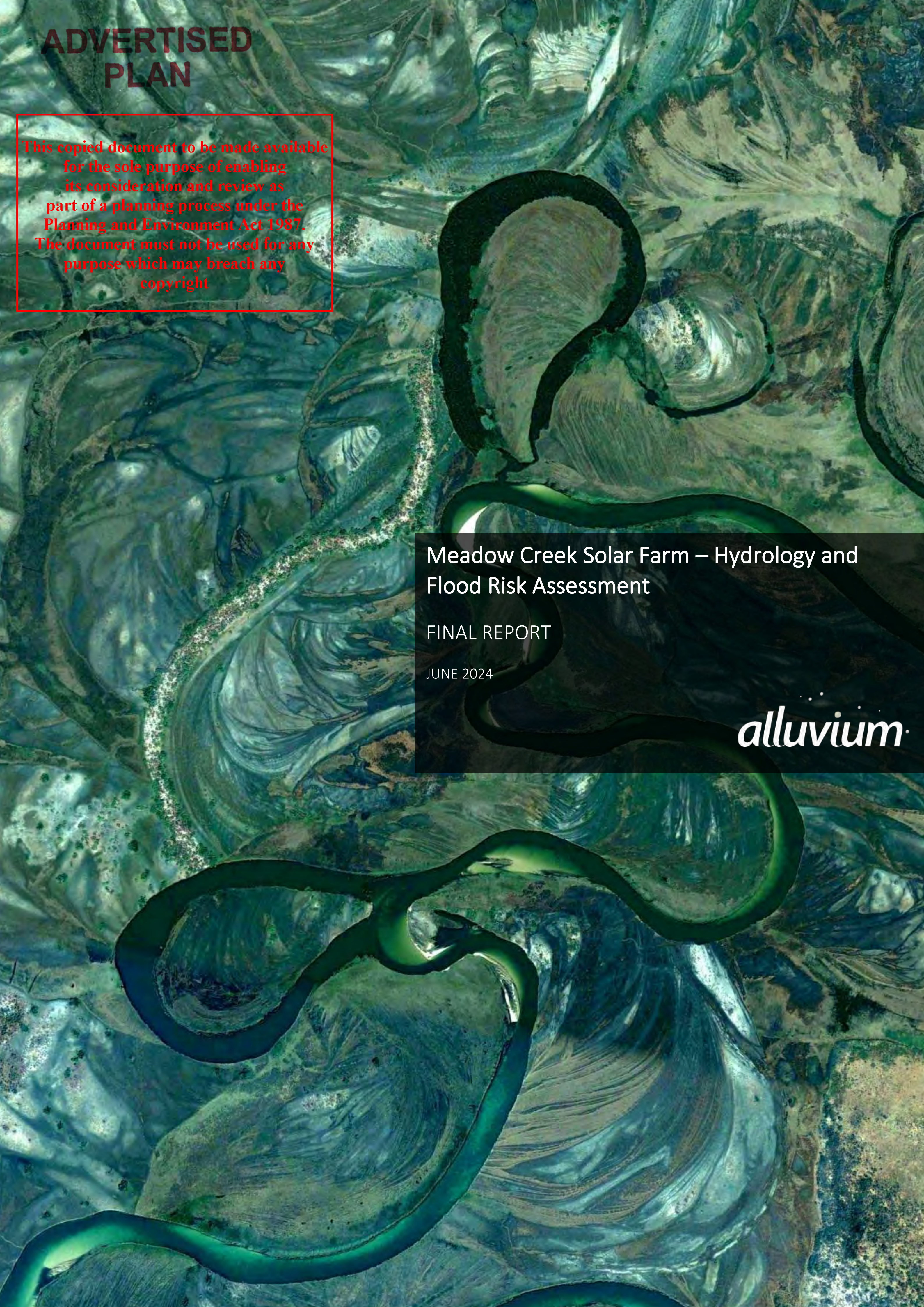

Meadow Creek Solar Farm – Hydrology and Flood Risk Assessment

FINAL REPORT

JUNE 2024

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Alluvium recognises and acknowledges the unique relationship and deep connection to Country shared by Aboriginal and Torres Strait Islander people, as First Peoples and Traditional Owners of Australia. We pay our respects to their Cultures, Country and Elders past and present.

Artwork by Vicki Golding. This piece was commissioned by Alluvium and has told our story of water across Country, from catchment to coast, with people from all cultures learning, understanding, sharing stories, walking to and talking at the meeting places as one nation.

This report has been prepared by Alluvium Consulting Australia Pty Ltd and Wilde Engineering Consulting for Urbis.

Authors:	Josh Wilde (Wilde – Engineering Consulting), Chris Barnes
Review:	Chris Barnes
Approved:	Chris Barnes
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Cover image:	abstract river image, Shutterstock

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Abbreviations

Alluvium	Alluvium Consulting Australia Pty Ltd
AEP	Annual Exceedance Probability
DEM	Digital Elevation Model
LiDAR	Light Detection and Ranging

1 Introduction

Alluvium has been commissioned by Biosis to provide an assessment of flood risk and a flood impact assessment for the proposed Meadow Creek Solar Farm in northern Victoria. The development will comprise a number of Photovoltaic (PV) arrays and associated infrastructure located approximately 2.5km east of Docker, Victoria.

This study aims to assess the risk of flooding on site under existing conditions and assess the impacts of the proposed development through hydrologic and hydraulic modelling. The hydrologic modelling was undertaken using the RORB software package and the hydraulic modelling was undertaken using the flood modelling software TUFLOW. Alluvium engaged Wilde – Engineering Consulting to undertake the hydraulic modelling and analysis component of this project. The hydrologic and hydraulic modelling and analysis presented in this report has been based on the requirements of Australian Rainfall and Runoff (ARR) 2019.

1.1 Scope of Works

The Scope of Works for this study are as follows:

- Engage a surveyor to undertake LiDAR survey of the study area
- assess the flood risk in baseline and post-development conditions at the site for the 10%, 2%, 1% 1% AEP + Climate Change and 0.05% Annual Exceedance Probability (AEP) storm events. The flood modelling and impact assessment provided in this report addresses the flooding components of the requirements summarised above.

1.2 Site Location and Details

The site is situated between Docker Carboor Rd to the north, the property boundary for title 1\TP399427 to the south, Allans Ln to the east and Oxley Meadow Creek Rd to the west. A locality map of the site is presented in Figure 1 below.

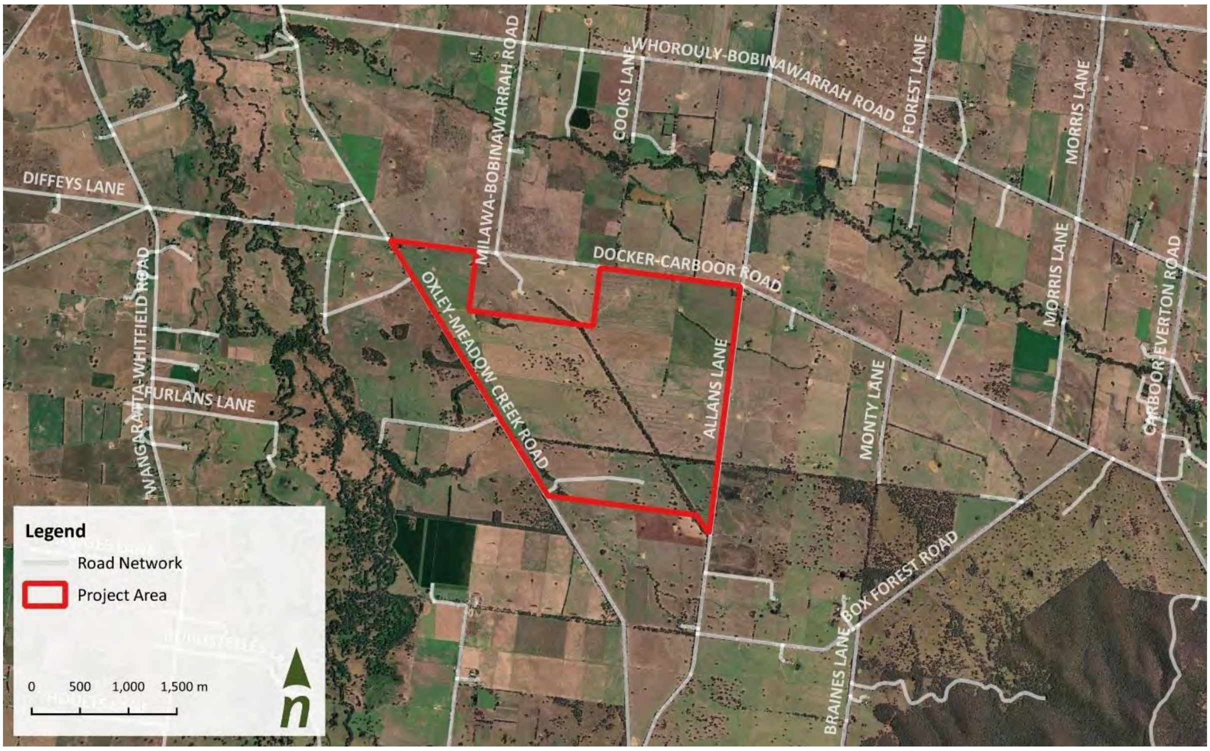

Figure 1. *Locality plan*

The proposed development is configured to sit atop land historically used for agriculture. The PV array area cover a majority of the overall site extent. The development also includes an access road network, BESS area and connection to a proposed transmission line. The proposed project site overview is shown in Figure 2.

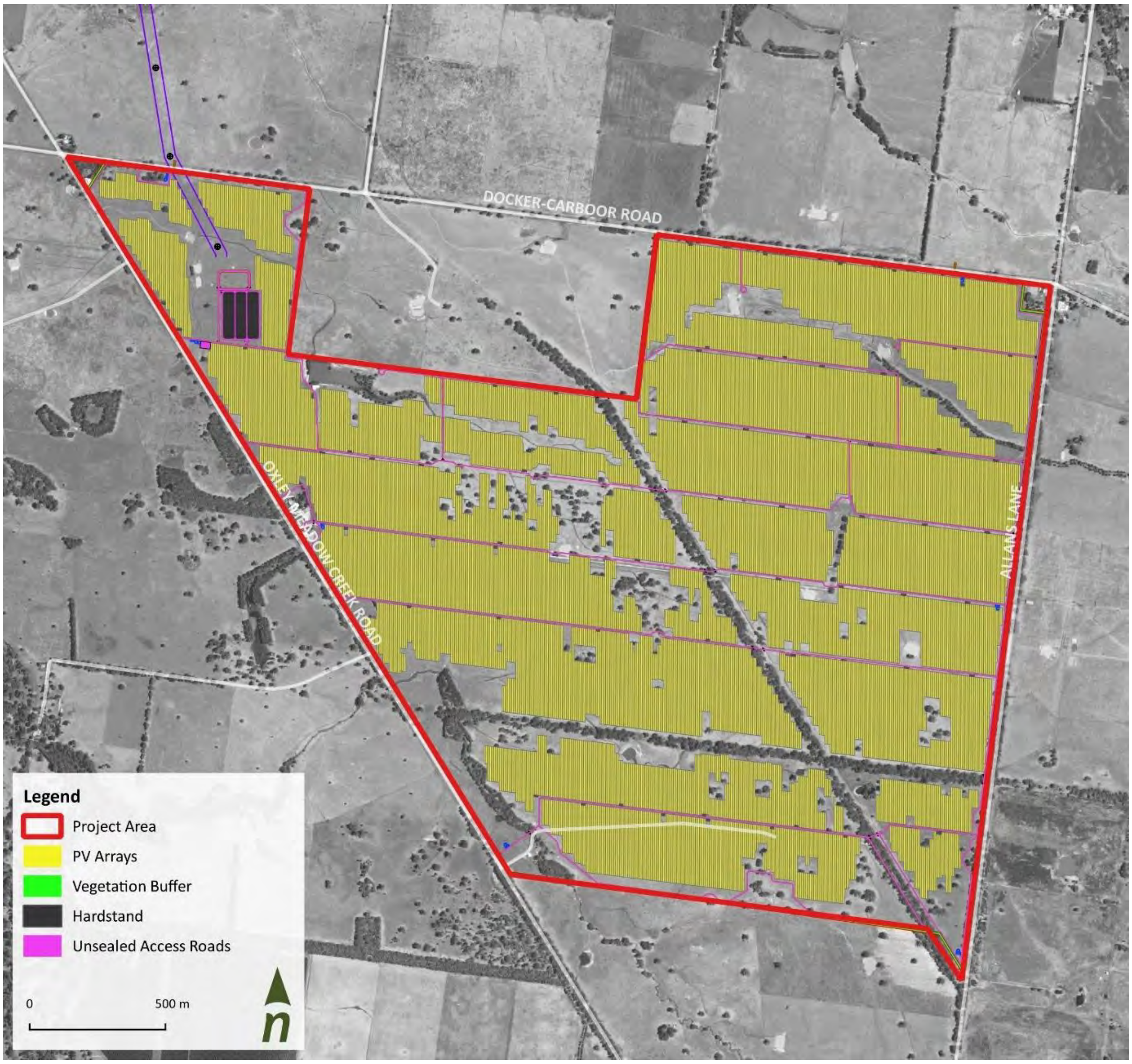

Figure 2. *Meadow Creek project site overview*

The catchment of the site is 32km^2 which is comprised of approximately 22km^2 of grazing farmland and 10km^2 of forested slopes to the west. The catchment drains via several small natural channels that divide the study area which flow in a general north westerly direction, where they converge with Hurdle Creek to the north of Docker. Refer to Figure 6 for the catchment plan.

2 Background Information

2.1 Modelling Rationale

A short literature review was conducted to assess industry trends in terms of modelling the surface water impact of PV arrays. A summary of relevant literature is given below:

Cook and McCuen, 2013. Journal of Hydrologic Engineering, ASCE. Hydrologic Response of Solar Farms.

- The solar panels themselves do not have a significant effect on catchment runoff.
- If the runoff characteristics of the final ground cover under the panels is increased (increased impervious hard-stand area or decreased roughness) then runoff may increase.

Water Solutions, 2017. Lower Wonga Solar Q1 Renewable Energy Generation Facility Flood study.

- There are no expected changes to the runoff volumes, peaks, or times to peak for flood events in the catchment due to all the additional surface area of solar panels provided the surface coverage is maintained.
- Considered that a healthy cover of vegetation will ensure similar levels of infiltration as currently experienced at the study area.

It may be concluded that so long as there is reinstatement of pervious groundcover in the study area, similar to pre-developed conditions, additional runoff from the study area is unlikely to occur. Small increases in imperviousness are unlikely to increase peaks due to hydrograph timing effects. Therefore, the modelled existing conditions are likely to reflect the impact of the solar panels on the downstream runoff. As such no change in the modelled imperviousness within the extent of the PV arrays was made in the developed model scenario.

3 Connectivity to Regional Transmission Network

The Meadow Creek project also includes the construction of transmission infrastructure to provide connectivity to the regional transmission line network. North of the main site and north of Hurdle Creek, this project will construct a Docker Terminal substation south of Whorouly-Bobinawarrah Road.

Because this infrastructure is situated in a separate catchment area, and is primarily subject to flooding from Hurdle Creek it has been assess separately from the remainder of the project and separate from the modelling described in the following sections.

This infrastructure has been assessed using the Victorian State Government's planning overlays. Specifically, the Land Subject to Inundation Overlay (LSIO) and Floodway Overlay (FO). These two overlays highlight the following:

- FO: The floodway overlay highlights areas in the floodplain which are important for the conveyance of flood flows. Development which significantly impacts areas within this overlay are likely to re-distribute flows and create changes in flood level and extent and create potential flood impacts to adjacent landholders.
- LSIO: The LSIO overlay highlights areas in the floodplain which are within the floodplain but characterised as flood storage areas which are less critical for flood conveyance. Infrastructure located in these areas should aim to minimise changes in the landform to ensure food storage is not impacted. Development in this area is less likely to impact peak flood levels and extent unless the changes to the landform are significant.

Within the current proposed design, two transmission towers sit within the LSIO or FO extents as shown in Figure 3 and Figure 4. The tower on the southern side of the Hurdle Creek floodplain is located in the LSIO overlay. The transmission tower is not expected to take up a significant volume of flood storage in this area (assuming tower foundations being at-grade) and the impacts of the tower placement in this location are expected to be negligible. The tower located on the north side of Hurdle Creek is located at the edge of the FO.

While this tower is located in the more critical Floodway extent, its placement is very close to the edge of the overlay which suggests that it is located in the flood fringe where depths are typically low. On this basis, this tower is also considered unlikely to create significant changes in flood level or extent if the tower foundations are designed to be at grade.

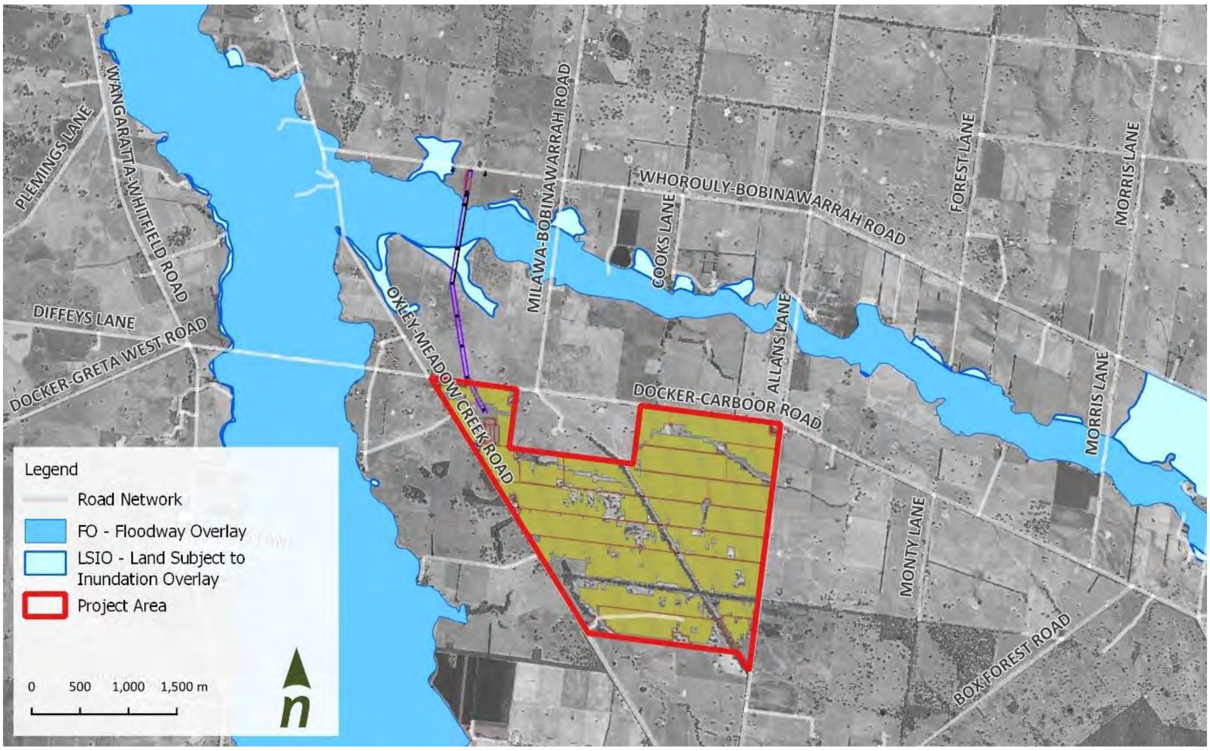

Figure 3. Extent of Development with LSIO and FO planning layers

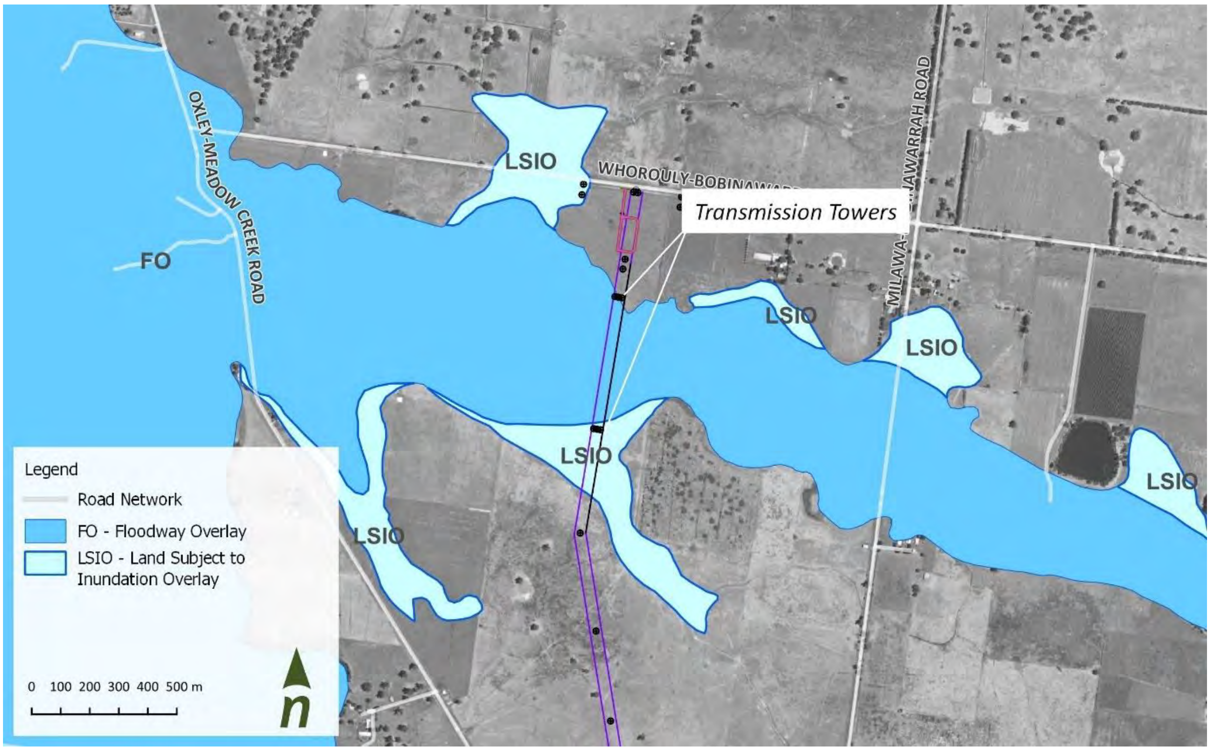

Figure 4. Proposed transmission line infrastructure with LSIO and FO planning layers

4 Modelling Approach

The adopted modelling approach involved undertaking hydrologic modelling using the RORB software package and using the resultant hydrographs as inputs into a 1/2-dimensional hydraulic model developed using the TUFLOW software package. The extents of the TUFLOW model allow a buffer between the boundary conditions and the study area, as shown in Figure 5.

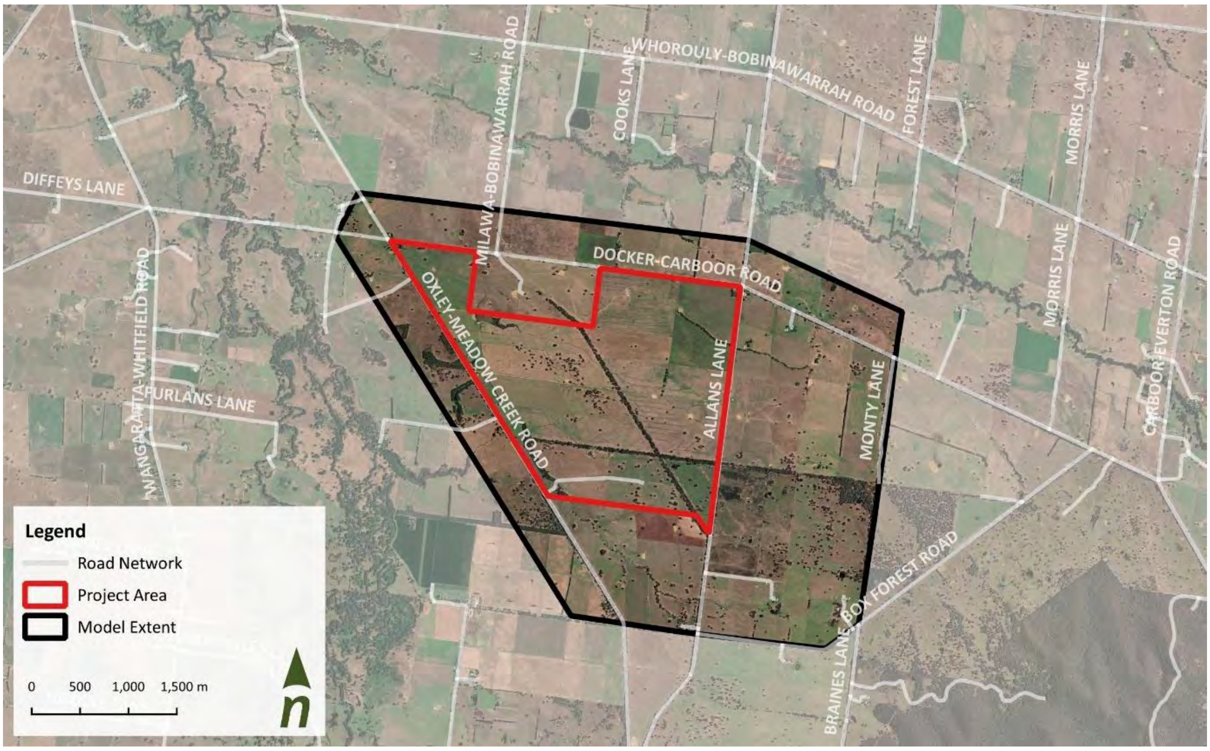

Figure 5. TUFLOW Model Extent

In additional to the inflow hydrographs developed using RORB, the TUFLOW model has adopted a rain on grid approach to apply rainfall within the extent of the model. A rain on grid model applies a rainfall hyetograph directly to the model grid which accounts for losses and undertakes routing of the flows. This is well suited to a flat site such as this one where flow is not heavily channelised and overland flow patterns dominate the site.

No calibration has been undertaken for either model due to a lack of historical flow and level data which would be required to undertake a model calibration or validation exercise. RORB flows have instead been verified using the Regional Flood Frequency Estimation (RFFE) model developed with ARR2019.

A baseline model scenario was developed which adopts current catchment land use and topographic conditions.

A developed scenario model was then configured, adopting the proposed development envelopes provided by Urbis, which outlines the extent of PV arrays, access roads, culverts and site infrastructure to enable a comparison with the existing results. PV arrays, roads and other site infrastructure were modelled by adjusting the hydraulic roughness (Manning's n) appropriately.

5 Hydrologic Model Development

This section summarises the development of the RORB model used for the hydrologic modelling component of this study.

5.1 Input Data

The outlines the data sources and inputs used in the hydrologic analysis for the project.

Topographic Data

For the development of the RORB model, data was sourced from Elevation and Depth – Foundation Spatial Data (ELVIS) web portal (Intergovernmental Committee on Surveying and Mapping (ICSM)). Vicmap DEM tiled data with a 10m grid resolution was downloaded for the 32 km^2 catchment. The DEM tiles were created by Vicmap™ and are based on Light Detection and Ranging (LiDAR) data and other sources.

Rainfall Intensity-Frequency-Duration Data

Intensity-Frequency-Duration (IFD) data issued in 2016 (most recent) rainfall was downloaded from the Bureau of Meteorology (BOM). The analysis was undertaken for the rainfall intensities for the following Annual Exceedance Probabilities (AEPs):

- 10% AEP
- 2% AEP
- 1% AEP
- 1% AEP + climate change
- 0.2% AEP
- 0.05% AEP – 1 in 2000 AEP

Storm durations ranging from 30 min to 18 hours was extracted from the BOM and used in this study.

Temporal Patterns

In accordance with ARR 2019, an ensemble method has been used for temporal patterns whereby 10 different patterns are run for each storm duration and AEP combination. Temporal patterns for this region were sourced from the ARR DataHub. Point temporal patterns have been adopted due to the size of the total catchment encompassing the project site.

Areal Reduction Factors

Given the nature of storm cells, larger catchments are less likely than smaller catchments to experience high intensity rainfall simultaneously over the whole of the catchment area. To account for this ARR 2019 prescribes the use of Areal Reduction Factors (ARFs) for catchments greater than 1 km^2. ARFs are a correction factor that reduce the average depth of rainfall across the whole catchment, they do not account for variability in the spatial patterns of its occurrence over the catchment. As the catchment is roughly 32km^2 the use of ARFs has been adopted. ARFs were calculated for use in this study by specifying the total catchment area in the development of design storms in RORB and in the development of rainfall hyetographs for TUFLOW.

5.2 Catchment Delineation

Using the 10-metre resolution DEM referenced above, the RORB model was configured into a total of 6 sub-catchment areas, to establish headwaters flowing to the site.

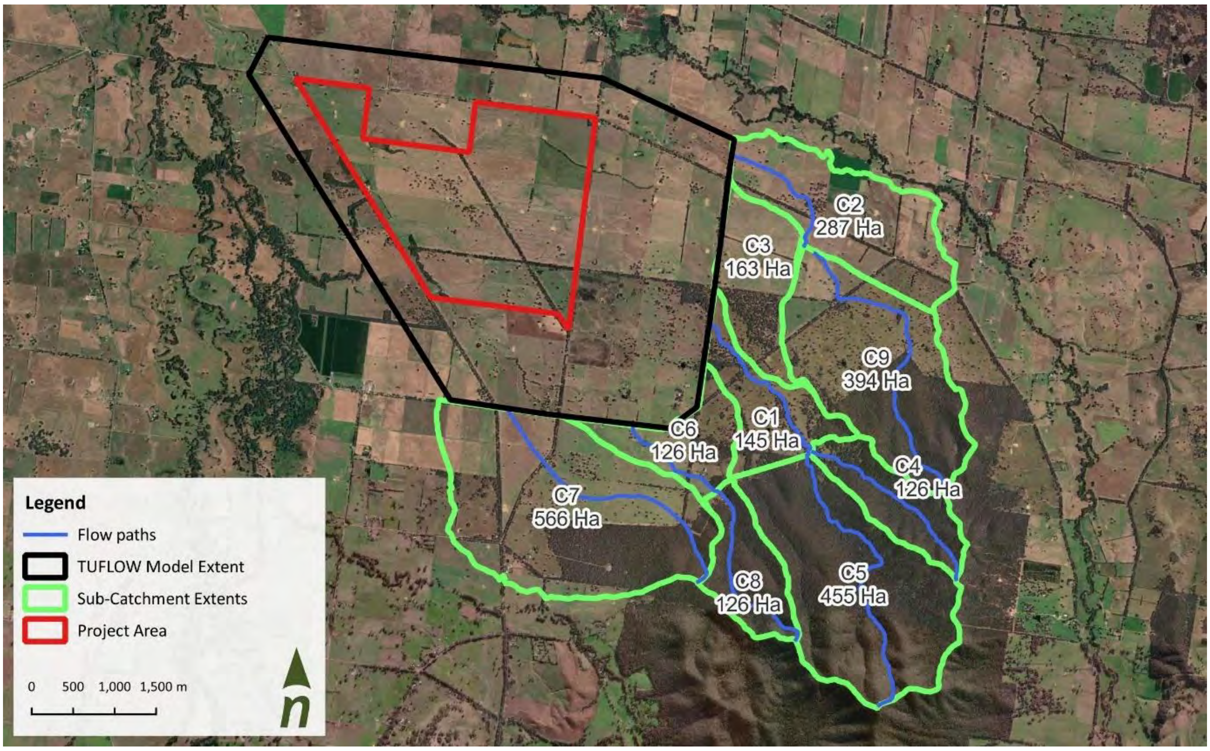

Figure 6. RORB sub-catchment delineation

5.3 Storm Losses & RORB Parameters

The losses recommended by the ARR Data Hub (non-NSW specific) are IL= 28 mm CL= 4.2 mm/hr, which have been adopted for hydrologic and hydraulic modelling purposes. Following flow verification against regional estimates developed using the RFFE, the loss values were adjusted to increase peak flows and provide a better match to the regional estimate. This is considered conservative as the reduction in losses will increase the amount of runoff generated. The values were lowered by ~10% and 30% respectively to IL= 25 mm CL= 3 mm/hr. Using these losses, peak flows were still marginally lower than those estimated using RFFE, but are well within the limits of confidence and adopt credible loss values.

Table 1 shows the adopted initial and continuing loss values as well as the Kc and m coefficients adopted in the RORB model.

Table 1. Adopted RORB model runoff and routing parameters

Parameter	Value	Note
Initial loss (mm)	25	Conservatively adjusted ARR Datahub value
Continuing Loss (mm/hr)	3	Conservatively adjusted ARR Datahub value
m	0.8	As per ARR Guidelines
k_c	3.51	As per ARR Guidelines for ungauged regional catchments

5.4 Critical Storm Establishment

The RORB model was run for a total of 660 event scenarios (6 AEPs, 11 durations, 10 temporal patterns). Hydrographs were recorded at the discharge location of each tributary. Results were extracted and the temporal pattern resulting in the median peak flow for each AEP / duration combination at the discharge location was selected. These medians were then compared and the critical storm duration for each AEP was established.

A summary of the critical duration event, selected temporal pattern and corresponding peak flow rate extracted from the RORB model are presented in Table 2. Also presented are the RFFE flowrates adopted from ARR Data hub and used for validation.

Table 2. Modelled Peak Flowrates (subcatchments combined)– Critical Storms

AEP (%)	Critical Duration	Median Temporal Pattern	Modelled Peak Flowrate (m^3/s)	RFFE Predicted Peak Flowrate (m^3/s)
10	9 hours	TP04	36.1	43.3
2	6 hours	TP02	70.1	78.4
1	6 hours	TP02	83.2	97.0
1 + climate change	6 hours	TP02	100.9	- ^
0.2	6 hours	TP02	125.1	- ^
0.05	6 hours	TP02	159.6	- ^

^ No RFFE flow prediction available for this event

5.5 Model Validation

As stated previously no calibration data in the form of historical flow or flood level data was available for this study to allow for detailed calibration of the RORB model. Therefore, validation was carried out using Regional Flood Frequency Estimation (RFFE), which is based on data from 853 gauged catchments in Australia. Full details of the technique are available in Book 3 of the ARR Guidelines (2019).

The peak modelled flow rates at the site for each critical storm were compared to the results of the RFFE. A summary of the model verification is presented below in Figure 7. It is noted that the RFFE does not allow for estimation of flood events greater than the 1% AEP.

The above table indicates that the hydrologic model achieves a satisfactory validation against the RFFE predicted flow rates. For the 1% AEP the estimated flood quantiles from the RFFE predict 97m^3/s, with a 5% confidence limit value of 40.4m^3/s. Hence, the modelled 1% AEP peak flow of 83.2 m^3/s is within acceptable confidence limits of the RFFE predicted flows. Given the inherent uncertainties involved in the application of regional statistical methods in model validation, it is considered that a satisfactory validation has been achieved and the hydrologic model is giving a reliable representation of flows in the study area.

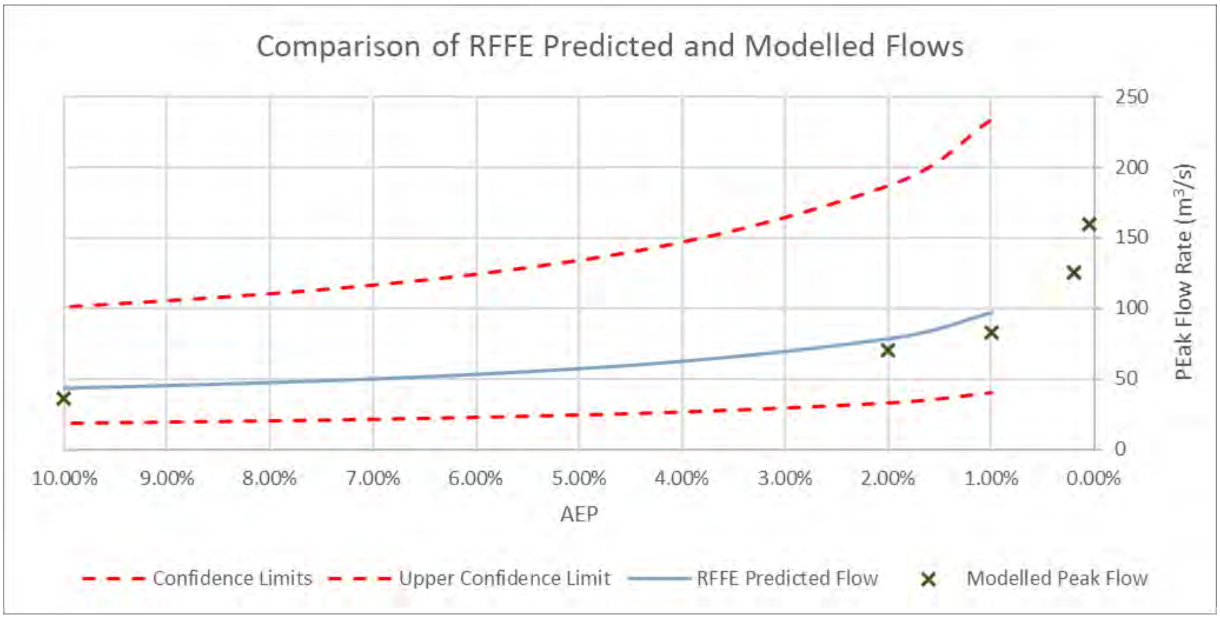

Figure 7. RFFE Flow Verification Results

5.6 Climate Change Scenario

Climate change has been considered for the 1% AEP event. Interim Climate Change guidance is provided through the ARR Datahub when downloading catchment specific parameters as described in Section 5.1.

Using a temporal horizon of 2090 and a Representative Concentration Pathway (RCP) of 8.5, rainfall depths are projected to increase by 20.02% in this catchment. RCP 8.5 is considered to be a conservative climate change scenario.

The simplified approach adopted has multiplied the 1% AEP rainfall and RORB inflows by 1.202 to represent the increases in rainfall. This approach is considered conservative but considered appropriate at early stages of design. It is understood that updated climate change guidance will be provided in ARR in the second half of 2024. This data should be reviewed for consistency at subsequent stages of design.

6 Hydraulic Model Development

Hydraulic modelling of the study area was undertaken using the TUFLOW hydraulic modelling package (version 2023-03-AD) utilising the GPU-based HPC solver method. This section summarises the development of the TUFLOW model used for the hydraulic modelling component of this study.

6.1 Input Data

This section outlines the data sources and inputs used in the hydrologic and hydraulic analysis of the site.

Topographic Data

The resolution of the LiDAR used for the mapping of catchments used in the hydrologic modelling was deemed insufficient for detailed hydraulic modelling of the site, and as such a higher resolution survey was sourced. As part of this project, Alluvium engaged AirBorn Insights Pty Ltd to undertake LiDAR survey of the site and based on this survey develop a Digital elevation Model (DEM) to be used in the TUFLOW modelling.

The LiDAR survey was captured in February 2023 and supplied to the project team at 0.5m resolution which is appropriate for use in this study. The LiDAR covers the full extent of the TUFLOW model.

Cell Size

The model adopts a 4m grid cell size and has used TUFLOW's Quadtree functionality to nest a finer 2m grid within the wider 4m domain. The finer grid has been applied to the larger flow paths across the site which characterise the flow within the model extent.

Hydraulic Roughness

In the study catchment the land uses were delineated based on the aerial imagery. Depth varying Manning's 'n' coefficients (i.e. Manning's coefficients reducing with increased flood depth) were then applied to the land uses based on typically adopted values as shown in Table 3 and the distribution of land use categories is provided in Figure 8.

To represent fully developed conditions, the extent of development shown has been added to the land use distribution using the categories and values from Table 3 and shown on Figure 9.

The BESS area on the site has been conservatively assumed to be a hardstand area with a runoff coefficient of 1. Based on discussions with the project team it is understood that site access roads will be unsealed and will maintain some permeability post construction. Overall, there is little overall impact on imperviousness across the site due to the installation of the solar farm works.

Table 3. Manning's 'n' coefficients for 2D model domain

Land use	Coefficient below 50mm depth	Coefficient below 30mm depth	Coefficient above 100mm depth	Note
Dense vegetation	0.100	-	0.065	Linear interpolation between depths
Medium vegetation	0.100	-	0.060	
Farmland	-	0.100	0.050	
Residential & Farm buildings	-	0.100	0.050	
Grazing/Grass	-	0.100	0.040	
Development – PV arrays	-	0.100	0.045	
Unsealed Road	-	0.035		Single value used
Sealed road network/Hardstand	-	0.025		Single value used
Drains & Riparian Areas	-	0.035		Single value used

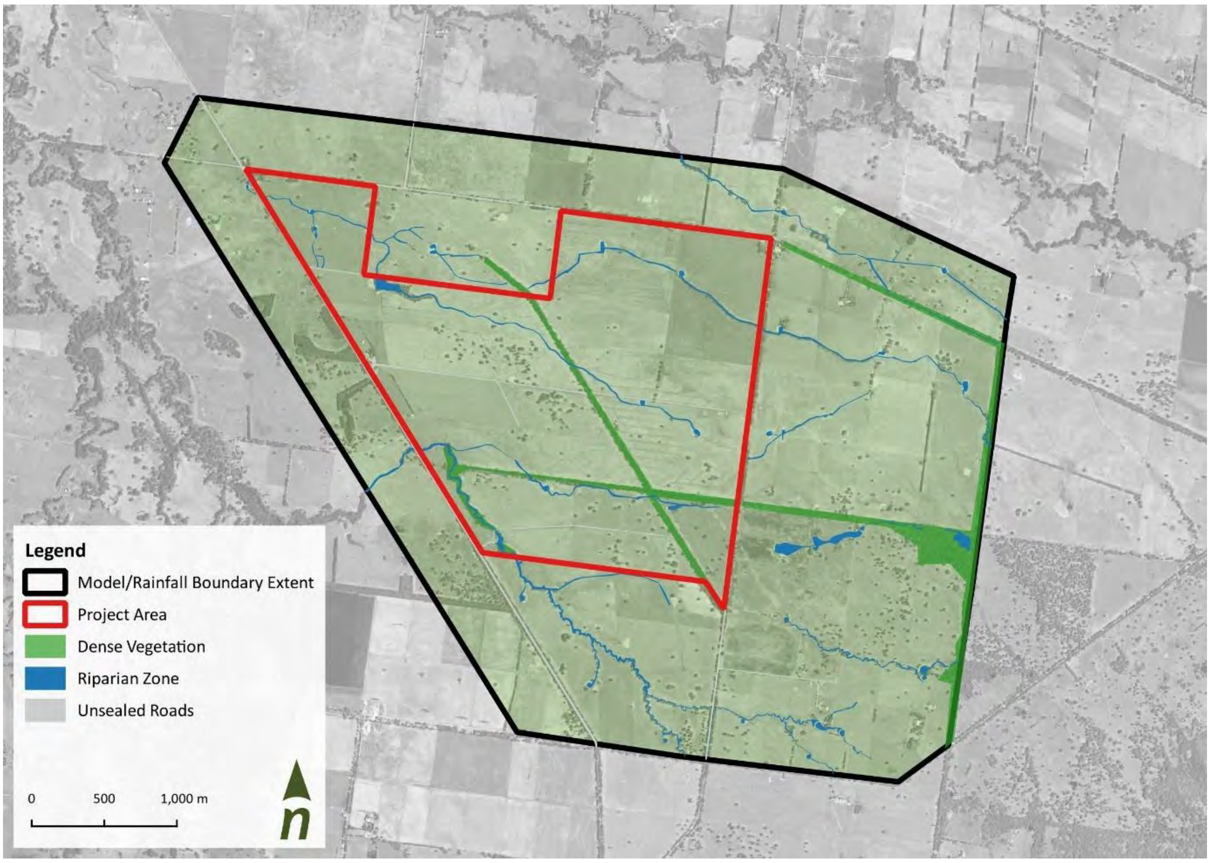

Figure 8. Distribution of land uses for Manning's 'n' hydraulic roughness – Baseline conditions

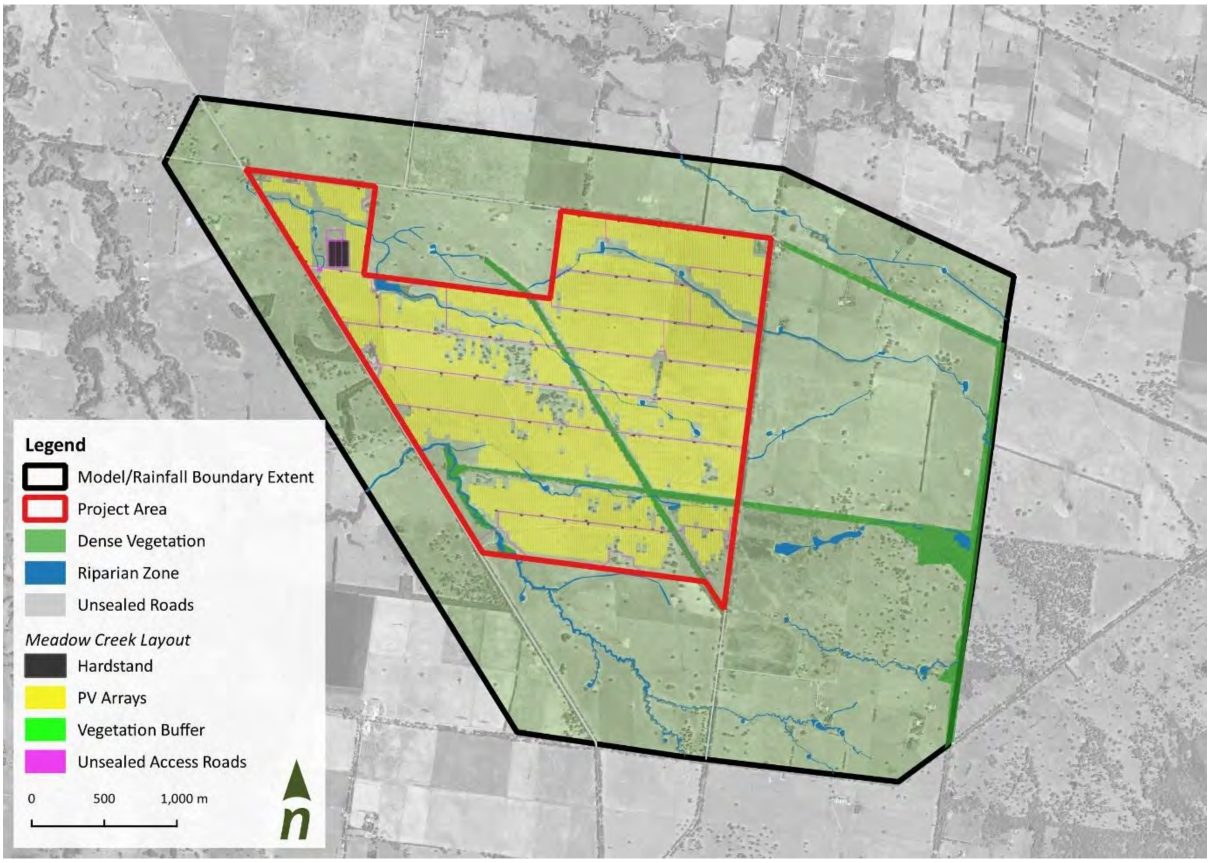

Figure 9. Distribution of land uses for Manning's 'n' hydraulic roughness – Design conditions

Limitations

Culverts which have been included in the model extent have been estimated based on aerial imagery and the LiDAR data captured for the project. While estimates, they are considered appropriate for this level of analysis and measurements of relative impact of the land use changes modelled at this stage of the project.

6.2 Model Configuration

This section briefly discusses the configuration of the separate components of the TUFLOW model.

Upstream Boundary Conditions

The 2D model boundary extent was set fully contain the extent of the proposed development and maximise available LiDAR. Hydrographs derived from the RORB model (Table 2) were used as inflow boundary conditions and applied directly to the corresponding flow path in the TUFLOW hydraulic model. The inflow hydrographs were applied more than 1km from the site boundary so as not to influence the hydraulics at the site.

Over the model extent a rain on grid boundary has been applied using a 2d_rf feature in TUFLOW. This applies the rainfall hyetograph to active model grid cells within the boundary.

Downstream Boundary Conditions

A stage-discharge boundary has been applied at the downstream and outer edges of the model extent. The relationship was developed using a 1% slope. As per the inflow hydrographs the downstream boundary condition was offset 400m from the site extents to reduce model sensitivity to this element.

Figure 10 illustrates the TUFLOW model extents in relation to the overall catchment.

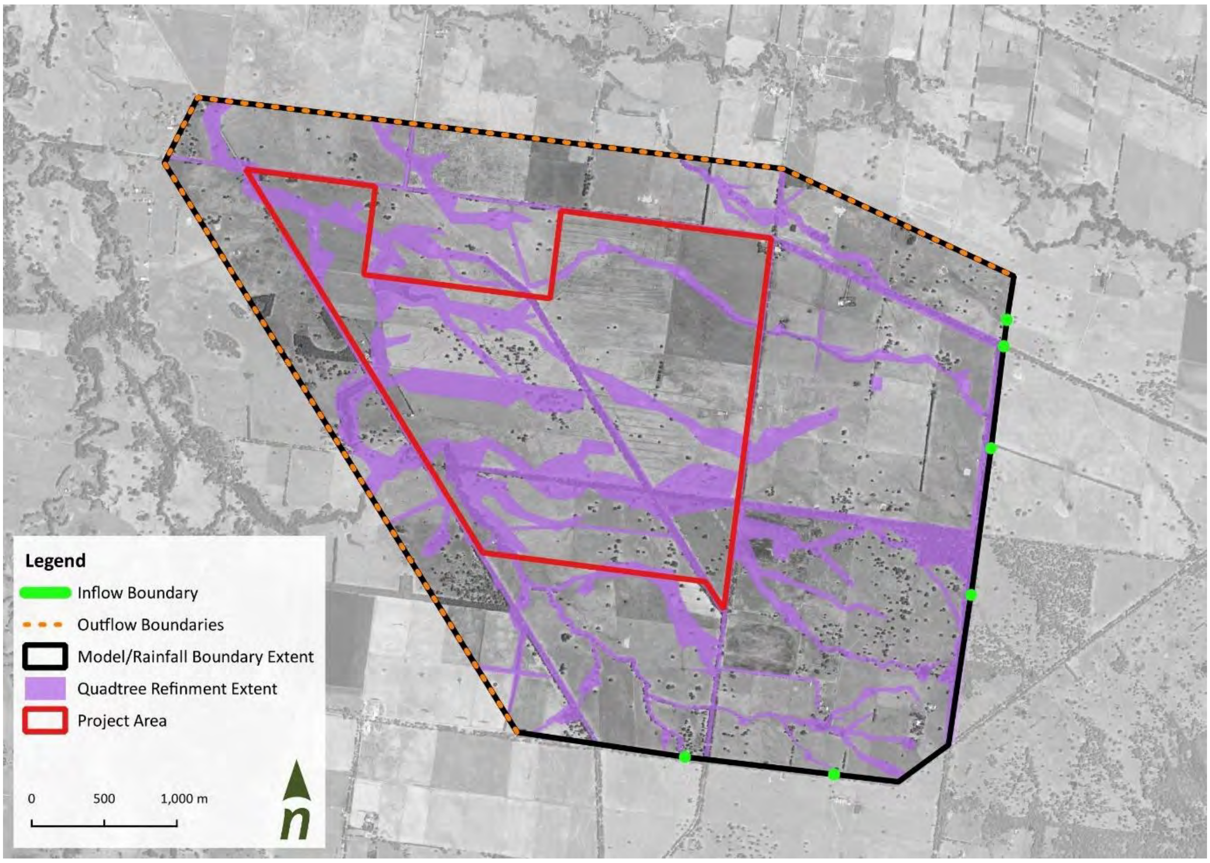

Figure 10. *TUFLOW Model Setup*

7 Flood Impact Assessment

Generally, there are two potential mechanisms by which development within the study area could have an impact on flood risk.

- Impacts on flood levels due to the proposed development obstructing flows, OR
- Impacts on flood levels due to the study area yielding additional runoff due to development.

As discussed in Section 2, the PV panels on the site are not anticipated to increase catchment imperviousness. Therefore, the only increases in impermeable area due to the development are from the construction of site infrastructure such as the BESS area or other hardstand areas.

As such, a developed case scenario was configured in the 2D model with adjusted rainfall losses within the project footprint (the area that will be disturbed) for the site infrastructure as outlined in drawing #202-FI Rev C, 'DETAIL PLAN-02' provided by Urbis on 27/5/24. As described in Section 6.1, the proposed access roads, vegetation buffers and site infrastructure have had their land use updated to reflect their respective changes.

7.1 Existing Conditions (Baseline)

The nature of the catchment has resulted in relatively shallow flood depths across the site. The slope of the terrain and small upstream catchment area has resulted in small, localised flow paths dominating the conveyance across the site.

In the 1% AEP event, the greatest flood depths on the site are located along the south-western edge o the upstream side of Oxley- Meadow Creek where flood depths up to 2.5m are seen in the channel. In the floodplain depths are much lower with flood depths typically less than 500mm in the 1% AEP event. The results show little flooding due to ponding away from the local drainage paths which cross the site from east to west.

The Isolated areas of ponding which are present in the results are close to the centre of the site are subject to peak flood depths of less than 300mm in the 1% AEP event.

Upstream of the site, some attenuation is seen on northernmost crossing of the local flow path and Allans Lane where the road embankment restricts flow to the project area to the culverts under the road. The crossings further are similar in that they attenuate flood flows however at these locations they are sufficient to flood Allans Lane in the 1% flood event.

Flow velocities within the major flow paths are typically low, with values generally between 0.3-0.8 m/s in the 1% AEP event. The flow paths entering the site from the south exhibit slightly higher peak velocities with values up to 1.3 m/s. Outside of the main flow paths through the site, velocities in all modelled events are generally under 0.3 m/s and pose a minimal risk to assets or erosion.

Comparisons between the 1% AEP and 1% AEP + Climate change event have shown that peak flood depths are typically 50mm higher in the climate change scenario in the flow paths through the site. This difference rises to 100m where there is significant attenuation such as the area upstream of Oxley-Meadow Creek Road to the south-west of the project area. The increase in the velocity under climate change are small and range from 0.05-0.1 m/s and is not considered significant. Overall, there are no significant changes in flood extent and flow regimes across the site with the addition of the climate change allowance at this site.

Baseline flood depth and flood velocity mapping is included in Attachment A and Attachment B.

7.2 Developed Scenarios

Due to the small extent of development (at the ground level) the impacts of development to flood depth, velocities and levels is small. The proposed site infrastructure is located outside the primary flow paths and flood impacts are considered to be small in all modelled events.

Flood afflux maps have been prepared and are included in Attachment C. These maps show the changes in flood level is small with impacts within a 10-50 mm range throughout all modelled events. This result is anticipated with all changes in model results being due to the change in land use described in Section 6.1. As a result of the minimal changes in flood level, the changes in flood extent seen in the results is negligible.

Flood level increases are predominantly seen within the extent of PV arrays where the rain striking surface is now hydraulicly smoother. Adverse increases in level are largely contained to the site boundary. The southern side of the site shows some increases in level outside but adjacent to the site boundary of 10-20mm however these increases do not materially impact flood extent or flood frequency and do not impact any structures or assets.

Changes in flood level seen at this stage of the design will be able to be mitigated through the subsequent stages of the design process. Discussions with the design team have indicated that the site access roads are proposed to be unsealed and located at grade to minimise the potential for impacts outside site extent. As the design develops access roads across the site may be able to be raised to provide improved flood immunity for the access to Oxley-Meadow Creek Road and to attenuate flows leaving the site.

The development plan provided also includes a vegetation buffer surrounding the site. Based on the model results the inclusion of this buffer has not materially impacted peak flood levels or velocities in the modelled events.

While there have been increases in impermeable area, in context the impervious proportion in the catchment is still insignificant and the model results have shown negligible changes in flood level overall.

7.3 Culvert Placement

While not currently detailed in the design, crossings of the site access roads with the flow paths within the project area will either need to be designed as at-grade floodways or as raised crossings with culverts to provide road access during flood events. To enable the initial design of the culverts, the peak flow rates in the 10% AEP and 2% AEP flood events have been captured for the locations shown in Figure 11 in Table 4.

The most significant flows are found on the south-western edge (Location 7 and 8 in particular) of the project area where the flow path runs parallel to Oxley-Meadow Creek Road and then crosses under the road. In the first instance matching the size of the culverts under the existing road will provide sufficient conveyance maintain current outflow in the desired design event.

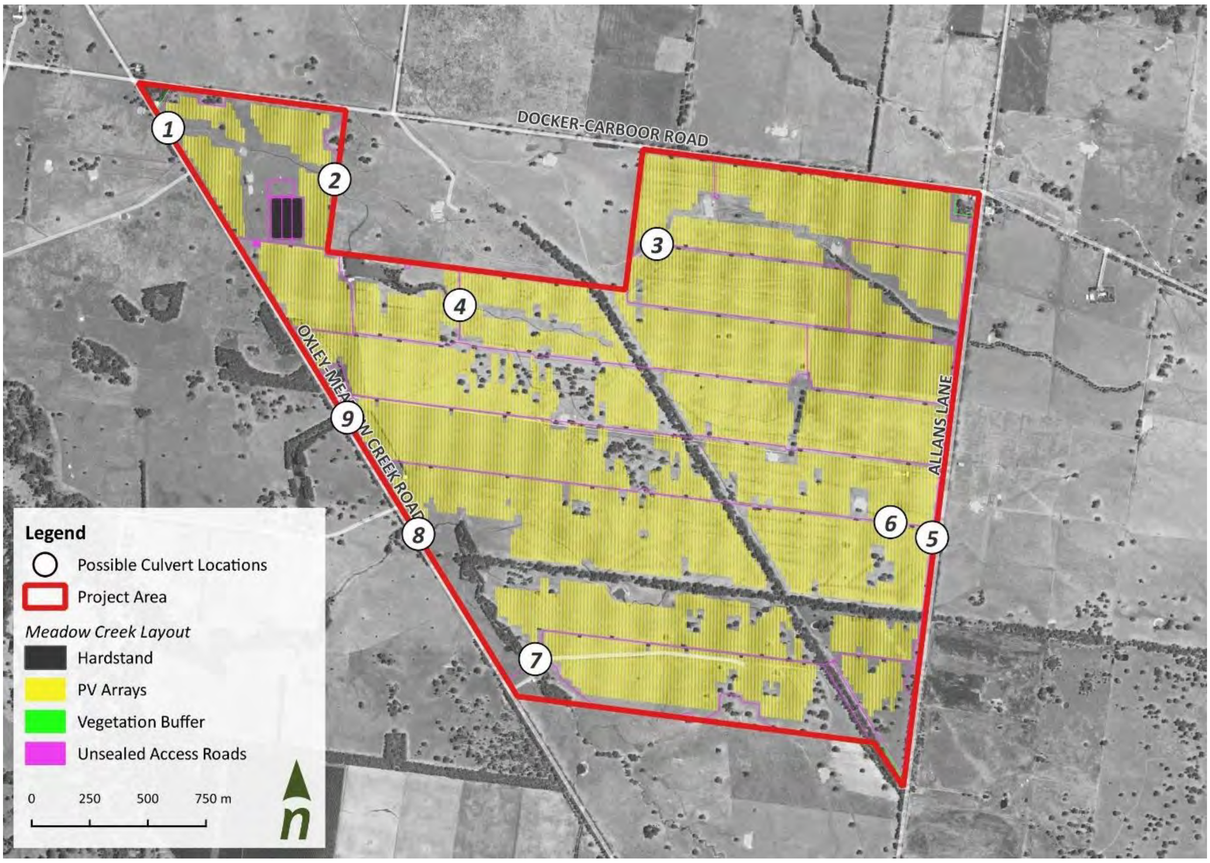

Figure 11. *Possible Culvert Locations*

Table 4. Peak flow rates at possible culvert locations – 10% and 2% AEP flood events.

Possible Culvert Location	10% AEP Peak Flow (m^3/s)	2% AEP Peak Flow (m^3/s)
1	1.6	4.9
2	1.6	3.5
3	1.4	3.2
4	1.4	4.3
5	2.3	9
6	2.3	9
7	8.2	24.5
8	11.3	26.3
9	1.1	1.8

7.4 Panel Placement

Based on the TUFLOW model results, the location of the PV arrays has been reviewed against higher risk areas in the 1% AEP event. In particular, the review focused on areas where:

- Flood depth exceed 0.5m (typical level of elevation under the panels); or
- Flood velocity exceeds 1 m/s.

The review found no panels located in areas of high velocity but found a number of locations where the panels were located in areas where flood depth was above 0.5m in the 1% AEP event (refer Figure 12). In these locations, the flood velocity is low and therefore the risk can be mitigated by elevating the panels sufficiently to ensure flooding can pass under the panels unimpeded.

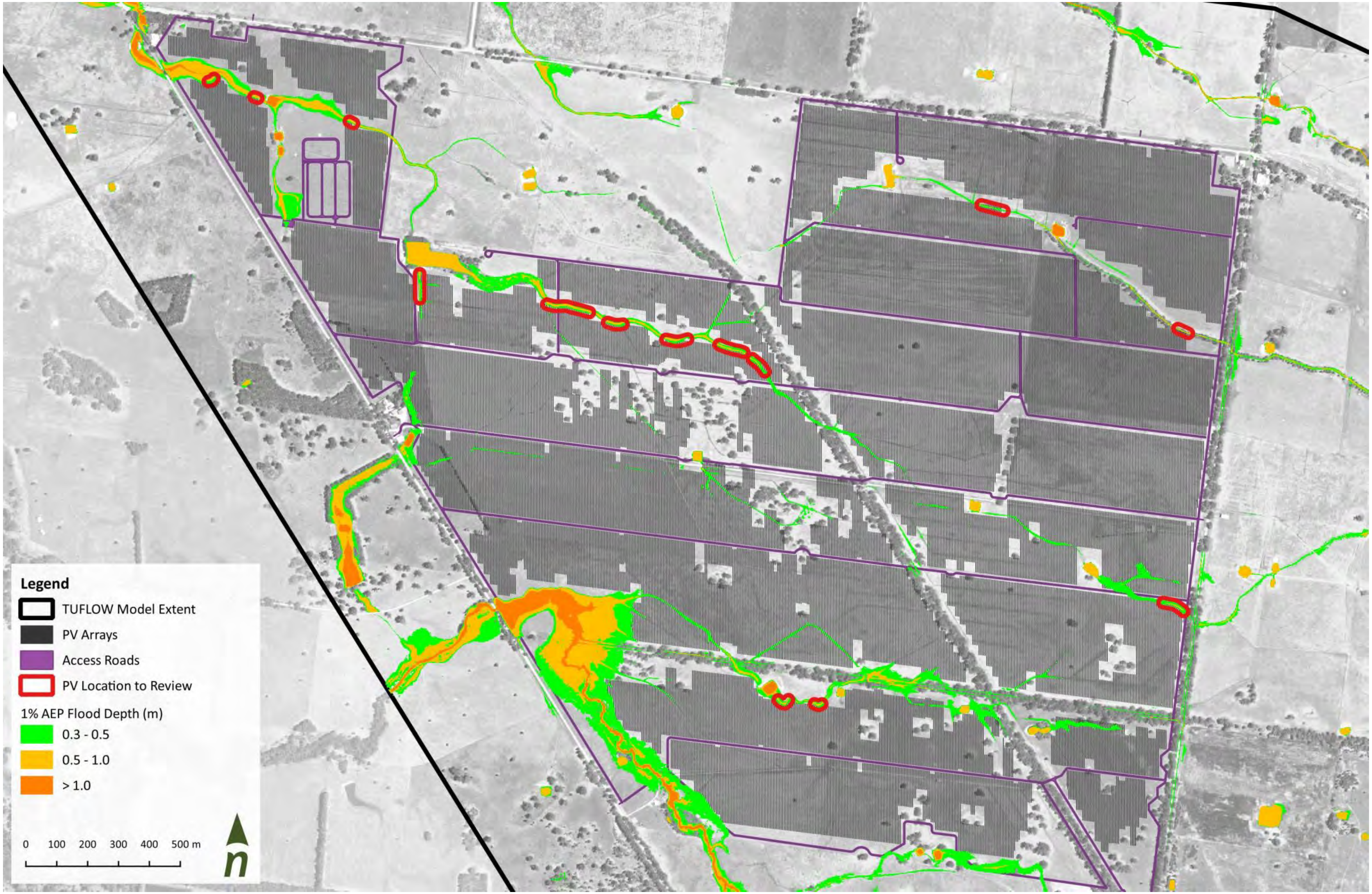

Figure 12. *Locations for PV placement review – 1% AEP event*

8 Conclusions & Recommendations

This investigation has been undertaken to provide a flood impact assessment in support of the construction of PV arrays, and other related infrastructures for the Meadow Creek Solar Farm.

Existing conditions flood modelling was undertaken for a range of AEP events including 5%, 1%, and 0.5% AEP for the entire study area to provide guidance on the planning of internal infrastructure and to assess any external impacts which may occur due to the site development.

Flood prone areas have been mapped and areas of higher flood risk identified. In the 1% AEP design event the flow is typically shallow and generally less than 0.03 m. The proposed permanent structures sit outside of the main flow paths and do not create significant flood impacts. The vegetation buffer and access road network run parallel to the western flow path and cause very small and localised increases in flood level within the site boundary in the 1% AEP design event.

Site facilities should be designed with consideration of the flood modelling results to ensure assets are set a minimum of 300mm from the 1% AEP flood level. Infrastructure placed in the mapped flow paths should consider the potential for localised increases in water level which may occur as a result of the redirection of flows which cannot be captured at this stage in the hydraulic modelling. More detailed hydraulic investigations of the finalised 3D infrastructure layout that would identify localised increases can be undertaken at detailed design if necessary. Where possible, site infrastructure should be located in areas showing slow and shallow moving waters. Consideration should also be given to the ongoing maintenance implications of situating access roads parallel to flow paths due to the increased risk of erosion which may impact site access.

It is understood that the PV modules are proposed to be installed with a minimum gap of 500mm under the lower edge. This is considered appropriate for the majority of the proposed panels. Some parts of the panel arrays have been highlighted where they sit within 1% AEP flood depths over 0.5m. In these areas localised raising of the panels will prevent any impacts to these assets and any material changes in water level.

Any fencing that crosses flow paths should be designed to reduce the likelihood of fence blockage due to lose vegetation in storm events. This may reduce the ongoing maintenance required.

The following actions are recommended to ensure site infrastructure is resilient to flooding in the 1% AEP event:

- Maintaining the natural state of the draining flow paths whenever possible. Where the proposed access roads cross these watercourses, we recommend at-grade compacted rock causeways at the majority of crossings to provide low maintenance access with limited impact on the waterway. Where access in flood events will be required, raised roads will be necessary and their flood impacts should be considered.

- Foundations for the photovoltaic arrays should be located away from areas that exceed flood depths of 0.5m and flow velocities greater than 1.0 m/s. Where this cannot be achieved, an increases maintenance frequency should be adopted to monitor possible erosion at the foundations.

- Fence alignments should be reviewed where possible to locate outside of significant flow paths, or designed to allow the passage of flow underneath to reduce the risk of blockage and potential damage and maintenance implications this brings.

- The lowest edge of the panel arrays shall maintain 300mm clearance to the 1% AEP flood level where possible. Maintaining this clearance will help mitigate any risk of flow redirection in large events as well and mitigate the risk of blockage with debris in the small openings under the panel arrays.

9 References

Ball J, Babister M, Nathan R, Weeks W, Weinmann E, Retallick M, Testoni I, (Editors), 2019, Australian Rainfall and Runoff: A Guide to Flood Estimation, Commonwealth of Australia

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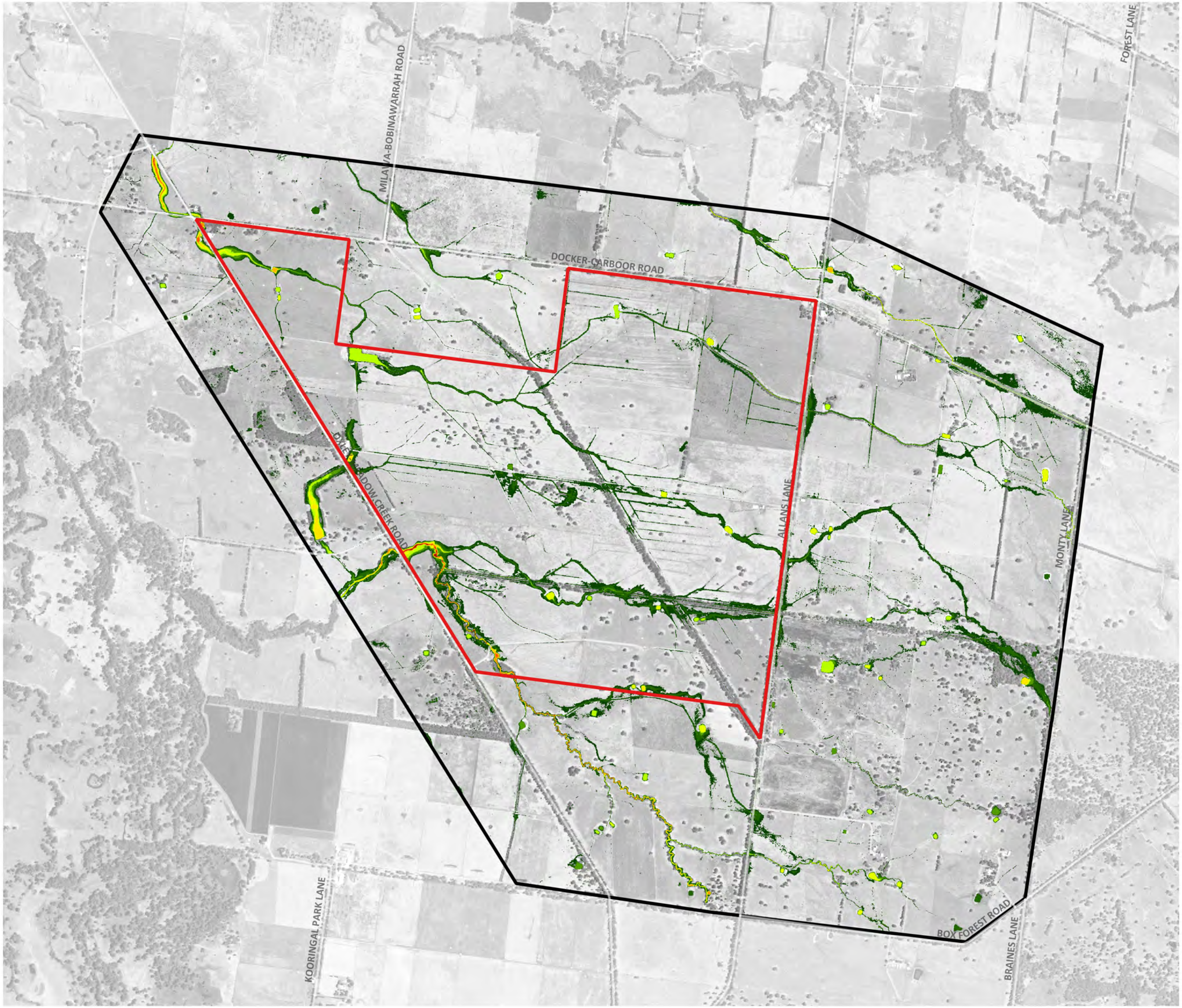
Urbis, 2024, DRAFT Site Layout Plans. Drawing 202-FI Rev C

Lyall & Associates, 2015. "Narrandera Flood Study Review and Levee Options Assessment". Prepared for Narrandera Shire Council. October 2015

Water Solutions, 2017, "Lower Wonga Solar Q1 Renewable Energy Generation Facility Flood Study", source: https://www.gympie.qld.gov.au/documents/40033667/0/Flood%20Study.pdf

Attachment A. Flood Depth Mapping



LEGEND

- Model Extent
- Site Boundary
- Road

Flood Depth (m)

- 0.1 - 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0
- 1.0 - 1.2
- 1.2 - 1.4
- 1.4 - 1.6
- 1.6 - 1.8
- 1.8 - 2.0
- > 2.0

0 0.5 1 km

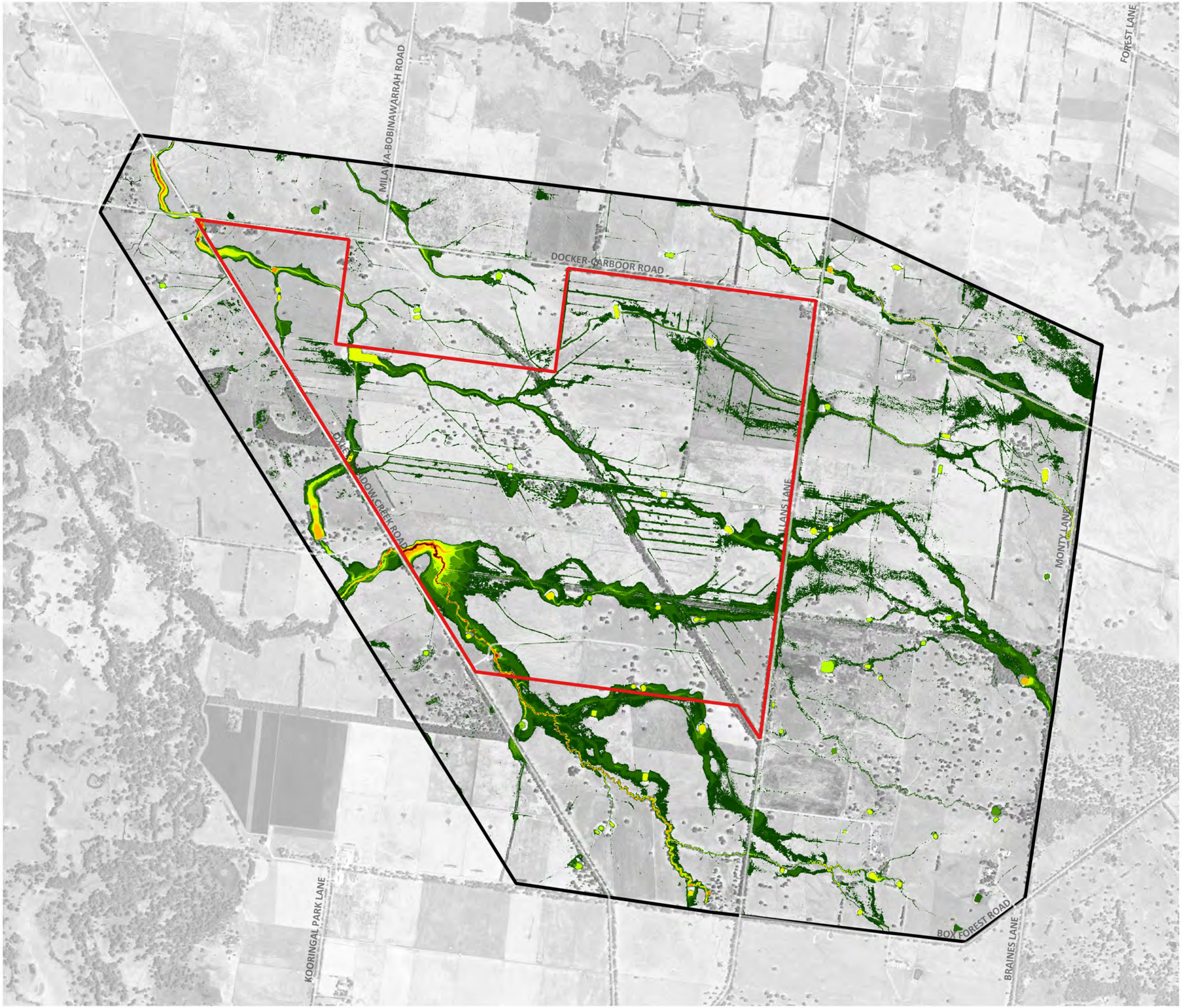
n

alluvium

MEADOW CREEK SOLAR FARM
BASELINE CONDITIONS
10% AEP FLOOD DEPTH

Coordinates: GDA2020 MGA Zone 55
Created: 14/6/2024
Scale: 1:20,000 at A3

Originator: DC
Checked: CB
Approved: CB



LEGEND

- Model Extent
- Site Boundary
- Road

Flood Depth (m)

- 0.1 - 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0
- 1.0 - 1.2
- 1.2 - 1.4
- 1.4 - 1.6
- 1.6 - 1.8
- 1.8 - 2.0
- > 2.0

0 0.5 1 km

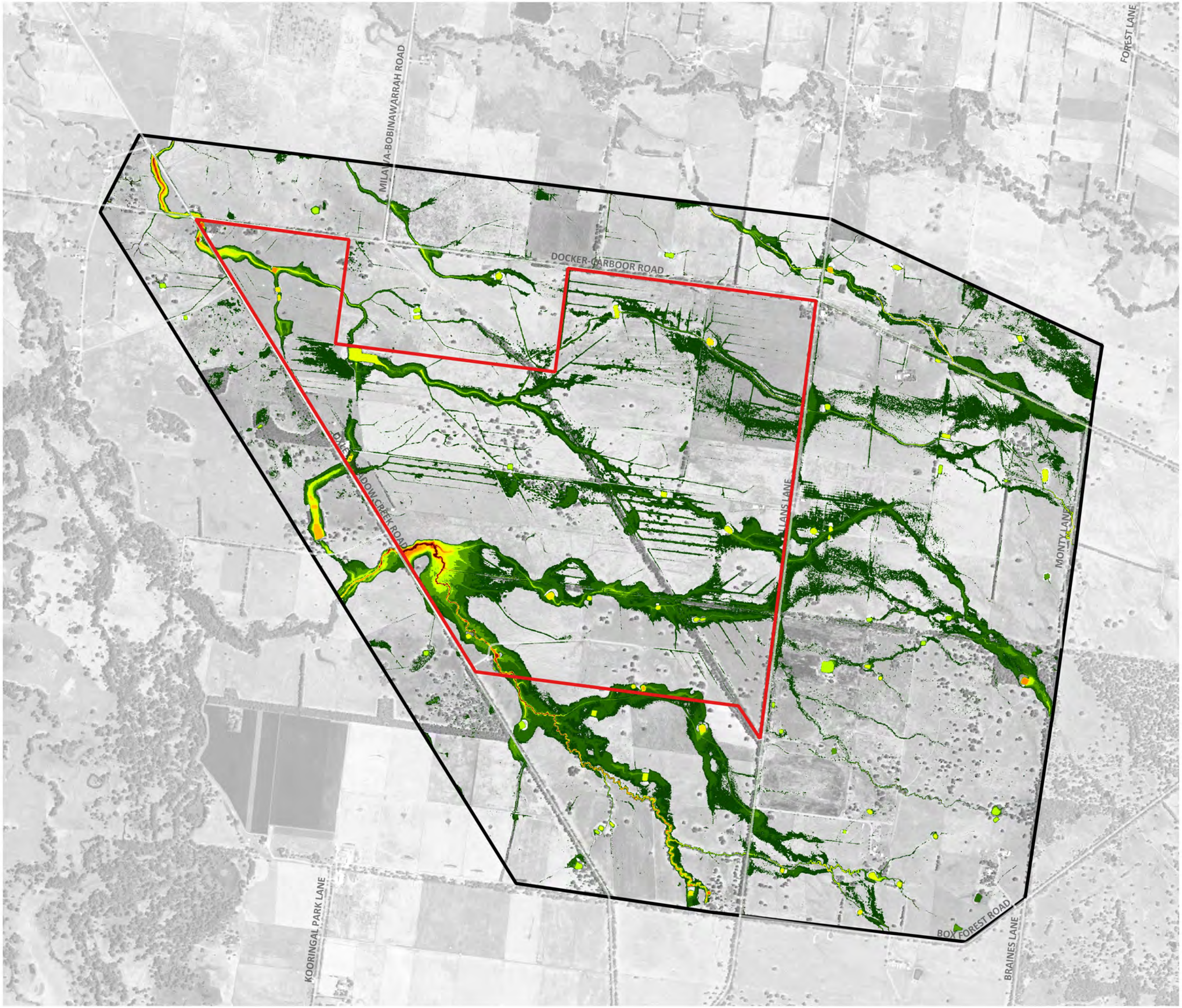
n

alluvium

MEADOW CREEK SOLAR FARM
BASELINE CONDITIONS
2% AEP FLOOD DEPTH

Coordinates: GDA2020 MGA Zone 55
Created: 14/6/2024
Scale: 1:20,000 at A3

Originator: DC
Checked: CB
Approved: CB



LEGEND

- Model Extent
- Site Boundary
- Road

Flood Depth (m)

- 0.1 - 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0
- 1.0 - 1.2
- 1.2 - 1.4
- 1.4 - 1.6
- 1.6 - 1.8
- 1.8 - 2.0
- > 2.0

0 0.5 1 km

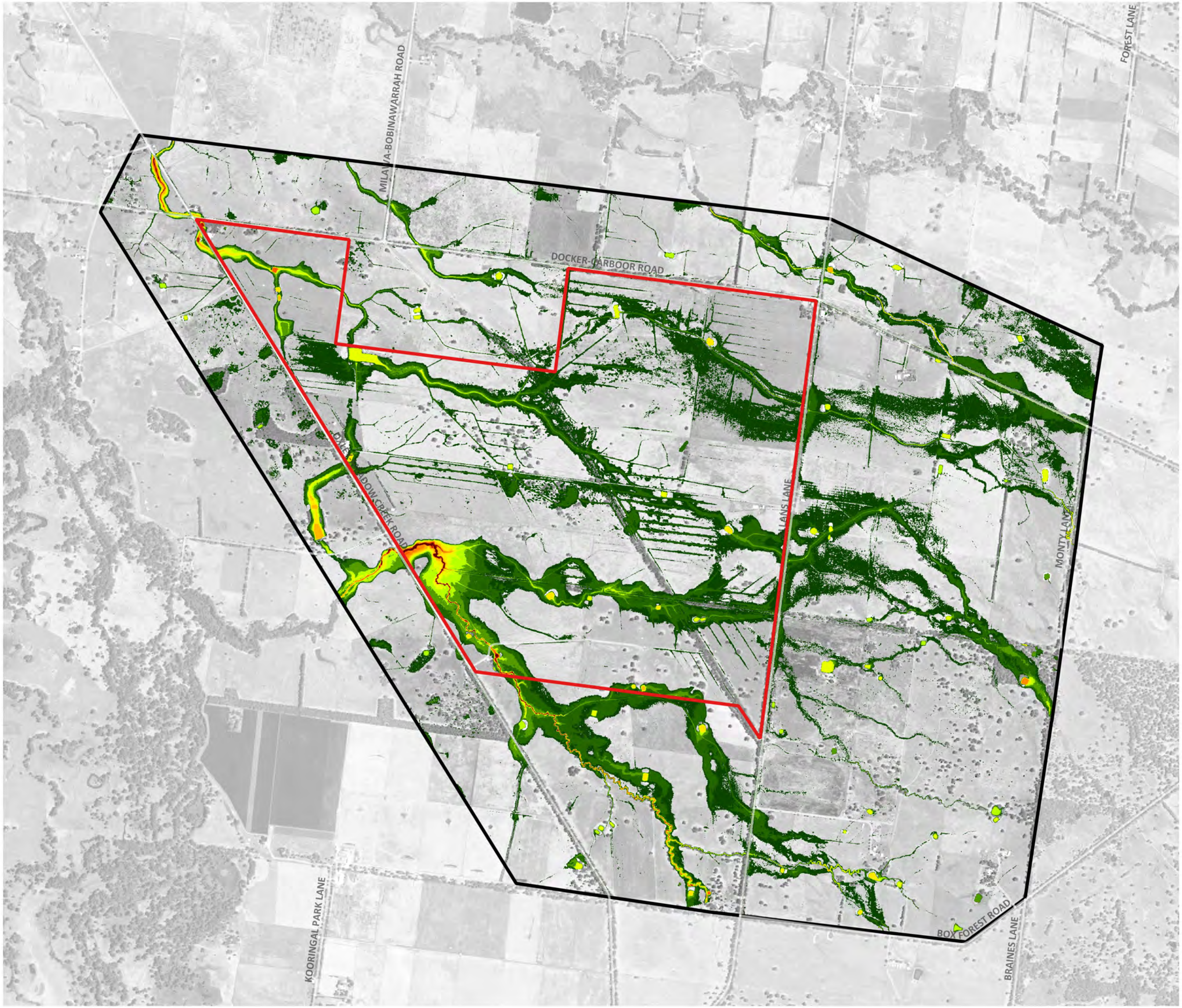
n

alluvium

MEADOW CREEK SOLAR FARM
BASELINE CONDITIONS
1% AEP FLOOD DEPTH

Coordinates: GDA2020 MGA Zone 55
Created: 14/6/2024
Scale: 1:20,000 at A3

Originator: DC
Checked: CB
Approved: CB



LEGEND

- Model Extent
- Site Boundary
- Road

Flood Depth (m)

- 0.1 - 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0
- 1.0 - 1.2
- 1.2 - 1.4
- 1.4 - 1.6
- 1.6 - 1.8
- 1.8 - 2.0
- > 2.0

0 0.5 1 km

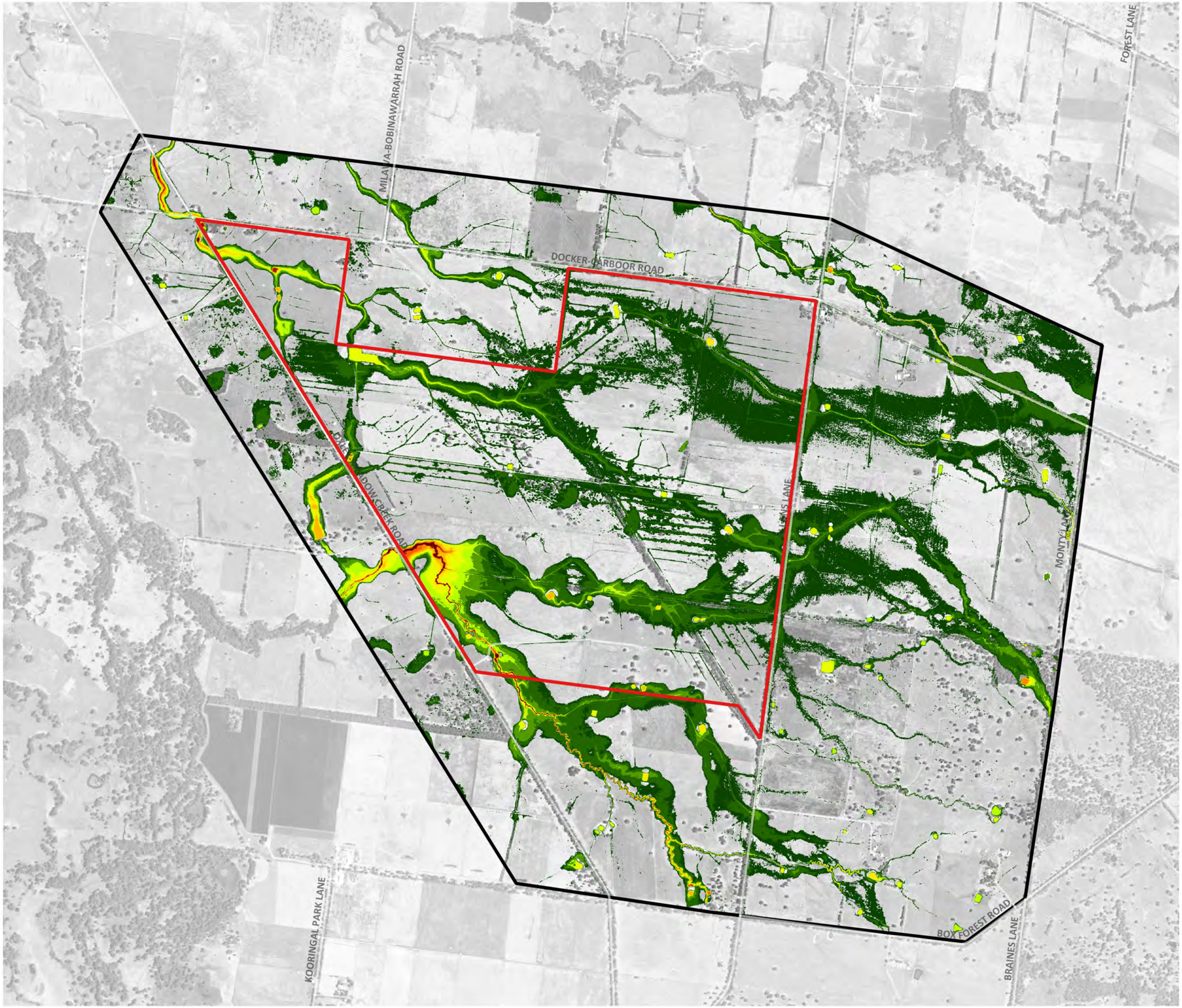
n

alluvium

MEADOW CREEK SOLAR FARM
BASELINE CONDITIONS
1% AEP + CC FLOOD DEPTH

Coordinates: GDA2020 MGA Zone 55
Created: 14/6/2024
Scale: 1:20,000 at A3

Originator: DC
Checked: CB
Approved: CB



LEGEND

- Model Extent
- Site Boundary
- Road

Flood Depth (m)

- 0.1 - 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0
- 1.0 - 1.2
- 1.2 - 1.4
- 1.4 - 1.6
- 1.6 - 1.8
- 1.8 - 2.0
- > 2.0

0 0.5 1 km

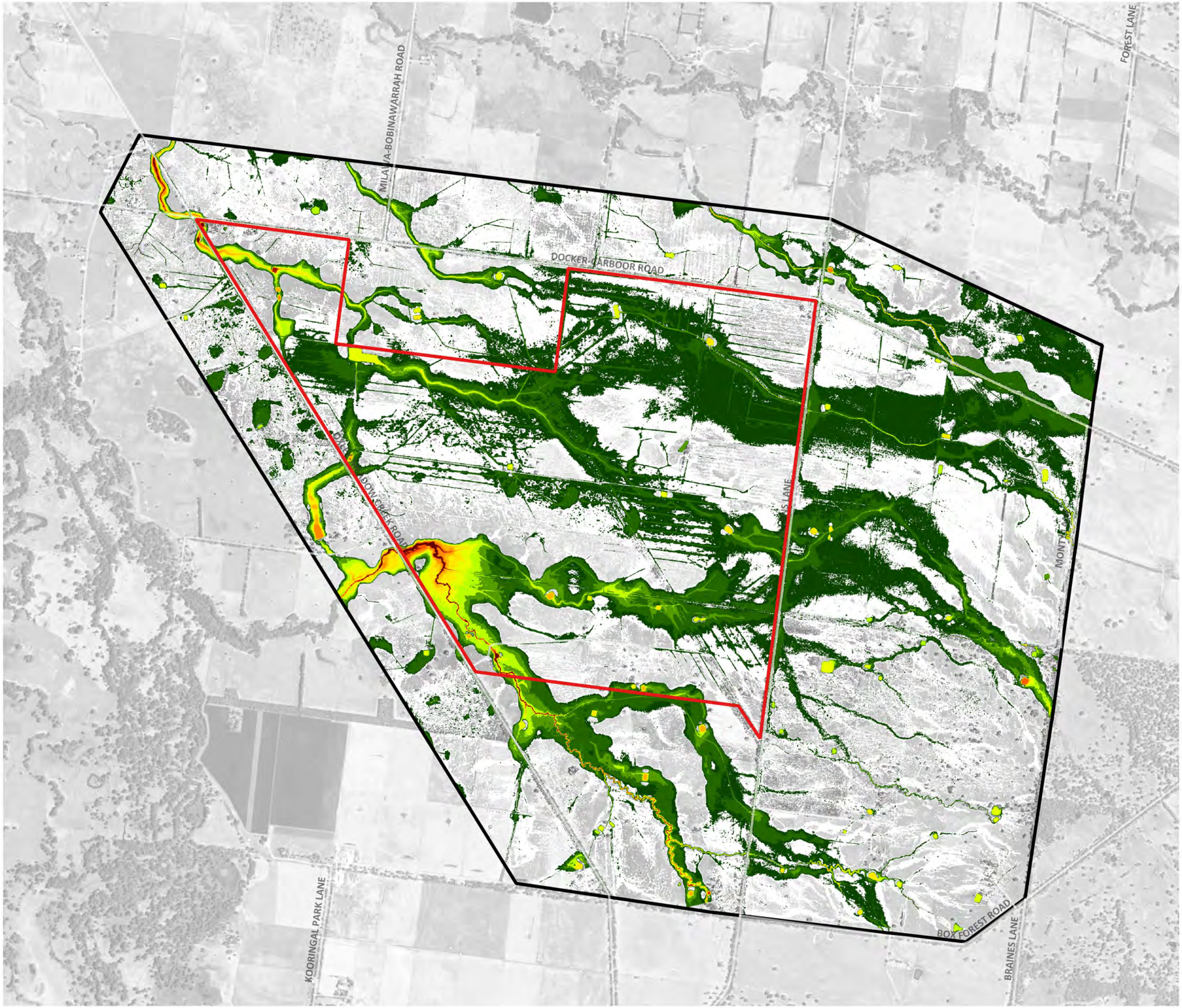
n

alluvium

MEADOW CREEK SOLAR FARM
BASELINE CONDITIONS
0.2% AEP FLOOD DEPTH

Coordinates: GDA2020 MGA Zone 55
Created: 14/6/2024
Scale: 1:20,000 at A3

Originator: DC
Checked: CB
Approved: CB



LEGEND

- Model Extent
- Site Boundary
- Road

Flood Depth (m)

- 0.1 - 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0
- 1.0 - 1.2
- 1.2 - 1.4
- 1.4 - 1.6
- 1.6 - 1.8
- 1.8 - 2.0
- > 2.0

0 0.5 1 km

n

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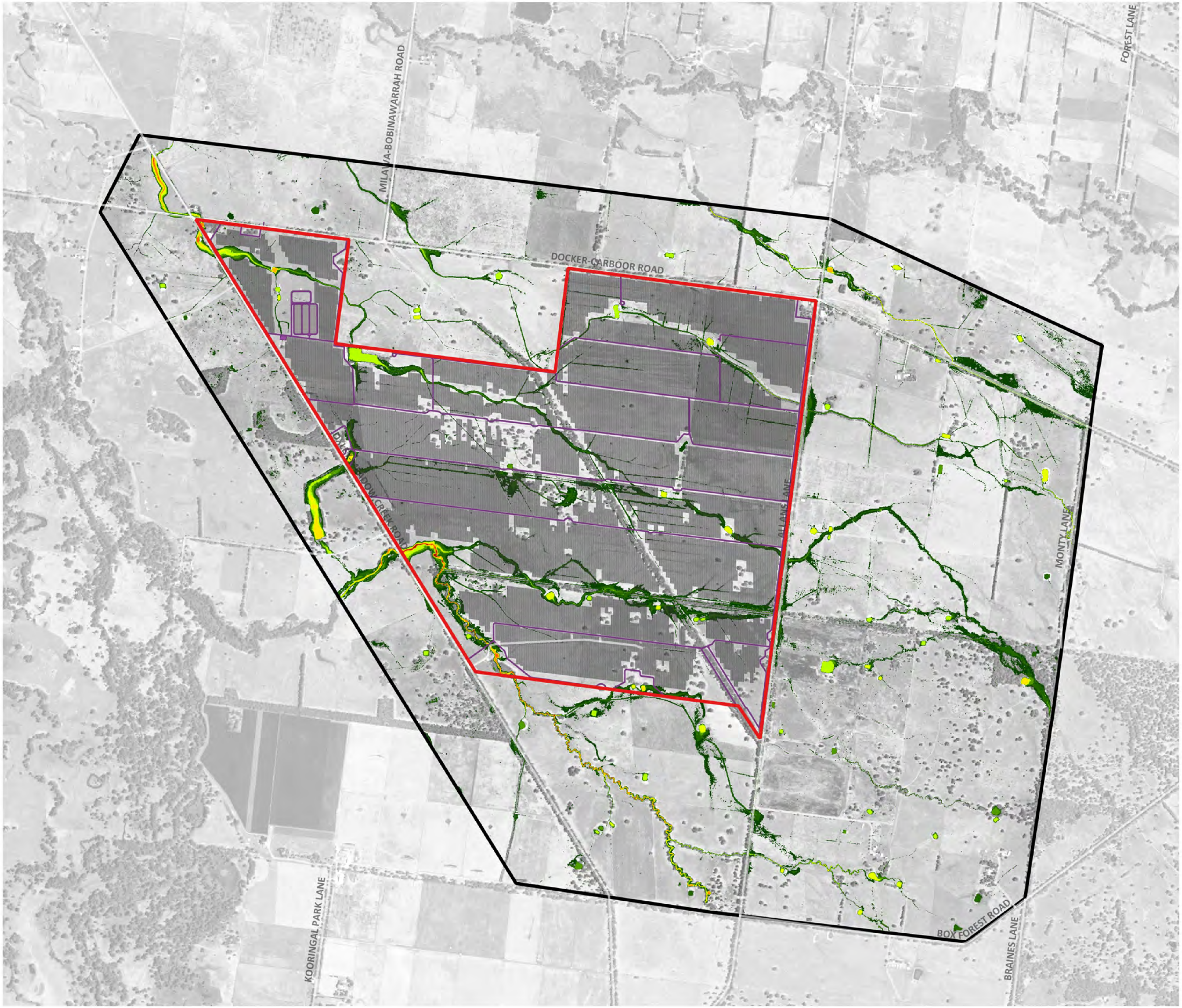
MEADOW CREEK SOLAR FARM
BASELINE CONDITIONS
0.05% AEP FLOOD DEPTH

Coordinates: GDA2020 MGA Zone 55
Created: 14/6/2024
Scale: 1:20,000 at A3

Originator: DC
Checked: CB
Approved: CB



LEGEND

- Model Extent
- Site Boundary
- Access Roads
- Hardstand
- PV Arrays
- Road

Flood Depth (m)

- 0.1 - 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0
- 1.0 - 1.2
- 1.2 - 1.4
- 1.4 - 1.6
- 1.6 - 1.8
- 1.8 - 2.0
- > 2.0

0 0.5 1 km

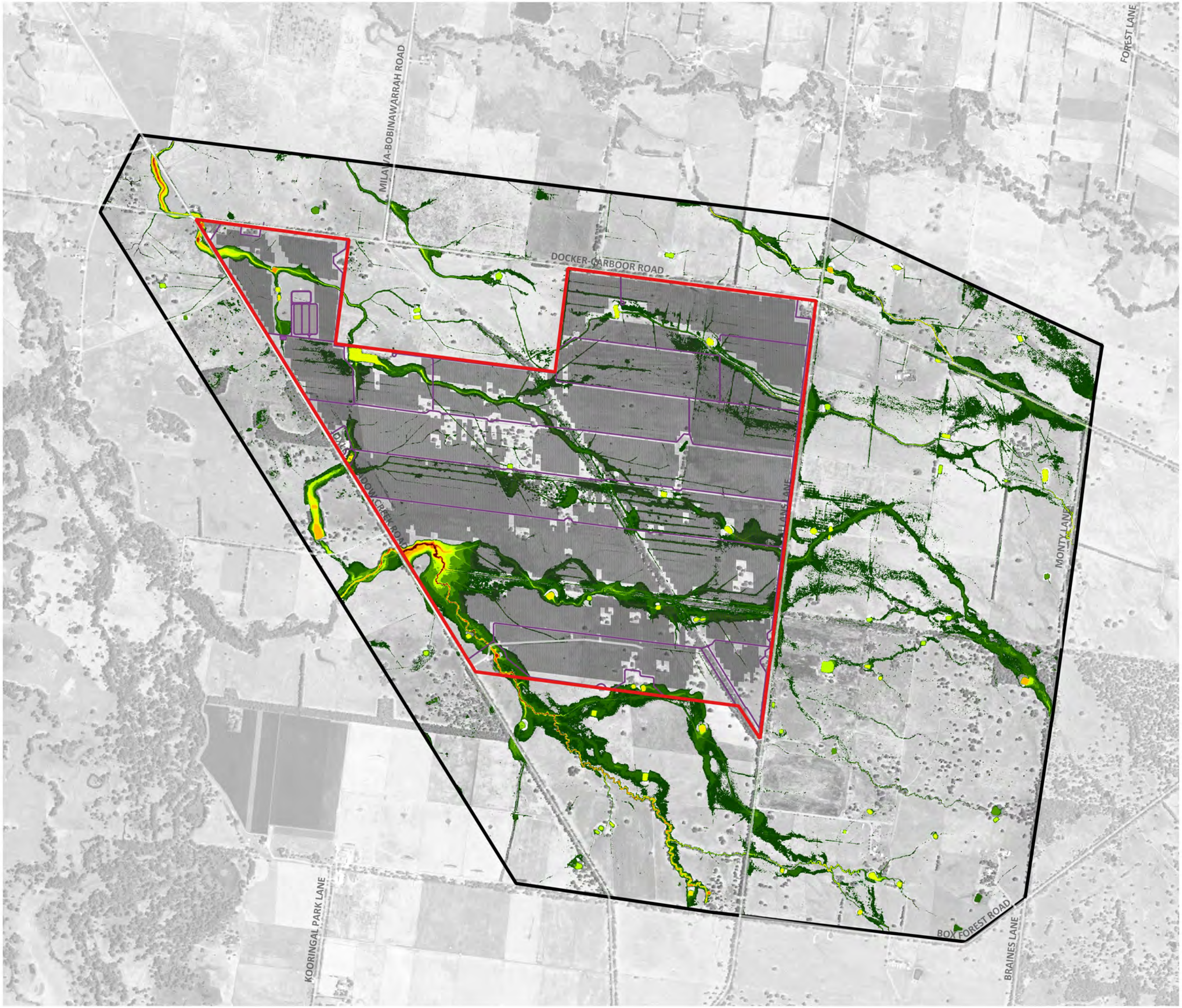
n

alluvium

MEADOW CREEK SOLAR FARM
DESIGN CONDITIONS
10% AEP FLOOD DEPTH

Coordinates: GDA2020 MGA Zone 55
Created: 14/6/2024
Scale: 1:20,000 at A3

Originator: DC
Checked: CB
Approved: CB



LEGEND

- Model Extent
- Site Boundary
- Access Roads
- Hardstand
- PV Arrays
- Road

Flood Depth (m)

- 0.1 - 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0
- 1.0 - 1.2
- 1.2 - 1.4
- 1.4 - 1.6
- 1.6 - 1.8
- 1.8 - 2.0
- > 2.0

0 0.5 1 km

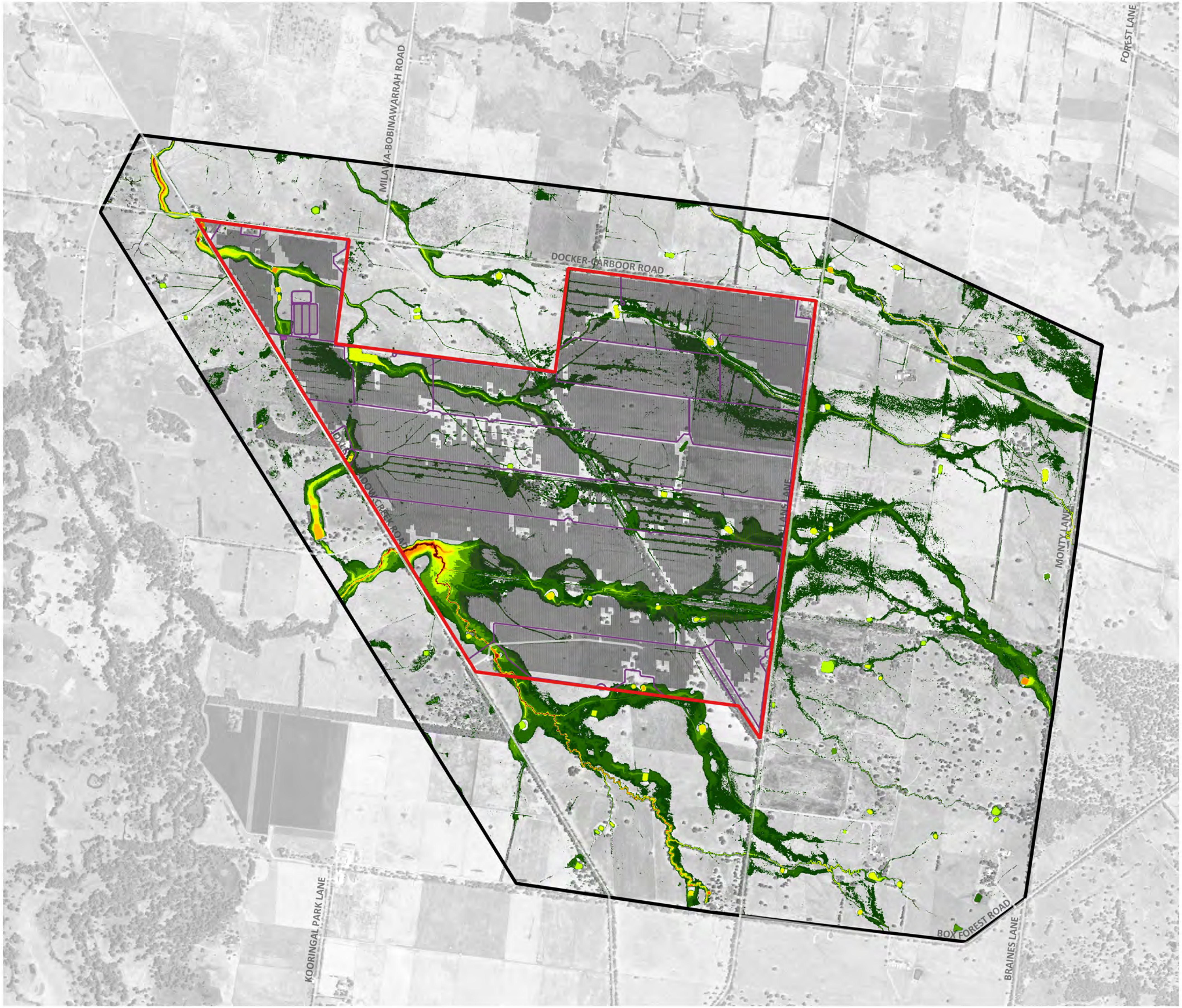
n

alluvium

MEADOW CREEK SOLAR FARM
DESIGN CONDITIONS
2% AEP FLOOD DEPTH

Coordinates: GDA2020 MGA Zone 55
Created: 14/6/2024
Scale: 1:20,000 at A3

Originator: DC
Checked: CB
Approved: CB



LEGEND

- Model Extent
- Site Boundary
- Access Roads
- Hardstand
- PV Arrays
- Road

Flood Depth (m)

- 0.1 - 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0
- 1.0 - 1.2
- 1.2 - 1.4
- 1.4 - 1.6
- 1.6 - 1.8
- 1.8 - 2.0
- > 2.0

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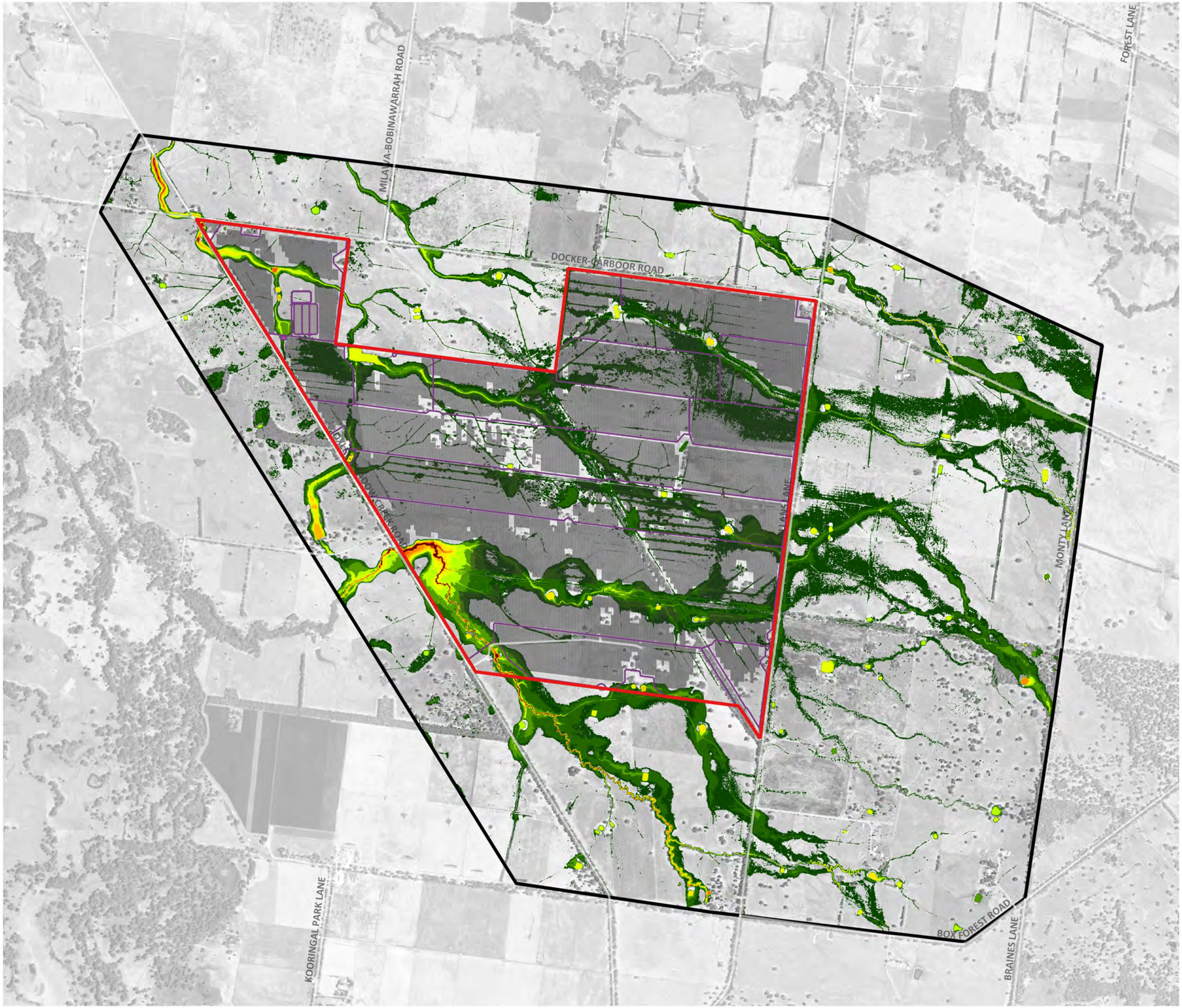
MEADOW CREEK SOLAR FARM
DESIGN CONDITIONS
1% AEP FLOOD DEPTH

Coordinates: GDA2020 MGA Zone 55
Created: 14/6/2024
Scale: 1:20,000 at A3

Originator: DC
Checked: CB
Approved: CB



LEGEND

- Model Extent
- Site Boundary
- Access Roads
- Hardstand
- PV Arrays
- Road

Flood Depth (m)

- 0.1 - 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0
- 1.0 - 1.2
- 1.2 - 1.4
- 1.4 - 1.6
- 1.6 - 1.8
- 1.8 - 2.0
- > 2.0

0 0.5 1 km

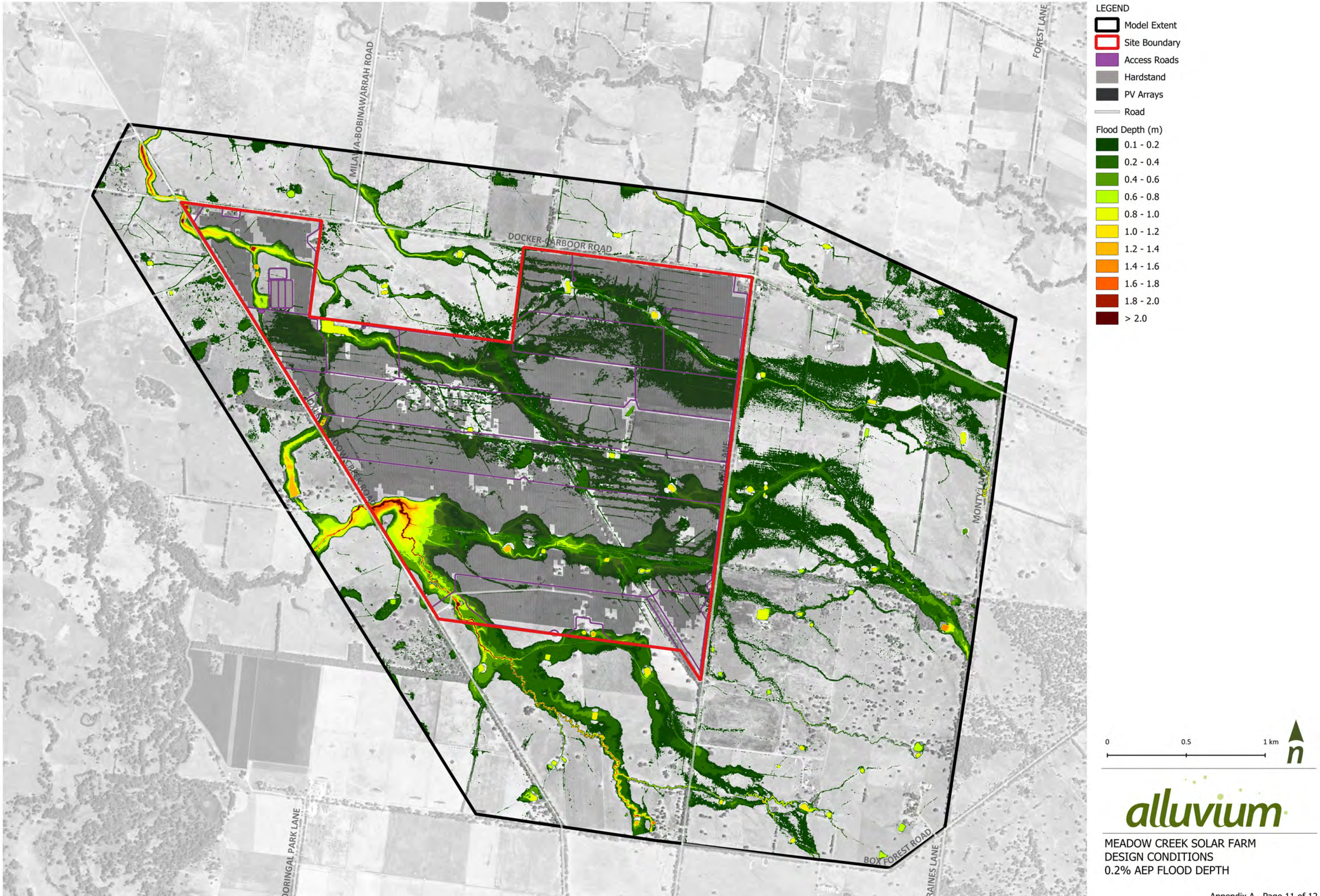
n

alluvium

MEADOW CREEK SOLAR FARM
DESIGN CONDITIONS
1% AEP + CC FLOOD DEPTH

Coordinates: GDA2020 MGA Zone 55
Created: 14/6/2024
Scale: 1:20,000 at A3

Originator: DC
Checked: CB
Approved: CB

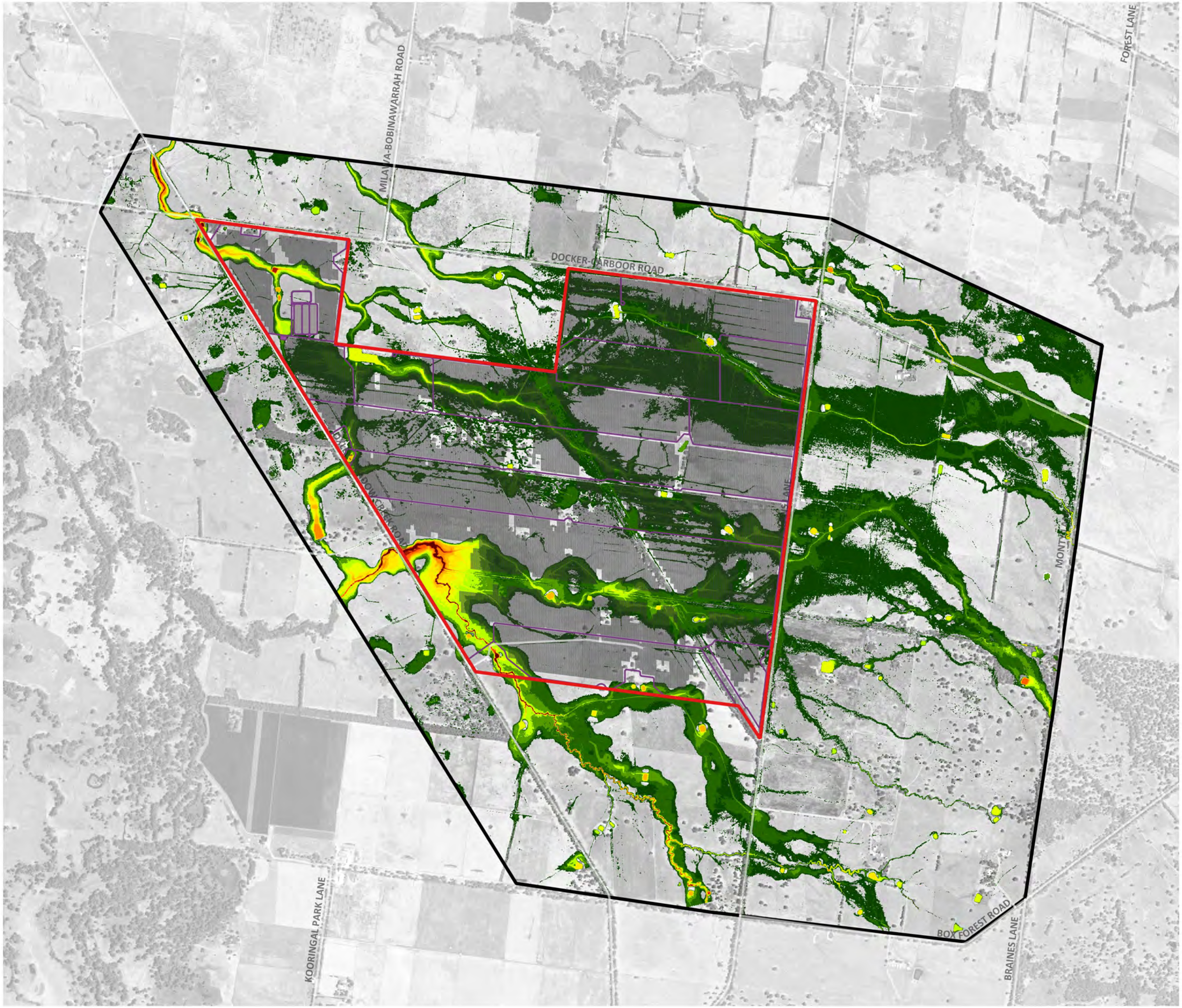


alluvium

MEADOW CREEK SOLAR FARM
DESIGN CONDITIONS
0.2% AEP FLOOD DEPTH

Coordinates: GDA2020 MGA Zone 55
Created: 14/6/2024
Scale: 1:20,000 at A3

Originator: DC
Checked: CB
Approved: CB



LEGEND

- Model Extent
- Site Boundary
- Access Roads
- Hardstand
- PV Arrays
- Road

Flood Depth (m)

- 0.1 - 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0
- 1.0 - 1.2
- 1.2 - 1.4
- 1.4 - 1.6
- 1.6 - 1.8
- 1.8 - 2.0
- > 2.0

0 0.5 1 km

n

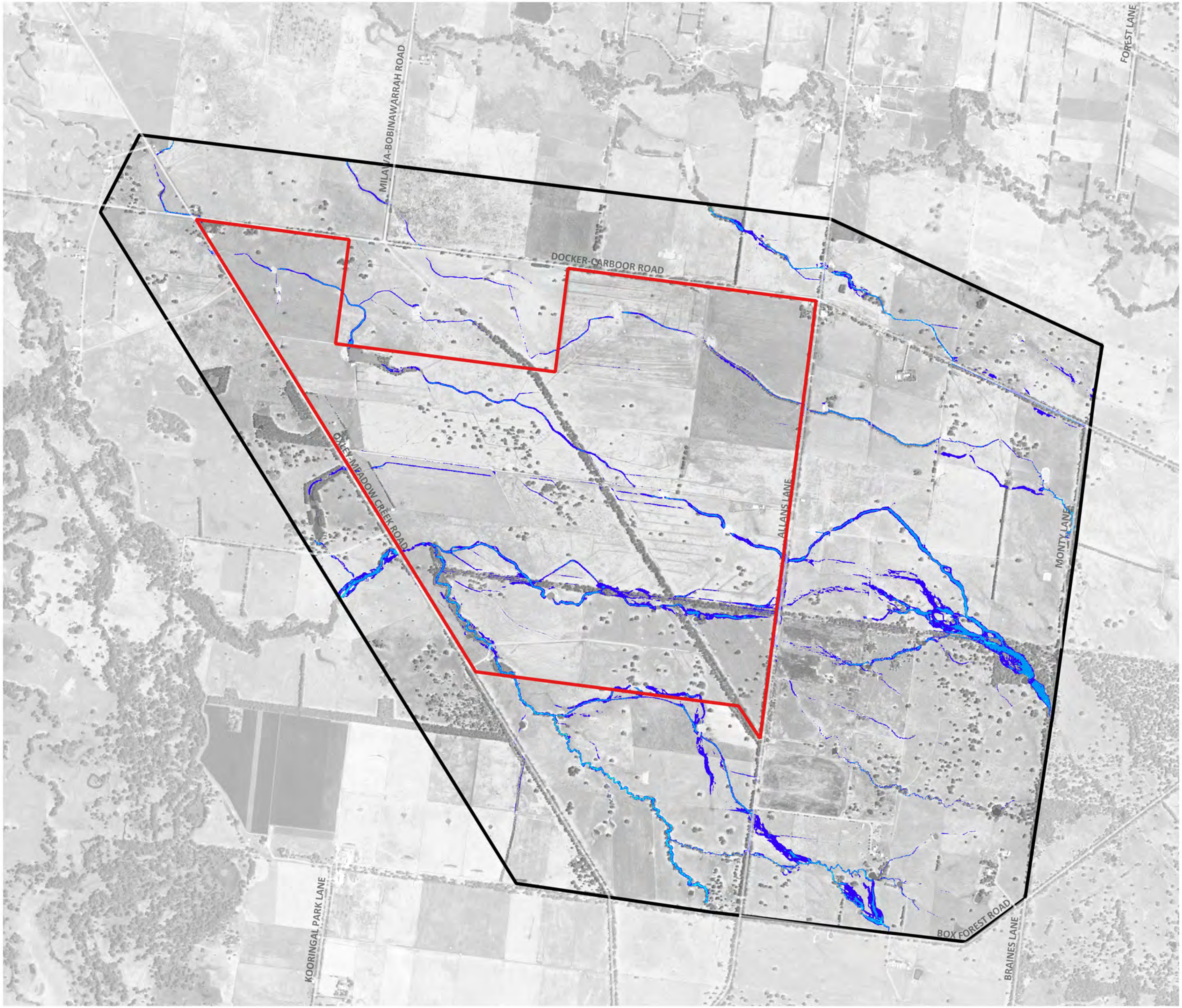
alluvium

MEADOW CREEK SOLAR FARM
DESIGN CONDITIONS
0.05% AEP FLOOD DEPTH

Coordinates: GDA2020 MGA Zone 55
Created: 14/6/2024
Scale: 1:20,000 at A3

Originator: DC
Checked: CB
Approved: CB

Attachment B. Flood Velocity Mapping



LEGEND

- Model Extent
- Site Boundary
- Road

Flood Velocity (m/s)

- 0.3 - 0.5
- 0.5 - 1
- 1 - 1.5
- 1.5 - 2
- 2 - 2.5
- 2.5 - 3
- 3 - 3.5
- > 3.5

0 0.5 1 km

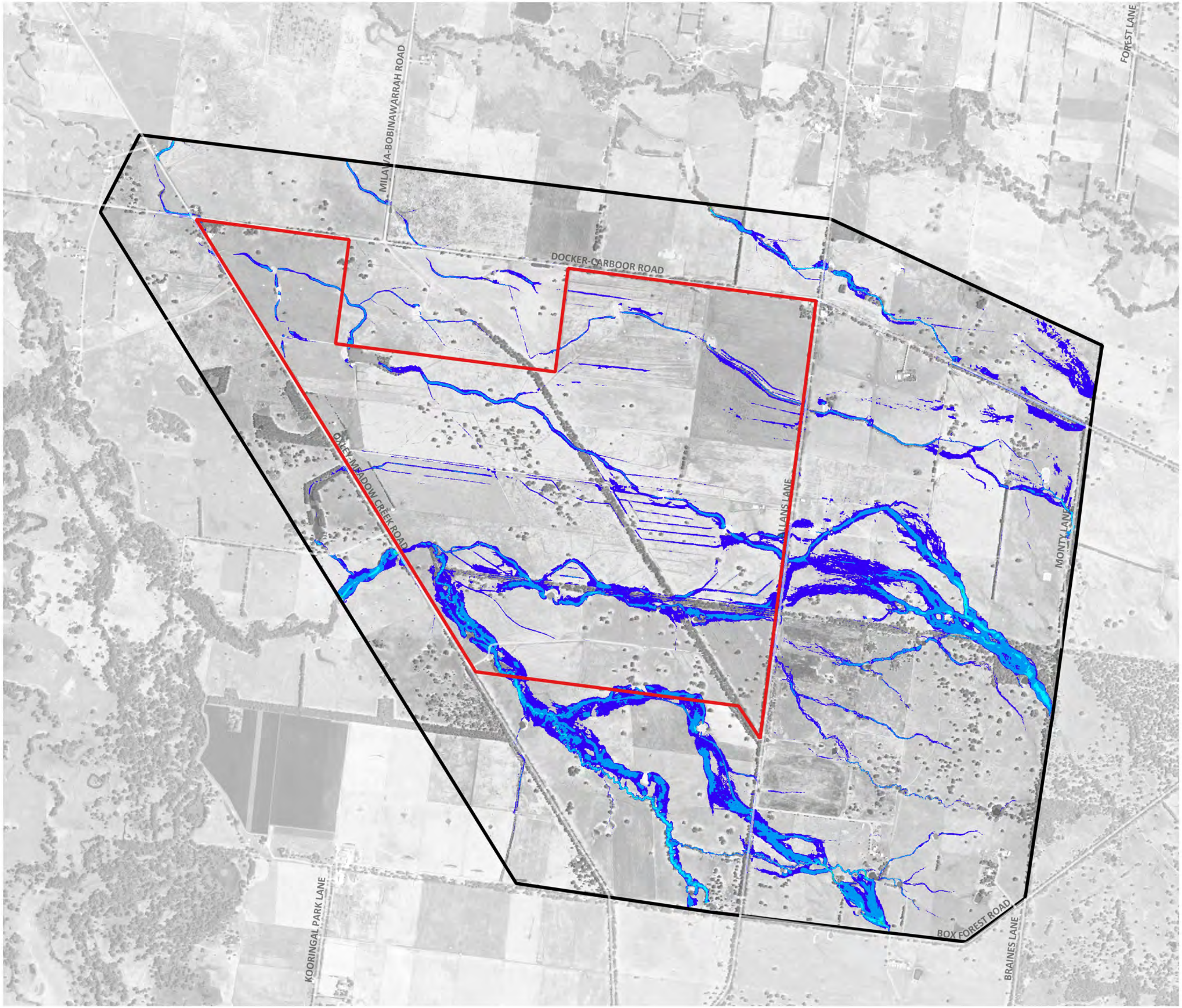
n

alluvium

MEADOW CREEK SOLAR FARM
BASELINE CONDITIONS
10% AEP FLOOD VELOCITY

Coordinates: GDA2020 MGA Zone 55
Created: 14/6/2024
Scale: 1:20,000 at A3

Originator: DC
Checked: CB
Approved: CB



LEGEND

- Model Extent
- Site Boundary
- Road

Flood Velocity (m/s)

- 0.3 - 0.5
- 0.5 - 1
- 1 - 1.5
- 1.5 - 2
- 2 - 2.5
- 2.5 - 3
- 3 - 3.5
- > 3.5

0 0.5 1 km

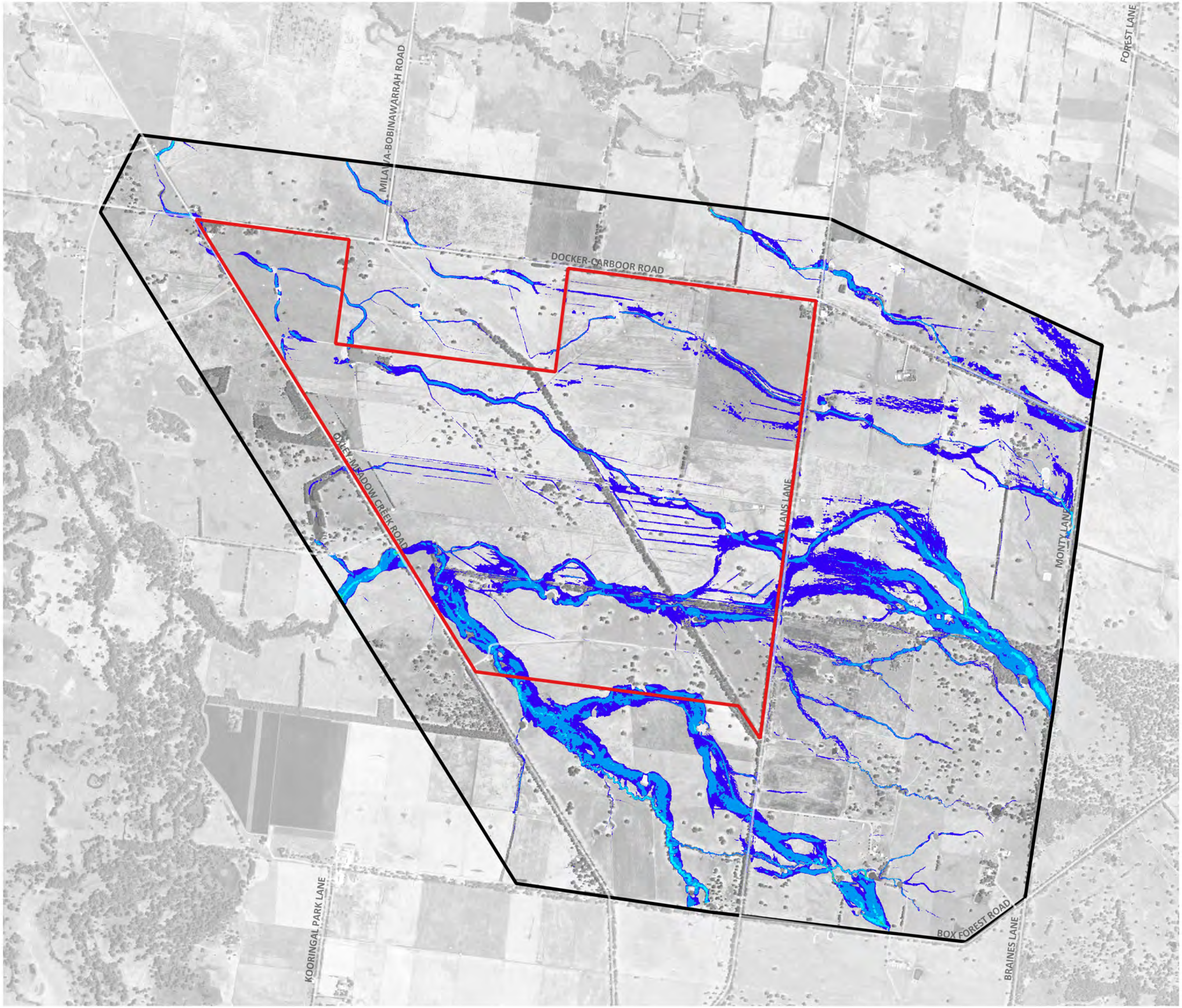
n

alluvium

MEADOW CREEK SOLAR FARM
BASELINE CONDITIONS
2% AEP FLOOD VELOCITY

Coordinates: GDA2020 MGA Zone 55
Created: 14/6/2024
Scale: 1:20,000 at A3

Originator: DC
Checked: CB
Approved: CB



LEGEND

- Model Extent
- Site Boundary
- Road

Flood Velocity (m/s)

- 0.3 - 0.5
- 0.5 - 1
- 1 - 1.5
- 1.5 - 2
- 2 - 2.5
- 2.5 - 3
- 3 - 3.5
- > 3.5

0 0.5 1 km

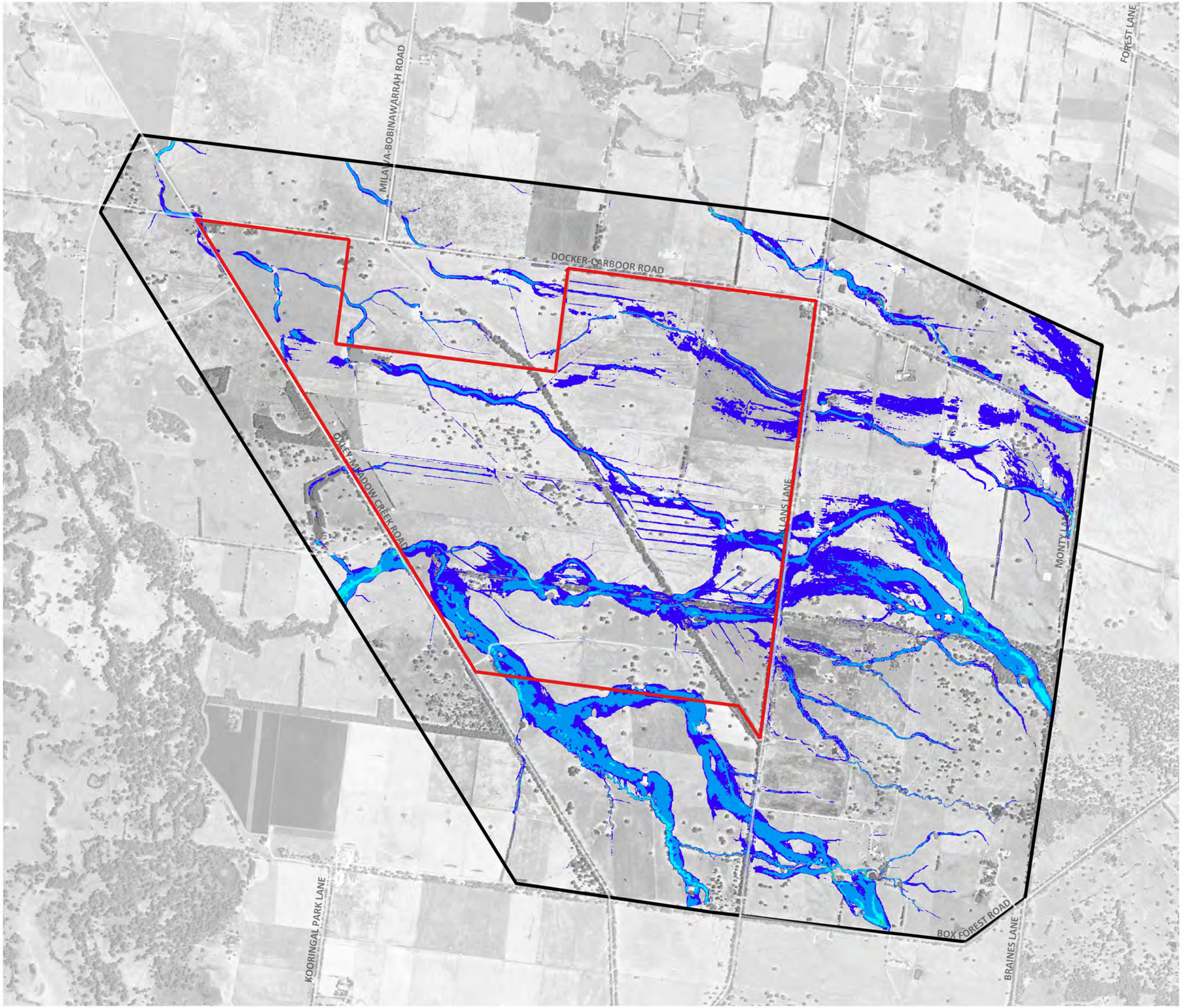
n

alluvium

MEADOW CREEK SOLAR FARM
BASELINE CONDITIONS
1% AEP FLOOD VELOCITY

Coordinates: GDA2020 MGA Zone 55
Created: 14/6/2024
Scale: 1:20,000 at A3

Originator: DC
Checked: CB
Approved: CB



LEGEND

- Model Extent
- Site Boundary
- Road

Flood Velocity (m/s)

- 0.3 - 0.5
- 0.5 - 1
- 1 - 1.5
- 1.5 - 2
- 2 - 2.5
- 2.5 - 3
- 3 - 3.5
- > 3.5

0 0.5 1 km

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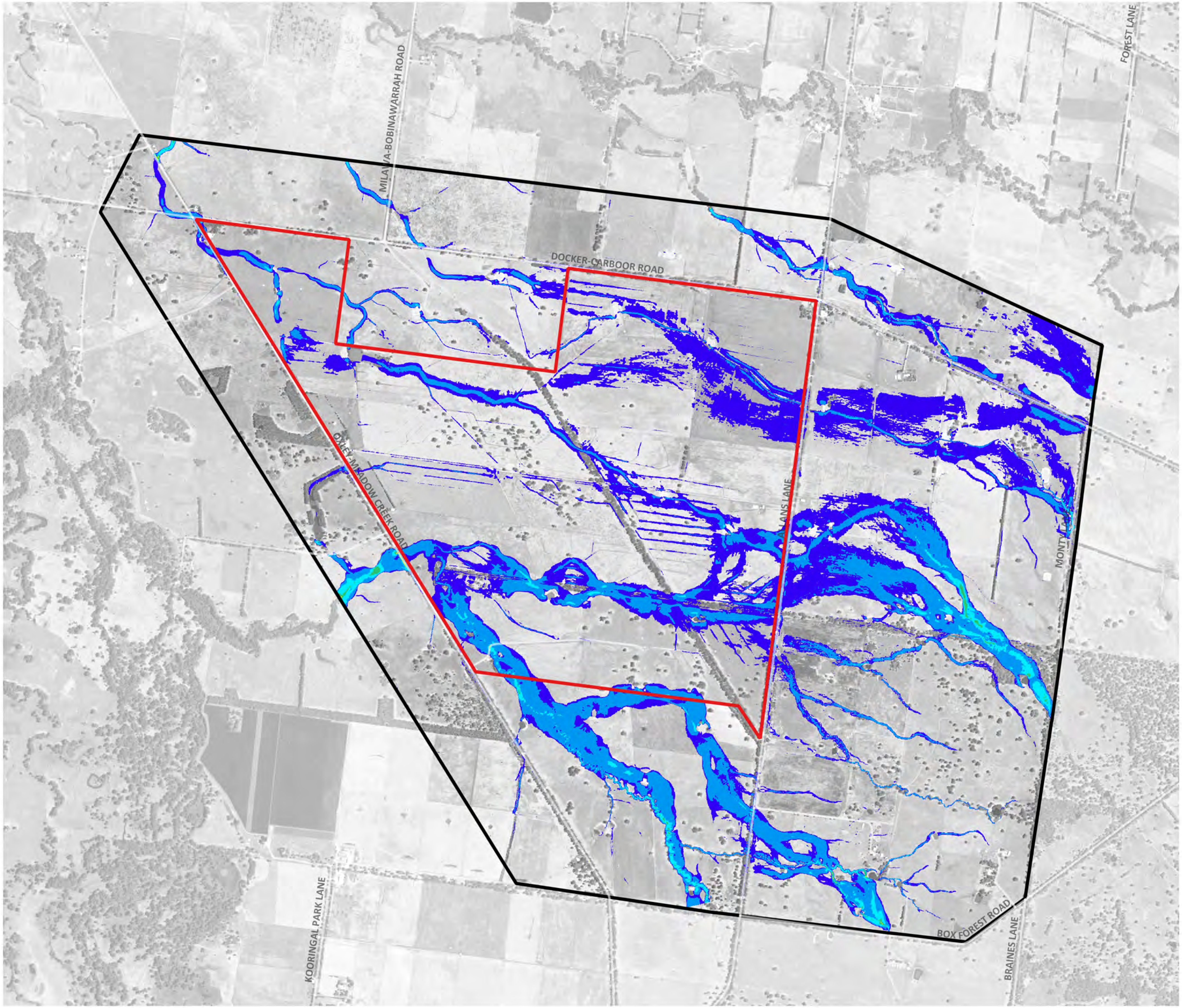
MEADOW CREEK SOLAR FARM
BASELINE CONDITIONS
1% AEP + CC FLOOD VELOCITY

Coordinates: GDA2020 MGA Zone 55
Created: 14/6/2024
Scale: 1:20,000 at A3

Originator: DC
Checked: CB
Approved: CB



LEGEND

- Model Extent
- Site Boundary
- Road

Flood Velocity (m/s)

- 0.3 - 0.5
- 0.5 - 1
- 1 - 1.5
- 1.5 - 2
- 2 - 2.5
- 2.5 - 3
- 3 - 3.5
- > 3.5

0 0.5 1 km

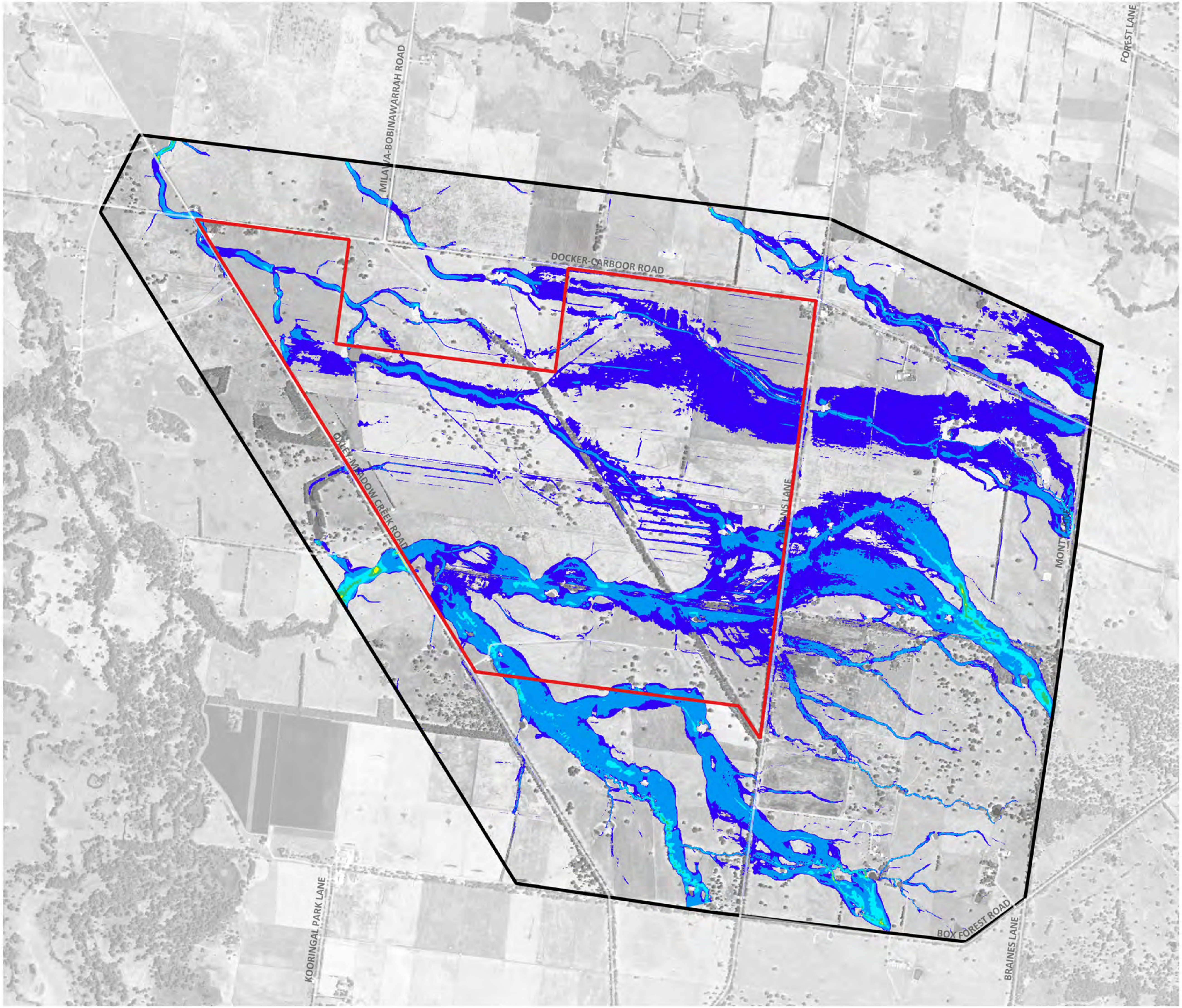
n

alluvium

MEADOW CREEK SOLAR FARM
BASELINE CONDITIONS
0.2% AEP FLOOD VELOCITY

Coordinates: GDA2020 MGA Zone 55
Created: 14/6/2024
Scale: 1:20,000 at A3

Originator: DC
Checked: CB
Approved: CB



LEGEND

- Model Extent
- Site Boundary
- Road

Flood Velocity (m/s)

- 0.3 - 0.5
- 0.5 - 1
- 1 - 1.5
- 1.5 - 2
- 2 - 2.5
- 2.5 - 3
- 3 - 3.5
- > 3.5

0 0.5 1 km

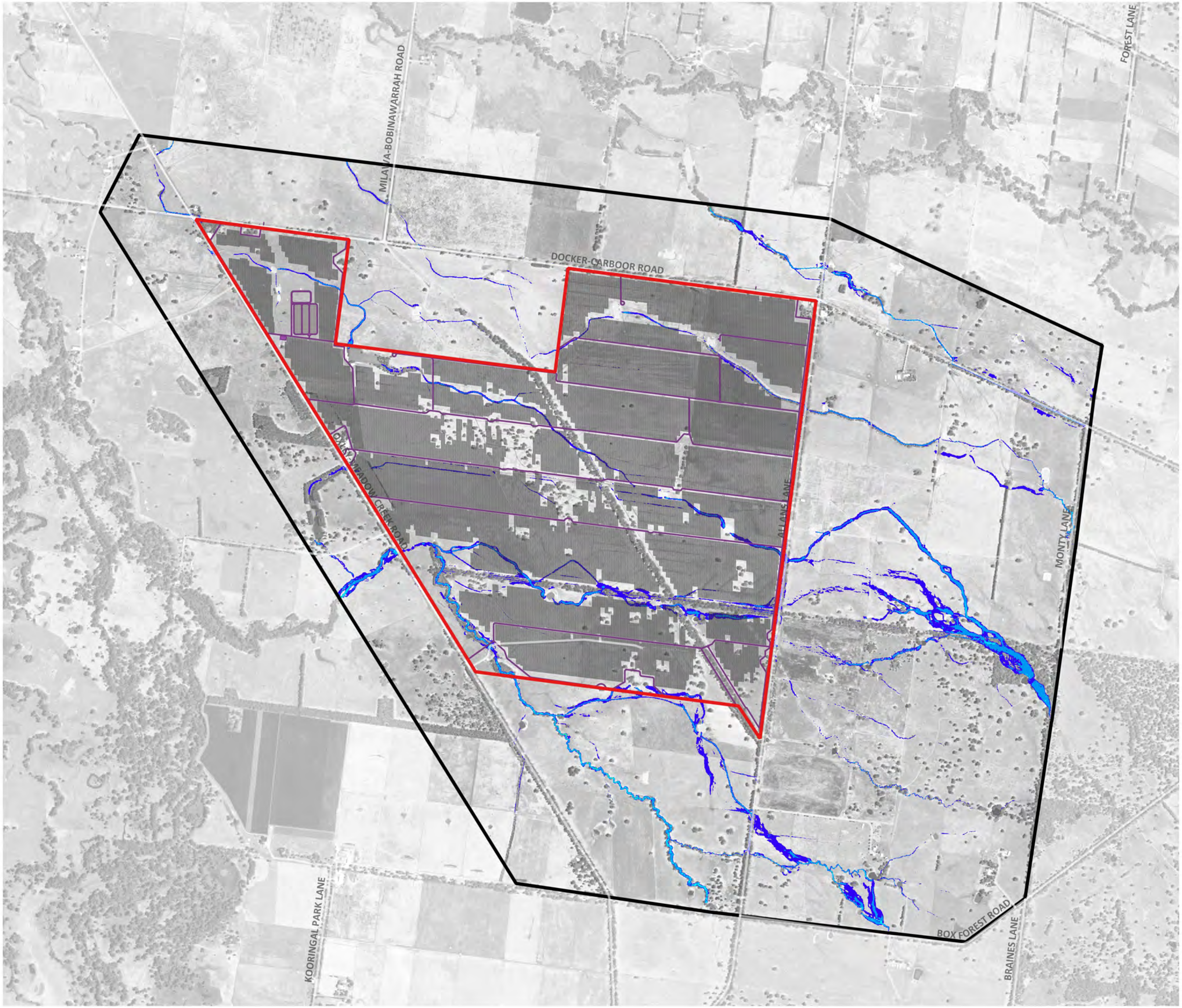
n

alluvium

MEADOW CREEK SOLAR FARM
BASELINE CONDITIONS
0.05% AEP FLOOD VELOCITY

Coordinates: GDA2020 MGA Zone 55
Created: 14/6/2024
Scale: 1:20,000 at A3

Originator: DC
Checked: CB
Approved: CB



LEGEND

- Model Extent
- Site Boundary
- Access Roads
- Hardstand
- PV Arrays
- Road

Flood Velocity (m/s)

- 0.3 - 0.5
- 0.5 - 1
- 1 - 1.5
- 1.5 - 2
- 2 - 2.5
- 2.5 - 3
- 3 - 3.5
- > 3.5

0 0.5 1 km

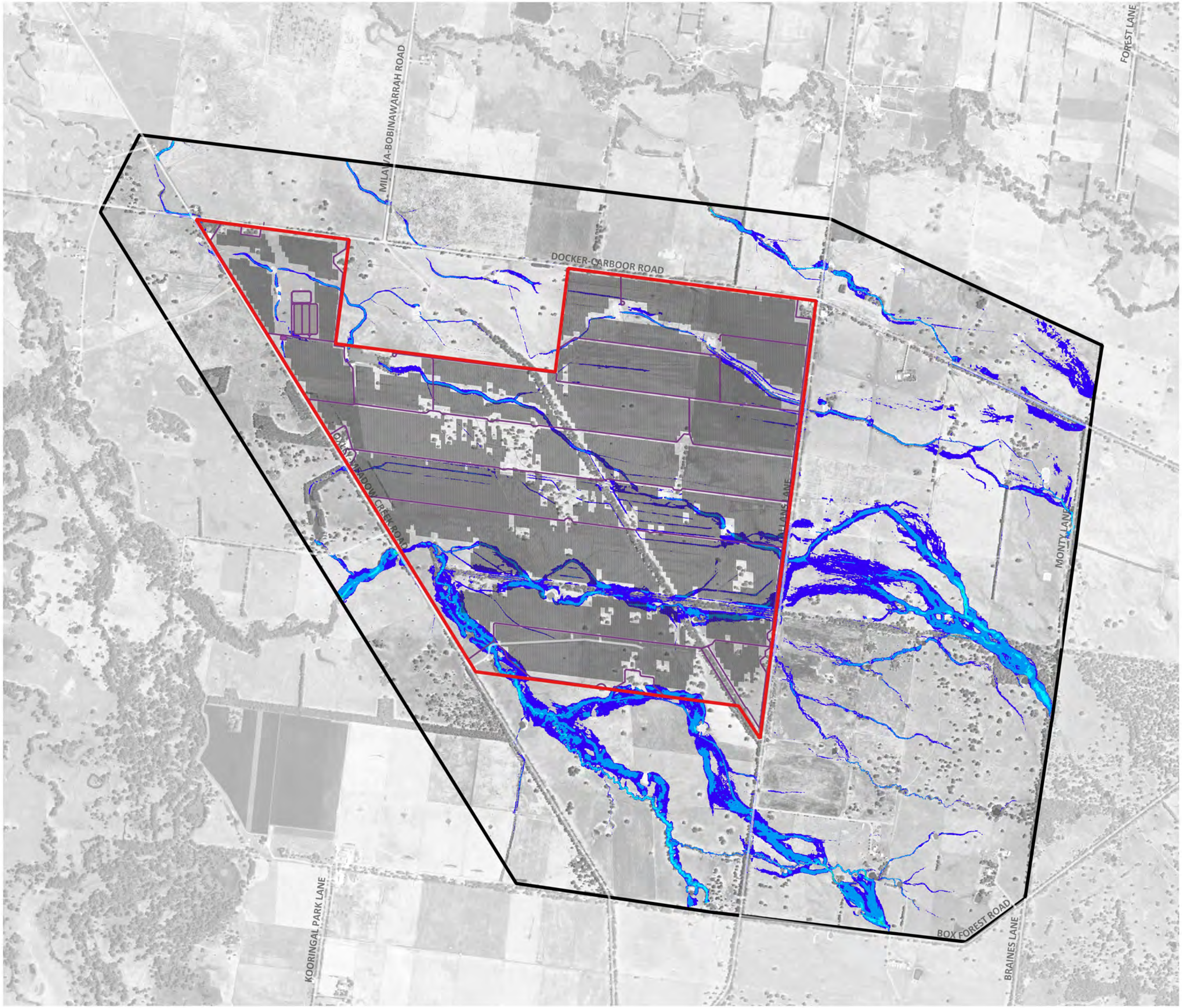
n

alluvium

MEADOW CREEK SOLAR FARM
DESIGN CONDITIONS
10% AEP FLOOD VELOCITY

Coordinates: GDA2020 MGA Zone 55
Created: 14/6/2024
Scale: 1:20,000 at A3

Originator: DC
Checked: CB
Approved: CB



LEGEND

- Model Extent
- Site Boundary
- Access Roads
- Hardstand
- PV Arrays
- Road

Flood Velocity (m/s)

- 0.3 - 0.5
- 0.5 - 1
- 1 - 1.5
- 1.5 - 2
- 2 - 2.5
- 2.5 - 3
- 3 - 3.5
- > 3.5

0 0.5 1 km

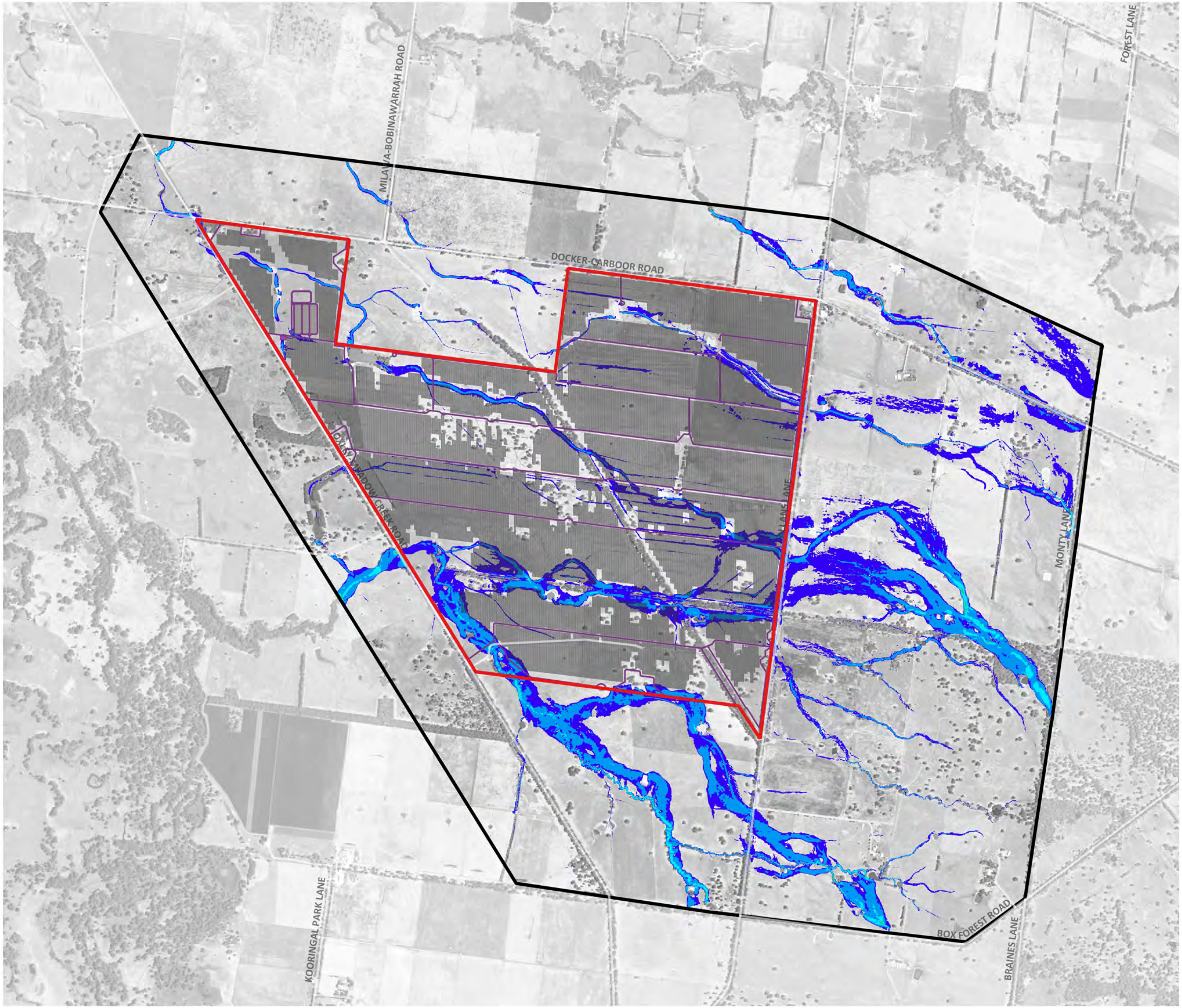
n

alluvium

MEADOW CREEK SOLAR FARM
DESIGN CONDITIONS
2% AEP FLOOD VELOCITY

Coordinates: GDA2020 MGA Zone 55
Created: 14/6/2024
Scale: 1:20,000 at A3

Originator: DC
Checked: CB
Approved: CB



LEGEND

- Model Extent
- Site Boundary
- Access Roads
- Hardstand
- PV Arrays
- Road

Flood Velocity (m/s)

- 0.3 - 0.5
- 0.5 - 1
- 1 - 1.5
- 1.5 - 2
- 2 - 2.5
- 2.5 - 3
- 3 - 3.5
- > 3.5

0 0.5 1 km

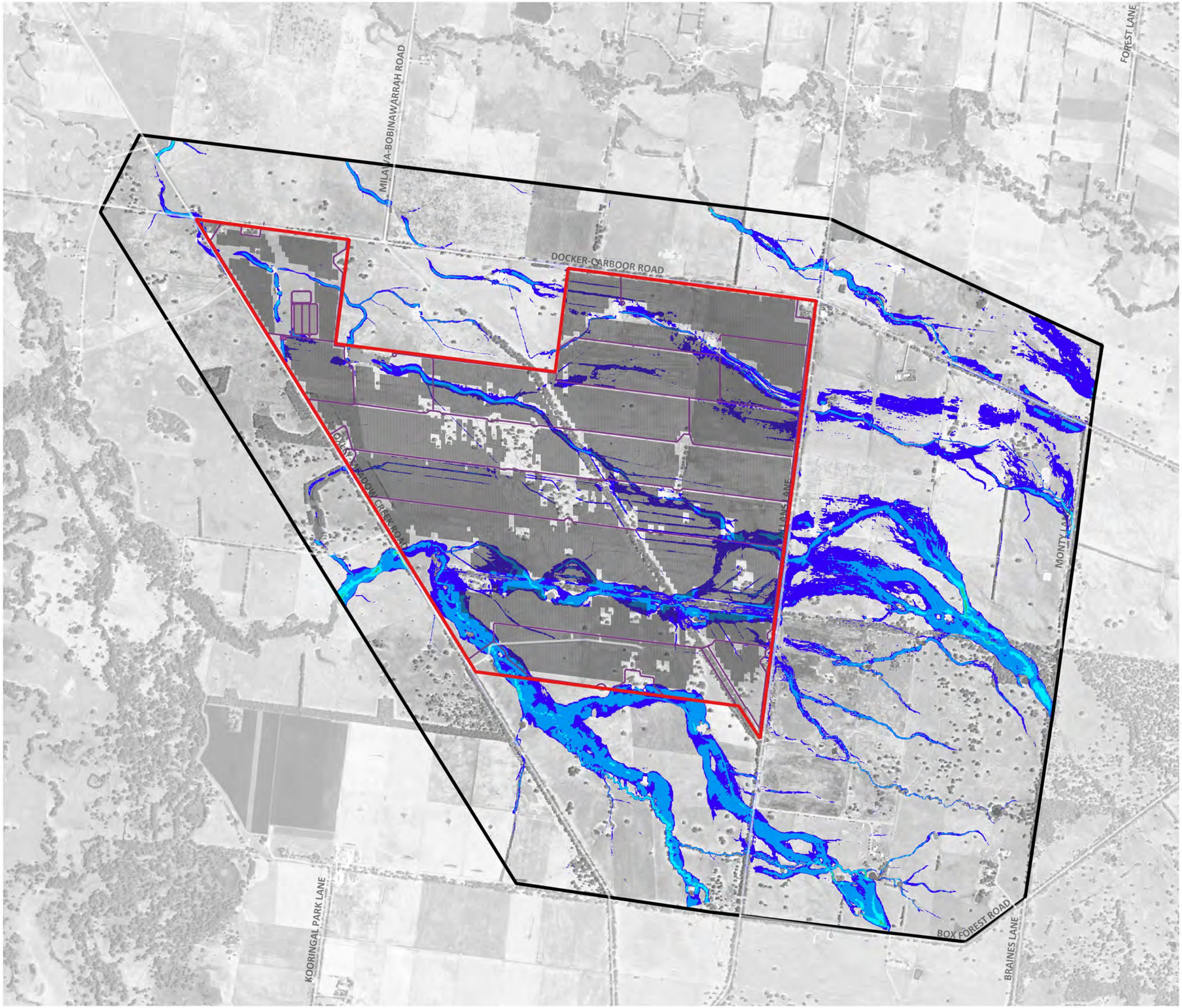
n

alluvium

MEADOW CREEK SOLAR FARM
DESIGN CONDITIONS
1% AEP FLOOD VELOCITY

Coordinates: GDA2020 MGA Zone 55
Created: 14/6/2024
Scale: 1:20,000 at A3

Originator: DC
Checked: CB
Approved: CB



LEGEND

- Model Extent
- Site Boundary
- Access Roads
- Hardstand
- PV Arrays
- Road

Flood Velocity (m/s)

- 0.3 - 0.5
- 0.5 - 1
- 1 - 1.5
- 1.5 - 2
- 2 - 2.5
- 2.5 - 3
- 3 - 3.5
- > 3.5

0 0.5 1 km

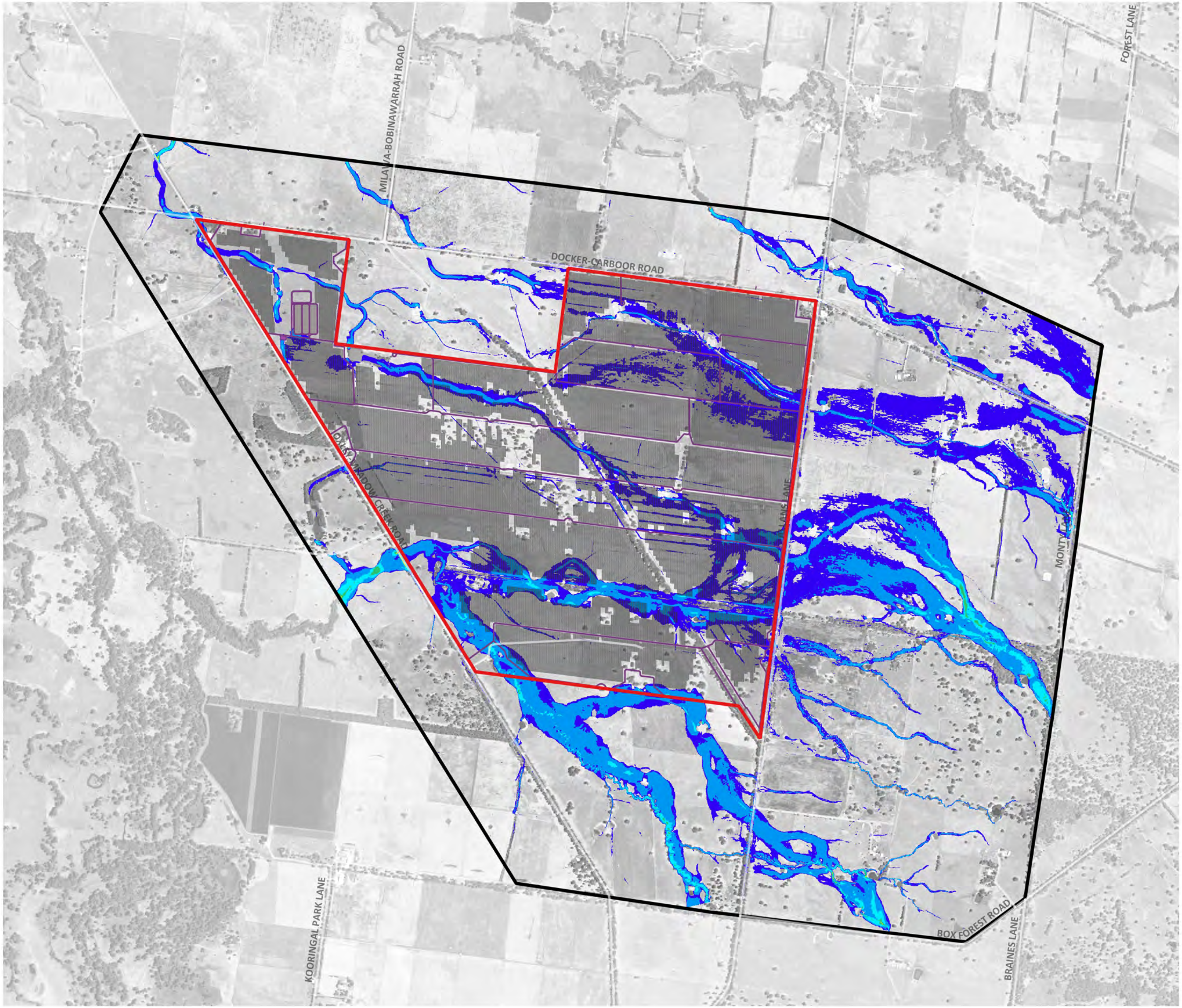
n

alluvium

MEADOW CREEK SOLAR FARM
DESIGN CONDITIONS
1% AEP + CC FLOOD VELOCITY

Coordinates: GDA2020 MGA Zone 55
Created: 14/6/2024
Scale: 1:20,000 at A3

Originator: DC
Checked: CB
Approved: CB



LEGEND

- Model Extent
- Site Boundary
- Access Roads
- Hardstand
- PV Arrays
- Road

Flood Velocity (m/s)

- 0.3 - 0.5
- 0.5 - 1
- 1 - 1.5
- 1.5 - 2
- 2 - 2.5
- 2.5 - 3
- 3 - 3.5
- > 3.5

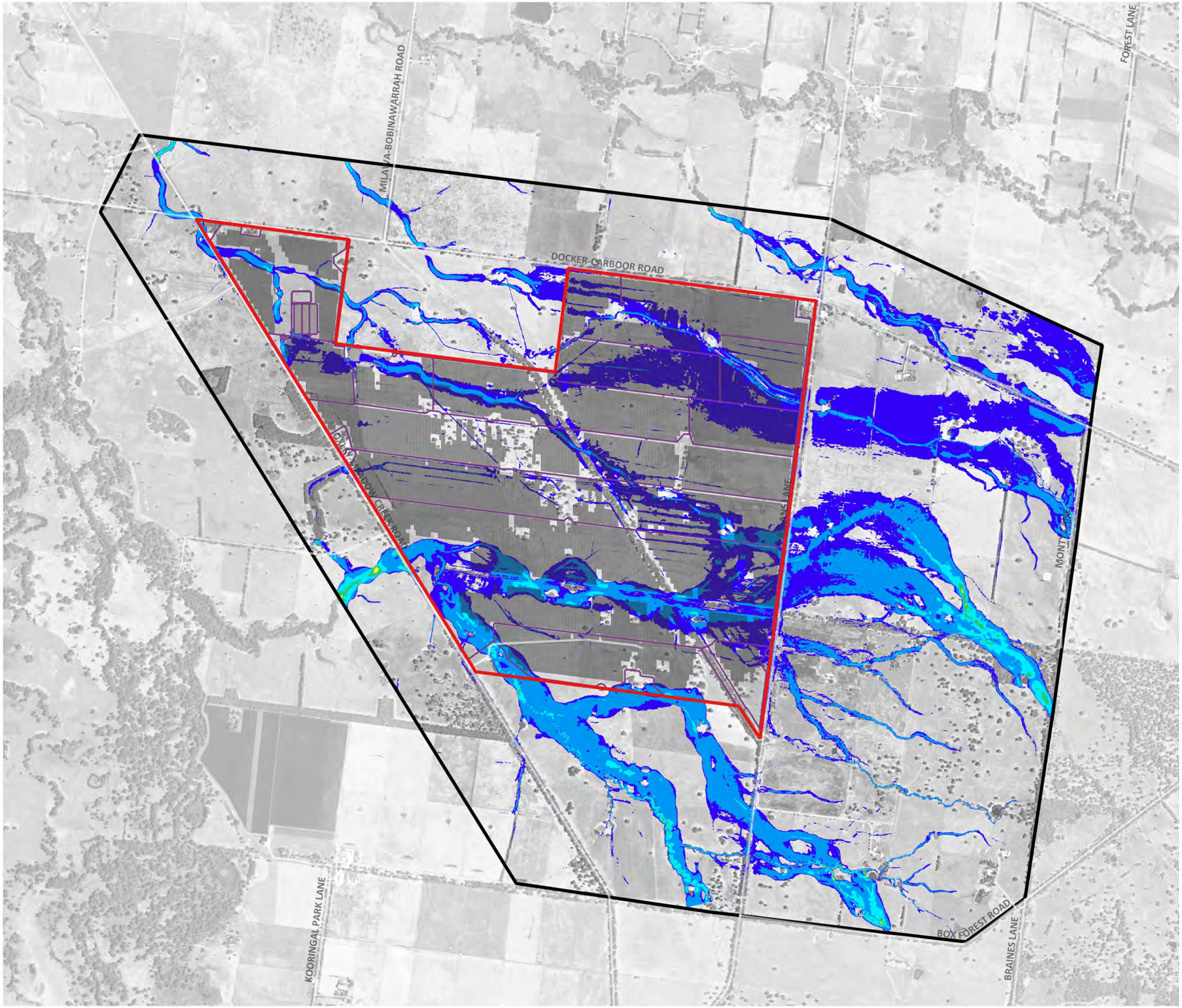
0 0.5 1 km

alluvium

MEADOW CREEK SOLAR FARM
DESIGN CONDITIONS
0.2% AEP FLOOD VELOCITY

Coordinates: GDA2020 MGA Zone 55
Created: 14/6/2024
Scale: 1:20,000 at A3

Originator: DC
Checked: CB
Approved: CB



LEGEND

- Model Extent
- Site Boundary
- Access Roads
- Hardstand
- PV Arrays
- Road

Flood Velocity (m/s)

- 0.3 - 0.5
- 0.5 - 1
- 1 - 1.5
- 1.5 - 2
- 2 - 2.5
- 2.5 - 3
- 3 - 3.5
- > 3.5

0 0.5 1 km

n

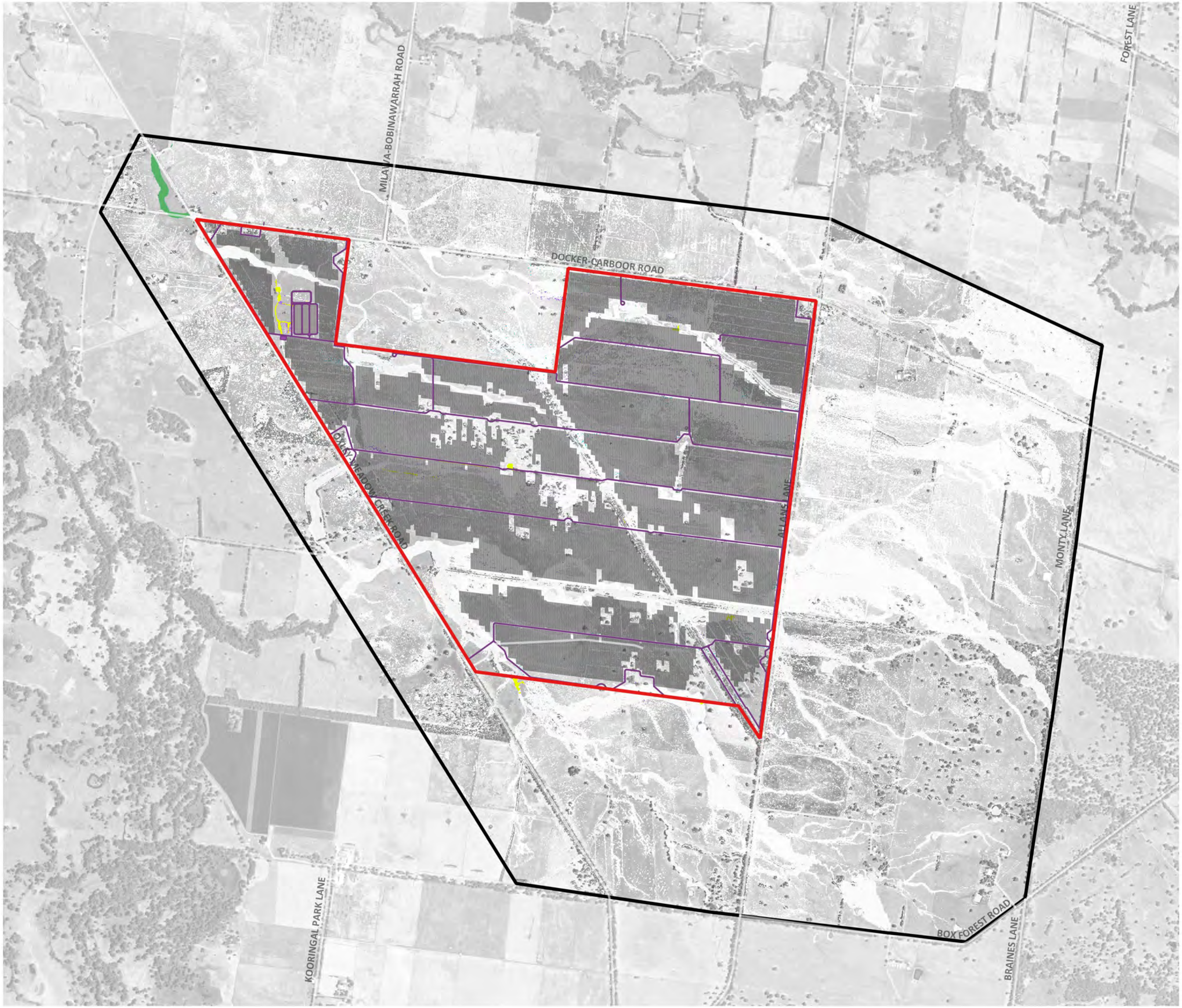
alluvium

MEADOW CREEK SOLAR FARM
DESIGN CONDITIONS
0.05% AEP FLOOD VELOCITY

Coordinates: GDA2020 MGA Zone 55
Created: 14/6/2024
Scale: 1:20,000 at A3

Originator: DC
Checked: CB
Approved: CB

Attachment C. Flood Afflux Mapping

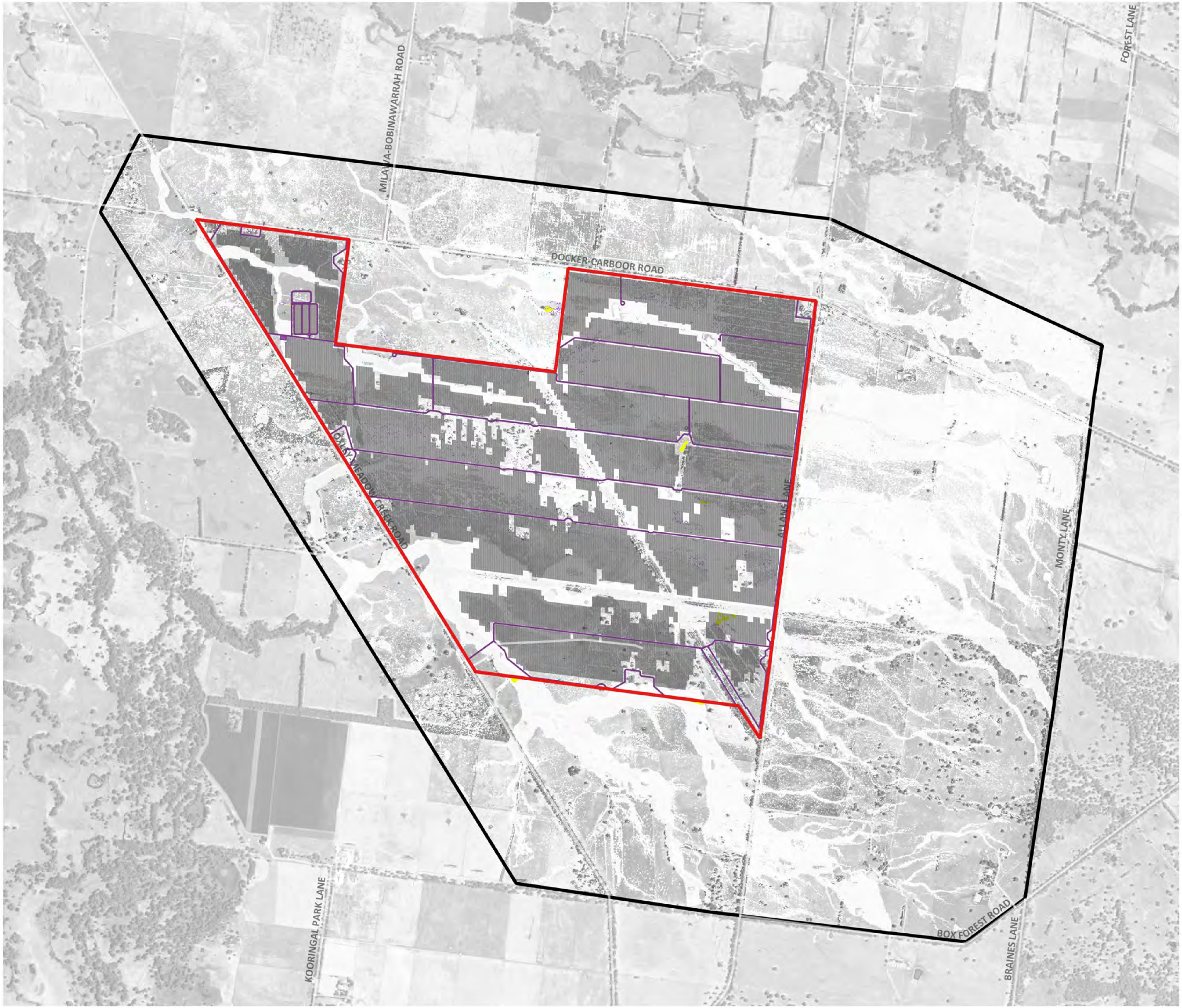


alluvium

MEADOW CREEK SOLAR FARM
DESIGN CONDITIONS
10% AEP FLOOD AFFLUX

Coordinates: GDA2020 MGA Zone 55
Created: 14/6/2024
Scale: 1:20,000 at A3

Originator: DC
Checked: CB
Approved: CB



LEGEND

- Model Extent
- Site Boundary
- Access Roads
- Hardstand
- PV Arrays
- Road

Flood Level Afflux (m)

- < -0.50
- -0.50 - -0.20
- -0.20 - -0.10
- -0.10 - -0.05
- -0.05 - -0.01
- -0.01 - 0.01
- 0.01 - 0.05
- 0.05 - 0.10
- 0.10 - 0.20
- 0.20 - 0.50
- > 0.50
- Was Wet, Now Dry
- Was Dry, Now Wet

0 0.5 1 km

n

alluvium

MEADOW CREEK SOLAR FARM
DESIGN CONDITIONS
2% AEP FLOOD AFFLUX

Coordinates: GDA2020 MGA Zone 55
Created: 14/6/2024
Scale: 1:20,000 at A3

Originator: DC
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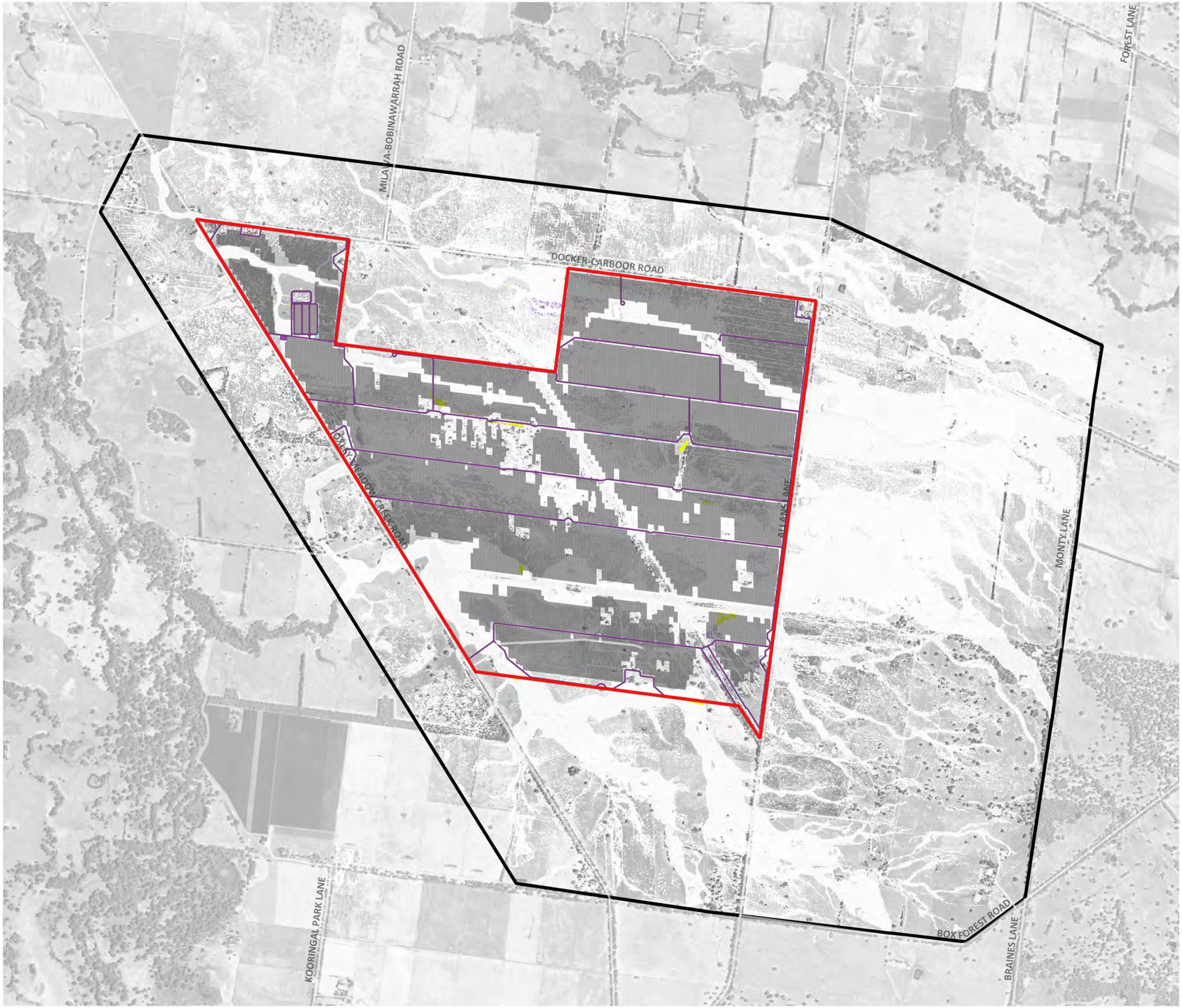
Approved: CB



LEGEND

- Model Extent
- Site Boundary
- Access Roads
- Hardstand
- PV Arrays
- Road

Flood Level Afflux (m)

- < -0.50
- -0.50 - -0.20
- -0.20 - -0.10
- -0.10 - -0.05
- -0.05 - -0.01
- -0.01 - 0.01
- 0.01 - 0.05
- 0.05 - 0.10
- 0.10 - 0.20
- 0.20 - 0.50
- > 0.50
- Was Wet, Now Dry
- Was Dry, Now Wet

0 0.5 1 km

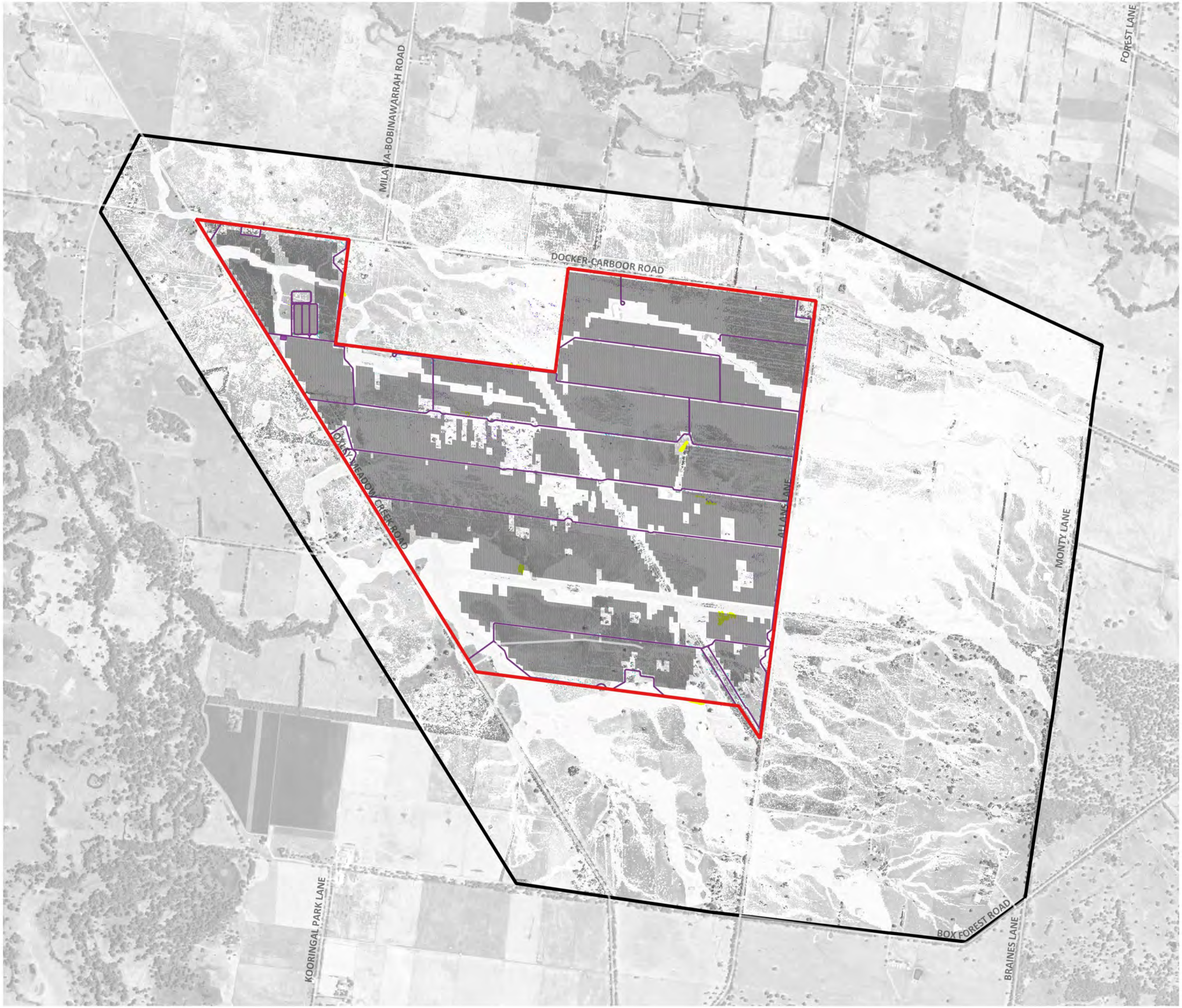
n

alluvium

MEADOW CREEK SOLAR FARM
DESIGN CONDITIONS
1% AEP FLOOD AFFLUX

Coordinates: GDA2020 MGA Zone 55
Created: 14/6/2024
Scale: 1:20,000 at A3

Originator: DC
Checked: CB
Approved: CB



LEGEND

- Model Extent
- Site Boundary
- Access Roads
- Hardstand
- PV Arrays
- Road

Flood Level Afflux (m)

- < -0.50
- -0.50 - -0.20
- -0.20 - -0.10
- -0.10 - -0.05
- -0.05 - -0.01
- -0.01 - 0.01
- 0.01 - 0.05
- 0.05 - 0.10
- 0.10 - 0.20
- 0.20 - 0.50
- > 0.50
- Was Wet, Now Dry
- Was Dry, Now Wet

0 0.5 1 km

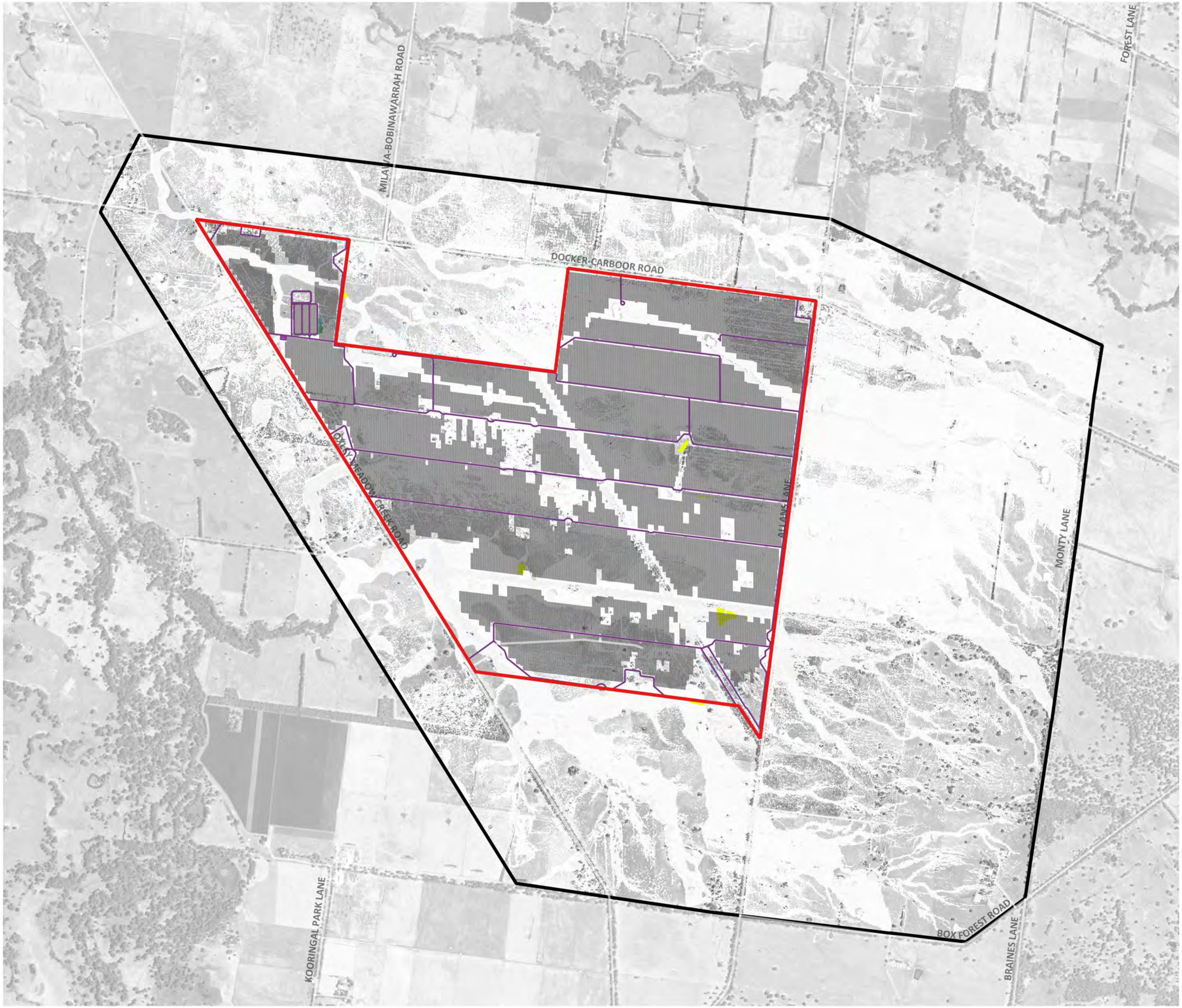
n

alluvium

MEADOW CREEK SOLAR FARM
DESIGN CONDITIONS
1% AEP + CC FLOOD AFFLUX

Coordinates: GDA2020 MGA Zone 55
Created: 14/6/2024
Scale: 1:20,000 at A3

Originator: DC
Checked: CB
Approved: CB



LEGEND

- Model Extent
- Site Boundary
- Access Roads
- Hardstand
- PV Arrays
- Road

Flood Level Afflux (m)

- < -0.50
- -0.50 - -0.20
- -0.20 - -0.10
- -0.10 - -0.05
- -0.05 - -0.01
- -0.01 - 0.01
- 0.01 - 0.05
- 0.05 - 0.10
- 0.10 - 0.20
- 0.20 - 0.50
- > 0.50
- Was Wet, Now Dry
- Was Dry, Now Wet

0 0.5 1 km

n

alluvium

MEADOW CREEK SOLAR FARM
DESIGN CONDITIONS
0.2% AEP FLOOD AFFLUX

Coordinates: GDA2020 MGA Zone 55
Created: 14/6/2024
Scale: 1:20,000 at A3

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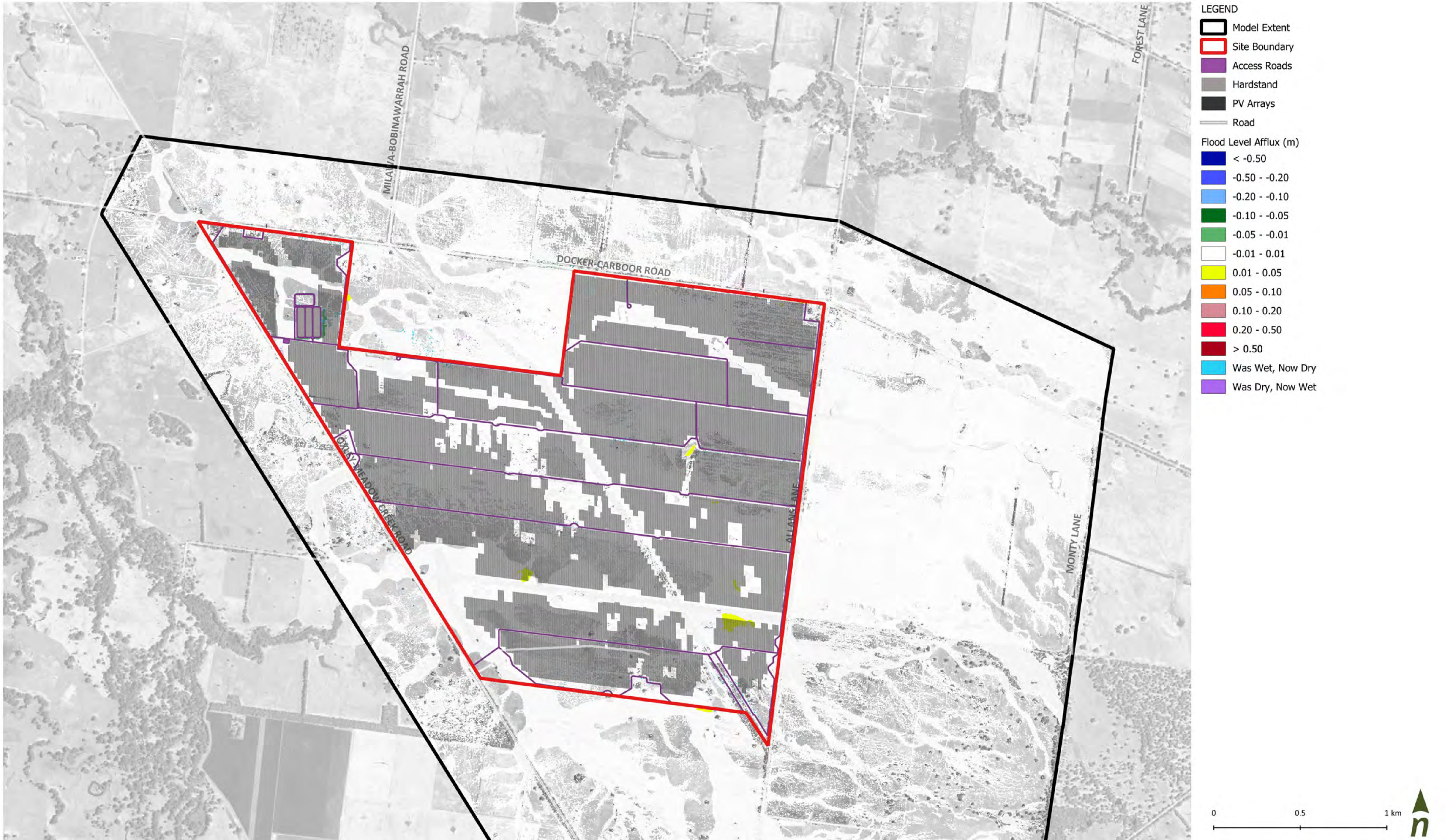

alluvium

MEADOW CREEK SOLAR FARM
DESIGN CONDITIONS
0.05% AEP FLOOD AFFLUX

Coordinates: GDA2020 MGA Zone 55
Created: 14/6/2024
Scale: 1:20,000 at A3

Originator: DC
Checked: CB
Approved: CB

Attachment D. Proposed Site Layout

MEADOW CREEK SOLAR FARM
DETAIL SITE PLAN

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PLOTTED BY: ALEX FREEMAN
PLOT DATE: 22.05.2024
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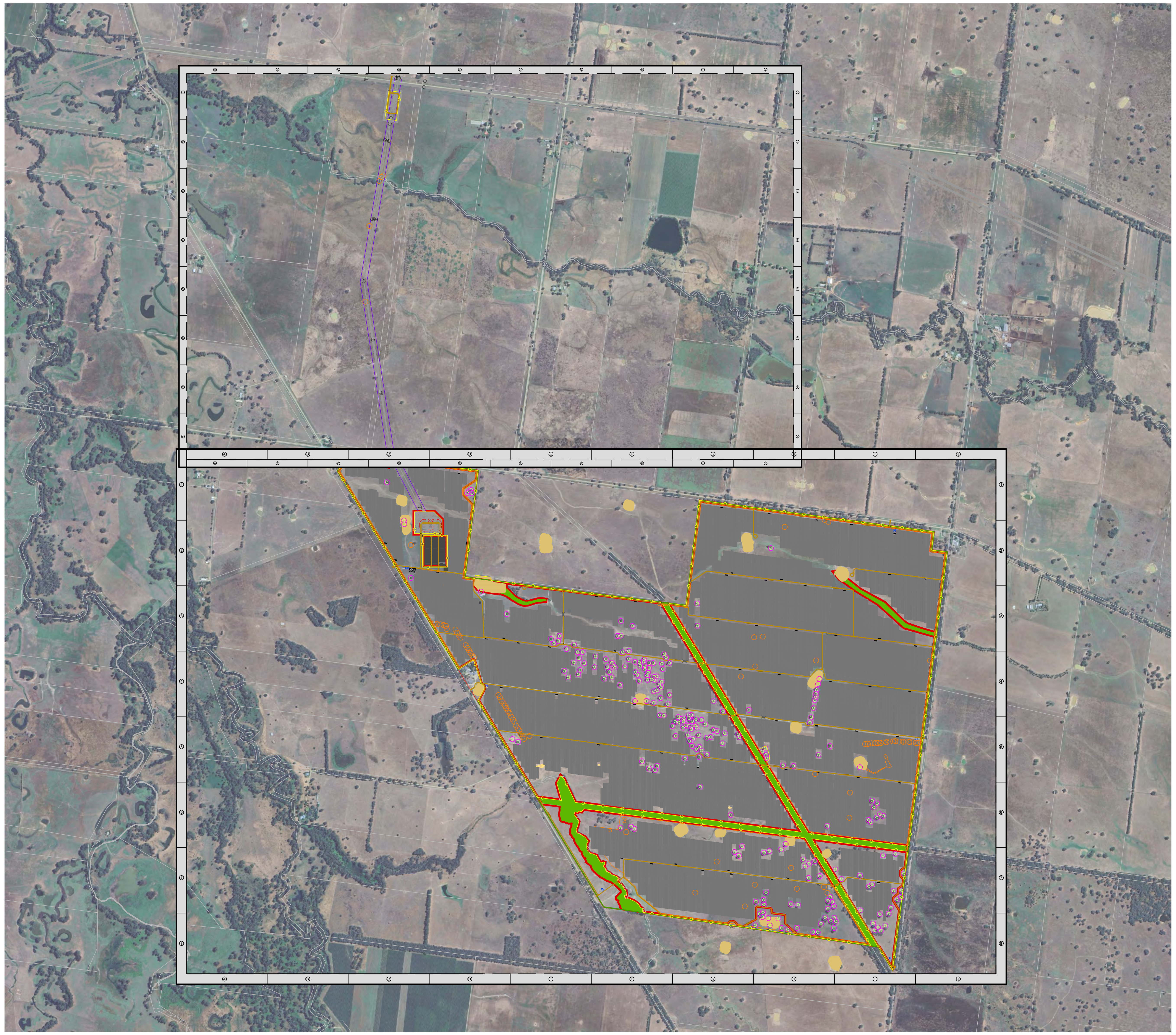

GENERAL NOTES

1. DESIGN IS CONCEPT ONLY. NOT FOR CONSTRUCTION.
2. CONCEPT DESIGN WILL COMPLY WITH THE CFA DESIGN GUIDELINES AND MODEL REQUIREMENTS RENEWABLE ENERGY FACILITIES V4 (2023).
3. OPERATION OF THE FACILITY TO ENSURE ADHERENCE TO FIRE DANGER PERIODS, HIGH FIRE DANGER AND TOTAL FIRE BAN DAYS.
4. BESS & PV SYSTEM AND ASSOCIATED EQUIPMENT SHALL HAVE SET-BACK FROM SECURITY FENCE OF MINIMUM 10M.

BESS LAYOUT AND DESIGN

5. REFER TO MEADOW CREEK SOLAR FARM BESS GENERAL ARRANGEMENT DRAWING SOLAR PANEL BANK LAYOUT AND DESIGN
6. ACCESS OF A MINIMUM SIX (6) METRE SEPARATION BETWEEN SOLAR PANEL BANKS AS PER CFA GUIDELINES.
7. UNBROKEN SOLAR PANEL BANK AREAS TO BE UNDER 25HA AS PER CFA GUIDELINES.
8. PV MODULES TO INCLUDE ANTI-REFLECTIVE COATING (AR); LOWIRON/HIGH TRANSMISSION (LFE/HT) PV GLASS OR EQUIVALENT; AND ANODISED PV FRAMES OR EQUIVALENT.
9. SOLAR PANEL BANK AREAS TO HAVE GRASS/VEGETATION MAINTAINED TO 100MM UNDER THE ARRAY INSTALLATION OR NON-COMBUSTIBLE MULCH SUCH AS STONE. VEGETATION MANAGEMENT CAN BE ACHIEVED THROUGH GRAZED PADDOCKS.
10. NO EXTERNAL LIGHTING IS PROPOSED.

FIRE BREAKS

11. DESIGN ADHERES TO CFA REQUIREMENTS FOR FIRE BREAKS. FIRE BREAKS TO BE ESTABLISHED AND MAINTAINED IN LINE WITH THE FOLLOWING:

a. AROUND THE PERIMETER OF THE FACILITY, COMMENCING FROM THE BOUNDARY OF THE FACILITY OR FROM THE VEGETATION SCREENING INSIDE THE PROPERTY BOUNDARY.

b. AROUND THE PERIMETER OF CONTROL ROOMS, ELECTRICITY COMPOUNDS, SUBSTATIONS AND ALL OTHER BUILDINGS ON-SITE.

c. BE A MINIMUM OF 10M, AND AT LEAST THE DISTANCE WHERE RADIANT HEAT FLUX (OUTPUT) FROM THE VEGETATION DOES NOT CREATE THE POTENTIAL FOR IGNITION OF ON-SITE INFRASTRUCTURE.

d. FIRE BREAK TO BE VEGETATION FREE AT ALL TIMES AND TO BE NON-COMBUSTIBLE, CONSTRUCTED USING EITHER MINERAL EARTH OR NON-COMBUSTIBLE MULCH SUCH AS CRUSHED ROCK.

e. FIRE BREAK TO BE FREE OF OBSTRUCTIONS AT ALL TIMES. NO PLANT OR EQUIPMENT OF ANY KIND IS TO BE STORED IN FIRE BREAKS.

VEGETATION MANAGEMENT AND LANDSCAPING

21. THERE IS TO BE NO LONG GRASS OR LEAF LITTER IN AREAS WHERE PLANT AND HEAVY EQUIPMENT WILL BE WORKING.
22. SOLAR PANEL BANKS ARE TO HAVE GRASS/VEGETATION MAINTAINED TO 100MM UNDER THE ARRAY INSTALLATION OR NON-COMBUSTIBLE MULCH SUCH AS STONE. VEGETATION MANAGEMENT CAN BE ACHIEVED THROUGH GRAZED PADDOCKS.
23. GRASS TO BE MAINTAINED BELOW 100 MM IN HEIGHT DURING DECLARED FIRE DANGER PERIODS.

EMERGENCY SERVICE ACCESS

24. ACCESS ROADS TO ARE TO BE OF ALL-WEATHER CONSTRUCTION AND CAPABLE OF ACCOMMODATING A VEHICLE OF 15 TONNES. ACCESS ROADS TO COMPLY WITH CFA REQUIREMENTS & PLANNING PERMIT.
25. CONSTRUCTED ROADS TO BE A MINIMUM OF 4M IN WIDTH WITH A 4M VERTICAL CLEARANCE FOR THE WIDTH OF THE FORMED ROADS.
26. PASSING BAYS TO BE INCORPORATED EVERY 600M AND AT LEAST 20M IN LENGTH, WITH A MINIMUM OF 6M IN WIDTH. WHERE ROADS ARE LESS THAN 600M LONG, AT LEAST ONE PASSING BAY IS TO BE INCORPORATED.
27. THE AVERAGE GRADE MUST BE NO MORE THAN 1 IN 7 (14.4% OR 8.1°) WITH A MAXIMUM OF NO MORE THAN 1 IN 5 (20% OR 11.3°) FOR NO MORE THAN 50M.
28. DIPS IN THE ROAD MUST HAVE NO MORE THAN 1 IN 8 (12.5% OR 7.1°) ENTRY AND EXIT ANGLE.
29. ACCESS ROADS AND HARDSTANDS TO BE KEPT CLEAR AT ALL TIMES.

FENCING

30. BLACK PVC COATED CHAIN WIRE SECURITY FENCING TO BE 2.2M WITH 300MM OF BARBED (OR EQUIVALENT WIRE) FOR A TOTAL MAXIMUM HEIGHT OF 2.5M, IN ACCORDANCE WITH PLANNING PERMIT.
31. GATES TO BE INSTALLED AT APPROPRIATE INTERVALS TO ALLOW ACCESS FOR LANDSCAPING MAINTENANCE ACTIVITIES INSIDE THE SITE.

WATER SUPPLY

32. FOR THIS FACILITY, WITH A BATTERY ENERGY STORAGE SYSTEM AND WITH NO RETICULATED WATER AVAILABLE, THE FIRE PROTECTION SYSTEM MUST INCLUDE A FIRE WATER SUPPLY IN STATIC WATER STORAGE TANKS, WHERE THE STATIC WATER TANKS ARE TO (SIGNAGE TO COMPLY WITH CFA

GUIDELINES):

a. COMPLY WITH AS 2419.1. AUSTRALIAN STANDARD FIRE HYDRANT INSTALLATIONS.

b. SHALL BE OF NOT LESS THAN 288,000L EFFECTIVE CAPACITY, OR AS PER THE PROVISIONS FOR OPEN YARD PROTECTION OF AS 2419.1-2005 FLOWING FOR A PERIOD OF NO LESS THAN FOUR HOURS AT 20L/S, WHICHEVER IS THE GREATER.

c. THE QUANTITY OF STATIC FIRE WATER STORAGE IS TO BE CALCULATED FROM THE NUMBER OF HYDRANTS REQUIRED TO FLOW FROM AS 2419.1-2005, TABLE 3.3.

d. FIRE HYDRANTS MUST BE PROVIDED AND LOCATED SO THAT EVERY PART OF THE BATTERY ENERGY STORAGE SYSTEM IS WITHIN REACH OF A 10M HOSE STREAM ISSUING FROM A NOZZLE AT THE END OF A 60M LENGTH OF HOSE CONNECTED TO A FIRE HYDRANT OUTLET.

e. THE FIRE WATER SUPPLY MUST BE LOCATED AT VEHICLE ENTRANCES TO THE FACILITY, AT LEAST 10M FROM ANY INFRASTRUCTURE (ELECTRICAL SUBSTATIONS, INVERTERS, BATTERY ENERGY STORAGE SYSTEMS, BUILDINGS).

f. THE FIRE WATER SUPPLY MUST BE REASONABLY ADJACENT TO THE BATTERY ENERGY STORAGE SYSTEM AND SHALL BE ACCESSIBLE WITHOUT UNDUE DANGER IN AN EMERGENCY. (E.G., FIRE WATER TANKS ARE TO BE LOCATED CLOSER TO THE SITE ENTRANCE THAN THE BATTERY ENERGY STORAGE SYSTEM.

g. STATIC WATER TANK SHALL BE AN ABOVE-GROUND WATER TANK CONSTRUCTED OF CONCRETE OR STEEL.

h. THE STATIC WATER STORAGE TANK(S) MUST BE CAPABLE OF BEING COMPLETELY REFILLED AUTOMATICALLY OR MANUALLY WITHIN 24 HOURS.

i. HARDSTAND AND ACCESS ROAD TO BE KEPT CLEAR AT ALL TIMES.

j. THE HARD-SUCTION POINT MUST BE PROVIDED, WITH A 150MM FULL BORE ISOLATION VALVE EQUIPPED WITH A STORZ CONNECTION, SIZED TO COMPLY WITH THE REQUIRED SUCTION HYDRAULIC PERFORMANCE. ADAPTERS THAT MAY BE REQUIRED TO MATCH THE CONNECTION ARE 125MM, 100MM, 90MM, 75MM, 65MM STORZ TREE ADAPTERS WITH A MATCHING BLANK END CAP TO BE PROVIDED.

k. THE HARD SUCTION POINT MUST BE POSITIONED WITHIN FOUR (4) METRES TO A HARDSTAND AREA AND PROVIDE A CLEAR ACCESS FOR EMERGENCY SERVICES PERSONNEL.

l. ALL-WEATHER ROAD ACCESS AND HARDSTAND SHALL BE PROVIDED TO THE HARD-SUCTION POINT. THE HARDSTAND SHALL BE MAINTAINED TO A MINIMUM OF 15 TONNES GVM, 8M LONG AND 6M WIDE OR TO THE SATISFACTION OF THE RELEVANT FIRE AUTHORITY.

m. THE HARD-SUCTION POINT MUST BE PROTECTED FROM MECHANICAL DAMAGE WHERE NECESSARY.

n. AN EXTERNAL WATER LEVEL INDICATOR MUST BE PROVIDED TO THE TANK AND BE VISIBLE FROM THE HARDSTAND AREA.

CAR PARKING

33. CAR PARKING AREA IS LOCATED WITHIN PROXIMITY TO THE ENTRANCE TO THE SITE WITH A TOTAL CAPACITY OF SEVEN (7) VEHICLES. DIMENSIONS TO BE CONFIRMED WITH ROAD DESIGNER TO BE IN ACCORDANCE WITH CAR PARKING DESIGN GUIDELINES CLAUSE 52.06.

HYBRID SOLAR FARM & AC-COUPLED BESS SPECIFICATIONS	
GRID TRANSFER LIMIT	250 MWac
SITE AREA (ha)	566.1 ha
SOLAR FARM	
SOLAR PV DC CAPACITY	332 MWp
SOLAR PV AC CAPACITY	285.60 MVA
INVERTER NAME / CAPACITY	SMA SC4200-UP / 4.2 MVA
TOTAL QUANTITY SOLAR INVERTERS	68
TRANSFORMER CAPACITY	4.4 MVA @ 25°C (0.63/33kV)
TOTAL SOLAR TRANSFORMERS	68
PV MODULE TYPE	592,752 x YINGLI YL615CF78 N-TYPE BI-FACIAL
PV MODULE CAPACITY	615 Wp
PV MODULE DIMENSIONS	2,465 x 1,134mm x 30mm
MODULES PER STRING	24
PV FRAMEWORK	SINGLE AXIS TRACKER
TRACKING RANGE	+/- 60° EAST-WEST/ BACK TRACKING
PITCH	5m
BATTERY ENERGY STORAGE SYSTEM	
BESS DC ENERGY CAPACITY @ RATED POWER	Up to 1000mWh [BOL]
BESS NAME / MAXIMUM RATED POWER	ENERGY VAULT 296.68 MW
INVERTER NAME / CAPACITY	SMA SC3600-UP-XT / 3.6 MVA
TOTAL QUANTITY BESS INVERTERS	98
TRANSFORMER CAPACITY	3.62 MVA @ 25°C (0.63/33kV)
TOTAL BESS TRANSFORMERS	98

GENERAL LEGEND

- DEVELOPMENT BOUNDARY
- BOUNDARY FENCE
- OVERHEAD CABLE 220kV
- INTERNAL ROADS 4M
- EXTERNAL VEGETATION BUFFER 5M
- FIRE SAFETY BUFFER 10M
- DAMS RETAINED
- EASEMENT
- CULTURAL SENSITIVITY AREA
- PASSING BAYS
- TRANSMISSION LINE TOWERS
- GATES
- CULVERT
- SOLAR INVERTER
- VEGETATION - REMOVED
- VEGETATION - RETAINED
- TREE PROTECTION ZONE 15M
- SOLAR TRACKERS (7172)
- 48-STRING TRACKERS (1240)
- 72-STRING TRACKERS (1510)
- 96-STRING TRACKERS (4422)

URBIS

PROJECT
MEADOW CREEK SOLAR FARM
.
1033 OXLEY-MEADOW CREEK RD, MEADOW CREEK
VICTORIA, AUSTRALIA

Level 10, 477 Collins Street | Melbourne VIC 3000 AUSTRALIA | +61 3 8663 4888 | URBIS Pty Ltd | ABN 50 105 256 228

ALL DRAWINGS ARE DESIGNED TO BE PRINTED AND READ IN COLOUR

IT IS THE CONTRACTORS' RESPONSIBILITY TO PRINT DRAWINGS IN COLOUR TO AVOID ANY POTENTIAL DISCREPANCIES IF DRAWINGS ARE PRINTED IN BLACK AND WHITE

REV	DESCRIPTION	DWN	CHK	DATE
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C	FOR REVIEW	AF	BB	21.05.2024
B	FOR REVIEW	AF	BB	15.04.2024
A	FOR REVIEW	AF	BB	25.03.2024
.	FOR REVIEW - DRAFT	AF	BB	28.02.2024

DISCLAIMER

PROJECT DIRECTOR: BRENTON BEGGS

CLIENT
MEADOW CREEK SOLAR FARM
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DRAWING TITLE
COVER SHEET
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ISSUE

SCALE

DRAWING NO.
001-CS

PROJECT NO.
P0050228

NORTH

REVISION
C

HYBRID SOLAR FARM & AC-COUPLED BESS SPECIFICATIONS	
GRID TRANSFER LIMIT	250 MWac
SITE AREA (ha)	566.1 ha
SOLAR FARM	
SOLAR PV DC CAPACITY	332 MWp
SOLAR PV AC CAPACITY	285.60 MVA
INVERTER NAME / CAPACITY	SMA SC4200-UP / 4.2 MVA
TOTAL QUANTITY SOLAR INVERTERS	68
TRANSFORMER CAPACITY	4.4 MVA @ 25°C (0.63/33kV)
TOTAL SOLAR TRANSFORMERS	68
PV MODULE TYPE	592,752 x YINGLI YL615CF78 N-TYPE BI-FACIAL
PV MODULE CAPACITY	615 Wp
PV MODULE DIMENSIONS	2,465 x 1,134mm x 30mm
MODULES PER STRING	24
PV FRAMEWORK	SINGLE AXIS TRACKER
TRACKING RANGE	+/- 60° EAST-WEST/ BACK TRACKING
PITCH	5m
BATTERY ENERGY STORAGE SYSTEM	
BESS DC ENERGY CAPACITY @ RATED POWER	Up to 1000mWh [BOL]
BESS NAME / MAXIMUM RATED POWER	ENERGY VAULT 296.68 MW
INVERTER NAME / CAPACITY	SMA SC3600-UP-XT / 3.6 MVA
TOTAL QUANTITY BESS INVERTERS	98
TRANSFORMER CAPACITY	3.62 MVA @ 25°C (0.63/33kV)
TOTAL BESS TRANSFORMERS	98

GENERAL LEGEND

- DEVELOPMENT BOUNDARY
- BOUNDARY FENCE
- OVERHEAD CABLE 220kV
- INTERNAL ROADS 4M
- EXTERNAL VEGETATION BUFFER 5M
- FIRE SAFETY BUFFER 10M
- DAMS RETAINED
- EASEMENT
- CULTURAL SENSITIVITY AREA
- PASSING BAYS
- TRANSMISSION LINE TOWERS
- GATES
- CULVERT
- SOLAR INVERTER
- VEGETATION - REMOVED
- VEGETATION - RETAINED
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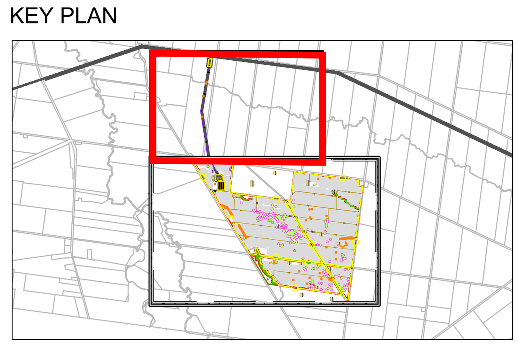
PROJECT

MEADOW CREEK SOLAR FARM

.
1033 OXLEY-MEADOW CREEK RD, MEADOW CREEK
VICTORIA, AUSTRALIA

Level 10, 477 Collins Street | Melbourne VIC 3000 AUSTRALIA | +61 3 8663 4888 | URBIS Pty Ltd | ABN 50 105 256 228

KEY PLAN



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B	FOR REVIEW	AF	BB	15.04.2024
A	FOR REVIEW	AF	BB	25.03.2024
.	FOR REVIEW - DRAFT	AF	BB	28.02.2024

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MEADOW CREEK SOLAR FARM
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DRAWING TITLE
DETAIL PLAN 01
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ISSUE

SCALE
1:3000 @ A3

DRAWING NO.
201-FI

PROJECT NO.
P0050228

NORTH

REVISION
C

HYBRID SOLAR FARM & AC-COUPLED BESS SPECIFICATIONS	
GRID TRANSFER LIMIT	250 MWac
SITE AREA (ha)	566.1 ha
SOLAR FARM	
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Level 10, 477 Collins Street | Melbourne VIC 3000 AUSTRALIA | +61 3 8663 4888 | URBIS Pty Ltd | ABN 50 105 256 228

KEY PLAN

REV	DESCRIPTION	DWN	CHK	DATE
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.	FOR REVIEW - DRAFT	AF	BB	28.02.2024

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PROJECT DIRECTOR: BRENTON BEGGS

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MEADOW CREEK SOLAR FARM

ISSUE

PROJECT NO.
P0050228

SCALE
1:6000 @ A3

NORTH

DRAWING TITLE
DETAIL PLAN 02

DRAWING NO.
202-FI

REVISION
C

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