 2                                                                | GDA              | 56                                                                               | 225900  | 6606697  | Open site   | Valid                  | Artefact : 2                                                                                          |           | 101906,103378 |
|           | <u>Contact</u>                                                       | <u>Recorders</u> | Mrs.Angela Besant                                                                |         |          |             |                        | <u>Permits</u>                                                                                        |           |               |
| 20-4-0200 | BCD 3                                                                | GDA              | 56                                                                               | 226322  | 6606222  | Open site   | Valid                  | Artefact : 1                                                                                          |           | 101906,103378 |
|           | <u>Contact</u>                                                       | <u>Recorders</u> | Mrs.Angela Besant                                                                |         |          |             |                        | <u>Permits</u>                                                                                        |           |               |
| 20-4-0347 | TCEP-ST-010                                                          | GDA              | 56                                                                               | 227984  | 6608219  | Open site   | Partially<br>Destroyed | Modified Tree<br>(Carved or Scarred) :<br>1                                                           |           | 103378        |
|           | <u>Contact</u>                                                       | <u>Recorders</u> | Kayandel Archaeological Services,RPS Australia East Pty Ltd - Hamilton,Mr.Warwic |         |          |             |                        | <u>Permits</u>                                                                                        |           |               |
| 20-4-0507 | Isolated Find Flake                                                  | GDA              | 56                                                                               | 226201  | 6609171  | Closed site | Valid                  | Artefact : -                                                                                          |           | 103378        |
|           | <u>Contact</u>                                                       | <u>Recorders</u> | Ms.Jane Delaney-John                                                             |         |          |             |                        | <u>Permits</u>                                                                                        |           |               |
| 20-4-0505 | Leard Stare Forest Grinding Stone Portable                           | GDA              | 56                                                                               | 226239  | 6609162  | Closed site | Valid                  | Aboriginal Resource<br>and Gathering : -,<br>Aboriginal Ceremony<br>and Dreaming : -,<br>Artefact : - |           | 103378        |
|           | <u>Contact</u>                                                       | <u>Recorders</u> | Ms.Jane Delaney-John                                                             |         |          |             |                        | <u>Permits</u>                                                                                        |           |               |
| 20-4-0474 | NV79                                                                 | GDA              | 56                                                                               | 224486  | 6608228  | Open site   | Valid                  | Artefact : 1                                                                                          |           | 103378        |
|           | <u>Contact</u>                                                       | <u>Recorders</u> | Mrs.Angela Besant,Insite Heritage Pty Ltd                                        |         |          |             |                        | <u>Permits</u>                                                                                        |           |               |
| 20-4-0510 | Leard Forest                                                         | GDA              | 56                                                                               | 226169  | 6609233  | Closed site | Valid                  | Artefact : -                                                                                          |           | 103378        |
|           | <u>Contact</u>                                                       | <u>Recorders</u> | Ms.Jane Delaney-John                                                             |         |          |             |                        | <u>Permits</u>                                                                                        |           |               |
| 20-4-0511 | Leard Forest Old Camp 3                                              | GDA              | 56                                                                               | 226178  | 6609239  | Closed site | Valid                  | Artefact : -                                                                                          |           | 103378        |
|           | <u>Contact</u>                                                       | <u>Recorders</u> | Ms.Jane Delaney-John                                                             |         |          |             |                        | <u>Permits</u>                                                                                        |           |               |
| 20-4-0512 | Leard Forest - Old Camp                                              | GDA              | 56                                                                               | 226200  | 6609177  | Closed site | Valid                  | Artefact : -                                                                                          |           | 103378        |
|           | <u>Contact</u>                                                       | <u>Recorders</u> | Ms.Jane Delaney-John                                                             |         |          |             |                        | <u>Permits</u>                                                                                        |           |               |
| 20-4-0565 | NV 84                                                                | GDA              | 56                                                                               | 226346  | 6608647  | Open site   | Valid                  | Artefact : -                                                                                          |           |               |
|           | <u>Contact</u>                                                       | <u>Recorders</u> | Mrs.Angela Besant                                                                |         |          |             |                        | <u>Permits</u>                                                                                        |           |               |
| 20-4-0566 | NV 85                                                                | GDA              | 56                                                                               | 226368  | 6608585  | Open site   | Valid                  | Artefact : -                                                                                          |           |               |
|           | <u>Contact</u>                                                       | <u>Recorders</u> | Mrs.Angela Besant                                                                |         |          |             |                        | <u>Permits</u>                                                                                        |           |               |
| 20-4-0570 | TC5/15                                                               | GDA              | 56                                                                               | 226251  | 6608783  | Open site   | Destroyed              | Artefact : -                                                                                          |           |               |
|           | <u>Contact</u>                                                       | <u>Recorders</u> | Ms.Taryn Gooley                                                                  |         |          |             |                        | <u>Permits</u>                                                                                        |           |               |
| 20-4-0571 | TC6/15                                                               | GDA              | 56                                                                               | 226722  | 6608998  | Open site   | Destroyed              | Artefact : -                                                                                          |           |               |

| SiteID    | SiteName                | Datum                     | Zone                                               | Easting | Northing | Context   | Site Status ** | SiteFeatures                                | SiteTypes | Reports |
|-----------|-------------------------|---------------------------|----------------------------------------------------|---------|----------|-----------|----------------|---------------------------------------------|-----------|---------|
|           | <a href="#">Contact</a> | <a href="#">Recorders</a> | Ms.Taryn Gooley                                    |         |          |           |                | <a href="#">Permits</a>                     |           |         |
| 20-4-0574 | TC9/15                  | GDA                       | 56                                                 | 226360  | 6608543  | Open site | Destroyed      | Artefact : -                                |           |         |
|           | <a href="#">Contact</a> | <a href="#">Recorders</a> | Ms.Taryn Gooley                                    |         |          |           |                | <a href="#">Permits</a>                     |           |         |
| 20-4-0526 | LFNV80                  | GDA                       | 56                                                 | 226282  | 6608635  | Open site | Valid          | Artefact : -                                |           | 103378  |
|           | <a href="#">Contact</a> | <a href="#">Recorders</a> | Mrs.Angela Besant                                  |         |          |           |                | <a href="#">Permits</a>                     |           |         |
| 20-4-0583 | BC30 (ST)               | GDA                       | 56                                                 | 226425  | 6608589  | Open site | Valid          | Modified Tree<br>(Carved or Scarred) :<br>- |           |         |
|           | <a href="#">Contact</a> | <a href="#">Recorders</a> | Mrs.Angela Besant                                  |         |          |           |                | <a href="#">Permits</a>                     |           |         |
| 20-4-0584 | TC2/14                  | GDA                       | 56                                                 | 226722  | 6608998  | Open site | Destroyed      | Artefact : -                                |           |         |
|           | <a href="#">Contact</a> | <a href="#">Recorders</a> | Mrs.Angela Besant,Ms.Taryn Gooley                  |         |          |           |                | <a href="#">Permits</a>                     |           |         |
| 20-4-0604 | VEP IA16                | GDA                       | 56                                                 | 225058  | 6606658  | Open site | Valid          | Artefact : -                                |           |         |
|           | <a href="#">Contact</a> | <a href="#">Recorders</a> | University of Queensland,Mr.Reiner Mantei          |         |          |           |                | <a href="#">Permits</a>                     |           |         |
| 20-4-0671 | VEP AS 13               | GDA                       | 56                                                 | 222194  | 6607364  | Open site | Valid          | Artefact : -                                |           |         |
|           | <a href="#">Contact</a> | <a href="#">Recorders</a> | University of Queensland,Ms.Jodie Crossman         |         |          |           |                | <a href="#">Permits</a>                     |           |         |
| 20-4-0663 | VEP IA17                | GDA                       | 56                                                 | 224758  | 6606874  | Open site | Valid          | Artefact : -                                |           |         |
|           | <a href="#">Contact</a> | <a href="#">Recorders</a> | University of Queensland,Mr.Reiner Mantei          |         |          |           |                | <a href="#">Permits</a>                     |           |         |
| 20-4-0740 | BC 20/17                | GDA                       | 56                                                 | 224570  | 6608561  | Open site | Valid          | Artefact : -                                |           |         |
|           | <a href="#">Contact</a> | <a href="#">Recorders</a> | Mrs.Angela Besant,Insite Heritage Pty Ltd          |         |          |           |                | <a href="#">Permits</a>                     |           |         |
| 20-4-0873 | Tarrawonga GG1          | GDA                       | 56                                                 | 227811  | 6607058  | Open site | Valid          | Grinding Groove : -                         |           |         |
|           | <a href="#">Contact</a> | <a href="#">Recorders</a> | Doctor.Matthew Whincop,Whincop Archaeology Pty Ltd |         |          |           |                | <a href="#">Permits</a>                     |           |         |
| 20-4-0925 | TPW A5S1                | GDA                       | 56                                                 | 222158  | 6607812  | Open site | Valid          | Artefact : -                                |           |         |
|           | <a href="#">Contact</a> | <a href="#">Recorders</a> | Mrs.Angela Besant,Insite Heritage Pty Ltd          |         |          |           |                | <a href="#">Permits</a>                     |           |         |
| 20-4-0926 | TPW A5 S3               | GDA                       | 56                                                 | 222197  | 6607169  | Open site | Valid          | Artefact : -                                |           |         |
|           | <a href="#">Contact</a> | <a href="#">Recorders</a> | Mrs.Angela Besant,Insite Heritage Pty Ltd          |         |          |           |                | <a href="#">Permits</a>                     |           |         |
| 20-4-0979 | Mod8_2/20               | GDA                       | 56                                                 | 226270  | 6609238  | Open site | Valid          | Hearth : -                                  |           |         |
|           | <a href="#">Contact</a> | <a href="#">Recorders</a> | Mrs.Angela Besant,Insite Heritage Pty Ltd          |         |          |           |                | <a href="#">Permits</a>                     |           |         |
| 20-4-0980 | Mod8_3/20 Cloned        | GDA                       | 56                                                 | 226691  | 6608744  | Open site | Valid          | Artefact : -                                |           |         |
|           | <a href="#">Contact</a> | <a href="#">Recorders</a> | Mrs.Angela Besant,Insite Heritage Pty Ltd          |         |          |           |                | <a href="#">Permits</a>                     |           |         |
| 20-4-0981 | Mod8_4/20               | GDA                       | 56                                                 | 226521  | 6608441  | Open site | Valid          | Modified Tree<br>(Carved or Scarred) :<br>- |           |         |
|           | <a href="#">Contact</a> | <a href="#">Recorders</a> | Mrs.Angela Besant,Insite Heritage Pty Ltd          |         |          |           |                | <a href="#">Permits</a>                     |           |         |
| 20-4-0982 | Mod8_5/20               | GDA                       | 56                                                 | 226349  | 6608568  | Open site | Valid          | Artefact : -                                |           |         |
|           | <a href="#">Contact</a> | <a href="#">Recorders</a> | Mrs.Angela Besant,Insite Heritage Pty Ltd          |         |          |           |                | <a href="#">Permits</a>                     |           |         |



# AHIMS Web Services (AWS)

## Extensive search - Site list report

Your Ref/PO Number : AU213008068.002

Client Service ID : 747640

| <u>SiteID</u> | <u>SiteName</u> | <u>Datum</u> | <u>Zone</u> | <u>Easting</u> | <u>Northing</u> | <u>Context</u> | <u>Site Status **</u> | <u>SiteFeatures</u> | <u>SiteTypes</u> | <u>Reports</u> |
|---------------|-----------------|--------------|-------------|----------------|-----------------|----------------|-----------------------|---------------------|------------------|----------------|
|---------------|-----------------|--------------|-------------|----------------|-----------------|----------------|-----------------------|---------------------|------------------|----------------|

**\*\* Site Status**  
**Valid** - The site has been recorded and accepted onto the system as valid  
**Destroyed** - The site has been completely impacted or harmed usually as consequence of permit activity but sometimes also after natural events. There is nothing left of the site on the ground but proponents should proceed with caution.  
**Partially Destroyed** - The site has been only partially impacted or harmed usually as consequence of permit activity but sometimes also after natural events. There might be parts or sections of the original site still present on the ground  
**Not a site** - The site has been originally entered and accepted onto AHIMS as a valid site but after further investigations it was decided it is NOT an aboriginal site. Impact of this type of site does not require permit but Heritage NSW should be notified

Report generated by AHIMS Web Service on 24/01/2023 for Sarah Van Der Linde for the following area at Lat, Long From : -30.6495, 150.1009 - Lat, Long To : -30.6125, 150.1627. Number of Aboriginal sites and Aboriginal objects found is 77

This information is not guaranteed to be free from error omission. Heritage NSW and its employees disclaim liability for any act done or omission made on the information and consequences of such acts or omission.



A large, light grey abstract shape with rounded corners and a maroon-colored cutout on its right side. The cutout is a rounded rectangle with a diagonal line through it, creating a sense of depth and movement.

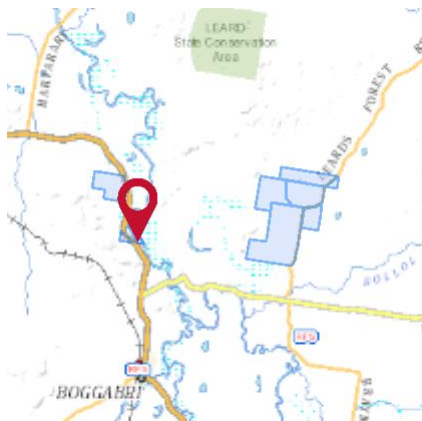
## Appendix D

### Property report



# Property Report

306 THERRIBRI ROAD BOGGABRI 2382



## Property Details

|             |                                  |                |                |
|-------------|----------------------------------|----------------|----------------|
| Address:    | 306 THERRIBRI ROAD BOGGABRI 2382 |                |                |
| Lot/Section | 1/-/DP566122                     | 107/-/DP755470 | 12/-/DP754940  |
| /Plan No:   | 124/-/DP754926                   | 125/-/DP754926 | 127/-/DP754926 |
|             | 157/-/DP755475                   | 17/-/DP754940  | 18/-/DP754940  |
|             | 19/-/DP754940                    | 191/-/DP755470 | 202/-/DP755475 |
|             | 21/-/DP754940                    | 22/-/DP754940  | 23/-/DP754940  |
|             | 3/-/DP566122                     | 37/-/DP754940  | 44/-/DP754940  |
|             | 5/-/DP754940                     | 8/-/DP754940   | 85/-/DP755475  |
| Council:    | NARRABRI SHIRE COUNCIL           |                |                |

## Summary of planning controls

Planning controls held within the Planning Database are summarised below. The property may be affected by additional planning controls not outlined in this report. Please contact your council for more information.

|                              |                                                          |
|------------------------------|----------------------------------------------------------|
| Local Environmental Plans    | Narrabri Local Environmental Plan 2012 (pub. 21-12-2012) |
| Land Zoning                  | RU1 - Primary Production: (pub. 24-2-2023)               |
| Height Of Building           | NA                                                       |
| Floor Space Ratio            | NA                                                       |
| Minimum Lot Size             | 100 ha                                                   |
| Heritage                     | NA                                                       |
| Land Reservation Acquisition | NA                                                       |
| Foreshore Building Line      | NA                                                       |

## Detailed planning information

### State Environmental Planning Policies which apply to this property

State Environmental Planning Policies can specify planning controls for certain areas and/or types of development. They can also identify the development assessment system that applies and the type of environmental assessment that is required.

This report provides general information only and does not replace a Section 10.7 Certificate (formerly Section 149)



# Property Report

306 THERRIBRI ROAD BOGGABRI 2382

- State Environmental Planning Policy (Biodiversity and Conservation) 2021: Allowable Clearing Area (pub. 21-10-2022)
- State Environmental Planning Policy (Biodiversity and Conservation) 2021: Land Application (pub. 2-12-2021)
- State Environmental Planning Policy (Exempt and Complying Development Codes) 2008: Land Application (pub. 12-12-2008)
- State Environmental Planning Policy (Housing) 2021: Land Application (pub. 26-11-2021)
- State Environmental Planning Policy (Industry and Employment) 2021: Land Application (pub. 2-12-2021)
- State Environmental Planning Policy (Planning Systems) 2021: Land Application (pub. 2-12-2021)
- State Environmental Planning Policy (Primary Production) 2021: Land Application (pub. 2-12-2021)
- State Environmental Planning Policy (Resilience and Hazards) 2021: Land Application (pub. 2-12-2021)
- State Environmental Planning Policy (Resources and Energy) 2021: Land Application (pub. 2-12-2021)
- State Environmental Planning Policy (Sustainable Buildings) 2022: Land Application (pub. 29-8-2022)
- State Environmental Planning Policy (Transport and Infrastructure) 2021: Land Application (pub. 2-12-2021)
- State Environmental Planning Policy No 65—Design Quality of Residential Apartment Development: Land Application (pub. 26-7-2002)

## Other matters affecting the property

Information held in the Planning Database about other matters affecting the property appears below. The property may also be affected by additional planning controls not outlined in this report. Please speak to your council for more information

|                                      |                                                                                                                                                                                      |
|--------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1.5 m Buffer around Classified Roads | Classified Road Adjacent                                                                                                                                                             |
| Biodiversity Value (BV) Map          | Clearing native vegetation for a development on an area on the BV Map may require a Biodiversity Development Assessment Report. Consult your local council.                          |
| Bushfire Prone Land                  | Vegetation Buffer                                                                                                                                                                    |
| Land near Electrical Infrastructure  | This property may be located near electrical infrastructure and could be subject to requirements listed under ISEPP Clause 45. Please contact Essential Energy for more information. |
| Local Aboriginal Land Council        | RED CHIEF                                                                                                                                                                            |
| Regional Plan Boundary               | New England North West                                                                                                                                                               |

This report provides general information only and does not replace a Section 10.7 Certificate (formerly Section 149)



## Appendix E

### Hazard risk assessment



Report

# State Environmental Planning Policy (Resilience and Hazards) – Screening Assessment

Merriown Solar Farm

Prepared for:

RPS Group

Prepared by:

Advitech Pty Limited

Job: AV-J-231034, Folder: F22867

Revision: 1 (Final) 23 October 2023

# Document Details

## State Environmental Planning Policy (Resilience and Hazards) – Screening Assessment

Filename: 22867 RPS Merriown Solar Farm SEPP H&OD Rev1.docx  
23 October 2023, Job: AV-J-231034, Folder: F22867, Revision: 1 (Final)

### Client

**Arie Zuanic**, Planner, RPS Group

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### Author

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Advitech Pty Limited, ABN: 29 003 433 458  
7 Riverside Drive, Mayfield West NSW 2304 Australia (PO Box 207 Mayfield NSW 2304)  
Email: tait.worthington@advitech.com.au, Phone: 02 4924 5400

### History

| Date       | Revision | Comments                                    |
|------------|----------|---------------------------------------------|
| 19-09-2023 | 0        | Final Issue                                 |
| 23-10-2023 | 1        | Final Issue Incorporating Client Commentary |

### Endorsements

|                                              |                                                                                     |                                                                                                                           |            |
|----------------------------------------------|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------|------------|
| Prepared By:                                 |  | <b>Tait Worthington</b><br>Process Engineer<br>BE(Chem), GradIEAust                                                       | 23-10-2023 |
| Checked and<br>Authorised for<br>Release By: |  | <b>Dr Carl Fung</b><br>Lead Consultant – Process Engineering<br>PhD, BE(Env), MIEAust, CPEng, NER, RPEQ,<br>CAQP (Casanz) | 23-10-2023 |

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## Appendices

A: Project Location and Indicative Arrangements



# 1. Introduction

Advitech Pty Limited (Advitech) was engaged by RPS Group (RPS), on behalf of Idemitsu Renewable Developments Australian Pty Ltd (IRDA), to prepare a *State Environmental Planning Policy (Resilience and Hazards) – Chapter 3: Hazardous and Offensive Development* (SEPP H&OD) screening report for the Idemitsu Merriown Solar Farm, a photovoltaic (PV) solar generation facility with a DC coupled battery energy storage system (BESS), located in Boggabri NSW. The site is located at 333 Leards Forest Road, Boggabri NSW 2382, designated as Lot 21 DP 754940.

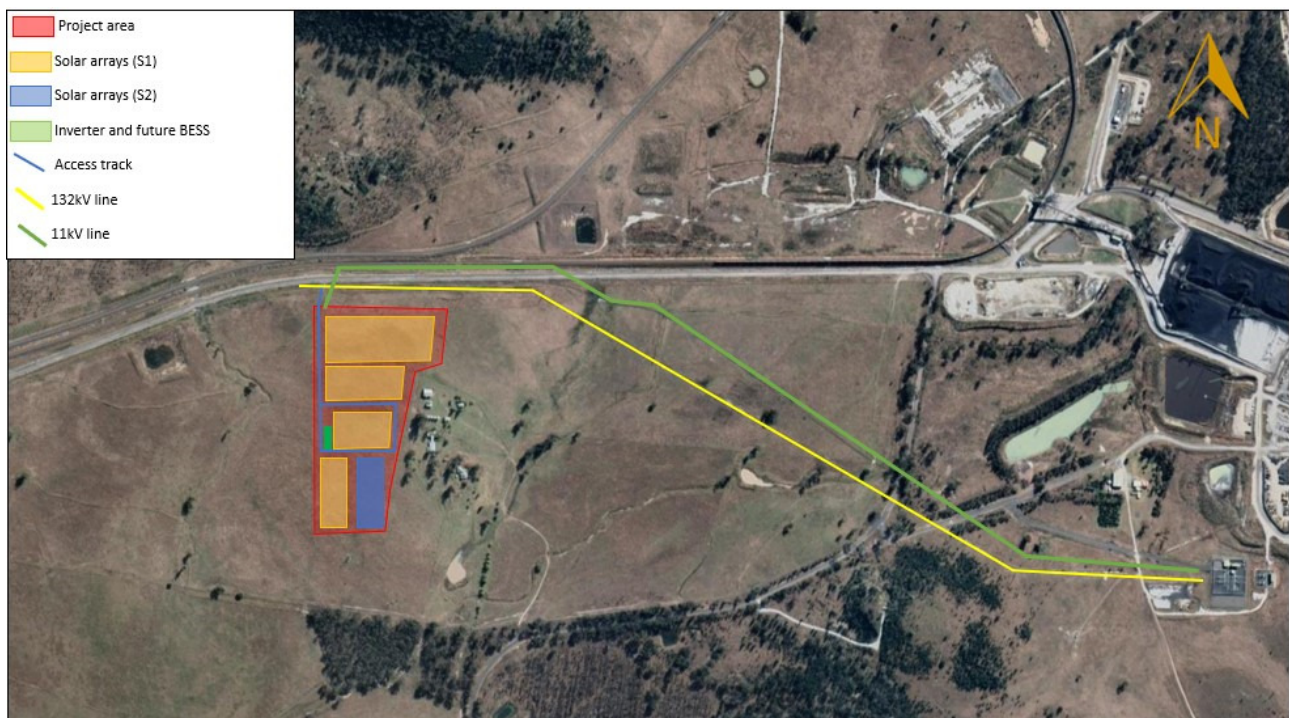
This report provides a review of the current hazardous chemicals information, together with the latest design layouts against current SEPP H&OD requirements and other applicable legislation, regulations, and guidelines.

It should be noted that this report was prepared by Advitech Pty Limited for RPS Group ('the customer') in accordance with the scope of work and specific requirements agreed between Advitech and the customer. This report was prepared with background information, terms of reference and assumptions agreed with the customer. The report is not intended for use by any other individual or organisation and as such, Advitech will not accept liability for use of the information contained in this report, other than that which was intended at the time of writing.

## 2. Background and Objectives

Idemitsu Renewable Developments Australia (IRDA) is the renewable energy development arm in Australia for the Japanese energy company Idemitsu Kosan. IRDA operates alongside its Australian mining operations arm (Idemitsu Australia). RPS has been engaged by IRDA to undertake design and development approval works for the proposed construction and installation of the 'Idemitsu Merriown Solar Farm' project. With IRDA progressing its renewable development operations, including a range of differing technologies such as solar, wind, pumped hydro, biomass, energy storage and green hydrogen, the Idemitsu Merriown Solar Farm continues Idemitsu's push for energy sustainability and self-sufficiency in its mining operations.

The Idemitsu Merriown Solar Farm project is located in Boggabri, NSW. The site is located adjacent to Idemitsu's Boggabri Coal Mine and is close to Tarrawonga and Maules Creek mines. **Figure 1** presents the location of the site in relation to Boggabri Coal Mine, and the closest neighbouring residential receptors.



**Figure 1: Site Location and Network Connections**

As presented in **Figure 1**, the following legend can be applied:

- Red – proposed project area;
- Orange and blue – PV arrays;
- Green (box) – inverter and future BESS installation area;
- Blue (line) – access track;
- Yellow – 132 kV line from substation; and
- Green (line) – 11 kV connection to the substation.

The aim of the project is to provide enough energy for all mining operations at Boggabri Coal Mine for the mine to be self-sufficient and run entirely off renewables during daytime operations. Additionally, the project may be capable of providing to the broader energy grid during periods of operational outage. The project will be constructed in two stages. Stage 1 will consist of the establishment of the five main array rows (approximate 11,900 PV modules), and the prospective Stage 2 would include an additional approximate 1,900 PV modules along with installation of a battery energy storage system (BESS).

The site is located within Narrabri Shire Local Government Area, within an area classified as RU1 – Primary Production (per the Narrabri Local Environmental Plan 2012 (DPE 2012)). The subject site lies approximately 17 km to the east of Baan Baa and 12 km to the northeast of Boggabri. A number of residential receptors lie within a 5 km radius from the proposed site, with the closest approximately 80 m to the east (Note: the closest property is currently unoccupied and owned by the Boggabri Coal Mine).

The Idemitsu Merriown Solar Farm project includes the following:

- Approximately 11,900 solar modules (Stage 1), with potential addition of approximately 1,900 solar modules (Stage 2). PV panels will be installed in rows running north to south;
- One central inverter station, tuned to operate to have a maximum output of 4.95 MW;
- A 11 kV / 50 Hz outdoor connection point kiosk, with the central inverter feeding into it;
- Potential future connection of a BESS solution;



- Security fence around the site's perimeter with an access gate installed at the location of the access track;
- Proposed stockpile and laydown area to the north of the development footprint, which will be later shifted to the proposed hardstand area; and
- Landscaping (outer side of security fence).

RPS Group, on behalf of IRDA, have required that a preliminary screening assessment be undertaken for the development, in accordance with SEPP H&OD, to determine if the required distances to protected places are met which ensure that the proposal does not cause undue risk or offence to the health and safety of people and the property within the surrounding area.

### 3. References

The analyses in this report were based on the following Australian Standards, codes and/or design references:

1. NSW Government Department of Planning and Environment (DPE) – *State Environmental Planning Policy (Resilience and Hazards)* December 2021.
2. NSW Government Department of Planning and Environment (DPE) – *Applying SEPP 33: Hazardous and Offensive Development* January 2011.
3. NSW Government Department of Planning and Environment (DPE) – Land Zoning Map – Sheet LZN\_004 (Narrabri Local Environmental Plan 2012) December 2012.
4. NSW Government – *Protection of the Environment Operations Act 1997 No 156* (POEO Act) February 2023.
5. NSW Government – *Work Health and Safety Regulation 2017* March 2023.
6. National Transport Commission – *Australian Code for the Transport of Dangerous Goods by Road and Rail* (ADG Code) Edition 7.8 April 2023.
7. Safe Work Australia – *Classifying Hazardous Chemicals National Guide* July 2020.
8. United Nations – *Globally Harmonized System of Classification and Labelling of Chemicals* (GHS) Seventh Revised Edition 2017
9. AS 1940:2017 – *The storage and handling of flammable and combustible liquids.*
10. AS 3780:2023 – *The storage and handling of corrosive substances.*
11. AS/NZS 4681:2000 – *The storage and handling of Class 9 (Miscellaneous) dangerous goods and articles.*
12. Q. Wang, P. Huang, P. Ping, Y. Du, K. Li and J. Sun – *Combustion behaviour of lithium iron phosphate battery induced external heat radiation* (Journal of Loss Prevention in the Process Industries, (2016), 1-9).
13. A.F Blum and R.T Long Jr – *Hazard Assessment of Lithium Ion Battery Energy Storage Systems* (NFPA Fire Protection Research Foundation, February 2016).
14. Hynynen J., Willstrand O., Blomqvist P., Andersson P. – *Analysis of combustion gases from large-scale electric vehicle fire tests* (Fire Safety Journal 139, 2023)

Note: Reference has been made to *Applying SEPP 33*, as of at the time of writing, no updated procedure has been put in place for *State Environmental Planning Policy (Resilience and Hazards) – Chapter 3: Hazardous and Offensive Developments*.

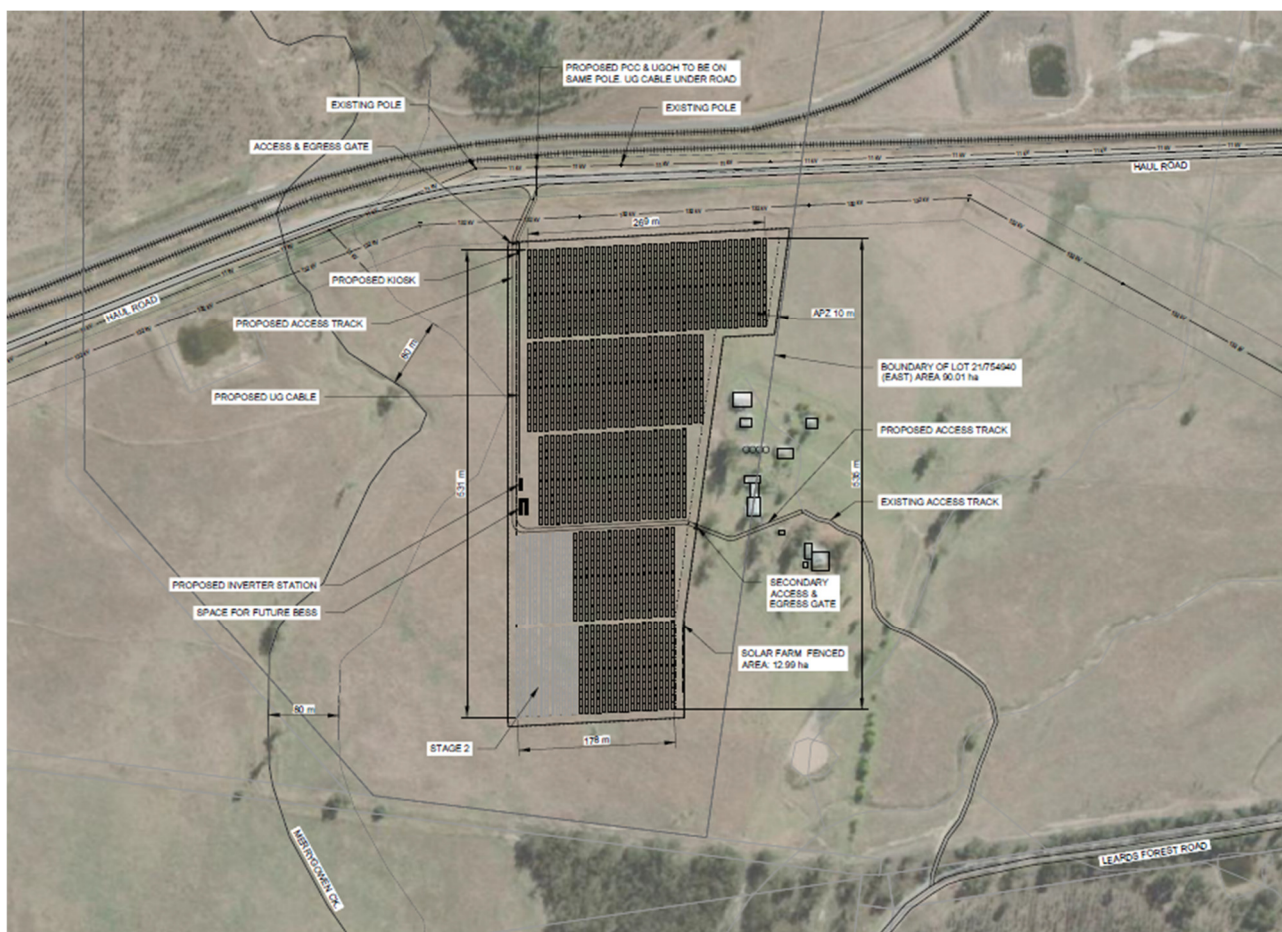


## 4.1 Location

The proposed development is located rurally within the Narrabri Plains Shire Council area, approximately 12 km northeast of Boggabri. To the east of the proposed solar farm lies Boggabri Coal mine, with Leards State Forest to the north. The closest neighbouring receptor lies approximately 80 m from the facility boundary. This property is understood to be currently unoccupied and under the ownership of the Boggabri Coal Mine. Another receptor lies to the south, approximately 1.25 km away. Advitech understands that this receptor is a former Idemitsu employee.

Included in the development is the construction, installation of Solar PV panels and BESS units (alongside other associated site infrastructure), and connection to both the Boggabri Coal Mine network (Stage 1). Post completion of Stage 1, there is potential to connect to Essential Energies' network as part of Stage 2 (point of connection is about 10 km to the southwest from the site).

The 30 % Design is presented in **Figure 2**, which includes the approximate locations of individual PV panels, invertors, access tracks (both existing and proposed), as well as space for the proposed BESS installation. The drawing has also been included in **Appendix A**.



**Figure 2: Site Arrangement (as adapted from drawing no. 23043-G-2100)**



## 4.2 Assumptions

The following assumptions were used as the assessment basis:

- The location and indicative arrangement of the Solar PV panels, BESS units, inverters and other site associated infrastructure as provided by RPS is presented in **Figure 2** and **Appendix A**.
- Space has been allowed for the future installation of BESS units. The SEPP H&OD has been undertaken on the proposed location.
- Assessment of the BESS units have been undertaken on a generalised basis for two (2) potential battery technologies to be used on site. They are; Lithium Ion (Li-Ion) and Redox Flow batteries. Typical configurations of the two battery types have been reviewed and applied to the SEPP H&OD screening.
- Li-Ion batteries and battery storage units are generally classified as Dangerous Goods (DG) Class 9, and as such are exempt from risk screening under the Australian Dangerous Goods Code (ADG Code). They are also not included under Schedule 11 Hazardous Chemicals in the NSW Work Health and Safety Regulation (2017). Thus, traditional SEPP H&OD screening may not apply, and an adjusted methodology has been adapted and utilised in this study.
- Only materials deemed 'Dangerous Goods' (DGs) under the ADG Code have been listed under **Table 1** (presented in **Section 4.4.1**). Of note, these items are generally limited to the BESS units.

## 4.3 Assessment Bases

As well as items under **Section 4.2**, the following assessment bases are also employed:

- Applying SEPP H&OD also requires consideration of risks associated with a development, additional to that of the prescribed screening thresholds. A number of public incidents have occurred in Li-Ion BESS facilities in recent years, resulting in off-site impacts. As such, a brief hazard identification and proxy screening has been undertaken to determine if the development can be considered as 'potentially hazardous' or 'potentially offensive'.
- Advitech understands IRDA are considering two different types of battery technology for the energy storage at their Idemitsu Merriown Solar Farm. They are a Li-Ion type and a Redox Flow Type. Due to the significant differences (and hazards) associated with the two battery types, the SEPP H&OD screening assessment has reviewed each battery technology.
- Li-ion type BESS units contain components that can be deemed as 'Hazardous Chemicals' or 'Dangerous Goods', included the electrolyte, solvent and cosolvent. For a complete screening assessment, these components have been assessed under **Table 3**.

## 4.4 Proposed Development

### 4.4.1 Storage

RPS Group, on behalf of IRDA, have provided relevant safety data sheets (SDSs) for the two proposed BESS types. As the assessment has been undertaken on a 'generalised' basis, these SDSs were reviewed and combined with Advitech's working knowledge to form a typical configuration. The final design of the site is yet to be resolved; thus, the SEPP H&OD screening has been undertaken for the typical configuration of a Li-Ion battery and for a redox flow type. Advitech understands only one battery technology will be used on site.

**Table 1** presents the relevant DGs to be stored onsite (including the BESS units and respectively chemical stores), as per methodology prescribed within *Applying SEPP 33*.



**Table 1: Materials Classified as DGs to be Stored Onsite**

| Material <sup>1</sup>    | DG Class and Packing Group (PG) <sup>2</sup> | Max. Quantity to be Stored         | Threshold Quantities from <i>Applying SEPP 33</i> <sup>3</sup> | SEPP H&OD Triggered |
|--------------------------|----------------------------------------------|------------------------------------|----------------------------------------------------------------|---------------------|
| Electrolyte (Redox Flow) | 8 PG II                                      | 2,555.4 t electrolyte (~ 8 units)  | 25 t                                                           | Yes                 |
| Cells (Li-Ion)           | 9                                            | 86.1 t cells (~ 2 BESS containers) | -                                                              | No <sup>4</sup>     |

Notes:

<sup>1</sup>: Materials have been separated by battery technology (i.e., either if they are to be stored should the site utilise Li-Ion or Redox Flow).

<sup>2</sup>: Packing group (PG) has been assumed as the most hazardous PG for DGs to be stored within the same general area, as per guidance from *Applying SEPP 33*.

<sup>3</sup>: Reference has been made to *Applying SEPP 33*, as of at the time of writing, no updated procedure has been put in place for SEPP H&OD.

<sup>4</sup>: DG Class 9 is excluded from risk screening; further explanation can be found in Appendix 6 *Applying SEPP 33* (January 2011). As Class 9 materials are exempt, SEPP H&OD cannot be triggered.

As presented in **Table 1** above, the storage of Li-Ion cells does not have a corresponding screening threshold within *Applying SEPP 33*, as Li-Ion cells are classified as DG Class 9. Based on storage quantity alone, there is no number of Li-Ion cells that would trigger the screening thresholds of SEPP H&OD. Storage of the Redox Flow electrolyte on the other hand, significantly exceeds the screening thresholds.

*Applying SEPP 33* also requires consideration of risks associated with a development, in addition to the screening thresholds. There have been a number of public incidents associated with BESS facilities in recent years resulting in off-site impacts. A brief hazard identification and proxy screening assessment has been undertaken and is presented in the following sections to determine whether the development can be considered 'potentially hazardous' or 'potentially offensive'.

#### 4.4.2 Hazard Identification

For risk screening purposes, risks have been derived from relevant SDSs of the two proposed battery types and assessed alongside potential hazard scenarios. **Table 2** outlines some of the potential hazard scenarios or events that may arise from Li-Ion or Redox Flow battery products.

Should a Preliminary Hazard Analysis (PHA) be found to be required, a more detailed hazard identification will be undertaken and shall consider other materials, equipment, operations, and interactions that may occur at the proposed development.

**Table 2: Key Hazards associated with Li-Ion and Redox Flow Batteries**

| Battery Type | Hazardous Event                                  | Causes                                                                                                                                                   | Potential Consequences                                                                                                                                                                                                                                                                                                                                  |
|--------------|--------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Li-Ion       | Fire / explosion                                 | Individual cell or battery unit overheating due to external heat source or improper use / abuse (e.g., short circuit, external pressure, or deformation) | <ul style="list-style-type: none"> <li>Cell may spout vapourised or decomposed and combustible electrolyte fumes.</li> <li>Battery units may explode or cause burns.</li> <li>Hazardous decomposition products include hydrogen fluoride (HF), carbon monoxide (CO), carbon dioxide (CO<sub>2</sub>), lithium oxide fumes (Li<sub>2</sub>O).</li> </ul> |
|              | Toxic exposure                                   | Individual cell or battery unit overheating due to external heat source or improper use / abuse (e.g., short circuit, external pressure, or deformation) | <ul style="list-style-type: none"> <li>As above, it is likely that hazardous decomposition products may be produced (in event of a fire).</li> <li>Personal exposure may result in severe eye damage, or respiratory tract.</li> <li>Environmental release, resulting in air pollution event</li> </ul>                                                 |
| Redox Flow   | Electrolyte leakage / toxic exposure / corrosive | Cell overheating due to external heat sources or improper use / abuse (e.g., short circuit, external pressure, or deformation)                           | <ul style="list-style-type: none"> <li>Personal exposure may result in severe skin burns and eye damage, or respiratory and/or damage to gastro / respiratory tract if ingested.</li> <li>Environmental release resulting in land and water pollution event.</li> </ul>                                                                                 |

Some of the potential hazards associated with BESS units are consistent with flammable, toxic and/or corrosive materials, not just with DG Class 9 materials. It is Advitech's opinion that the substances with the batteries contribute to the hazards present. Therefore, Advitech has completed a brief review of the quantities of battery components which would be considered a 'Hazardous Chemical' (HC) or a 'Dangerous Good' (DG) if they were to be stored outside the battery units. This review has only been undertaken on the Li-ion units, as the Redox Flow units are classified as DG Class 8.

The review encapsulates quantities of materials which would be considered potentially hazardous or materials that meet SafeWork Australia (SWA) manifest threshold quantities. Importantly, battery components are either chemically or physically bound and/or contained within the battery cell and may not present the same hazards as that of a separate store of the same substances.

**Table 3: HC and DG Classification of Li-ion BESS unit component materials**

| Substance <sup>1,2</sup>                                                     | UN No. | DG Class and PG | GHS Classification           | Max Quantity to be Stored                   | Schedule 11 (Manifest) Threshold Quantities | Screening Method from <i>Applying SEPP 33</i> | Threshold Quantities from <i>Applying SEPP 33</i> <sup>3,4</sup> |
|------------------------------------------------------------------------------|--------|-----------------|------------------------------|---------------------------------------------|---------------------------------------------|-----------------------------------------------|------------------------------------------------------------------|
| Electrolyte<br>7.5 % (wt/wt) cell <sup>5</sup>                               | 1161   | 3 PG II         | H225                         | 6,037 L <sup>6</sup><br>6.46 t <sup>7</sup> | 2,500 L                                     | Heat radiation impact (distance)              | Other – 4.5 m <sup>8</sup><br>Sensitive – 8.0 m <sup>8</sup>     |
| Cosolvent<br>7.5 % (wt/wt) cell <sup>5</sup>                                 | 3272   | 3 PG II         | H225<br>H315                 | 6,395 L <sup>6</sup><br>6.46 t <sup>7</sup> | 2,500 L                                     | Heat radiation impact (distance)              | Other – 4.5 m <sup>8</sup><br>Sensitive – 8.0 m <sup>8</sup>     |
| Solvent<br>7.5 % (wt/wt) cell <sup>5</sup>                                   | 2366   | 3 PG III        | H226                         | 6,625 L <sup>6</sup><br>6.46 t <sup>7</sup> | 10,000 L                                    | Heat radiation impact (distance)              | Other – 4.5 m <sup>8</sup><br>Sensitive – 8.0 m <sup>8</sup>     |
| Electrolyte (Lithium hexafluorophosphate)<br>2.5 % (wt/wt) cell <sup>5</sup> | 2923   | 8 PG II         | H311<br>H314<br>H302<br>H372 | 2,153 kg<br>2.15 t <sup>7</sup>             | 2,500 kg or L                               | Quantity                                      | 25 t                                                             |

Notes:

<sup>1</sup>: Typical substances have been applied. Generally, components classified as hazardous or dangerous are contained within the electrolyte (corrosive and/or flammable elements).

<sup>2</sup>: In order to utilise the ingredients of the Li-ion cells as an example of hazardous material to be stored on site, further material SDSs were reviewed and the United Nations (UN) no., DG Class and PG, GHS Classifications and Manifest quantities. It should be noted that whilst contained within the battery cell, they do not exist as individual components. For example, the electrolyte in combination with the cosolvent, solvent and li-ion salt form a paste like substance.

<sup>3</sup>: The screening thresholds from *Applying SEPP 33* have been reapplied to the total storage capacity of the proposed development. This has been used as a comparative measure, as stated within **Table 1**, DG Class 9 materials do not trigger a risk screening.

<sup>4</sup>: From *Applying SEPP 33*, 'sensitive' refers to residential or other more sensitive land users. 'Other' applies to all other land users (e.g., commercial, or industrial).

<sup>5</sup>: Approximate weight (wt) % of the components has been applied. With a typical cell, a range for the composition is given.

<sup>6</sup>: Litres (L) has been provided for a direct comparison to the manifest quantities for flammable liquids. As individual quantities of flammable liquids (i.e., 3 PG II) have exceeded the relevant manifest thresholds, there is no need for a combination quantity to be applied.

<sup>7</sup>: Total amount in tonnes (t) is based on the wt % of the cell and the total quantity of the cells to be stored on site (presented in **Table 1**).

<sup>8</sup>: The total quantity of DG Class 3 (PG II and PG III) has been summed to determine the distance for potential heat radiation impacts from the storage of Flammable Liquids. For a total of ~ 20 t it is considered potentially hazards to sensitive receptors within 8 m and/or potentially hazardous to other receptors within 5 m.





As previously stated in **Table 1**, the Li-ion units are classified as DG Class 9 (Miscellaneous) and as such are exempt from risk assessment. However, due to potential hazards that are associated with Li-ion units (listed under **Table 2**), along with review of some typical SDSs for Li-ion units, a brief review was undertaken with respect to manifest threshold quantities.

From **Table 3**, the highly flammable components of the cell (i.e., electrolyte and cosolvent) do exceed their respective manifest threshold quantities. When the substances were re-applied to the thresholds from *Applying SEPP 33*, the following was determined:

- The storage of flammable material (DG Class 3 PG II and PG III) can be considered potentially hazardous if there are sensitive users within 8.0 m of the stores and/or if there are other users within 4.5 m of the stores. The closest offsite unoccupied receptor is approximately 400 m away from the BESS area and the closest occupied receptor is 1.7 km from the BESS area. It is unlikely that sensitive or other users would be within the required separation distance; and
- The storage of corrosive material (DG Class 8) is below the screening threshold.

The flammable component of the Li-ion batteries makes up the largest percentage (~ 22.5 % wt/wt in a typical cell). Li-ion batteries combust in a vastly different manner to that of a liquid fuel. Within publicly available literature, experimentation has been undertaken to determine how Li-ion cells combust. Results have found that there are several stages of jet fire and a stable, long-lasting combustion but no explosion (Wang et al 2016).

Should a fire event occur within a Li-ion BESS unit, there is potential for off-gases to be emitted. The off gases are high toxic and can cause significant risk to people both on and off site. A further brief study of potential impacts from a toxic release was also undertaken for the Li-Ion units.

#### 4.4.3 Impact of a Fire Event – Toxic Plume

From review of potential hazards associated with Li-Ion batteries, alongside review of other hazard assessments undertaken for similar BESS facilities, it was found thermal runaway to be of significant consequence to site and neighbouring receptors. The thermal runaway hazard is largely independent of the overall site installed kWh of the BESS unit. Current, scrutiny is largely focused on one BESS container being involved in a thermal scenario before corrective actions and/or emergency services prevent fire spreading to adjoining BESS containers. Once a fire scenario occurs and is established, it is almost impossible to contain the fire to individual modules within the container.

In the event of a fire, the electrolyte of a Li-ion battery will decompose, creating harmful toxic emissions. The electrolyte of a Li-ion battery typically contains lithium hexafluorophosphate (LiPF<sub>6</sub>) or other Li-salts containing fluorine. Decomposition of the electrolyte to fluoride binders include harmful emissions of hydrogen fluoride (HF).

For the screening assessment, a conservative Level 1 air quality plume assessment was undertaken using current NSW Environmental Protection Agency (EPA) methodology. The Level 1 air quality plume assessment assumed the following factors:

- Single Li-ion BESS container as a basis;
- Installed kWh of a single container was utilised;
- The single container is assumed to be completely engulfed in fire;
- A generic meteorological dataset, running through various wind speeds and atmospheric stability possibilities was applied; and
- Each container has the potential to produce up to 89 kg per hour of Hydrogen Fluoride (HF), equating to approximately 20 g/s emission rate (over a 1-hour period).

From the Level 1 air quality assessment, it was determined that for the capacity of Li-ion unit to be installed on-site, a thermal runaway fire event has the potential to result in unacceptable on-site consequences, and may have potential to risk to human life offsite within a radius of 200 m. Note: this is a conservative estimate for approximate radius based on the 30 parts per million (ppm) 'Immediately Dangerous to Life and Health Limits' (IDLH).



The closest neighbouring residential receptor is located just outside the eastern boundary of the site (approximately 270 m from the proposed BESS installation). It is understood that the residence is currently unoccupied, and mine owned. Considering the relative distance to the receptor, emission from a thermal event is not expected to be an issue. Advitech recommends that additional assessments be undertaken to determine the potential impact to all receptors (both mine personnel and members of public) within the conservative vicinity of 200 – 250 m of the proposed battery units.

It should be noted, the redox flow battery has not been assessed in the same manner (i.e., breakdown of component materials and the impact of a fire causing a toxic release). This is due to the redox flow battery has already triggered the SEPP H&OD screening thresholds, and as such can already be deemed 'potentially hazardous'. Furthermore, the inherent design of the redox flow battery will make it unlikely for fire to develop.

## 5. Impact to Proposed Development

### 5.1 State Environmental Planning Policy (Resilience and Hazards) – Chapter 3: Hazardous and Offensive Developments

Further consideration to the screening results must be undertaken to determine whether SEPP H&OD applies to the proposed development. This includes resolving whether the proposed development is considered a 'potentially hazardous industry', either by way of inventory or through transport thresholds, and concluding whether the proposed development is or has cause to be considered 'potentially offensive'.

#### 5.1.1 Potentially Hazardous Industry

The objective of *State Environmental Planning Policy (Resilience and Hazards) – Chapter 3: Hazardous and Offensive Developments* (SEPP H&OD) is to link the permissibility of a proposal to its safety and pollution control performance. It aims to ensure that the merits of the proposal are properly assessed in relation to offsite risk and offence. SEPP H&OD applies to any proposals which fall under the definition of 'potentially hazardous industry'.

SEPP H&OD define 'potentially hazardous industry' as:

*A development for the purposes of an industry which, if the development were to operate without employing any measures to reduce or minimise its impact in the locality or on the existing or likely future development on other land, would pose a significant risk in relation to the locality:*

- *To human health, life, or property;*
- *To the biophysical environment.*

*And includes a hazardous industry and a hazardous storage establishment.*

If a development falls within the definition of a 'potentially hazardous industry', then the proponent must prepare, or cause to be prepared, a Preliminary Hazard Analysis (PHA). SEPP H&OD provides the definition of a 'potentially hazardous industry' as a site which holds quantities of dangerous goods in excess of the screening threshold levels prescribed within the NSW Department of Planning document entitled '*Applying SEPP 33*' (January 2011). Note, at the time of writing, there have been no changes to encapsulate *Applying SEPP 33* under the new SEPP arrangements (i.e., SEPP Resilience and Hazards). As such, *Applying SEPP 33* has been referred to.

#### 5.1.1.1 Storage Screening Threshold

##### *Li-ion batteries*

Li-ion batteries are classified as DG Class 9. As such are exempt from risk screening under the SEPP H&OD screening thresholds. With consideration to hazards associated with Li-ion batteries, the typical composition of the cell was split and reassessed against manifest threshold quantities and SEPP H&OD thresholds. The highly flammable components (i.e., electrolyte and cosolvent) exceeded the manifest quantities. When re-assessed against the SEPP H&OD thresholds, it was considered unlikely for a sensitive or other users would be between 5-8 m of the proposed battery storage location.



Note: the distance is to be taken with respect to potential offsite land uses. *Applying SEPP 33* defines 'sensitive' uses as residential or other more sensitive land uses and 'other' applying to all other land uses (e.g., commercial or industrial).

A further brief air quality impact assessment was undertaken to determine whether there would be significant off-site impacts to classify the development as 'potentially hazardous', as presented under **Section 5.1.1.2**.

#### *Redox Flow batteries*

Electrolyte contained within the redox flow batteries is classified as DG Class 8. The storage of redox flow batteries does exceed the screening thresholds prescribed within *Applying SEPP 33*. As such, should the development utilise redox flow type batteries on site, the development has cause to be classified as 'potentially hazardous' and a PHA must be prepared.

#### *5.1.1.2 Other Considerations (BESS Specific)*

A brief Level 1 air quality assessment was undertaken to quantify potential impacts from a 'thermal runaway fire event leading to a toxic off-gas' scenario. From the assessment undertaken, there is potential risk to human life extending to an approximate radius of 200 m. The closest receptor is a currently unoccupied mine owned property located 270 m from the BESS. Based on the conservative screening approach, the emission from a thermal event is not expected to be an issue with consideration to the closest receptor.

#### *5.1.1.3 Transport Screening Thresholds*

A development may also be considered as 'potentially hazardous' if the Transport Screening thresholds are exceeded for vehicular movements to and from the site. The transport screening thresholds for DG Class 8 and Class 9 materials from *Applying SEPP 33* have been reproduced and compared against the movements for the development in **Table 4**.

For the purposes of comparison, it has been assumed that a significant quantity of DGs delivered to the site during the construction and/or commissioning phase of the project. For a Redox flow battery type, there may be a requirement to have additional electrolyte delivered during the operation of the site. The approximate movements for the development were estimated from similar facilities (i.e., Solar Farms with battery energy storage capabilities).

**Table 4: Transportation Screening Thresholds (adapted from *Applying SEPP 33*)**

| Class | Approx. Movements for Development <sup>1</sup> |             | Vehicle Movements |             | Minimum quantity per load (t) <sup>2</sup> |         |
|-------|------------------------------------------------|-------------|-------------------|-------------|--------------------------------------------|---------|
|       | Cumulative Annual                              | Peak Weekly | Cumulative Annual | Peak Weekly | Bulk                                       | Package |
| 8     | 120                                            | 30          | > 500             | > 30        | 2                                          | 5       |
| 9     | 60                                             | 20          | > 1000            | > 60        | No limit                                   | -       |

Notes:

<sup>1</sup>: Based on information provided by RPS. Values taken and maximum in range for estimation purposes. Additional estimation used for assumption detailed above.

<sup>2</sup>: If the quantities are below this level, the potential risk is unlikely to be significant unless the number of traffic movements is high.

Li-ion and Redox Flow batteries are both classified as a 'Dangerous Good' under the ADG Code, care must be taken when handling and transporting the units to and from the site. As presented in **Table 4**, the cumulative annual and peak weekly transport of DG Class 8 and DG Class 9 materials are well below their respective screening thresholds. As such, it is unlikely that the potential risk associated with transport to be significant.



### 5.1.2 Potentially Offensive Industry

SEPP H&OD would also apply where a development is considered a 'potentially offensive industry', which is defined as follows:

***Potentially Offensive Industry** means a development for the purposes of industry which, if the development were to operate without employing any measures (including, for example, isolation from existing or likely future development on other land) to reduce or minimise its impact in the locality or on the existing likely future development on other land, would emit a polluting discharge (including, for example, noise) in a manner which would have a significant adverse impact in the locality or on the existing or likely future development on other land, and includes an offensive industry and an offensive storage establishment.*

In deciding if a proposal is a 'potentially offensive industry', it is necessary to consider whether, in the absence of safeguards, the proposal would emit a polluting discharge which would cause a significant level of offence. Generally, a development may be classified as 'potentially offensive' where, either:

- A licence is required under pollution control legislation; or
- Where no such licence is required, the proposal has the potential to cause offence having regard to the sensitivity of the surrounding environment.

The proposed development lies in close vicinity to Leards Forest Road and an access road for the Boggabri Coal Mine (as presented in **Appendix A**). There are several receptors located within vicinity of the proposed development, one just off the eastern boundary approximately 80 m from the boundary and another 1.25 km to the southwest of the site. Both are mined owned, with the closest property to be permanently uninhabited. In the case of a catastrophic event (i.e., thermal runaway leading to a battery container fire), there is potential for Li-ion BESS units to produce highly toxic gases (e.g., hydrogen fluoride). Some recently documented Li-ion large scale battery fires have burned for considerable lengths of time, with authorities recommending the public to remain indoors.

Comparatively, there is limited knowledge of potential fire (and off gassing) hazards known about the Redox flow type batteries. They are much more likely to represent a corrosive electrolyte leakage hazard rather than a fire hazard.

Due to the location of the proposed development, consideration to zoning and a review of how the batteries will be stored, it is unlikely for the proposed development to be deemed a 'potentially hazardous industry'. From review of Schedule 1 Scheduled Activities under the *Protection of the Environment Act* (POEO Act 1997), neither battery storage nor solar electricity generation are considered and as such do not require a licence under relevant pollution control legislation. There is potential to cause offense to sensitive receptors with the storage of Li-ion batteries should there be a significant event. Further assessment may be required to determine impacts of other potential emissions of polluting discharges (i.e., noise, odour, air emissions etc).

## 5.2 Outcomes

Li-ion batteries are classified as DG Class 9, and as such do not require a risk screening. Redox flow batteries are classified as DG Class 8 (based on electrolyte quantities). The screening thresholds only form a part of the SEPP H&OD screening assessment. Further consideration to some of the potential hazardous involved with the storing of Li-ion and/or Redox flow battery types were also assessed. This assessment led to a brief review of the components of the batteries and a brief impact assessment based on toxic emissions.

### 5.2.1 Li-ion Batteries

It was determined that the flammable components of the Li-ion battery type did exceed the manifest thresholds from Schedule 11 of Work Health and Safety Regulation. Re-assessing the components against the screening thresholds from *Applying SEPP 33*, it was found to be unlikely for receptors (sensitive or otherwise) to be present within the required separation distances.





Based on the findings of the impact assessment, should a significant thermal runaway or an exterior fire, there is potential for the batteries to release toxic HF gas. From a Level 1 air quality assessment, there is potential to impact receptors up to 200 m away. With consideration to the distance to sensitive offsite receptors, it is unlikely the storage or impacts from potential events affect neighbours in the vicinity. As such, a PHA does not need to be prepared.

#### 5.2.2 Redox Flow Batteries

The Redox flow the battery was found to exceed both the manifest threshold and the screening thresholds. Based on the quantity of corrosive material alone (electrolyte), selection of Redox flow battery for the proposed development can be considered 'potentially hazardous'. Therefore a PHA has cause to be prepared and would be required should the development utilise Redox flow type batteries.

## 6. Conclusions

Advitech was engaged by RPS Group, on behalf of IRDA, to prepare a SEPP H&OD screening report in accordance with an EIS for the construction and operation of a solar photovoltaic (PV) generation facility and associated battery storage system in Boggabri NSW.

Based on the supplied information reviewed, it is Advitech's professional opinion that a PHA be undertaken should the proposed development utilise a Redox flow type battery, based on the reasoning provided throughout the report.

Were the proposed development to utilise Li-ion type batteries, though there are significant risks associated with LI-ion units, a PHA does not need to be undertaken. Advitech does recommend undertaking further assessments be undertaken to determine and quantify impact to receptors.

This report has been prepared on the basis of information supplied by RPS Group, on behalf IRDA, and relies on the assessment of Hazardous Chemicals (HCs) and Dangerous Goods (DGs) present within the associated battery types, as presented in **Section 4.4**, along with the locations of the proposed BESS units as shown in **Appendix A**.



# Appendix A

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## Project Location and Indicative Arrangements

# BOGGABRI SOLAR FARM

## 30% DESIGN

ADDRESS:  
LEARDS FOREST ROAD  
BOGGABRI  
NSW 2382



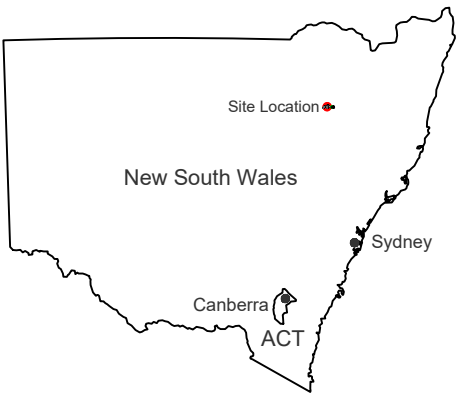
DEVELOPED BY:  
IDEMITSU RENEWABLE DEVELOPMENTS AUSTRALIA

| Sheet List Table |                          |
|------------------|--------------------------|
| Sheet Number     | Sheet Title              |
| G-0100           | TITLE                    |
| G-0400           | LOCATION PLAN            |
| G-2100           | GENERAL ARRANGEMENT PLAN |
| E-1100           | AC SLD                   |

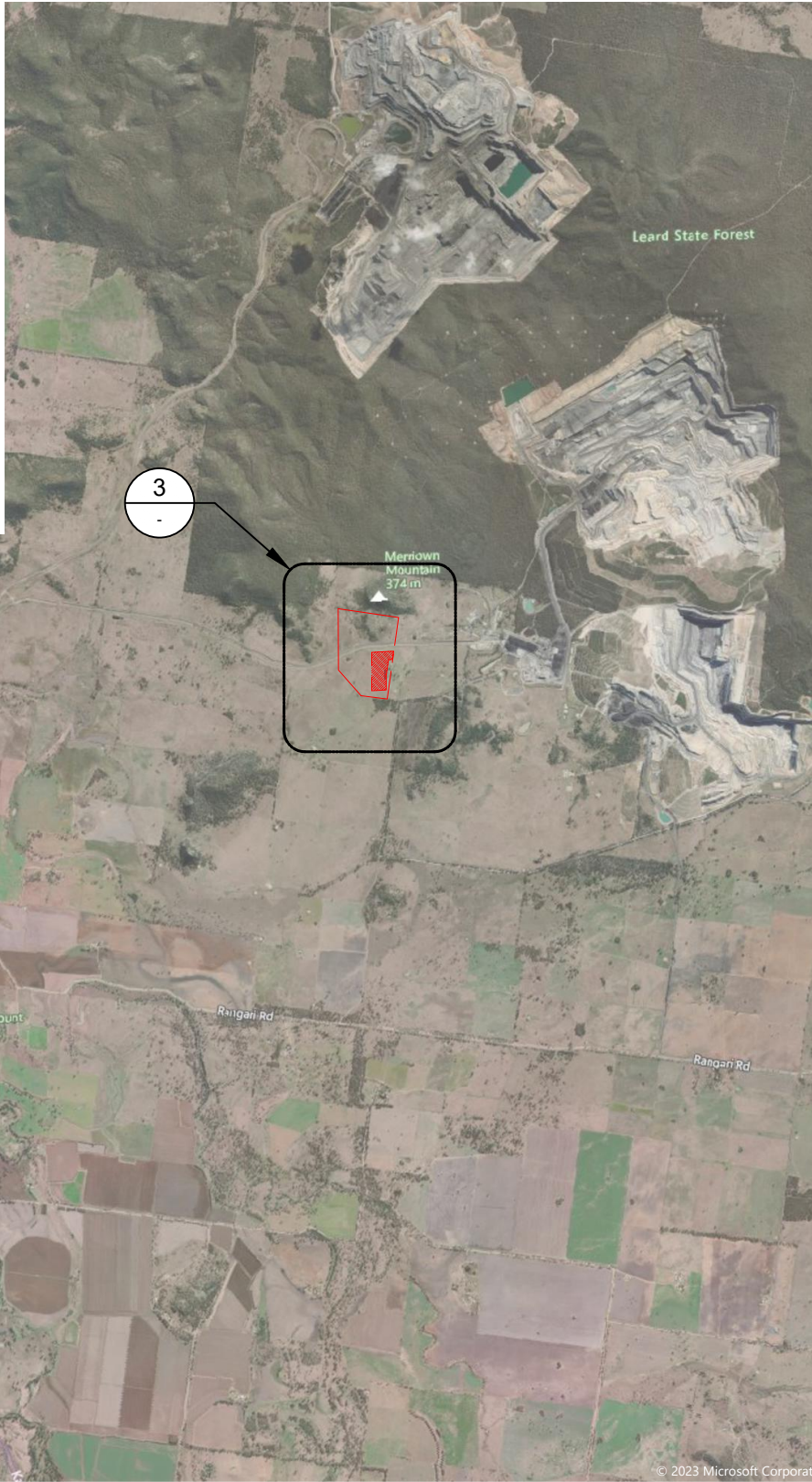


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1 STATE MAP  
SCALE: NTS



2 LOCATION PLAN  
SCALE: NTS



3 SITE PLAN  
SCALE: 1:10000

30% DESIGN

| NO. | STAGE                            | DSN  | DWN  | CHKD | APPR | DATE       |
|-----|----------------------------------|------|------|------|------|------------|
| 1   | 30% DESIGN                       | ISC  | MJB  | ISC  | LF   | 15/08/2023 |
| 2   | OH WIRES ADDED                   | ISC  | MJB  | ISC  | LF   | 28/08/2023 |
| 3   | SECURITY FENCE FOOTPRINT UPDATED | ISC  | MJB  | ISC  | ISC  | 04/10/2023 |
| 4   | ----                             | ---- | ---- | ---- | ---- | ----       |
| 5   | ----                             | ---- | ---- | ---- | ---- | ----       |
| 6   | ----                             | ---- | ---- | ---- | ---- | ----       |

| NOTES |
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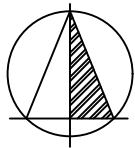
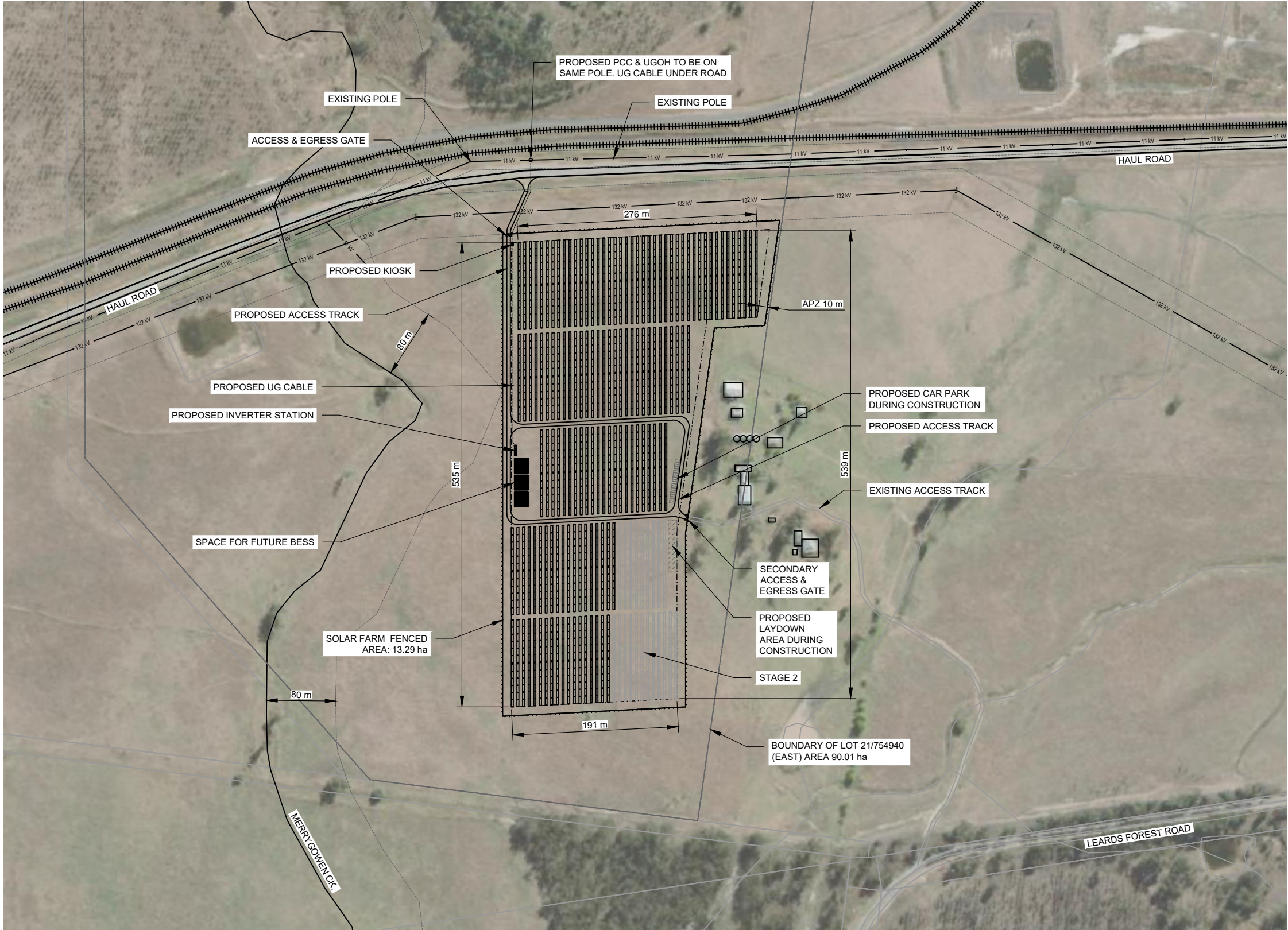


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AUSTRALIA

| DSN                                                                                                      | ISC | DWN  | MJB | DRG TITLE                                        |
|----------------------------------------------------------------------------------------------------------|-----|------|-----|--------------------------------------------------|
| CHKD                                                                                                     | ISC | APPR | ISC | LOCATION PLAN                                    |
| DO NOT SCALE                                                                                             |     |      |     | ----                                             |
| ALL MEASUREMENTS IN mm UNLESS OTHERWISE STATED.                                                          |     |      |     | PROJECT BOGGABRI SOLAR FARM                      |
| THIS DOCUMENT MAY ONLY BE USED BY CLIENTS OF ITP OR THOSE WHO HAVE RECEIVED EXPRESS PERMISSION FROM ITP. |     |      |     | CLIENT IDIMITSU RENEWABLE DEVELOPMENTS AUSTRALIA |
| THE USE OF THIS DRAWING SHALL NOT EXTEND BEYOND THE PURPOSE FOR WHICH IT WAS ORIGINALLY PREPARED.        |     |      |     | ADDRESS LEARDS FOREST ROAD BOGGABRI, NSW 2382    |
| SCALE AS NOTED                                                                                           |     |      |     | SHEET SIZE A3                                    |
| ORIG. DATE 2/8/23                                                                                        |     |      |     | REV. DATE 4/10/23                                |
| DRG NO. 23043-G-0400                                                                                     |     |      |     | REV NO. 3                                        |





SITE INFORMATION

|             |                                        |
|-------------|----------------------------------------|
| LOT / DP    | 21/754940                              |
| ADDRESS     | LEARDS FOREST ROAD, BOGGABRI, NSW 2382 |
| LGA         | NARRABRI SHIRE COUNCIL                 |
| LAT / LONG  | -30.626901 / 150.122058                |
| LOT AREA    | 90.01 ha                               |
| FENCED AREA | 13.29 ha                               |
| NSP         | TRANSGRID                              |

PROJECT INFORMATION

|                        |                                          |
|------------------------|------------------------------------------|
| DC CAPACITY            | 6.528 MW (STAGE 1)<br>1.023 MW (STAGE 2) |
| INVERTERS              | 4.95 MW                                  |
| TRACKER SPACING (N-S)  | MIN. 6.0 m                               |
| ARRAY PITCH            | 6.5 m                                    |
| CONNECTION VOLTAGE     | 11 kV                                    |
| CONNECTION FEEDER      | TRANSGRID                                |
| CONNECTION SUBSTATION  | TRANSGRID                                |
| SECURITY FENCE SETBACK | MIN. 3 m FROM OPTION BOUNDARY            |
| ARRAY SETBACK          | MIN. 10 m FROM SECURITY FENCE            |
| ACCESS PATH WIDTH      | 4 m                                      |

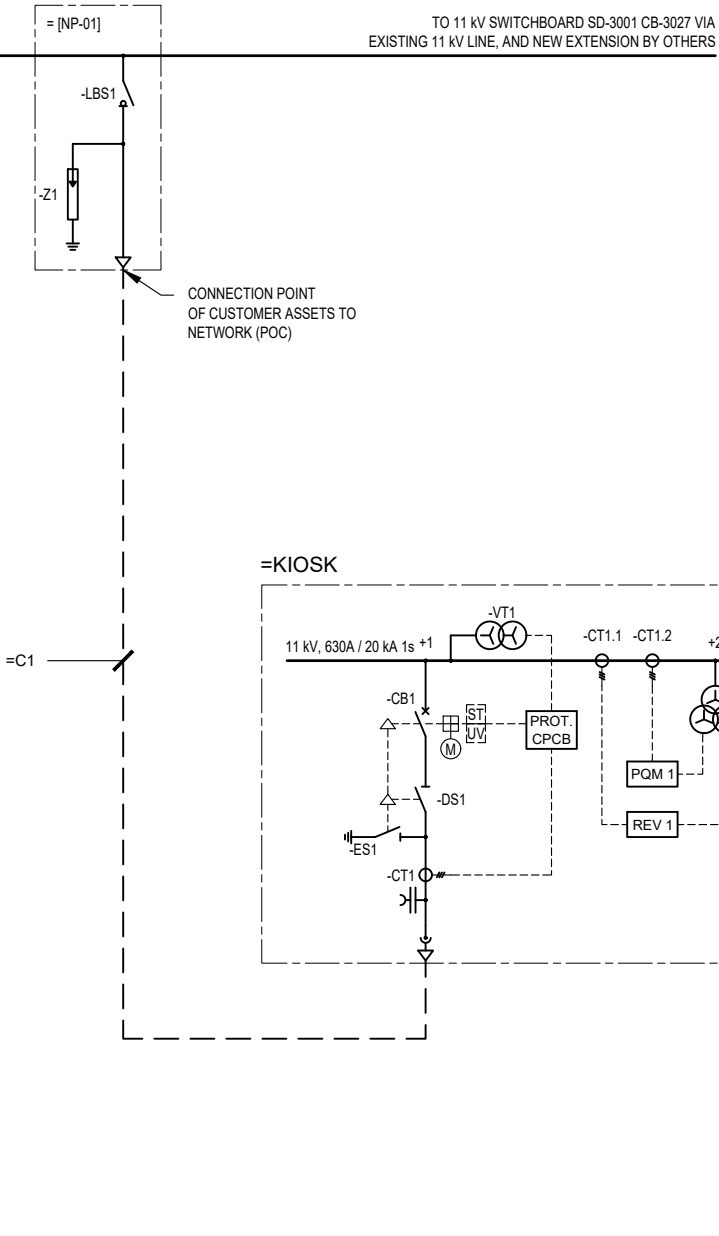
1 GENERAL ARRANGEMENT PLAN

SCALE: 1:5000

30% DESIGN

| NO. |  | STAGE                               | DSN  | DWN  | CHKD | APPR | DATE       | NOTES | <div><div><div><div>itp</div></div><div>RENEWABLES</div></div><div><div>info@itpau.com.au<br/>itpau.com.au<br/>+61 2 6257 3511</div><div>PO Box 6217<br/>O'Connor, ACT 2602<br/>AUSTRALIA</div></div></div> | DSN                                                                                                               |  | ISC                                                | DWN                                                                                   | MJB        | DRG TITLE                                |         | GENERAL ARRANGEMENT PLAN |  |
|-----|--|-------------------------------------|------|------|------|------|------------|-------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------|--|----------------------------------------------------|---------------------------------------------------------------------------------------|------------|------------------------------------------|---------|--------------------------|--|
| 1   |  | 30% DESIGN                          | ISC  | MJB  | ISC  | LF   | 15/08/2023 |       |                                                                                                                                                                                                             | CHKD                                                                                                              |  | ISC                                                | APPR                                                                                  | ISC        | ----                                     |         |                          |  |
| 2   |  | SITE FOOTPRINT OPTIMISED            | ISC  | MJB  | ISC  | LF   | 28/08/2023 |       |                                                                                                                                                                                                             | DO NOT SCALE                                                                                                      |  | ALL MEASUREMENTS IN mm<br>UNLESS OTHERWISE STATED. |                                                                                       | PROJECT    | BOGGABRI SOLAR FARM                      | SCALE   | AS NOTED                 |  |
| 3   |  | VANADIUM REDOX FLOW BATTERIES ADDED | ISC  | MJB  | ISC  | ISC  | 04/10/2023 |       |                                                                                                                                                                                                             | THIS DOCUMENT MAY ONLY BE<br>USED BY CLIENTS OF ITP OR<br>THOSE WHO HAVE RECEIVED<br>EXPRESS PERMISSION FROM ITP. |  | CLIENT<br>ADDRESS                                  | IDEMITSU RENEWABLE DEVELOPMENTS AUSTRALIA<br>LEARDS FOREST ROAD<br>BOGGABRI, NSW 2382 | SHEET SIZE | A3                                       |         |                          |  |
| 4   |  | ----                                | ---- | ---- | ---- | ---- | ----       |       |                                                                                                                                                                                                             | THE USE OF THIS DRAWING<br>SHALL NOT EXTEND BEYOND THE<br>PURPOSE FOR WHICH IT WAS<br>ORIGINALLY PREPARED.        |  |                                                    |                                                                                       | ORIG. DATE | 2/8/23                                   |         |                          |  |
| 5   |  | ----                                | ---- | ---- | ---- | ---- | ----       |       |                                                                                                                                                                                                             |                                                                                                                   |  |                                                    |                                                                                       | REV. DATE  | 4/10/23                                  |         |                          |  |
| 6   |  | ----                                | ---- | ---- | ---- | ---- | ----       |       |                                                                                                                                                                                                             |                                                                                                                   |  |                                                    |                                                                                       | DRG NO.    | 23043-G-2100 <th>REV NO.</th> <td>3</td> | REV NO. | 3                        |  |

BATTERY LIMIT OF  
SOLAR FARM WORKS



| INSTRUMENT TRANSFORMER SCHEDULE |       |       |      |                       |        |       |               |
|---------------------------------|-------|-------|------|-----------------------|--------|-------|---------------|
| Area                            | Panel | ID    | Core | Ratio                 | Burden | Class | Functions     |
| =KIOSK                          |       | -CT1  | 1    | 200/1 A               | 5 VA   | 0.5   | REVENUE METER |
|                                 |       | -CT1  | 2    | 200/1 A               | 5 VA   | 0.5   | PQM           |
|                                 |       | -VT1  | 1    | (11000/V3)/(110/V3) V | 50 VA  | 0.5M  | REVENUE METER |
|                                 |       | -VT1  | 2    | (11000/V3)/(110/V3) V | 50 VA  | 0.5M  | PQM           |
|                                 | +ACR1 | -CT1  | 1    |                       |        | 5P    | PROT. CPCB    |
|                                 |       | -CVT1 | 1    |                       |        | 5P    | PROT. CPCB    |
|                                 |       | -CVT2 | 1    |                       |        | 5P    | PROT. CPCB    |

| TRANSFORMER SCHEDULE |       |    |                               |                   |           |         |              |
|----------------------|-------|----|-------------------------------|-------------------|-----------|---------|--------------|
| Area                 | Plant | ID | Primary (kV) / Secondary (kV) | Rated Power (kVA) | Impedance | Cooling | Vector Group |
| =PCS                 | +TX1  |    | 11 / 0.550                    | 5000              | 8%        | ONAN    | Dy11         |
|                      | +TX2  |    | 0.550 / 0.400                 | 20                |           |         | Dyn5         |

| PROTECTION RELAY SCHEDULE |                        |        |                                                                |  |
|---------------------------|------------------------|--------|----------------------------------------------------------------|--|
| Type                      | Description            | Device | Functions                                                      |  |
| PROT. CPCB                | Grid Protection Relay  | TBC    | 50P, 50N, 50SEF/N, 51P, 51N, 50BF, 27S, 27P, 59P, 81O/U/R, 78V |  |
| PROT. TX                  | Transformer Protection |        | 26, 63                                                         |  |
| PROT. INV                 | Inverter Protection    |        | 27P, 59P, 81O/U/R, AIP, 50, 51                                 |  |

| SWITCHGEAR SCHEDULE |       |                |             |            |        |          |
|---------------------|-------|----------------|-------------|------------|--------|----------|
| Area                | Plant | ID             | Vm (kV)     | Vd/Vp (kV) | Ir (A) | Isk (kA) |
| =KIOSK              |       | +ACR1, -CB1    | 15.5        | 50/110     | 630    | 16       |
| =PCS                | +INV1 | -LVCB1, -LVCB2 | 600 V (AC)  | n/a        | 2000   |          |
|                     | +INV2 | -DCCB1, -DCCB2 | 1500 V (DC) | n/a        |        |          |

| CABLE & CONDUCTOR SCHEDULE |            |             |               |
|----------------------------|------------|-------------|---------------|
| Area                       | Length (m) | Type        | Specification |
| =C1                        | 110        | UNDERGROUND | TBC           |
| =C2                        | 265        | UNDERGROUND | TBC           |

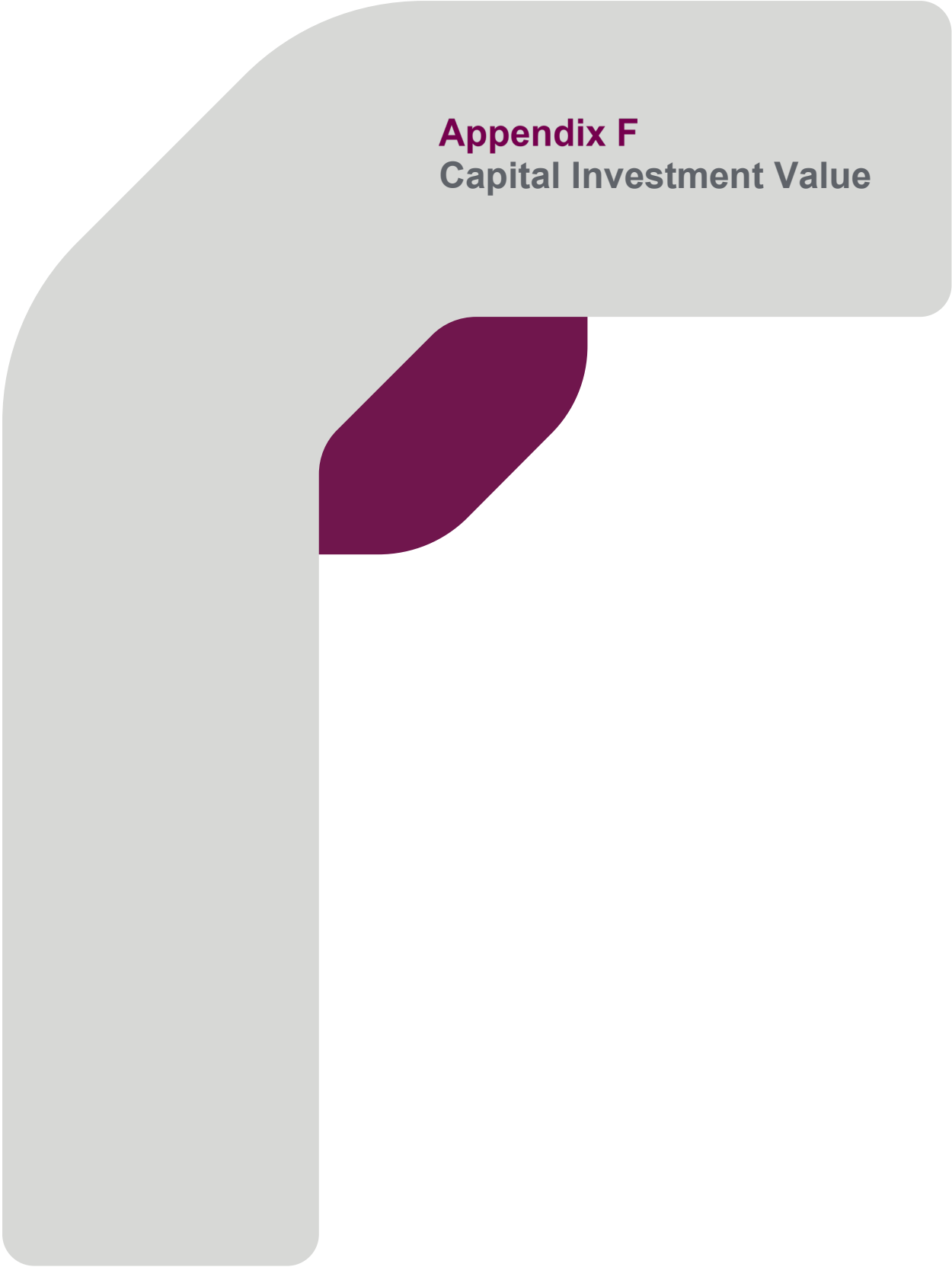
| INVERTER SCHEDULE |       |             |         |                   |
|-------------------|-------|-------------|---------|-------------------|
| Area              | Plant | Description | ID      | Rated Power (MVA) |
| =PCS              | +INV1 | TBC         | -INV1.1 | 4.950             |

# 1 ELECTRICAL AC SLD

SCALE: NTS

30% DESIGN

| NO. |  | STAGE                                          | DSN  | DWN  | CHKD | APPR | DATE       | NOTES | ITP RENEWABLES                                                                                           |  |  |  | DRG TITLE                                        |  |                    |  |
|-----|--|------------------------------------------------|------|------|------|------|------------|-------|----------------------------------------------------------------------------------------------------------|--|--|--|--------------------------------------------------|--|--------------------|--|
| 1   |  | 30% DESIGN                                     | ISC  | NAL  | ISC  | LF   | 15/08/2023 |       |                     |  |  |  | AC SLD                                           |  |                    |  |
| 2   |  | OGOHPCC ADDED, KIOSK REPLACED, PCS S/B REMOVED | ISC  | MJB  | ISC  | LF   | 28/08/2023 |       | DO NOT SCALE                                                                                             |  |  |  | ----                                             |  |                    |  |
| 3   |  | ----                                           | ---- | ---- | ---- | ---- | ----       |       | ALL MEASUREMENTS IN mm UNLESS OTHERWISE STATED.                                                          |  |  |  | PROJECT BOGGABRI SOLAR FARM                      |  |                    |  |
| 4   |  | ----                                           | ---- | ---- | ---- | ---- | ----       |       | THIS DOCUMENT MAY ONLY BE USED BY CLIENTS OF ITP OR THOSE WHO HAVE RECEIVED EXPRESS PERMISSION FROM ITP. |  |  |  | CLIENT IDEMITSU RENEWABLE DEVELOPMENTS AUSTRALIA |  |                    |  |
| 5   |  | ----                                           | ---- | ---- | ---- | ---- | ----       |       | THE USE OF THIS DRAWING SHALL NOT EXTEND BEYOND THE PURPOSE FOR WHICH IT WAS ORIGINALLY PREPARED.        |  |  |  | ADDRESS LEARDS FOREST ROAD BOGGABRI, NSW 2382    |  |                    |  |
| 6   |  | ----                                           | ---- | ---- | ---- | ---- | ----       |       | info@itpau.com.au<br>itpau.com.au<br>+61 2 6257 3511                                                     |  |  |  | PO Box 6217<br>O'Connor, ACT 2602<br>AUSTRALIA   |  |                    |  |
|     |  |                                                |      |      |      |      |            |       | 1. PCC IS BASED ON THE LATEST GENERAL ARRANGEMENT LAYOUT (23043-G-2100).                                 |  |  |  |                                                  |  | SCALE AS NOTED     |  |
|     |  |                                                |      |      |      |      |            |       | Vm: RATED MAXIMUM VOLTAGE                                                                                |  |  |  |                                                  |  | SHEET SIZE A3      |  |
|     |  |                                                |      |      |      |      |            |       | Vd: RATED SHORT-DURATION POWER-FREQUENCY WITHSTAND VOLTAGE                                               |  |  |  |                                                  |  | ORIG. DATE 10/5/22 |  |
|     |  |                                                |      |      |      |      |            |       | Vp: RATED LIGHTNING WITHSTAND VOLTAGE                                                                    |  |  |  |                                                  |  | REV. DATE 25/8/23  |  |
|     |  |                                                |      |      |      |      |            |       | Ir: RATED CONTINUOUS CURRENT                                                                             |  |  |  |                                                  |  | REV NO. 2          |  |
|     |  |                                                |      |      |      |      |            |       | Isk: RATED SHORT-DURATION WITHSTAND CURRENT                                                              |  |  |  |                                                  |  |                    |  |



## **Appendix F**

### **Capital Investment Value**



Our Ref: PR8068CIV

Date: 28 September 2023

IDEMITSU RENEWABLE DEVELOPMENTS AUSTRALIA PTY LTD  
LEVEL 9, 175 EAGLE STREET  
BRISBANE QLD 4000

**RE: CAPITAL INVESTMENT VALUE  
PROPOSED BOGGABRI SOLAR FARM PROJECT  
LOT 21 / DP 754940, LEARDS FOREST ROAD, BOGGABRI NSW**

As requested, and in accordance with your supplied information, please find attached our Capital Investment Value estimate in the amount of **\$25,345,425 excluding GST** for the above development.

The Capital Investment Value has been calculated in accordance with the definition contained in the Environmental Planning and Assessment Regulation 2021, being:

**“capital investment value** of a development or project includes all costs necessary to establish and operate the project, including the design and construction of buildings, structures, associated infrastructure and fixed or mobile plant and equipment, other than the following costs—

- a) amounts payable, or the cost of land dedicated or other benefit provided, under a condition imposed under the Act, Division 7.1 or 7.2 or a planning agreement,
- b) costs relating to a part of the development or project that is the subject of a separate development consent or project approval,
- c) land costs, including costs of marketing and selling land,
- d) GST, within the meaning of the A New Tax System (Goods and Services Tax) Act 1999 of the Commonwealth.”.

In addition, the calculation of the CIV has been prepared in accordance with the ‘Calculation of capital investment value’ Planning Circular (PS 21-020 Issued 2 December 2021), with the trade breakup of our valuation reflecting that being represented in the Planning Circular as follows:

**“Costs that should be included**

***Design and construction***

The calculation of CIV should include the amount required to design and construct all buildings and other facilities that are part of/included in the application, including any temporary buildings that will be used during the construction phase. Costs for details that may not be included in a development application but are likely to be included in an application for a construction certificate should be included. For example, details relating to plumbing, water supply points, mechanical requirements such as for air conditioning, electrical wiring and the provision of wet areas and amenities.

***Structures and infrastructure***

CIV should include all costs incurred from the construction of associated structures and infrastructure that are the subject of the relevant application. These costs include any supplementary or site preparatory works such as remediation, demolition, excavation and filling, that are required for the construction of buildings, provided these works are needed to make the site suitable for construction and for the operation of the development.



### ***Site services***

CIV should include the costs of providing electrical services, water, gas, sewerage and stormwater drainage, including any temporary diversions and/ or arrangements during construction. The costs of fire protection and communications services that are reasonably required to construct and operate the development should also be included. Site works such as landscaping, car parking, roads and footpaths should also be included.

### ***Plant and equipment***

CIV should include standard building plant, such as lifts and air-conditioning, and all specialist and specific equipment related to the operation of the development. CIV should include costs for the replacement of plant and equipment if the replacement of such equipment is a cost necessary to operate the development over the course of an extended consent period. For example, mobile mining equipment such as trucks and loaders for mining development.

### ***Fit-out costs***

Fit-out costs of a building may be included in the calculation of CIV where the costs are identified in the application. In such cases, the application would need to include specific tenancy use, and would be defined by specific reference to the description in the application. Where such tenancy is not referred to or will be subject to further applications, the fit-out costs should not be included.

### ***Labour fees***

All labour and personnel costs, including the payment of long service levies and other associated construction and labour costs should be included in the calculation of the CIV.

### ***Other fees***

Depending on the particular circumstances, costs that are not of a capital nature such as consultant fees should also be included in the calculation of CIV. Whether costs that are not of a capital nature should be included in the calculation of CIV will turn on the question of whether such costs are necessary to establish and operate the development.

### ***Costs that should be excluded***

#### ***Development contributions***

It is not appropriate to include development contribution charges when calculating CIV. These charges are considered an external cost that do not contribute to the CIV of the development.

#### ***Costs subject to a separate consent or approval***

The CIV of the development must only include those works that are subject to the current application, not prior applications.

#### ***Finance costs***

Costs such as finance application fees, mortgage stamp duty, fees paid to register strata titles or to amalgamate land prior to development, and interest payable on the loans associated with the development should be excluded from the calculation of CIV.

#### ***Land costs***

Land costs including any costs for marketing and selling land that is subject to the development should be excluded in the calculation of CIV. ”.

Our valuation has also taken into consideration in-house research including:

- analysis of compiled Capital Investment Value
- review of drawings
- scope of the proposed facility
- enquiries within the industry
- Built-up rates incorporating materials, Labour Fees, plant, preliminaries, margin, etc.; and
- our own experience with “similar” type projects

Lastly, we confirm that in our opinion all information provided above is accurate as of the date of this letter.

We trust this information is sufficient for your purposes, however, should you require any further details or clarification, please do not hesitate to contact the writer by telephone.

Yours sincerely

**RPS**



**Ryan Scott**  
**Senior Quantity Surveyor**  
**BConMgt (BLDG) (Hons), MAIQS, CQS (12256)**

# Boggabri Solar Farm Project

|                       |                                       |                                                                            |
|-----------------------|---------------------------------------|----------------------------------------------------------------------------|
| <b>Job Name :</b>     | <u>PR8068CIV</u>                      | <b>Job Description</b>                                                     |
| <b>Client's Name:</b> | <u>Idemitsu Renewable Development</u> | Proposed Boggabri Solar Farm Project -<br>Leards Forest Road, Boggabri NSW |

| Trd No. | Trade Description                                   | Trade %       | Cost/m2 | Trade Total       |
|---------|-----------------------------------------------------|---------------|---------|-------------------|
| 1       | Sediment & Erosion Control                          | 0.08          |         | 19,485            |
| 2       | Site Clearance                                      | 0.13          |         | 32,475            |
| 3       | Preparation Works/ Earthworks                       | 0.64          |         | 162,375           |
| 4       | Pavement Works                                      | 0.89          |         | 224,338           |
| 5       | Building Works                                      |               |         |                   |
| 6       | Fencing & Landscaping                               | 0.61          |         | 155,375           |
| 7       | External Services                                   | 0.07          |         | 17,500            |
| 8       | Plant & Equipment                                   | 90.76         |         | 23,004,035        |
| 9       | Preliminaries & Margin (incl. Temporary Facilities) | 5.59          |         | 1,416,935         |
| 10      | Subtotal                                            |               |         | <u>25,032,518</u> |
| 11      | Design & Consultants Fees Allowance                 | 1.23          |         | 312,907           |
| 12      | GST exclusive "Capital Investment Value"            |               |         | <u>25,345,425</u> |
| 13      | SCHEDULE OF EXCLUSIONS                              |               |         |                   |
|         |                                                     | <b>100.00</b> |         | <b>25,345,425</b> |

**Final Total : \$ 25,345,425**



# Trade Breakup

Job Name : PR8068CIV

Job Description

Client's Name: Idemitsu Renewable Development

Proposed Boggabri Solar Farm Project -  
Leards Forest Road, Boggabri NSW

| Item No.                                        | Item Description                                                                                                                    | Quantity   | Unit | Rate  | Amount     |
|-------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|------------|------|-------|------------|
| Trade : 1 <u>Sediment &amp; Erosion Control</u> |                                                                                                                                     |            |      |       |            |
| 1                                               | Sediment and erosion control allowance across site (Fenced Area)                                                                    | 129,900.00 | m2   | 0.15  | 19,485.00  |
| <u>Sediment &amp; Erosion Control</u> Total :   |                                                                                                                                     |            |      |       | 19,485.00  |
| Trade : 2 <u>Site Clearance</u>                 |                                                                                                                                     |            |      |       |            |
| 1                                               | Site clearance allowance (NB: Predominantly cleared farmland/Disturbed Area)                                                        | 129,900.00 | m2   | 0.25  | 32,475.00  |
| 2                                               | Slashing and/or removal of areas of non-native vegetation                                                                           |            | Item |       | INCL       |
| 3                                               | Removal of existing trees as necessary                                                                                              |            | Item |       | INCL       |
| 4                                               | Remove existing fencing, gates, farm structures, etc. as necessary                                                                  |            | Item |       | INCL       |
| <u>Site Clearance</u> Total :                   |                                                                                                                                     |            |      |       | 32,475.00  |
| Trade : 3 <u>Preparation Works/ Earthworks</u>  |                                                                                                                                     |            |      |       |            |
| 1                                               | Allowance to trim & compact site, re: "flattening out" lumps etc (Disturbed Area)                                                   | 129,900.00 | m2   | 1.25  | 162,375.00 |
| 2                                               | Allowance for temporary diversions and/or stormwater management during construction, incl. diversion channels, swales, basins, etc. |            | Item |       | INCL       |
| 3                                               | Allowance for a temporary site compound, lay-down area, and equipment storage areas (NB: Refer trade titled 'Pavement Works')       |            | Item |       | INCL       |
| <u>Preparation Works/ Earthworks</u> Total :    |                                                                                                                                     |            |      |       | 162,375.00 |
| Trade : 4 <u>Pavement Works</u>                 |                                                                                                                                     |            |      |       |            |
|                                                 | <u>Internal Vehicle Access Tracks</u>                                                                                               |            |      |       |            |
| 1                                               | Trim & compact subgrade                                                                                                             | 8,268.00   | m2   | 2.90  | 23,977.20  |
| 2                                               | Compacted gravel                                                                                                                    | 8,268.00   | m2   | 20.00 | 165,360.00 |
|                                                 | <u>External Vehicle Access Tracks</u>                                                                                               |            |      |       |            |
| 3                                               | Provisional Allowance to Upgrade/Connection to Existing Haul Road                                                                   |            | Item |       | 10,000.00  |
|                                                 | <u>Sundry</u>                                                                                                                       |            |      |       |            |
| 4                                               | Provisional Allowance for hardstand areas                                                                                           | 1,250.00   | m2   | 20.00 | 25,000.00  |
| <u>Pavement Works</u> Total :                   |                                                                                                                                     |            |      |       | 224,337.20 |
| Trade : 5 <u>Building Works</u>                 |                                                                                                                                     |            |      |       |            |
| 1                                               | Allowance for O&M Building complete incl. Fit-out costs (NB: Appears not to be required)                                            |            | Item |       | EXCL       |

# Trade Breakup

Job Name : PR8068CIV

Job Description

Client's Name: Idemitsu Renewable Development

Proposed Boggabri Solar Farm Project -  
Leards Forest Road, Boggabri NSW

| Item No.                                    | Item Description                                                                                                                            | Quantity | Unit | Rate      | Amount     |
|---------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------|----------|------|-----------|------------|
| Trade : 5 <u>Building Works</u> (Continued) |                                                                                                                                             |          |      |           |            |
| 2                                           | Provisional Allowance for Rainwater Reuse System, incl. tanks, pumps, etc. (Ditto)                                                          |          | Item |           | EXCL       |
| 3                                           | Provisional Allowance for Onsite Sewer Treatment System (Ditto)                                                                             |          | Item |           | EXCL       |
| 4                                           | Allowance for carpark complete (Ditto)                                                                                                      |          | Item |           | EXCL       |
| <u>Building Works</u> Total :               |                                                                                                                                             |          |      |           |            |
| Trade : 6 <u>Fencing &amp; Landscaping</u>  |                                                                                                                                             |          |      |           |            |
| 1                                           | 1800mm high security/safety fencing complete to perimeter                                                                                   | 1,685.00 | m    | 80.00     | 134,800.00 |
| 2                                           | Allowance for main entrance gates, etc. to last                                                                                             | 1.00     | No.  | 12,760.00 | 12,760.00  |
| 3                                           | Ditto, but emergency access gate                                                                                                            | 1.00     | No.  | 2,815.00  | 2,815.00   |
| 4                                           | Landscaping allowance (NB: As per previous 'similar' developments)                                                                          |          | Item |           | 5,000.00   |
| <u>Fencing &amp; Landscaping</u> Total :    |                                                                                                                                             |          |      |           | 155,375.00 |
| Trade : 7 <u>External Services</u>          |                                                                                                                                             |          |      |           |            |
|                                             | <u>Electrical</u>                                                                                                                           |          |      |           |            |
| 1                                           | Once operational, it is anticipated that the Project will utilise power generated from the solar farm rather than a grid connected service. |          | Item |           | INCL       |
| 2                                           | Allowance for temporary power                                                                                                               |          | Item |           | 17,500.00  |
|                                             | <u>Water</u>                                                                                                                                |          |      |           |            |
| 3                                           | Allowance for new/upgrades to Water Mains (NB: Assumed to be Rainwater only)                                                                |          | Item |           | EXCL       |
|                                             | <u>Sewer</u>                                                                                                                                |          |      |           |            |
| 4                                           | Allowance for new/upgrades to Sewer Mains (NB: Assumed to be onsite treatment only)                                                         |          | Item |           | EXCL       |
|                                             | <u>Stormwater</u>                                                                                                                           |          |      |           |            |
| 5                                           | Allowance for new/upgrades to Stormwater Mains (NB: Assumed to not be required/run-off to natural)                                          |          | Item |           | EXCL       |
|                                             | <u>Communications</u>                                                                                                                       |          |      |           |            |
| 6                                           | Allowance for new/upgrades to incoming communication (NB: Assumed to not be required/remote internet access)                                |          | Item |           | EXCL       |
| <u>External Services</u> Total :            |                                                                                                                                             |          |      |           | 17,500.00  |
| Trade : 8 <u>Plant &amp; Equipment</u>      |                                                                                                                                             |          |      |           |            |

# Trade Breakup

Job Name : PR8068CIV

Job Description

Client's Name: Idemitsu Renewable Development

Proposed Boggabri Solar Farm Project -  
Leards Forest Road, Boggabri NSW

| Item No.                                 | Item Description                                                                                                                                                                        | Quantity  | Unit | Rate         | Amount               |
|------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|------|--------------|----------------------|
| Trade : 8 <u>Plant &amp; Equipment</u>   |                                                                                                                                                                                         |           |      |              |                      |
| 1                                        | NB: Built-up rates below include, and account, for costs associated for the maintenance and replacement of plant/equipment factoring in the projected life of the item and the project. |           | Note |              |                      |
| 2                                        | Nominal DC-Power (NB: Rate as per previous 'similar' projects)                                                                                                                          | 7,551.00  | kWp  | 690.22       | 5,211,878.40         |
| 3                                        | Projected Total AC Power                                                                                                                                                                | 4,950.00  | kWac |              | INCL                 |
| 4                                        | Allowance for Solar Photovoltaic (PV) Modules (ground mounted) complete, incl. install, tracker/frames, foundations, etc. (Approx. Quantity)                                            | 11,870.00 | No.  |              | INCL                 |
| 5                                        | Allowance for AC/DC cabling complete                                                                                                                                                    |           | Item |              | INCL                 |
| 6                                        | Allowance for Power Conversion Units (PCUs) complete (NB: Approx number)                                                                                                                | 1.00      | No.  |              | INCL                 |
| 7                                        | Allowance for Battery Energy Storage System (BESS) complete (NB: Allowed for Vanadium Redox Flow)                                                                                       | 12.00     | MWhr | 1,350,000.00 | 16,200,000.00        |
| 8                                        | Provisional Allowance for connection to Boggabri Coal Substation/Switching Station complete incl. transformers, connection to existing transmission lines onsite, etc.                  |           | Item |              | 150,000.00           |
| 9                                        | Provisional Allowance for CCTV System complete                                                                                                                                          |           | Item |              | 15,000.00            |
| 10                                       | Subtotal                                                                                                                                                                                |           |      |              | <u>21,561,878.40</u> |
|                                          | <u>Sundry</u>                                                                                                                                                                           |           |      |              |                      |
| 11                                       | - Commissioning allowance (1.75%)                                                                                                                                                       |           | Item |              | 377,595.37           |
| 12                                       | - Design Development Allowance/Contingency (2.5%)                                                                                                                                       |           | Item |              | 548,861.84           |
| 13                                       | - Cost Escalation (4.45% x 50%/NB: Above rate/kWp includes Cost Escalation allowances of pervious projects)                                                                             |           | Item |              | 500,699.22           |
| 14                                       | Subtotal                                                                                                                                                                                |           |      |              | <u>23,004,034.83</u> |
| <u>Plant &amp; Equipment Total :</u>     |                                                                                                                                                                                         |           |      |              | <b>23,004,034.83</b> |
| Trade : 13 <u>SCHEDULE OF EXCLUSIONS</u> |                                                                                                                                                                                         |           |      |              |                      |
| 1                                        | Land costs & legal fees                                                                                                                                                                 |           | Note |              |                      |
| 2                                        | Authorities/Consultants fees & charges UNO                                                                                                                                              |           | Note |              |                      |
| 3                                        | Holding costs & interest charges                                                                                                                                                        |           | Note |              |                      |
| 4                                        | Future costs escalation (NB: If construction timeframes extended beyond those proposed in the EIS)                                                                                      |           | Note |              |                      |
| 5                                        | Design development allowance                                                                                                                                                            |           | Note |              |                      |

# Trade Breakup

|                       |                                       |                                                                            |
|-----------------------|---------------------------------------|----------------------------------------------------------------------------|
| <b>Job Name :</b>     | <u>PR8068CIV</u>                      | <b><u>Job Description</u></b>                                              |
| <b>Client's Name:</b> | <u>Idemitsu Renewable Development</u> | Proposed Boggabri Solar Farm Project -<br>Leards Forest Road, Boggabri NSW |

| <b>Item<br/>No.</b>                                                                                           | <b>Item Description</b>                                                             | <b>Quantity</b> | <b>Unit</b> | <b>Rate</b> | <b>Amount</b> |
|---------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-----------------|-------------|-------------|---------------|
| <i>Trade :</i> <b>13    <u>SCHEDULE OF EXCLUSIONS</u></b> <span style="float:right"><i>(Continued)</i></span> |                                                                                     |                 |             |             |               |
| <b>6</b>                                                                                                      | Unknown ground conditions & Engineering Design                                      |                 | Note        |             |               |
| <b>7</b>                                                                                                      | All items denoted as EXCL                                                           |                 | Note        |             |               |
| <b>8</b>                                                                                                      | Construction Contingency Sum (NB: For unexpected finds, unforeseeable events, etc.) |                 | Note        |             |               |
| <b>9</b>                                                                                                      | GST                                                                                 |                 | Note        |             |               |
| <div><u>SCHEDULE OF EXCLUSIONS</u>    <b>Total :</b></div>                                                    |                                                                                     |                 |             |             |               |