

# AURIN

## High Impact Projects Dataset Description and Usage Examples



Building first-class research infrastructure  
Enabling leading-edge research

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# 1 Introduction

The data sets are licensed under the Creative Commons: Attribution 4.0 International. Please see section 5.1 on page 19.

These data sets are based on a number of publicly available data sets. The input data sets are described in section 2.

## 2 Input DataSets

### 2.1 Microsoft/Bing Footprints

These data sets are based on the ‘Bing footprints for Australia’ available from <https://github.com/microsoft/AustraliaBuildingFootprints>. The data is licensed under the Open Data Commons Open Database License (ODbL) <https://opendatacommons.org/licenses/odbl/> licence. See also section 5.2 on page 23. The current (2023) data set’s vintage “is anywhere from 2013 to 2018, with majority being from 2018” *Microsoft/Australian Building Footprints* (2022).

### 2.2 Australian Bureau of Statistics

The geographic region for this project is defined using the Mesh Blocks (*Mesh Blocks | Australian Bureau of Statistics*, 2021) defined by the Australia Bureau of Statistics. For copyright, see section 5.3 on page 30. These datasets provided are geolocated and compatible for analysis against the 2021 Australian Census datasets. The study area comprises 530 mesh blocks derived by extracting all mesh blocks containing “Kalgoorlie”, “Boulder” and “Trafalgar” in the name.

### 2.3 Elvis Elevation Data

Elevation data was obtained from ‘Elvis - Elevation and Depth - Foundation Spatial Data’ <https://elevation.fsdf.org.au/>. For copyright, see section 5.4 on page 31. This data was used to add ground elevation information to the Bing Footprints.

### 2.4 GNAF/Core

The footprint address data has been matched up to the November 2022 Australian geocoded address database, available from <https://geoscape.com.au/data/g-naf-core/>. For copyright, see section 5.5 on page 32.

## 3 Output DataSets

The field names used in the datasets are documented in the following tables:

- Monthly Cumulative irradiance values
- Daily Average irradiance values
- Hourly irradiance values
- Weather Data based on temperature and irradiation from [https://climate.onebuilding.org/WMO\\_Region\\_5\\_Southwest\\_Pacific/AUS\\_Australia/WA\\_Western\\_Australia/AUS\\_WA\\_Kalgoorlie-Boulder.AP.946370\\_TMYx.2004-2018.zip](https://climate.onebuilding.org/WMO_Region_5_Southwest_Pacific/AUS_Australia/WA_Western_Australia/AUS_WA_Kalgoorlie-Boulder.AP.946370_TMYx.2004-2018.zip)
- The Datasets have been compressed and archived into zip files to reduce transmission times from the server. The ‘QGIS’ application *does not* require the files to be extracted from the zip files.

The calculations are based on the panel specifications (Table 1):

Table 1: Panel Performance Variables

|                         |         |
|-------------------------|---------|
| Width                   | 1.08 m  |
| Length                  | 1.755 m |
| Panel Efficiency        | 0.27    |
| Temperature Coefficient | -0.5    |



A basic panel layout has been calculated for every footprint, allowing for 300 mm offset from the leading edge, and 100 mm between each panel. The maximum number of panels, in either a horizontal or vertical orientation, panels is used as the basis for the total irradiance calculation.

The irradiance values are calculated in  $W/m^2$ .

The total PV solar potential field is calculated as follows:

$$\begin{aligned} total\_solar\_potential = round(&(\frac{irradiance}{1000} * panel\_efficiency * number\_panels * \\ &panel\_average\_width * panel\_average\_length) / \\ &(((temperature - 25) * \\ &abs(temperature\_coefficient)) / 100 + 1) / 3.6) \end{aligned} \quad (1)$$

### 3.1 Other useful Resources: (Table 2)

<https://www.abs.gov.au/census/2021-census-data-release-plans/2021-census-product-release-guide#geopackages>

Table 2: Other Resources

| Source   | URL   |
|--|---|
| Australian Bureau of Statistics - Downloads for GDA2020 digital boundary files | <a href="https://www.abs.gov.au/statistics/standards/australian-statistical-geography-standard-asgs-edition-3/jul2021-jun2026/access-and-downloads/digital-boundary-files#downloads-for-gda2020-digital-boundary-files">https://www.abs.gov.au/statistics/standards/australian-statistical-geography-standard-asgs-edition-3/jul2021-jun2026/access-and-downloads/digital-boundary-files#downloads-for-gda2020-digital-boundary-files</a> |
| Mesh Blocks- 2021 - Shapefile  | <a href="https://www.abs.gov.au/statistics/standards/australian-statistical-geography-standard-asgs-edition-3/jul2021-jun2026/access-and-downloads/digital-boundary-files/MB_2021_AUST_SHP_GDA2020.zip">https://www.abs.gov.au/statistics/standards/australian-statistical-geography-standard-asgs-edition-3/jul2021-jun2026/access-and-downloads/digital-boundary-files/MB_2021_AUST_SHP_GDA2020.zip</a>                                 |
| Postal Areas - 2021 - Shapefile  | <a href="https://www.abs.gov.au/statistics/standards/australian-statistical-geography-standard-asgs-edition-3/jul2021-jun2026/access-and-downloads/digital-boundary-files/POA_2021_AUST_GDA2020_SHP.zip">https://www.abs.gov.au/statistics/standards/australian-statistical-geography-standard-asgs-edition-3/jul2021-jun2026/access-and-downloads/digital-boundary-files/POA_2021_AUST_GDA2020_SHP.zip</a>                               |
| Suburbs and Localities - 2021 - Shapefile                                      | <a href="https://www.abs.gov.au/statistics/standards/australian-statistical-geography-standard-asgs-edition-3/jul2021-jun2026/access-and-downloads/digital-boundary-files/SAL_2021_AUST_GDA2020_SHP.zip">https://www.abs.gov.au/statistics/standards/australian-statistical-geography-standard-asgs-edition-3/jul2021-jun2026/access-and-downloads/digital-boundary-files/SAL_2021_AUST_GDA2020_SHP.zip</a>                               |

### 3.2 Australian Mesh Blocks [Kalgoorlie, Boulder, Trafalgar]: (Table 3)

File: `australian_mesh_blocks_kalgoorlie_boulder_trafalgar.gpkg` (GeoPackage File) contained in 'australian\_mesh\_blocks\_kalgoorlie\_boulder\_trafalgar.zip'.

For information on fields, see:

- Mesh Blocks <https://www.abs.gov.au/statistics/standards/australian-statistical-geography-standard-asgs-edition-3/jul2021-jun2026/main-structure-and-greater-capital-city-statistical-areas/mesh-blocks>
- Statistical Area Level 1 <https://www.abs.gov.au/statistics/standards/australian-statistical-geography-standard-asgs-edition-3/jul2021-jun2026/main-structure-and-greater-capital-city-statistical-areas/statistical-area-level-1>
- Statistical Area Level 2 <https://www.abs.gov.au/statistics/standards/australian-statistical-geography-standard-asgs-edition-3/jul2021-jun2026/main-structure-and-greater-capital-city-statistical-areas/statistical-area-level-2>
- Statistical Area Level 3 <https://www.abs.gov.au/statistics/standards/australian-statistical-geography-standard-asgs-edition-3/jul2021-jun2026/main-structure-and-greater-capital-city-statistical-areas/statistical-area-level-3>
- Statistical Area Level 4 <https://www.abs.gov.au/statistics/standards/australian-statistical-geography-standard-asgs-edition-3/jul2021-jun2026/main-structure-and-greater-capital-city-statistical-areas/statistical-area-level-4>
- Greater Capital City Statistical Areas <https://www.abs.gov.au/statistics/standards/australian-statistical-geography-standard-asgs-edition-3/jul2021-jun2026/main-structure-and-greater-capital-city-statistical-areas/greater-capital-city-statistical-areas>
- Special purpose coding <https://www.abs.gov.au/statistics/standards/australian-statistical-geography-standard-asgs-edition-3/jul2021-jun2026/main-structure-and-greater-capital-city-statistical-areas/special-purpose-codes>
- Mesh Blocks Resident Population and Dwelling count <https://www.abs.gov.au/census/guide-census-data/mesh-block-counts/latest-release>

Table 3: Australian Mesh Blocks [Kalgoorlie, Boulder, Trafalgar]

| Count | Field Name     | Data Type                 | Comments   |
|-------|----------------|---------------------------|--|
| 1     | amb_mb_code21  | character<br>varying(11)  | 11-digit Mesh Block code comprises:<br>State and Territory identifier (1 digit),<br>and a Mesh Block identifier (10 digits)  |
| 2     | amb_mb_cat21   | character<br>varying (30) | Topography category  |
| 3     | amb_chg_flag21 | character<br>varying (1)  | Changed since 2016 census (0/1)  |
| 4     | amb_chg_lbl21  | character<br>varying (11) | Change description   |
| 5     | mb_sa1_code21  | character<br>varying (11) | 11-digit fully hierarchical code,<br>comprising the 1-digit State and<br>Territory, and Statistical Areas Level<br>1-4 identifiers   |
| 6     | amb_sa2_code21 | character<br>varying (9)  | 9-digit fully hierarchical code<br>comprising the 1-digit State or<br>Territory identifier, and Statistical<br>Areas Level 2-4 identifiers.  |
| 7     | amb_sa2_name21 | character<br>varying (50) | Locality Name  |
| 8     | amb_sa3_code21 | character<br>varying (5)  | 1-digit State or Territory identifier<br>followed by a 2-digit SA4 identifier,<br>unique within each State and<br>Territory, and a 2-digit SA3 identifier,<br>unique within each SA4 |
| 9     | amb_sa3_name21 | character<br>varying (50) | Region name  |
| 10    | amb_sa4_code21 | character<br>varying (3)  | 1-digit State or Territory identifier,<br>which precedes a 2-digit SA4 identifier,<br>unique within each State and Territory   |

Australian Mesh Blocks [Kalgoorlie, Boulder, Trafalgar] (continued)

| Count | Field Name     | Data Type                     | Comments  |
|-------|----------------|-------------------------------|---|
| 11    | amb_sa4_name21 | character<br>varying (50)     | Labour Market   |
| 12    | amb_gcc_code21 | character<br>varying (5)      | 1-digit State or Territory identifier followed by a 4-character GCCSA identifier that is unique within each State and Territory |
| 13    | amb_gcc_name21 | character<br>varying (50)     | City or Rest of State   |
| 14    | amb_ste_code21 | character<br>varying (1)      | State or Territory Code Number  |
| 15    | amb_ste_name21 | character<br>varying (50)     | State or Territory Name   |
| 16    | amb_aus_code21 | character<br>varying (3)      | Special purpose coding for region   |
| 17    | amb_aus_name21 | character<br>varying (50)     | Name of Special Purpose Region  |
| 18    | amb_areasqkm21 | numeric<br>(31,15),           | Mesh Block area $km^2$  |
| 19    | amb_loci_uri21 | character<br>varying<br>(254) | URL for Mesh Block  |
| 20    | amb_geom       | geometry                      | Mesh Block polygon  |
| 21    | amb_centroid   | geometry                      | Mesh centroid   |
| 22    | amb_dwelling   | integer                       | Dwelling occupied on Census Night   |
| 23    | amb_person     | integer                       | Count of people where they usually live   |

### 3.3 Australian Footprints [Kalgoorlie, Boulder, Trafalgar]: (Table 4)

File: `australian_footprints_kalgoorlie_boulder_trafalgar_elev.gpkg` (GeoPackage File) contained in ‘`australian_footprints_kalgoorlie_boulder_trafalgar_elev.zip`’.

For information on fields, see Section 3.2 above.

Table 4: Australian Footprints [Kalgoorlie, Boulder, Trafalgar]

| Count | Field Name     | Data Type                 | Comments  |
|-------|----------------|---------------------------|---|
| 1     | af_id          | integer                   | Footprint id  |
| 2     | af_geom        | geom                      | Footprint geometry  |
| 3     | af_centroid    | integer                   | Footprint centroid  |
| 4     | amb_mb_code21  | character<br>varying(11)  | 11-digit Mesh Block code comprises: State and Territory identifier (1 digit), and a Mesh Block identifier (10 digits)     |
| 5     | amb_mb_cat21   | character<br>varying (30) | Topography category   |
| 6     | amb_chg_flag21 | character<br>varying (1)  | Changed since 2016 census (0/1)   |
| 7     | amb_chg_lbl21  | character<br>varying (11) | Change description  |
| 8     | mb_sa1_code21  | character<br>varying (11) | 11-digit fully hierarchical code, comprising the 1-digit State and Territory, and Statistical Areas Level 1-4 identifiers |

## Australian Footprints [Kalgoorlie, Boulder, Trafalgar] (continued)

| Count | Field Name     | Data Type                     | Comments   |
|-------|----------------|-------------------------------|--|
| 9     | amb_sa2_code21 | character<br>varying (9)      | 9-digit fully hierarchical code comprising the 1-digit State or Territory identifier, and Statistical Areas Level 2-4 identifiers.                                       |
| 10    | amb_sa2_name21 | character<br>varying (50)     | Locality Name  |
| 11    | amb_sa3_code21 | character<br>varying (5)      | 1-digit State or Territory identifier followed by a 2-digit SA4 identifier, unique within each State and Territory, and a 2-digit SA3 identifier, unique within each SA4 |
| 12    | amb_sa3_name21 | character<br>varying (50)     | Region name  |
| 13    | amb_sa4_code21 | character<br>varying (3)      | 1-digit State or Territory identifier, which precedes a 2-digit SA4 identifier, unique within each State and Territory   |
| 14    | amb_sa4_name21 | character<br>varying (50)     | Labour Market  |
| 15    | amb_gcc_code21 | character<br>varying (5)      | 1-digit State or Territory identifier followed by a 4-character GCCSA identifier that is unique within each State and Territory  |
| 16    | amb_gcc_name21 | character<br>varying (50)     | City or Rest of State  |
| 17    | amb_ste_code21 | character<br>varying (1)      | State or Territory Code Number   |
| 18    | amb_ste_name21 | character<br>varying (50)     | State or Territory Name  |
| 19    | amb_aus_code21 | character<br>varying (3)      | Special purpose coding for region  |
| 20    | amb_aus_name21 | character<br>varying (50)     | Name of Special Purpose Region   |
| 21    | amb_areasqkm21 | numeric<br>(31,15),           | Mesh Block area $km^2$   |
| 22    | amb_loci_uri21 | character<br>varying<br>(254) | URL for Mesh Block   |
| 23    | amb_geom       | geometry                      | Mesh Block polygon   |
| 24    | amb_centroid   | geometry                      | Mesh centroid  |
| 25    | amb_dwelling   | integer                       | Dwelling occupied on Census Night  |
| 26    | amb_person     | integer                       | Count of people where they usually live  |
| 27    | af_elev        | double<br>precision           | Height in Metres   |

## 3.4 Monthly Cumulative Irradiance Values: (Table 5)

File: solar\_irradiance\_monthly\_cumulative\_kbf.gpkg (GeoPackage File)  
contained in 'solar\_irradiance\_monthly\_cumulative\_kbf.zip'.

Table 5: Monthly Cumulative Irradiance Values

| Count | Field Name              | Data Type | Comments                             |
|-------|-------------------------|-----------|--------------------------------------|
| 1     | SIMCKBF_Footprint_af_id | bigint    | Footprint record number              |
| 2     | SIMCKBF_January         | real      | January Cumulative Total ( $W/m^2$ ) |

Monthly Cumulative Irradiance Values (continued)

| Count | Field Name           | Data Type                 | Comments                                |
|-------|----------------------|---------------------------|---|
| 3     | SIMCKBF_February     | real                      | February Cumulative Total ( $kWh/m^2$ ) |
| 4     | SIMCKBF_March        | real                      | March Cumulative Total ( $W/m^2$ )      |
| 5     | SIMCKBF_April        | real                      | April Cumulative Total ( $W/m^2$ )      |
| 6     | SIMCKBF_May          | real                      | May Cumulative Total ( $W/m^2$ )        |
| 7     | SIMCKBF_June         | real                      | June Cumulative Total ( $W/m^2$ )       |
| 8     | SIMCKBF_July         | real                      | July Cumulative Total ( $W/m^2$ )       |
| 9     | SIMCKBF_August       | real                      | August Cumulative Total ( $W/m^2$ )     |
| 10    | SIMCKBF_September    | real                      | September Cumulative Total ( $W/m^2$ )  |
| 11    | SIMCKBF_October      | real                      | October Cumulative Total ( $W/m^2$ )    |
| 12    | SIMCKBF_November     | real                      | November Cumulative Total ( $W/m^2$ )   |
| 13    | SIMCKBF_December     | real                      | December Cumulative Total ( $W/m^2$ )   |
| 14    | SIMCKBF_Annual       | real                      | Annual Cumulative Total ( $W/m^2$ )     |
| 15    | SIMCKBF_Geom         | geometry                  | Footprint polygon                       |
| 16    | SIMCKBF_mb_code_2021 | character<br>varying (11) | Australian Mesh Block<br>mb_code_2021   |

### 3.5 Daily Average Irradiance Values: (Table 6)

File: solar\_irradiance\_footprint\_daily\_average.gpkg (GeoPackage File)  
contained in 'solar\_irradiance\_footprint\_daily\_average.zip'.

Table 6: Daily Average Irradiance Values

| Count | Field Name            | Data Type                 | Comments                              |
|-------|-----------------------|---------------------------|---------------------------------------|
| 1     | SIFDA_Footprint_af_id | bigint                    | Footprint Record Number               |
| 2     | SIFDA_January         | real                      | January Daily Average ( $W/m^2$ )     |
| 3     | SIFDA_February        | real                      | February Daily Average ( $W/m^2$ )    |
| 4     | SIFDA_March           | real                      | March Daily Average ( $W/m^2$ )       |
| 5     | SIFDA_April           | real                      | April Daily Average ( $W/m^2$ )       |
| 6     | SIFDA_May             | real                      | May Daily Average ( $W/m^2$ )         |
| 7     | SIFDA_June            | real                      | June Daily Average ( $W/m^2$ )        |
| 8     | SIFDA_July            | real                      | July Daily Average ( $W/m^2$ )        |
| 9     | SIFDA_August          | real                      | August Daily Average ( $W/m^2$ )      |
| 10    | SIFDA_September       | real                      | September Daily Average ( $W/m^2$ )   |
| 11    | SIFDA_October         | real                      | October Daily Average ( $W/m^2$ )     |
| 12    | SIFDA_November        | real                      | November Daily Average ( $W/m^2$ )    |
| 13    | SIFDA_December        | real                      | December Daily Average ( $W/m^2$ )    |
| 14    | SIFDA_Geom            | geometry                  | Footprint polygon                     |
| 15    | SIFDA_mb_code_2021    | character<br>varying (11) | Australian Mesh Block<br>mb_code_2021 |

### 3.6 Hourly Potential Values: (Table 7)

File: solar\_pv\_potential\_footprint\_hourly.gpkg (GeoPackage File)  
contained in 'solar\_pv\_potential\_footprint\_hourly.zip'.

Table 7: Hourly Potential Values

| Count | Field Name               | Data Type | Comments                             |
|-------|--------------------------|-----------|--------------------------------------|
| 1     | SPVPFH_Footprint_af_id   | bigint    | Footprint Record Number              |
| 2     | SPVPFH_Month             | integer   | Month number                         |
| 3     | SPVPFH_Day               | integer   | Day within the month                 |
| 4     | SPVPFH_Minute            | integer   |                                      |
| 5     | SPVPFH_Panels            | integer   | Number of panels used in calculation |
| 6     | SPVPFH_Irradiance_W_sq_m | real      | Irradiance ( $W/m^2$ )               |

## Hourly Potential Values (continued)

| Count | Field Name                       | Data Type | Comments  |
|-------|----------------------------------|-----------|---|
| 7     | SPVPFH_Potential_Total_Panels_kW | real      | Irradiance for total number of panels ( $kWh$ ) |
| 8     | SPVPFH_Geom                      | geometry  | Footprint polygon                               |
| 9     | SPVPFH_mb_code_2021              | character | Australian Mesh Block varying (11) mb_code_2021 |

## 3.7 Daily Average Potential Values: (Table 8)

File: solar\_pv\_potential\_footprint\_daily\_average.gpkg (GeoPackage File)  
 contained in 'solar\_pv\_potential\_footprint\_daily\_average.zip'.

Table 8: Daily Average Potential Values

| Count | Field Name              | Data Type | Comments  |
|-------|-------------------------|-----------|---|
| 1     | SPVPFDA_Footprint_af_id | bigint    | Footprint Record Number                         |
| 2     | SPVPFDA_January         | real      | January Daily Average ( $kWh/m^2$ )             |
| 3     | SPVPFDA_February        | real      | February Daily Average ( $kWh/m^2$ )            |
| 4     | SPVPFDA_March           | real      | March Daily Average ( $kWh/m^2$ )               |
| 5     | SPVPFDA_April           | real      | April Daily Average ( $kWh/m^2$ )               |
| 6     | SPVPFDA_May             | real      | May Daily Average ( $kWh/m^2$ )                 |
| 7     | SPVPFDA_June            | real      | June Daily Average ( $kWh/m^2$ )                |
| 8     | SPVPFDA_July            | real      | July Daily Average ( $kWh/m^2$ )                |
| 9     | SPVPFDA_August          | real      | August Daily Average ( $kWh/m^2$ )              |
| 10    | SPVPFDA_September       | real      | September Daily Average ( $kWh/m^2$ )           |
| 11    | SPVPFDA_October         | real      | October Daily Average ( $kWh/m^2$ )             |
| 12    | SPVPFDA_November        | real      | November Daily Average ( $kWh/m^2$ )            |
| 13    | SPVPFDA_December        | real      | December Daily Average ( $kWh/m^2$ )            |
| 14    | SPVPFDA_Geom            | geometry  | Footprint polygon                               |
| 15    | SPVPFDA_mb_code_2021    | character | Australian Mesh Block varying (11) mb_code_2021 |

## 3.8 Monthly Cumulative Potential Values: (Table 9)

File: solar\_pv\_potential\_monthly\_cumulative\_kbf.gpkg (GeoPackage File)  
 contained in 'solar\_pv\_potential\_monthly\_cumulative\_kbf.zip'.

Table 9: Monthly Cumulative Potential Values

| Count | Field Name                | Data Type | Comments                                 |
|-------|---------------------------|-----------|--|
| 1     | SPVPMCKBF_Footprint_af_id | bigint    | Footprint record number                  |
| 2     | SPVPMCKBF_January         | real      | January Cumulative Total ( $kWh/m^2$ )   |
| 3     | SPVPMCKBF_February        | real      | February Cumulative Total ( $kWh/m^2$ )  |
| 4     | SPVPMCKBF_March           | real      | March Cumulative Total ( $kWh/m^2$ )     |
| 5     | SPVPMCKBF_April           | real      | April Cumulative Total ( $kWh/m^2$ )     |
| 6     | SPVPMCKBF_May             | real      | May Cumulative Total ( $kWh/m^2$ )       |
| 7     | SPVPMCKBF_June            | real      | June Cumulative Total ( $kWh/m^2$ )      |
| 8     | SPVPMCKBF_July            | real      | July Cumulative Total ( $kWh/m^2$ )      |
| 9     | SPVPMCKBF_August          | real      | August Cumulative Total ( $kWh/m^2$ )    |
| 10    | SPVPMCKBF_September       | real      | September Cumulative Total ( $kWh/m^2$ ) |
| 11    | SPVPMCKBF_October         | real      | October Cumulative Total ( $kWh/m^2$ )   |
| 12    | SPVPMCKBF_November        | real      | November Cumulative Total ( $kWh/m^2$ )  |
| 13    | SPVPMCKBF_December        | real      | December Cumulative Total ( $kWh/m^2$ )  |

## Monthly Cumulative Potential Values (continued)

| Count | Field Name             | Data Type                 | Comments                              |
|-------|------------------------|---------------------------|---------------------------------------|
| 14    | SPVPMCKBF_Annual       | real                      | Annual Cumulative Total ( $kWh/m^2$ ) |
| 15    | SPVPMCKBF_Geom         | geometry                  | Footprint polygon                     |
| 16    | SPVPMCKBF_mb_code_2021 | character<br>varying (11) | Australian Mesh Block<br>mb_code_2021 |

### 3.9 Weather Data: (Table 10)

File: solar\_irradiance\_weather\_irradiance.gpkg (GeoPackage File)  
contained in 'solar\_irradiance\_weather\_irradiance.zip'.

Table 10: Weather Data

| Count | Field Name       | Data Type               | Comments            |
|-------|------------------|-------------------------|---------------------|
| 1     | SIWR_Staion_id   | character varying (10)  | Weather station id  |
| 2     | SIWR_Filename    | character varying (256) | Climate filename    |
| 3     | SIWR_DateTime    | DateTime                | YYYY-MM-DD HH:MM:SS |
| 4     | SIWR_Temperature | real                    | Temperature (°C)    |

## 4 Examples of Usage

The datasets are provided using the GeoPackage (<https://www.geopackage.org/>) format. Specifically, the packages were created using ‘ogr2ogr’ version GDAL 3.5.0, released 2022/05/10.

There are a number of programs which implement GeoPackages (<https://www.geopackage.org/implementations.html>). For the purposes of illustrating usage of the datasets, the ‘QGIS’ program will be used - see <https://www.qgis.org/en/site/>.

### 4.1 GNAF/Core Filtered on Mesh Blocks

From experience, using an external database solution such as ‘Postgresql/Postgis’ results in faster fetching and filtering of layers than the internal ‘SQLite’ database native to ‘QGIS’.

The current Australian geocoded address database is available from <https://geoscape.com.au/data/g-naf-core/>. Complete the form to download the file. Click on the link provided in the email and select all files and download the zip file (over 1 GB). In this example, the filename is ‘Files.zip’.

---

```

1 unzip Files.zip
2 chmod a+r G-NAFCore_NOV22_AUSTRALIA_GDA2020_PSV_101.zip
3 unzip G-NAFCore_NOV22_AUSTRALIA_GDA2020_PSV_101.zip
4
5 sudo chmod -R a+r *
6
7 ln -s G-NAF\ Core\G-NAF\ Core\ NOVEMBER\ 2022\Standard\GNAF_CORE.psv gnaf\_core.psv

```

---

The process of importing the ‘gnaf-core.psv’ file into a new QGIS project, filtering the mesh blocks for the ‘Kalgoorlie/Boulder/Traffar’ dataset and then exporting the layer to a ‘postgres’ database is as follows:

- Start the ‘QGIS’ application
- Update the Project Properties (see Figure 1)

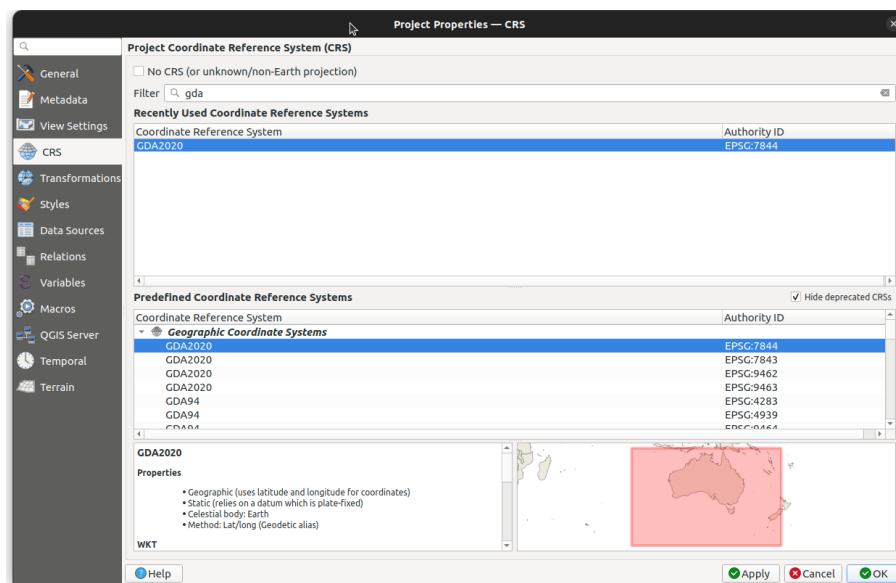


Figure 1: Project Coordinate System

- Drag and drop the ‘australian\_mesh\_blocks\_kalgoorlie\_boulder\_traffalgar’ package into the ‘Layers’ box (see Figure 2).
- Right-click on the ‘australian\_mesh\_blocks\_kalgoorlie\_boulder\_traffalgar’ layer and select ‘Zoom to Layer(s)’
- Click ‘Layer’ then ‘Data Source Manager’ and select the ‘Delimited Text’ option (see Figure 3).



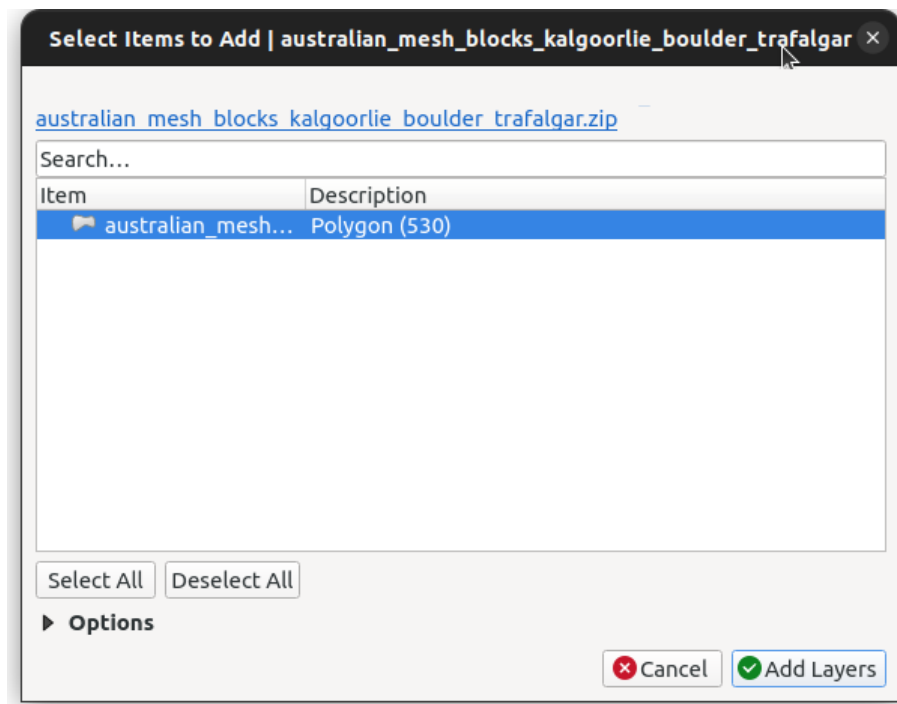


Figure 2: Mesh Block Layer

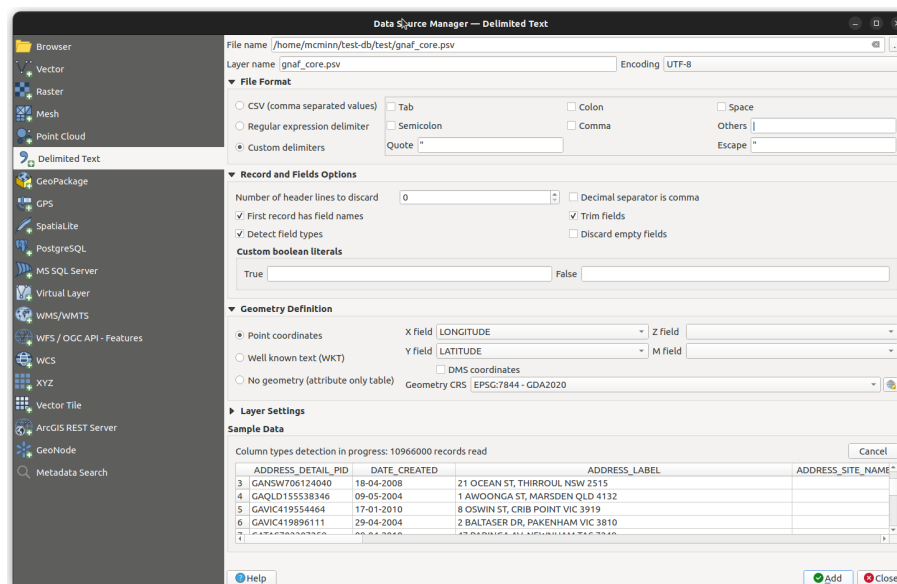


Figure 3: Data Source - Delimited Text

- Select the 'Layer' menu item, then 'Create Layer | New Virtual Layer...'
  - Import the 'australian\_mesh\_blocks\_kalgoorlie\_boulder\_trafalgar' and the 'gnaf\_core' layers.
  - Add the 'SQLite' formatted query (see [https://docs.qgis.org/testing/en/docs/user\\_manual/managing\\_data\\_source/create\\_layers.html#supported-query-language](https://docs.qgis.org/testing/en/docs/user_manual/managing_data_source/create_layers.html#supported-query-language) for details). The query needed to join the two layers together and filter the very large gnaf\_core layer 15,399,579 records) down to the smaller number of mesh blocks in the Kalgoorlie/Boulder/Trafalgar dataset (18,318 addresses for the 530 mesh blocks) is as follows and see Figure 4:

```
1 SELECT *
```

```

2 FROM "gnaf_core" AS gnaf
3 JOIN "australian_mesh_blocks_kalgoorlie_boulder_trafalgar.gpkg" AS kbf
4 ON to_string(gnaf.mb_code) = kbf.amb_mb_code21;

```

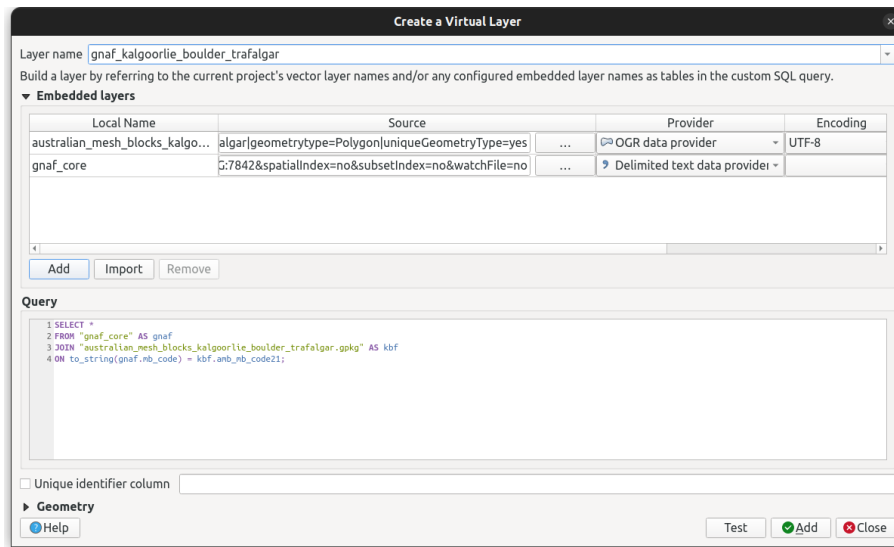


Figure 4: Virtual Layer

Note: The conversion of the integer value of gnaf\_core's 'mb\_code' to match the string values in the australian\_mesh\_blocks\_kalgoorlie\_boulder\_trafalgar's 'amb\_mb\_code' layer using the 'to\_string' function.

- There should not be any points showing outside the defined mesh blocks area. See Figure 5.

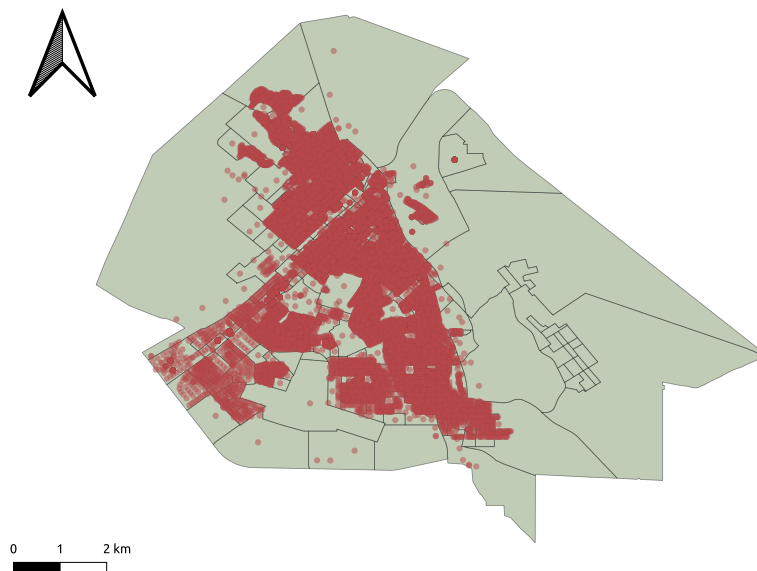


Figure 5: GNAF Filtered On Mesh Blocks

- Once the new 'gnaf\_kalgoorlie\_boulder\_trafalgar' layer has populated (this may take some time), select it in the Layers box, then using the 'Processing Toolbox': Select: Database | Export to PostgreSQL (this can take some time - see Figure 6).

Note: Don't remove any dependent layer in use by a 'virtual layer'.

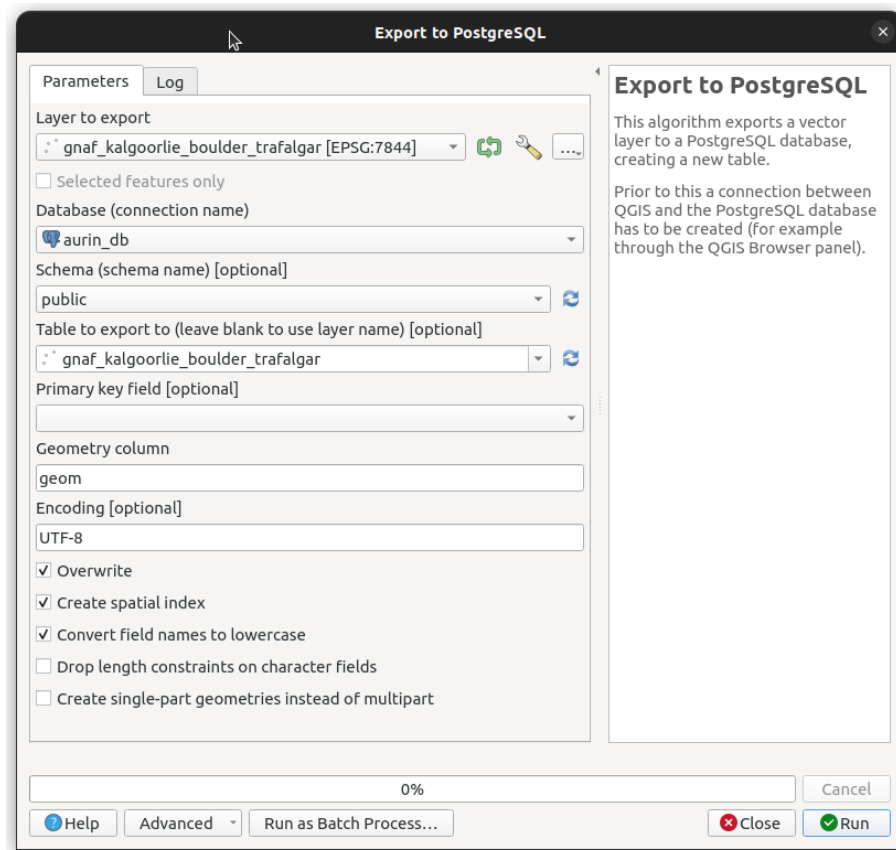


Figure 6: Export to PostgreSQL

## 4.2 Sub-setting

Add the 'australian\_footprints\_kalgoorlie\_boulder\_trafalgar\_elev' layer. The statistics from this layer and the 'amb\_mb\_cat21' column (Footprints) are as follows:

- 15,858 footprints/roofs in Kalgoorlie-Boulder

Table 11: Categories (amb\_mb\_cat21) Codes

| Categories         | Footprints Mesh Blocks |     |
|--------------------|------------------------|-----|
| Residential roofs  | 13,654                 | 356 |
| Commercial         | 823                    | 56  |
| Hospital/Medical   | 25                     | 1   |
| Industrial         | 721                    | 34  |
| Primary Production | 318                    | 8   |
| Education          | 165                    | 15  |
| Parkland           | 116                    | 55  |
| Transport          | 36                     | 5   |

- **530** Mesh Blocks
- **476** Mesh Blocks with footprints
- **54** Mesh Blocks with zero footprints

To filter the footprints using the 'amb\_mb\_cat21' column in this layer:

- Right-click on the required layer to be filtered.
- Select 'Filter...'
- Enter the following Expression:

```
1 amb_mb_cat21 = 'Commercial'
```

as shown in Figure 7:

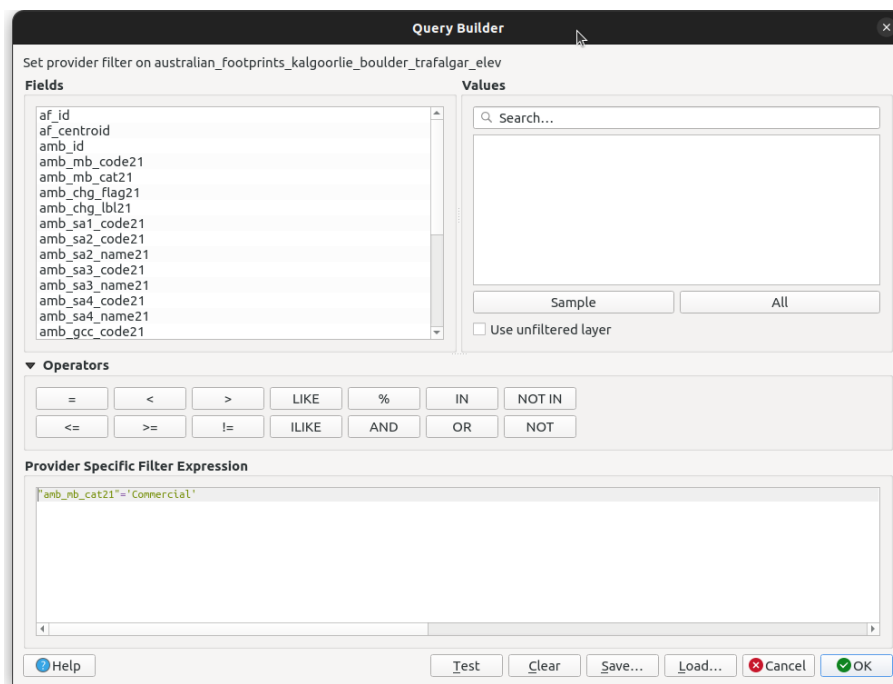


Figure 7: Layer Filter Footprints Commercial

The results should be similar to Figure 8.

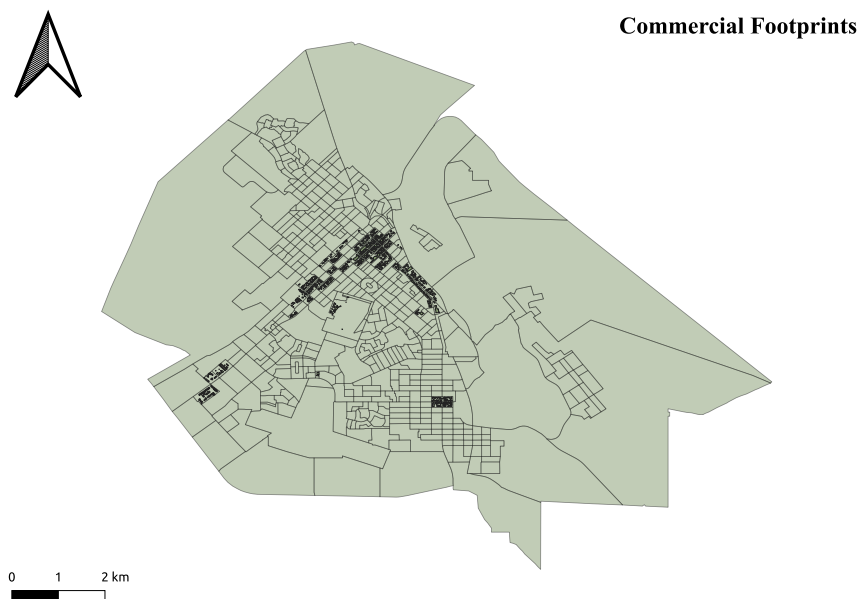


Figure 8: Commercial Footprints Highlighted

### 4.3 Solar Potential Daily Average

Queries of the Solar Potential or Irradiance can be done in a similar sub-setting methodology. The procedure is as follows:

- Add the 'solar\_pv\_potential\_footprint\_hourly.gpkg' layer.
- Filter this layer using the following expression:

1 "SPVPFDA\_June">2000

See Figure 9.

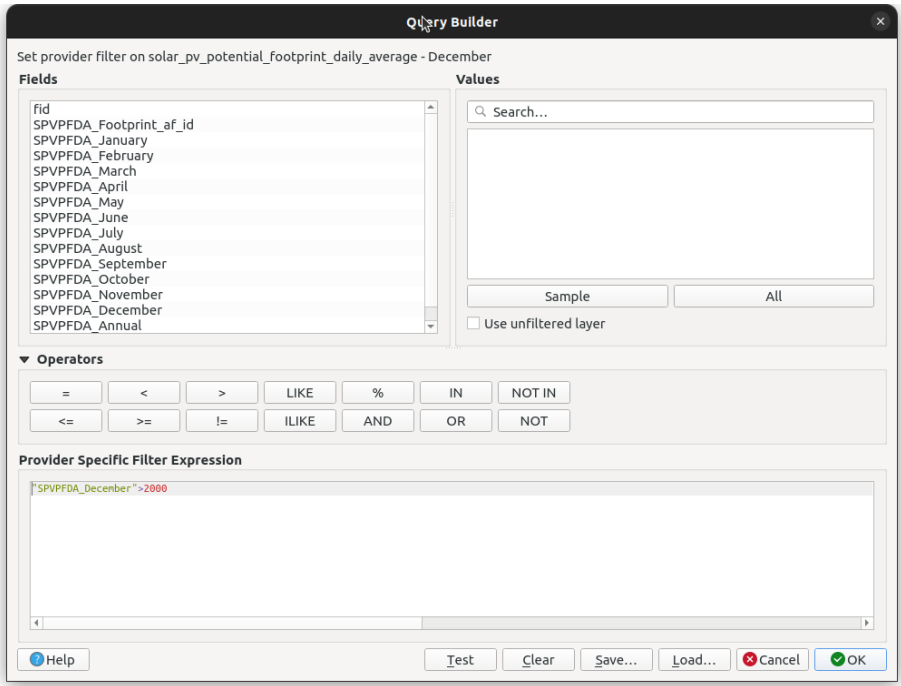


Figure 9: Solar PV Potential Footprint Daily Average - June

- Right-Click on the 'solar\_pv\_potential\_footprint\_daily\_average - June' layer' and choose the 'Duplicate Layer'.
- Click on the filter for this new layer and change the field to 'SPVPFDA\_December'.

The results should be similar to Figures 10 and 11.

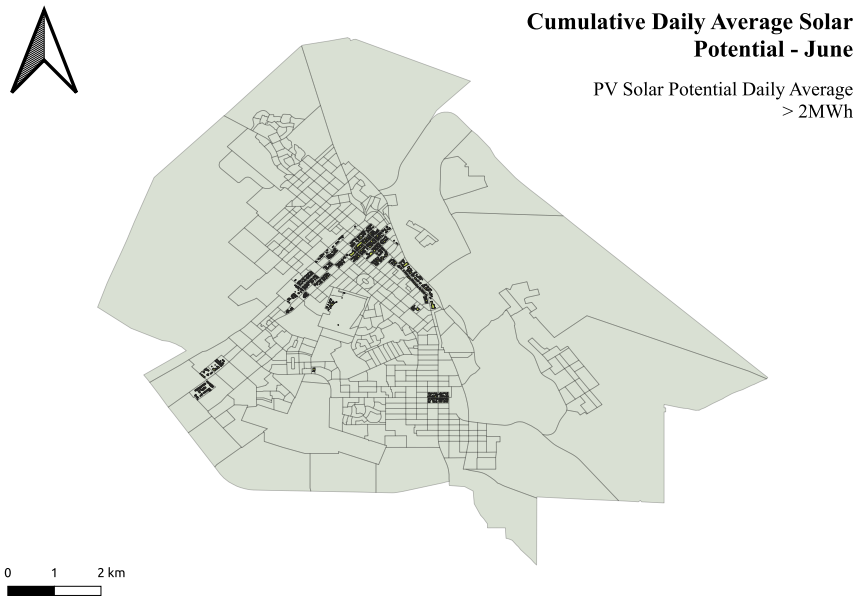


Figure 10: Cumulative Daily Average Solar Potential - June

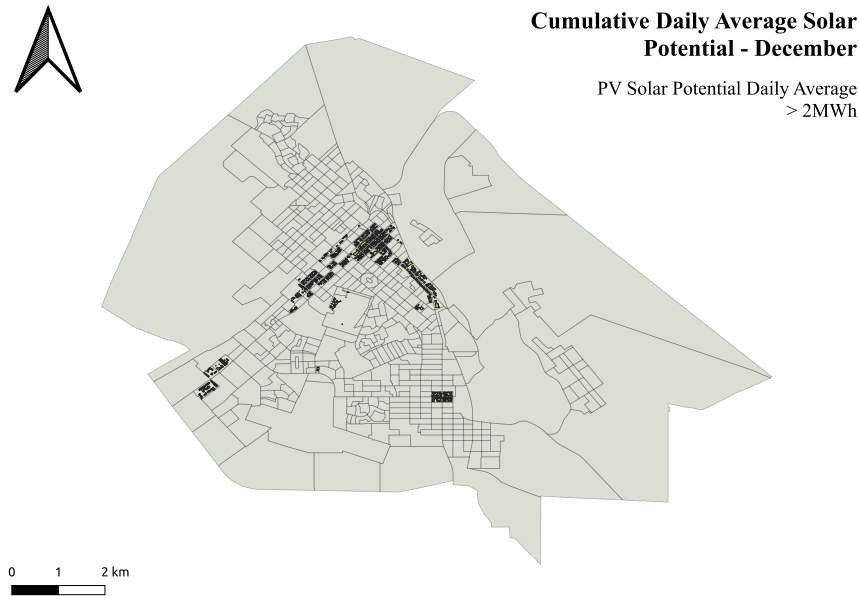


Figure 11: Cumulative Daily Average Solar Potential - December

#### 4.4 Using GNAF/Core to Determine a Footprint ID


To aid in identifying a footprint to the specific address, it is useful to display the street map as an underlay. Use the following procedure: Download the 'QGIS' plugin from [https://plugins.qgis.org/plugins/openlayers\\_plugin/](https://plugins.qgis.org/plugins/openlayers_plugin/)<sup>1</sup>

- Optional: Add the mesh block layer.
- Add the footprints layer.
- Enable the 'OpenLayers' Plugin. Use the 'Plugins' menu item, then 'Manage and Install Plugins...'. Find the 'OpenLayers' plugin as shown in Figure 12 and install.
- There should now be a new menu item, 'Web'. Click on the sub menu item 'OpenLayer Plugin | OpenStreet Map | OpenStreetMap'<sup>2</sup>. Drag the 'OpenStreetMap' Layer to the top of the list of Layers. You may need to adjust the Transparency of the different layers via the Layer's 'Properties'. (Normal Layers under Symbology - Opacity; OpenLayers under Transparency - Global Opacity)
- Right-Click on the 'gnaf' layer and choose 'Filter'. Enter the following expression using the 'address\_label' field<sup>3</sup> as shown in Figure 13. This filter expression returns 1776 rows:

---

```
1 "address_label" LIKE '%HANNAN%'
```

---

- Zoom into the Town Hall on Hannan and Wilson Streets.
- Use the 'Identify Features' arrow  and right-click on the GNAF point. A selection of layers at that point will be displayed as in Figure 14.
- Hover the mouse over the Footprints layer in the selection. This will highlight the footprint.
- Click on the Footprint selection to display the attributes for that footprint as seen in Figure 15.
- The Town Hall's footprint is 6473743 in field af\_id.

#### 4.5 Using Virtual Layers to Join, Filter and Export to spreadsheet

This procedure is similar to the previous examples:

---

<sup>1</sup>QGIS version 3.30 and above requires OpenLayer Version 2.0 or higher

<sup>2</sup>OpenStreetMap is not as up to date as Google Map, but is available without subscription compared with Google Map.

<sup>3</sup>The address\_label column's values are all caps, therefore you will need to use capital letters in the expression. The % symbol is used as a wildcard expression.

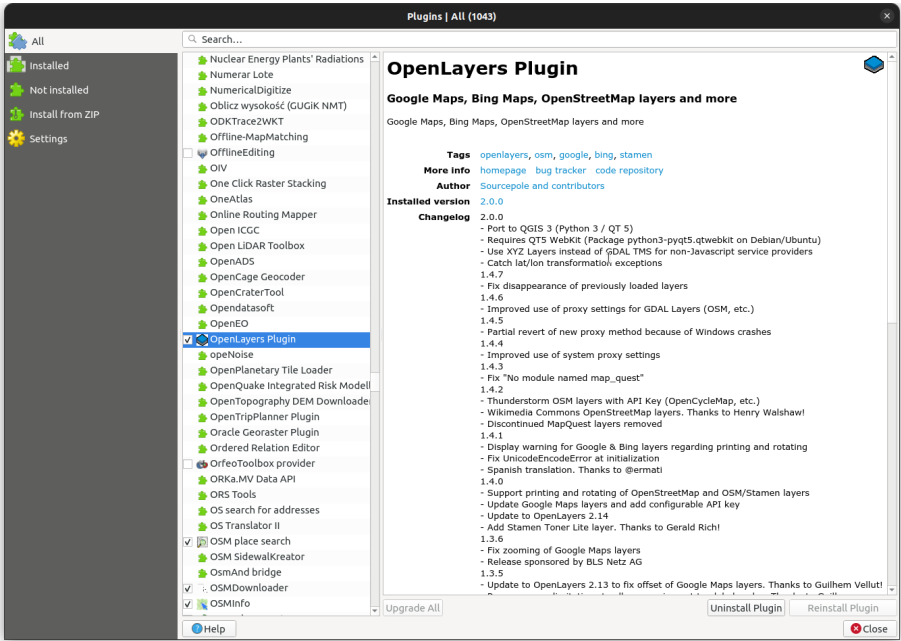


Figure 12: Plugin OpenLayers Install

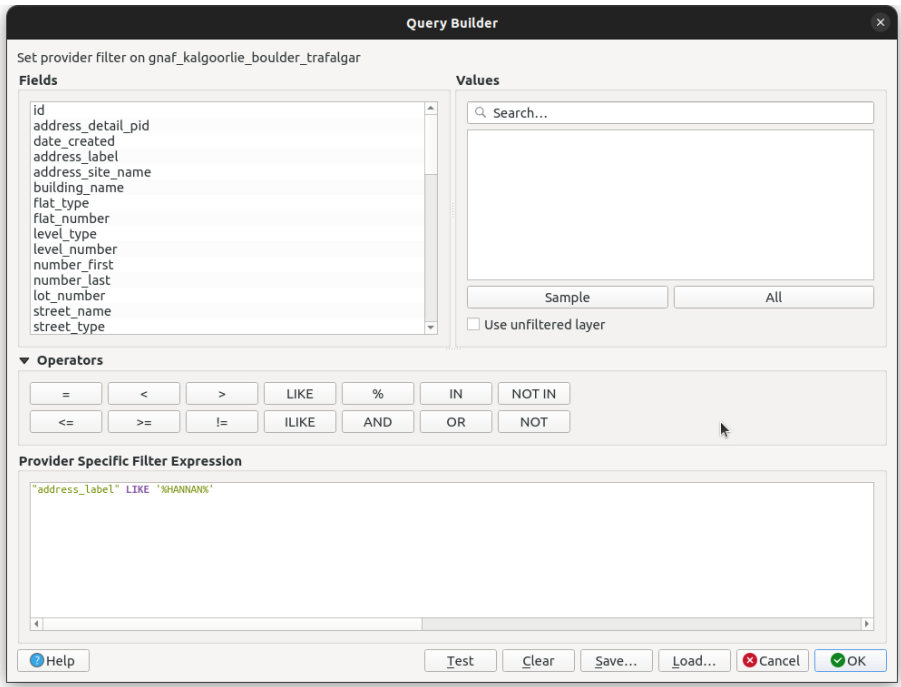


Figure 13: GNAF Filter

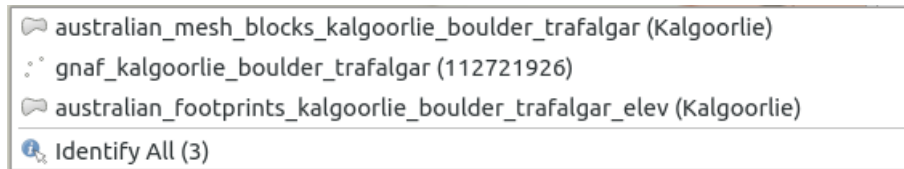


Figure 14: Identify Features Layers

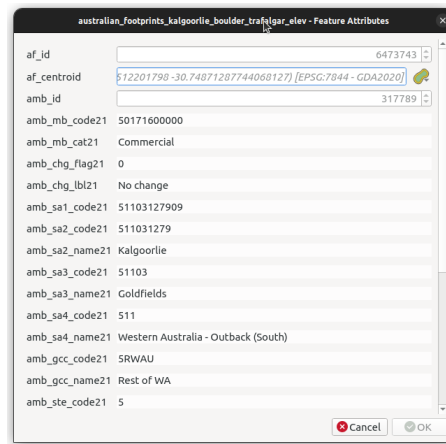


Figure 15: TownHall Footprint Attributes

- Add the 'solar\_pv\_potential\_monthly\_cumulative' to the project.
- Click on the new layer.
- Add a new 'Virtual Layer' via the 'Layer | Add/Edit Virtual Layer...'
- Import both the 'australian\_footprints\_kalgoorlie\_boulder\_trafalgar\_elev' and the 'solar\_pv\_potential\_monthly\_cumulative\_kbf' layers.
- Add the following Query:

---

```

1 SELECT *
2 FROM
3 JOIN australian_footprints_kalgoorlie_boulder_trafalgar_elev
4 ON "af_id" = "SPVPMCKBF_Footprint_af_id"
5 WHERE amb_mb_cat21 = 'Commercial'

```

---

as shown in Figure 16.

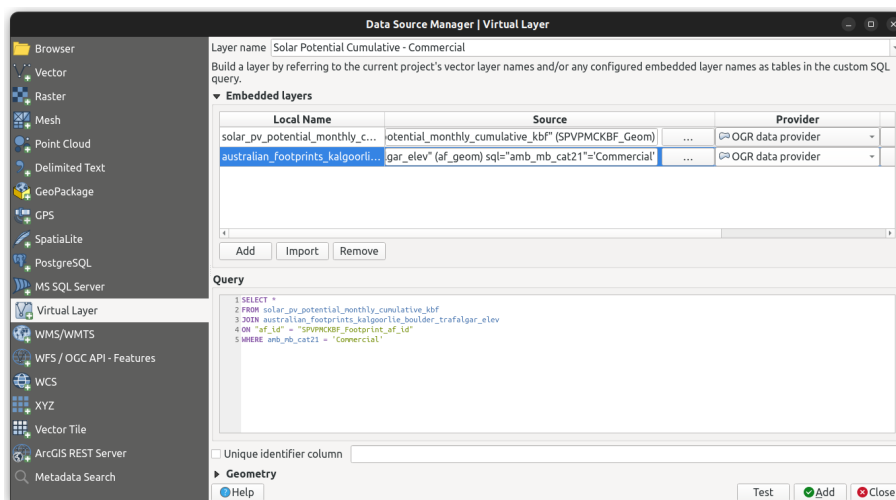


Figure 16: Cumulative Solar Potential - Commercial Properties



- Right-click on the new virtual layer and select ‘Export | Save Feature As...’. See Figure 17.

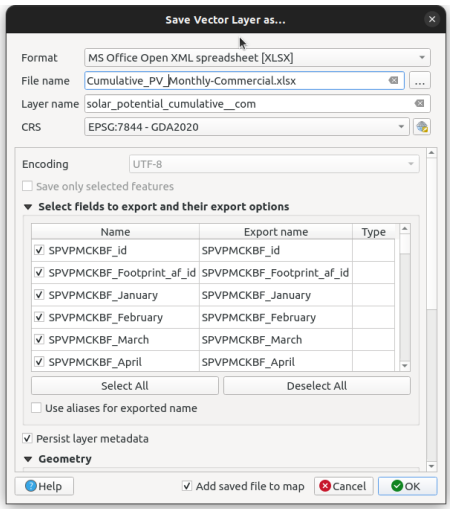


Figure 17: Export to MS Office Open XML spreadsheet[XLSX]

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3. To the extent possible, the Licensor waives any right to collect royalties from You for the exercise of the Licenced Rights, whether directly or through a collecting society under any voluntary or waivable statutory or compulsory licensing scheme. In all other cases the Licensor expressly reserves any right to collect such royalties.

### 5.5.3 Section 3 – Licence Conditions.

Your exercise of the Licenced Rights is expressly made subject to the following conditions.

#### a. Attribution.

1. If You Share the Licenced Material (including in modified form), You must:



- A. retain the following if it is supplied by the Licensor with the Licenced Material:
    - i. identification of the creator(s) of the Licenced Material and any others designated to receive attribution, in any reasonable manner requested by the Licensor (including by pseudonym if designated);
    - ii. a copyright notice;
    - iii. a notice that refers to this Public Licence;
    - iv. a notice that refers to the disclaimer of warranties;
    - v. a URI or hyperlink to the Licenced Material to the extent reasonably practicable;
  - B. indicate if You modified the Licenced Material and retain an indication of any previous modifications; and
  - C. indicate the Licenced Material is licensed under this Public Licence, and include the text of, or the URI or hyperlink to, this Public Licence.
2. You may satisfy the conditions in Section 3(a)(1) in any reasonable manner based on the medium, means, and context in which You Share the Licenced Material. For example, it may be reasonable to satisfy the conditions by providing a URI or hyperlink to a resource that includes the required information.
  3. If requested by the Licensor, You must remove any of the information required by Section 3(a)(1)(A) to the extent reasonably practicable.
  4. If You Share Adapted Material You produce, the Adapter's Licence You apply must not prevent recipients of the Adapted Material from complying with this Public Licence.

#### 5.5.4 Section 4 – Sui Generis Database Rights.

Where the Licenced Rights include Sui Generis Database Rights that apply to Your use of the Licenced Material:

- a. for the avoidance of doubt, Section 2(a)(1) grants You the right to extract, reuse, reproduce, and Share all or a substantial portion of the contents of the database;
- b. if You include all or a substantial portion of the database contents in a database in which You have Sui Generis Database Rights, then the database in which You have Sui Generis Database Rights (but not its individual contents) is Adapted Material; and
- c. You must comply with the conditions in Section 3(a) if You Share all or a substantial portion of the contents of the database. For the avoidance of doubt, this Section 4 supplements and does not replace Your obligations under this Public Licence where the Licenced Rights include other Copyright and Similar Rights.

#### 5.5.5 Section 5 – Disclaimer of Warranties and Limitation of Liability.

- a. Unless otherwise separately undertaken by the Licensor, to the extent possible, the Licensor offers the Licenced Material as-is and as-available, and makes no representations or warranties of any kind concerning the Licenced Material, whether express, implied, statutory, or other. This includes, without limitation, warranties of title, merchantability, fitness for a particular purpose, non-infringement, absence of latent or other defects, accuracy, or the presence or absence of errors, whether or not known or discoverable. Where disclaimers of warranties are not allowed in full or in part, this disclaimer may not apply to You.
- b. To the extent possible, in no event will the Licensor be liable to You on any legal theory (including, without limitation, negligence) or otherwise for any direct, special, indirect, incidental, consequential, punitive, exemplary, or other losses, costs, expenses, or damages arising out of this Public Licence or use of the Licenced Material, even if the Licensor has been advised of the possibility of such losses, costs, expenses, or damages. Where a limitation of liability is not allowed in full or in part, this limitation may not apply to You.

- c. The disclaimer of warranties and limitation of liability provided above shall be interpreted in a manner that, to the extent possible, most closely approximates an absolute disclaimer and waiver of all liability.

#### **5.5.6 Section 6 – Term and Termination.**

- a. This Public Licence applies for the term of the Copyright and Similar Rights licensed here. However, if You fail to comply with this Public Licence, then Your rights under this Public Licence terminate automatically.
- b. Where Your right to use the Licenced Material has terminated under Section 6(a), it reinstates:
  - 1. automatically as of the date the violation is cured, provided it is cured within 30 days of Your discovery of the violation; or
  - 2. upon express reinstatement by the Licensor. For the avoidance of doubt, this Section 6(b) does not affect any right the Licensor may have to seek remedies for Your violations of this Public Licence.
- c. For the avoidance of doubt, the Licensor may also offer the Licenced Material under separate terms or conditions or stop distributing the Licenced Material at any time; however, doing so will not terminate this Public Licence.
- d. Sections 1, 5, 6, 7, and 8 survive termination of this Public Licence.

#### **5.5.7 Section 7 – Other Terms and Conditions.**

- a. The Licensor shall not be bound by any additional or different terms or conditions communicated by You unless expressly agreed.
- b. Any arrangements, understandings, or agreements regarding the Licenced Material not stated herein are separate from and independent of the terms and conditions of this Public Licence.

#### **5.5.8 Section 8 – Interpretation.**

- a. For the avoidance of doubt, this Public Licence does not, and shall not be interpreted to, reduce, limit, restrict, or impose conditions on any use of the Licenced Material that could lawfully be made without permission under this Public Licence.
- b. To the extent possible, if any provision of this Public Licence is deemed unenforceable, it shall be automatically reformed to the minimum extent necessary to make it enforceable. If the provision cannot be reformed, it shall be severed from this Public Licence without affecting the enforceability of the remaining terms and conditions.
- c. No term or condition of this Public Licence will be waived and no failure to comply consented to unless expressly agreed to by the Licensor.
- d. Nothing in this Public Licence constitutes or may be interpreted as a limitation upon, or waiver of, any privileges and immunities that apply to the Licensor or You, including from the legal processes of any jurisdiction or authority.

## 6 Bibliography

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