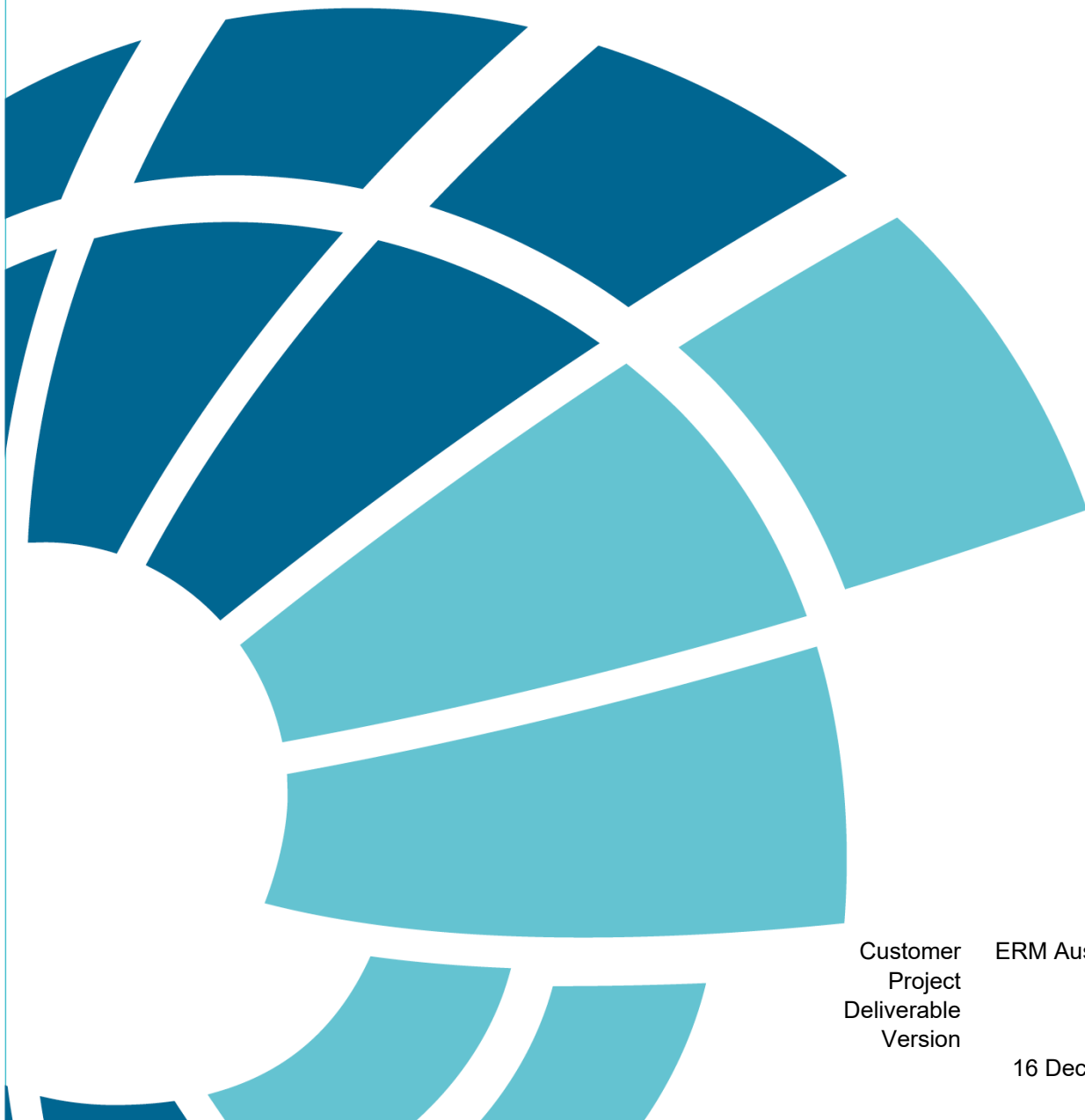


Keri Keri Wind Farm Flood Assessment - Addendum



Customer	ERM Australia Pty Ltd
Project	000673
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Document Identification

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Customer	ERM Australia Pty Ltd
Customer Contact	Mark Davey
Synopsis	This addendum report documents the additional flood assessments undertaken for the proposed Keri Keri Wind Farm as part of the Environmental Impact Statement (EIS) to address the Secretary's Environmental Assessment Requirements (SEARs) and agency advice.
Author	Yasser Khalegian, Eranda Perera
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Project Manager	Owen de Jong

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1 Introduction

This report presents an addendum to the flood assessment undertaken by BMT (2024) on behalf of Acciona Energy Australia Global Pty Ltd (Acciona) to support the State Significant Development Application (SSD-38358962) of the proposed Keri Keri Wind Farm Project (the “Project”). The flood assessment was undertaken to address the Secretary’s Environmental Assessment Requirements (SEARs) for SSD-38358962, with the main objectives to establish the flood risks and flood impacts of the Project infrastructure including the proposed wind turbine generators (WTGs) and waterway crossings. This addendum addresses item 2.1 of the BCS & NPWS letter (DOC24/399724, dated 15 July 2024), to investigate the potential riverine risk posed to the project site because of breakout flows originating from the Murrumbidgee River during the extreme event scenario. This addendum also incorporates a revised site layout provided on 10 October 2025.

1.1 Site Description

The approximate 18,006 ha (or 180 km²) Project site is located in Keri Keri approximately 37 km east of Balranald in NSW within the Murray River Council (“Council”) Local Government Area (LGA). Figure 1.1 shows the Project site locality in relation to Abercrombie Creek and surrounding floodplain, with Abercrombie Creek traverses near the southern site boundary. Murrumbidgee River, which is a major tributary of the Murray-Darling River System, is found approximately 30 km north of the Project site (at the closest point).

The Project site is bounded by Sturt Highway to the north, Keri Keri Road to the west, Abercrombie Creek to the south and rural lands to the east. The majority of the Project site is undeveloped rural lands.

The existing topography around the Project site is shown in Figure 1.2 and is based on the 1 m Digital Elevation Model (DEM) generated from LiDAR (Light Detection and Ranging) data collected in 2021 available from the ELVIS webpage¹. Additional LiDAR survey was also collected as part of the Project in early 2022. Based on the topographic information, the Project site terrain was found to vary between 65 and 70 m AHD, which signifies a flat terrain and typically sloping towards the west. A series of lake systems is found to the west, all of which eventually discharge into the Murray-Darling River System along with the Abercrombie Creek system.

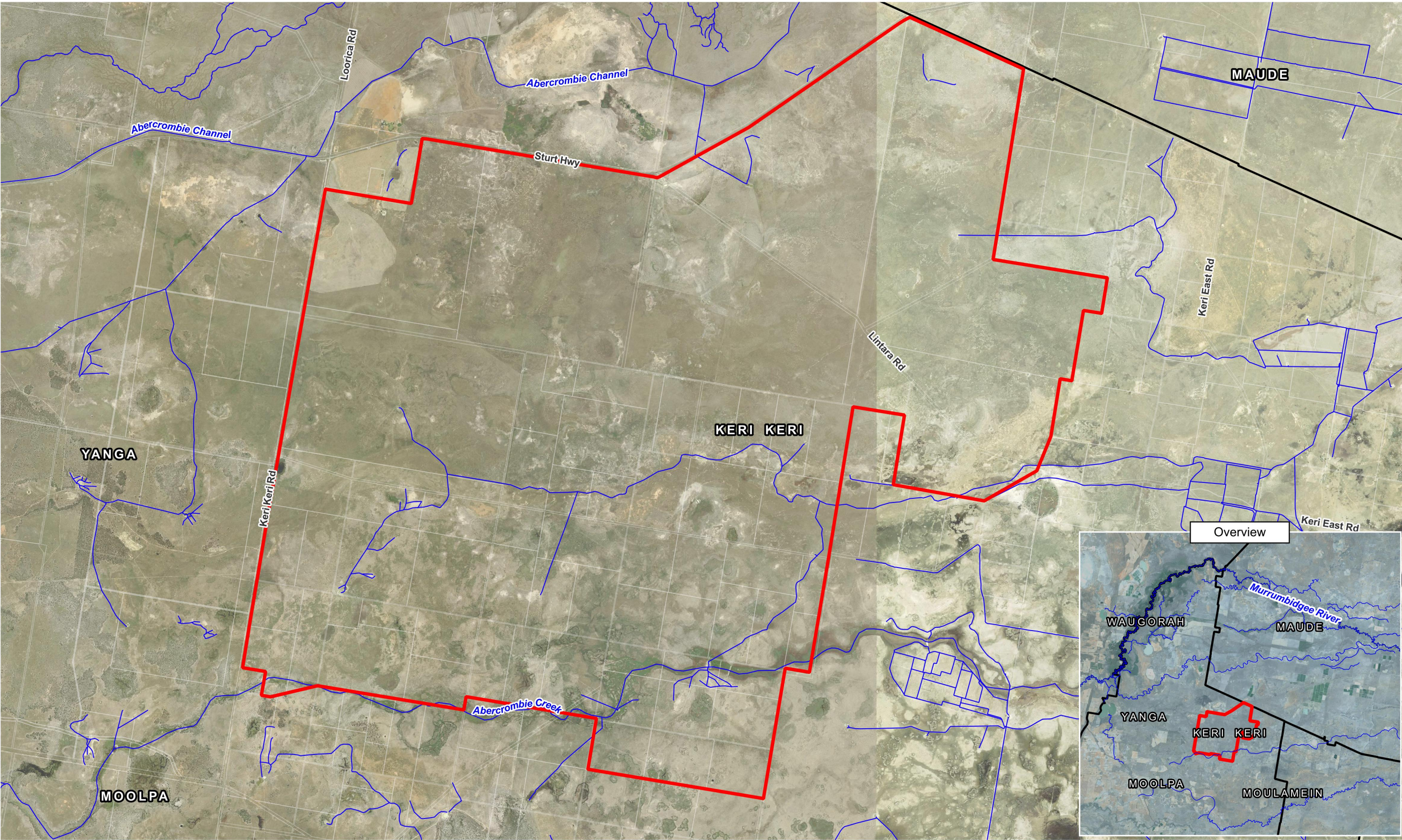
1.2 Scope of Assessment

The following tasks have been undertaken as part of the assessment:

- Review of available topographic and flood information for the Project site;
- Simulation and assessment of proposed development flood risk for design flood events including the 5% AEP (Annual Exceedance Probability), 1% AEP, 0.5% AEP, 0.2% AEP, Probable Maximum Flood (PMF) and PMF with regional model inflows;
- Investigation of the potential riverine risk posed to the project because of breakout flows originating from the Murrumbidgee River (based on regional model) during an extreme event case;
- Review of the proposed development works, assess flood impacts,

The scope of work does not include the development of a Stormwater Management Plan for the Project site.

¹ <https://elevation.fsdf.org.au/>



LEGEND

- Project Extent
- LGA Boundary
- Hydrolines
- Cadastre

Title:
Site Locality

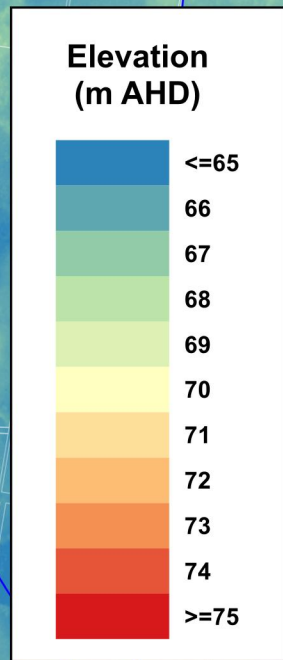
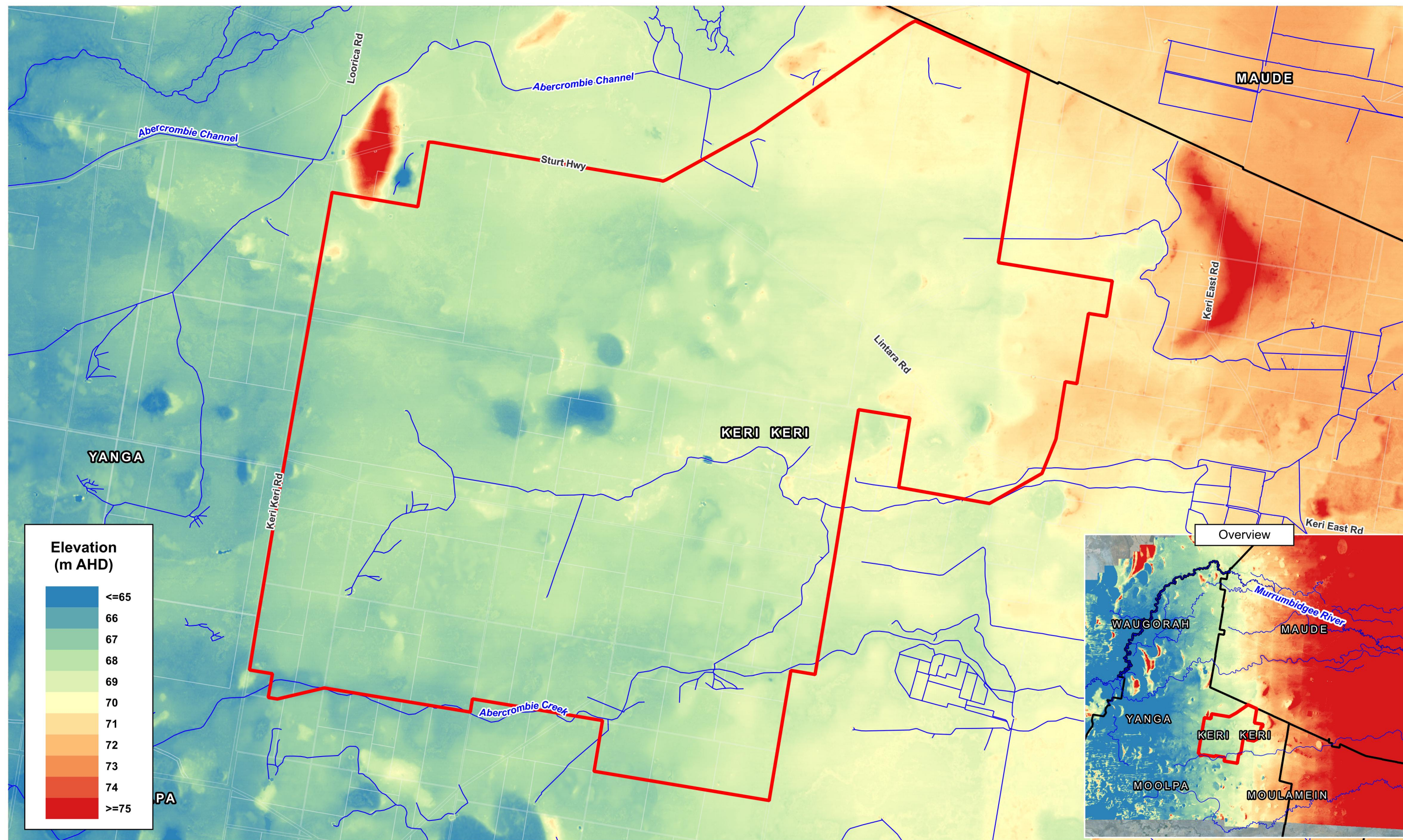
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- LEGEND**
- Project Extent
 - LGA Boundary
 - Hydrolines
 - Cadastre

Title:
Site Topography

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2 Project Description

The Project involves the construction, operation, maintenance and decommissioning of the Keri Keri Wind Farm, as generally illustrated on Figure 2.1, including:

- Up to 114 wind turbine generators (WTGs), each with:
 - A generating capacity of approximately 775 MW;
 - Three blades mounted to a rotor hub (hub height of up to 200 m) on a nacelle above a tubular steel tower, with a blade tip height (blade length plus hub height) of up to 291.5 m AGL²;
 - A gearbox and generator assembly housed in the nacelle; and
 - Adjacent hardstands for use as crane pads, assembly and laydown areas.
- Electrical infrastructure:
 - Three (3) 33/330 kV electrical substations, including control room, transformers, circuit breakers, switches and other ancillary equipment;
 - A battery energy storage system (BESS) of up to 200 MW/800 MWh (four hours of storage);
 - Underground 33 kV electrical reticulation connecting the WTGs to the onsite substations (generally following site access tracks); and
 - A 330 kV overhead transmission line of approximately 16.21 km, connecting the three substations to a new electrical switching station (including circuit breakers, switches and other ancillary equipment). A 220 kV or 330 kV overhead transmission line of approximately up to 0.7 km, connecting the switching station to the existing transmission line or the planned NSW-SA interconnector, Project EnergyConnect.
- Ancillary infrastructure:
 - One (1) operations and maintenance (O&M) facility;
 - Internal access tracks (combined total length of approximately 116.5 km) connecting the WTGs and associated Project infrastructure with the public road network; and
 - Decommissioning of three (3) temporary meteorological monitoring masts and installation of up to three (3) permanent meteorological monitoring masts for power testing. The permanent monitoring masts will be located close to a WTG location with a maximum height of approximately 200 m AGL.
- Upgrades to roads and intersections required for the delivery of oversize and overmass WTG components, transformers and associated construction-phase materials and vehicular movements.

² Above Ground Level

The following temporary elements will be required during the construction phase of the Project:

- Two (2) temporary construction compounds which includes buildings and facilities for construction contractors/equipment;
- One (1) workers accommodation compound;
- Mobile concrete batching plants to supply concrete for WTG footings and substation construction works;
- Earthworks for access tracks, WTG platforms and foundations, potentially including controlled blasting in certain areas;
- Hardstand laydown areas for the storage of construction materials, plant, and equipment;
- Up to three (3) temporary meteorological monitoring masts. The temporary monitoring masts will be located close to a WTG location with a maximum height of approximately 200 m AGL;
- External water supply and storage for concrete batching and construction activities;
- The transport, storage and handling of fuels, oils and other hazardous materials for construction and operation of wind farm infrastructure; and
- Beneficial reuse of materials won from within the development footprint during cut and fill and WTG foundation excavation works for use in access track, hardstands and foundation material.

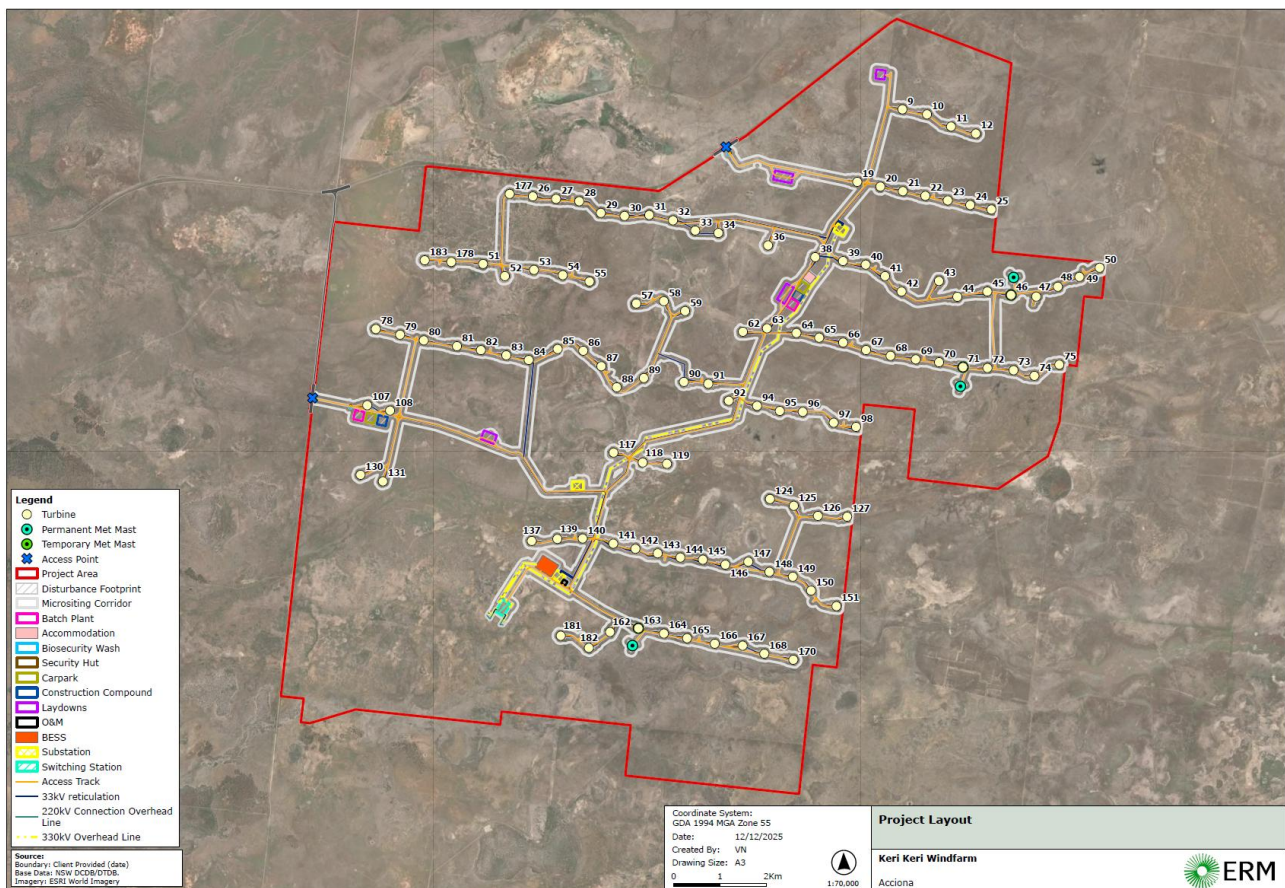


Figure 2.1 Project Layout (Source: Acciona)

3 Flood Assessment Approach

The flood assessment has been undertaken using new flood models developed based on the Australian Rainfall and Runoff 2019 (ARR 2019) data and methodology to establish existing (baseline) and post-development flood behaviour for the Project site. The assessment approach is discussed further in the following sections.

3.1 Input Data

To facilitate the assessment, the following datasets have been provided by ERM Australia Pty Ltd or obtained from publicly available sources:

- Aerial imagery of the study area;
- Project layout as GIS files (issued 10 October 2025);
- Digital Elevation Model (DEM) in 1 m resolution tiles based on LiDAR aerial survey obtained from 2021 by the NSW Government, available from the ELVIS webpage³;
- DEM in 1 m resolution tiles based on LiDAR aerial survey obtained early 2022 for the Project by RPS;
- Cadastral information and hydrolines (watercourses) from SIX Maps⁴;
- Bureau of Meteorology (BoM) 2016 design rainfalls⁵; and
- Storm losses and temporal patterns for design rainfalls from ARR Data Hub⁶.

3.2 Regional Catchment Modelling

Breakout flows from the Murrumbidgee River were assessed for the extreme event, to determine the potential for them to affect the site. This will assist in informing emergency management considerations, in combination along with the PMF modelled for the local model. A regional model was developed for this purpose, using available LiDAR for topography and a relatively coarse cell size to ensure reasonable model simulation times. Modelling of structures, bathymetry or detailed survey were not included at this regional scale. The regional model setup is shown in Figure 3.1.

The extreme event flow rate was estimated based on flood frequency analysis (FFA) of available flow data from Narrandera, Darlington Point, Carrathool Bridge, Hay Weir and Maude Weir stream gauges (see Section 3.2.2 for FFA). The 0.05% AEP (1 in 2,000 year) event was adopted as the 'Extreme Event' in this work. After conducting the FFA, the highest flow rate estimated observed from the FFAs across the 5 gauges was adopted in the hydraulic model to obtain a conservative modelling outcome.

The 'Extreme Event' flow rate obtained from the FFA was applied at the upstream boundary of the model as a discharge vs time (HT) boundary, located at Darlington Point, approximately 190 km east of the site. A coarse grid model (100 m cell sizes) was used with TUFLOW's sub-grid sampling (SGS) feature. The Sturt highway was represented using a breakline based on LiDAR data. Roughness was applied assuming a global roughness for medium grass floodplain (0.055), watercourses (0.045), and roads (0.02). At the downstream extent of the model, surface water is allowed to freely drain using a height vs discharge (HQ) boundary with 0.1% slope due to the flat nature of the terrain.

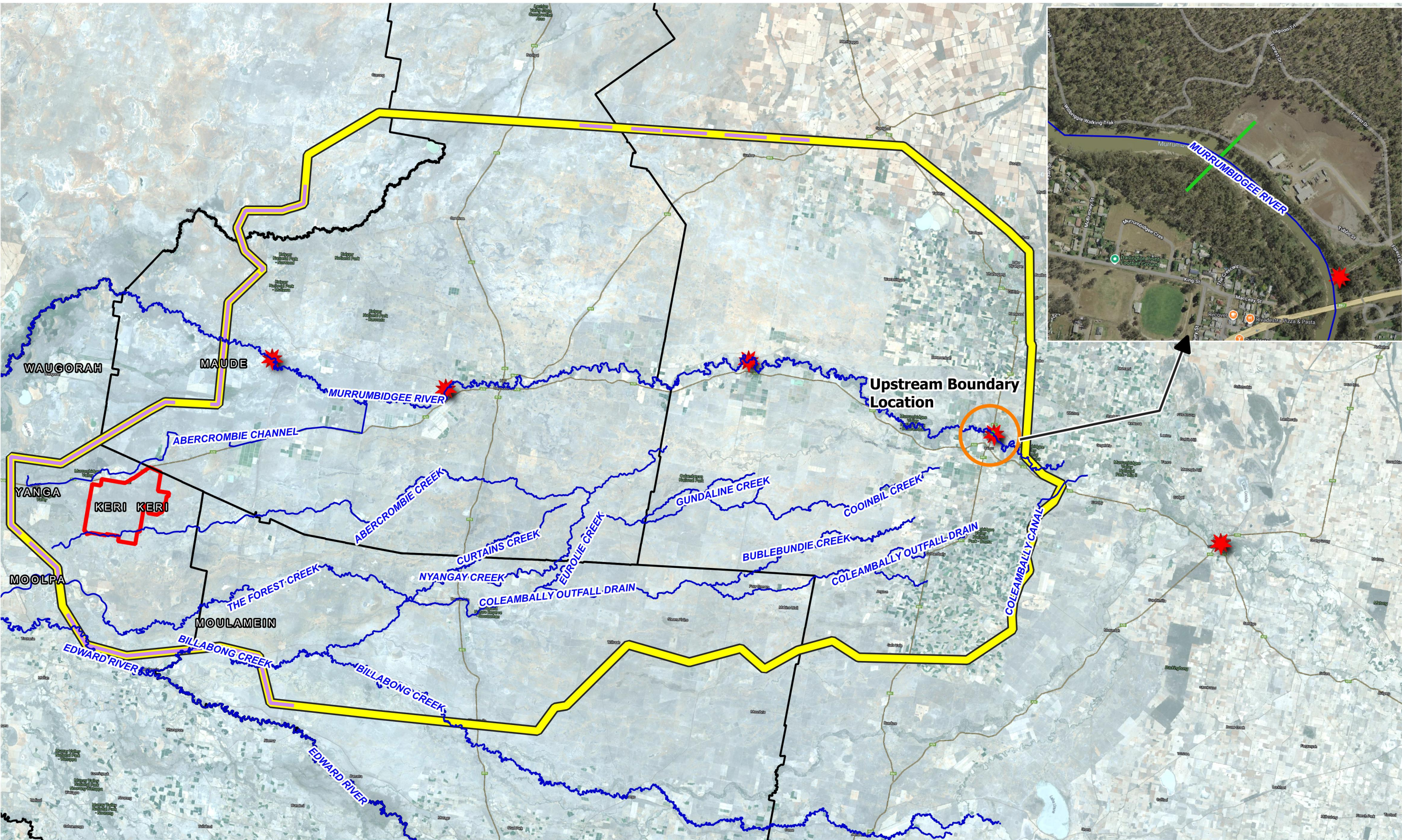
³ <https://elevation.fsdf.org.au/>

⁴ <https://maps.six.nsw.gov.au/clipnship.html>

⁵ <http://www.bom.gov.au/water/designRainfalls/revised-ifd/>

⁶ <https://data.arr-software.org/>

At the upstream boundary, the peak 0.05% AEP flow rate was applied as a constant flow rate for a duration of 2,000 hours, which ensured that the flow reaches the site area. A long duration was required due to large catchment scale, low velocities (due to relatively flat terrain) and presence of a large number of storage areas. At the site area, water levels and flow rates were reviewed to ensure that the flow reaches the site and steady-state levels were achieved.



LEGEND

Model Extent

Project Extent

LGA Boundary

Hydrolines

Upstream Boundaries

Downstream Boundaries

Gauges Adopted for FFA

Title:
Regional Model with Gauges Adopted for FFA

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Fig 3.1

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Filepath: K:\A10766_KeriKeri_WindSolar_EIS_Flooding\02_Workspace\Figure 3.1 Regional model with gauges adopted for FFA.qgz

3.2.2 Flood Frequency Analyses

The FFAs adopted a Log Pearson III fitting model, along with a Grubbs Beck test to censor low flow outliers above the zero threshold (noting that this resulted in no data values). Table 3.1 shows the information of gauges used for the FFAs.

Table 3.1 Data available for Flood Frequency Analyses

Gauge Number	Gauge Name	Period of Record	Years of Record	Comments
410021	Murrumbidgee River at Darlington Point	1970 to 2023	55	No censored data.
410005	Murrumbidgee River at Narrandera	1891 to 1933, 1973 to 2023	43 + 52 = 95	Gap in data from January 1934 to August 1973
41000281	Murrumbidgee River at Carrathool Bridge	1995 to 2023	29	No censored data.
410136	Murrumbidgee River Downstream Hay Weir	1982 to 2023	43	2 data points censored.
410040	Murrumbidgee River Downstream Maude Weir	1974 to 2023	51	25 data points censored

FFA results for the five selected gauges are shown in Table 3.2 to Table 3.6, with results illustrated in the plots presented in Table 3.2 to Figure 3.6.

Table 3.2 FFA results for Murrumbidgee River at Darlington Point

AEP	Best Fit	5% Quantile	95% Quantile
5% AEP (1 in 20)	895.66	752.29	1112.8
1% AEP (1 in 100)	1433.57	1103.74	2072.2
0.5% AEP (1 in 200)	1689.89	1243.54	2628.8
0.2% AEP (1 in 500)	2051.49	1418.90	3528.4
0.05% AEP (1 in 2,000)	2647.38	1655.24	5326.1

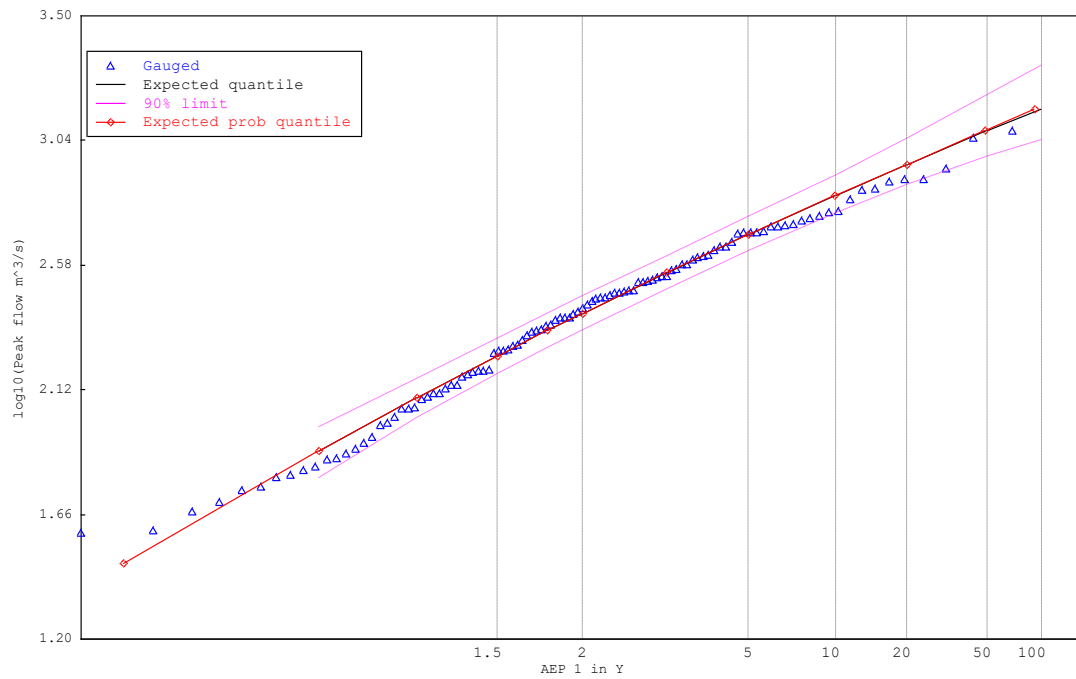


Figure 3.2 FFA at Murrumbidgee River at Darlington Point.

Table 3.3 FFA results for Murrumbidgee River at Narrandera

AEP	Best Fit	5% Quantile	95% Quantile
5% AEP (1 in 20)	2395.61	1775.98	3561.4
1% AEP (1 in 100)	4670.61	2795.39	9500.2
0.5% AEP (1 in 200)	5948.62	3187.74	14065.2
0.2% AEP (1 in 500)	7960.12	3658.14	23249.0
0.05% AEP (1 in 2,000)	11805.17	4331.19	47834.8

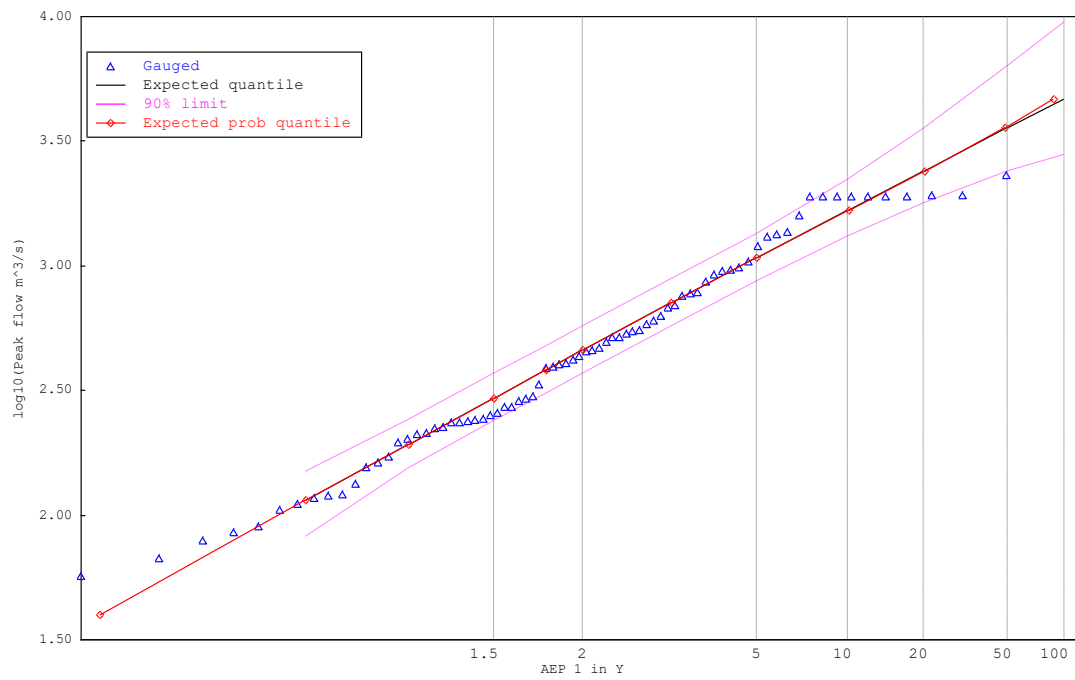


Figure 3.3 FFA at Murrumbidgee River at Narrandera.

Table 3.4 FFA results for Murrumbidgee River at Carrathool Bridge

AEP	Best Fit	5% Quantile	95% Quantile
5% AEP (1 in 20)	807.59	458.90	1833.6
1% AEP (1 in 100)	2142.70	882.76	8602.4
0.5% AEP (1 in 200)	3165.49	1117.37	16529.1
0.2% AEP (1 in 500)	5204.08	1478.54	38448.0
0.05% AEP (1 in 2,000)	10707.29	2155.92	133458.7

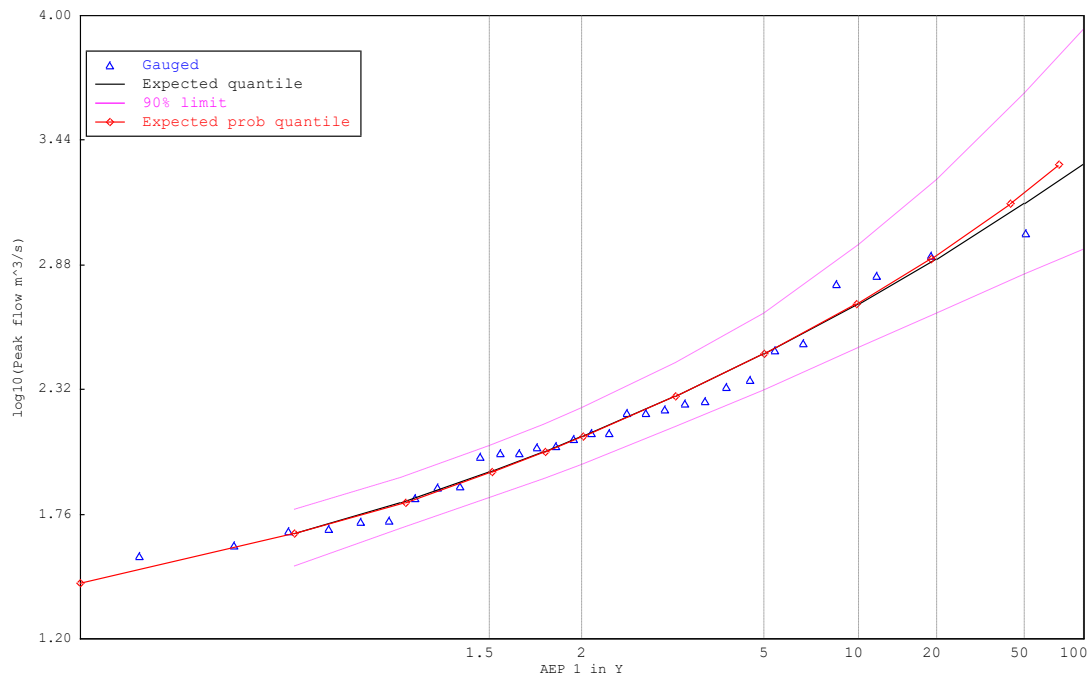


Figure 3.4 FFA at Murrumbidgee River at Carrathool Bridge.

Table 3.5 FFA results for Murrumbidgee River Downstream Hay Weir

AEP	Best Fit	5% Quantile	95% Quantile
5% AEP (1 in 20)	739.03	511.10	1300.1
1% AEP (1 in 100)	1367.02	738.24	3772.2
0.5% AEP (1 in 200)	1706.79	806.68	5916.3
0.2% AEP (1 in 500)	2228.55	878.34	10384.5
0.05% AEP (1 in 2,000)	3193.70	966.18	23721.2

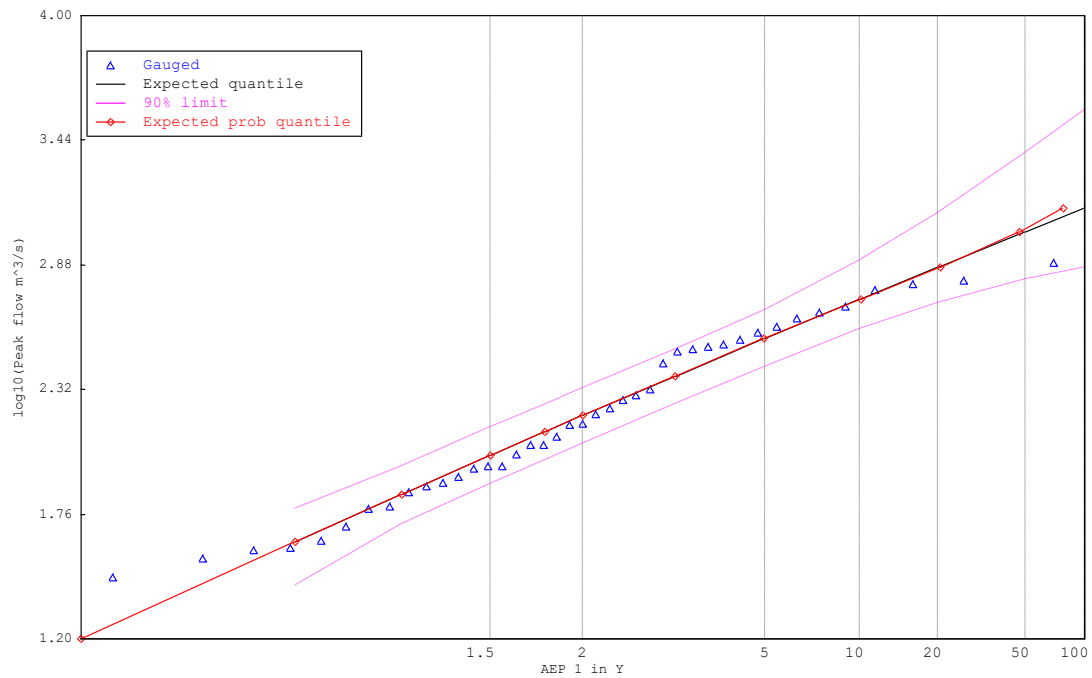


Figure 3.5 FFA at Murrumbidgee River Downstream Hay Weir.

Table 3.6 FFA results for Murrumbidgee River Downstream Hay Weir

AEP	Best Fit	5% Quantile	95% Quantile
5% AEP (1 in 20)	338.17	300.43	395.4
1% AEP (1 in 100)	407.31	361.35	506.9
0.5% AEP (1 in 200)	429.19	380.44	550.9
0.2% AEP (1 in 500)	452.81	393.01	605.8
0.05% AEP (1 in 2,000)	479.72	406.88	682.9

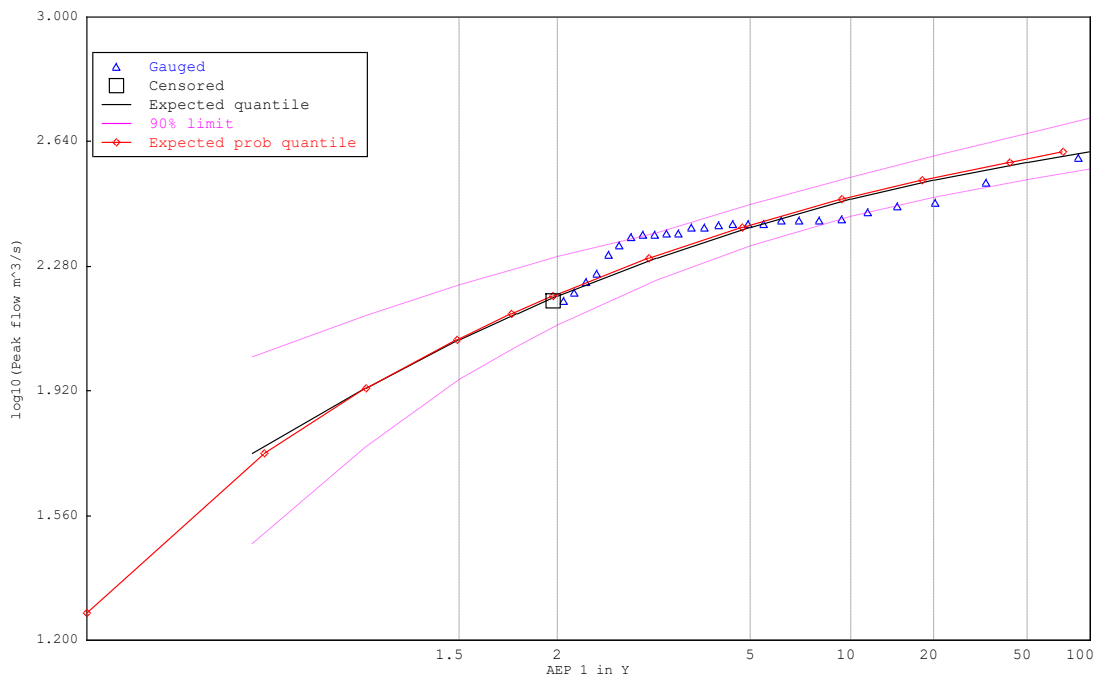


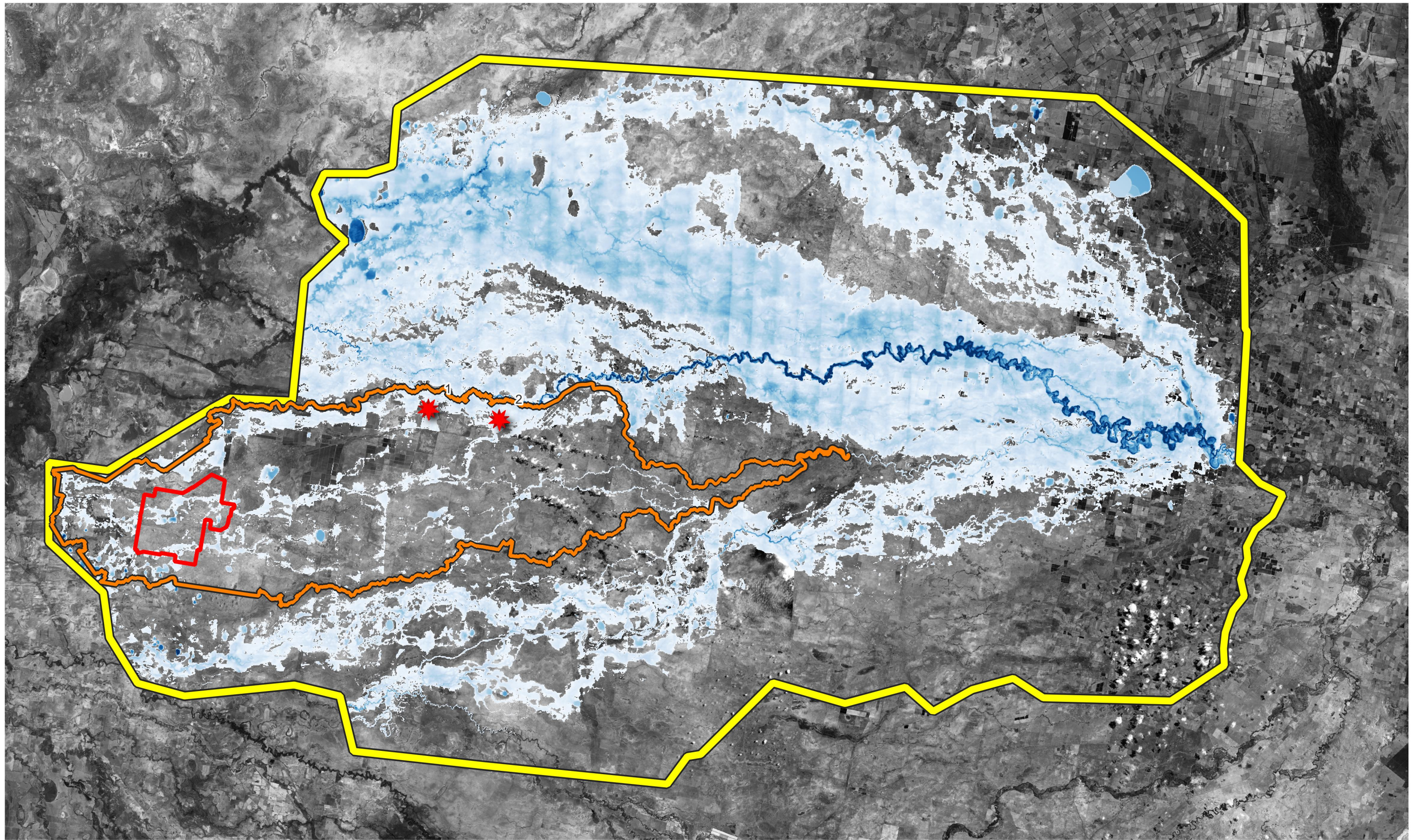
Figure 3.6 FFA at Murrumbidgee River Downstream Hay Weir.

The FFA results show that the estimated peak flow rates for 0.05% AEP event (adopted Extreme Event) at each of the gauges are as follows:

- Murrumbidgee River at Narrandera (11,810 m³/s)
- Murrumbidgee River at Carrathool Bridge (10,710 m³/s)
- Murrumbidgee River Downstream Hay Weir (3,190 m³/s)
- Murrumbidgee River at Darlington Point (2,650 m³/s)
- Murrumbidgee River Downstream Maude Weir (479 m³/s)

For the modelling of Extreme event, the maximum 0.05% AEP flow rate at Narrandera was selected to be conservative. A steady flow rate of 11,810 m³ was applied at the upstream boundary of the regional model and simulated for a period of 2,000 hours, ensuring that this flow reaches the site approximately 220 km downstream.

The regional model flood extent for 0.05% AEP, the gauges used in the FFAs and the location of inflows to local model are illustrated in Figure 3.7.



LEGEND

 Regional Model Extent

 Local Model Extent

 Project Extent

 Regional Model Inflows Location

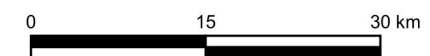
Peak Flood Depth (m)



Title:

Regional Model Flood Extent (0.05% AEP) and the Location of Regional Model Inflows to Local Model

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Filepath: K:\A10766_KeriKeri_WindSolar_EIS_Flooding\02_Workspace\Figure 3.7 Regional model flood extent.qgz

3.3 Proposed Development

Following the definition of existing case flood conditions for the study area, relevant details of the proposed development layout and configuration were included to represent any potential interactions between the proposed works and the floodplain. This includes access roads, hardstand, buildings, structures and WTG. For structures that are expected to be elevated above the floodplain (e.g. buildings, compounds, BESS, etc), these were raised by nominal amount of 10m in the model. This was to ensure structures extend out of the floodplain, and do not reflect actual heights

BMT were provided with an updated list of elements for the proposed development on 10 October 2025. Table 3.7 summarises the elements with a description and their respective representation in the hydraulic model. Since completion of modelling, BMT were advised that the borrow pit has been replaced with an additional laydown area, which has not been reflected in model results presented. This change would be expected to have negligible impacts to the model outcomes.

Table 3.7 Developed Case Representation in the hydraulic model

Proposed Design Item	Representation*
Substation	2d_zshp region polygon with elevation* above 1% AEP +0.5m freeboard. Building model roughness.
BESS and Transformer	2d_zshp region polygon with elevation* above 1% AEP +0.5m freeboard. Building model roughness.
Access Roads	Gravel model roughness.
Accommodation Buildings	2d_zshp region polygon with elevation* above 1% AEP +0.5m freeboard. Building model roughness.
Construction Compound	2d_zshp region polygon with elevation* above 1% AEP +0.5m freeboard. Building model roughness.
Borrow Pit [^]	2d_zshp region polygon with drop 4m below surface ground level. Excavated pit model roughness.
WTG and associated infrastructure	WTG hardstand footprint, with elevation 0.1m above ground. Gravel model roughness. Tower, 12.5m diameter, with elevation* above floodplain. Building model roughness.

*10m elevations were adopted to ensure structures extend out of the floodplain, and do not reflect actual heights.

[^]To be replaced with additional laydown area in modelling for subsequent design phases.

To represent Access Roads, TUFLOW model cell size has been refined from 25 m within the Site to 12.5 m using Quadtree functionality. Note that the global cell size outside the Site maintained at 100 m.



LEGEND

	Local Model Extent		WTG
	Project Extent		Substation
	Construction Compound		Borrow Pit
	Accommodation Buildings		Access Roads

Title:

Proposed Development Setup in Local TUFLOW Model

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Filepath: K:\A10766_KeriKeri_WindSolar_EIS_Flooding\02_Workspace\Figure 3.1 Proposed development at Keri Keri.qgz

Drawing: **Fig 3.8** Rev: -



4 Flood Assessment Results

Results indicate that the surface flow hydrodynamics are significantly storage driven due to the shallow slopes and presence of many small basins within the catchment. This is demonstrated by relatively low velocities observed in the PMF event with regional inflows (Annex A). Significant ponded water depths are also observed in the region for the same event.

Developed case results are shown in Annex B, whereas differences in water levels between base case and developed case (impacts) are shown in Annex C. Increases in water levels were observed in the developed case outside the proposed Site for all events:

- 5% AEP event: up to magnitude 30mm,
- 1% AEP event: up to magnitude 30mm,
- 0.5% AEP event: up to magnitude 39mm,
- 0.2% AEP event: up to magnitude 34mm,
- PMF event: up to magnitude 48mm,
- PMF with regional inflows event: up to magnitude 41mm.

Decreases in water levels observed with the developed case outside the proposed Site for all events:

- 5% AEP event: up to magnitude 78mm,
- 1% AEP event: up to magnitude 35mm,
- 0.5% AEP event: up to magnitude 42mm,
- 0.2% AEP event: up to magnitude 41mm,
- PMF event: up to magnitude 110mm,
- PMF with regional inflows event: up to magnitude 111mm.

For the 1% AEP event, some isolated storages exhibit larger apparent changes (up to approximately 1.45 m). These are not observed in any other events (including rarer events) and are considered to be a modelling anomaly rather than true hydraulic impacts.

Overall, impacts are considered to be non-detrimental following AustRoads (2023) which indicates acceptable impacts up to 400mm for regions of open space/forest.

Modelling for the events from 5% AEP to PMF with regional inflows showed that there are relatively low hazards along the Abercrombie Creek (up to Hazard Category H3) as shown in Annex B. Higher hazard levels (up to H5) are observed in pits where water is shown to accumulate.

The flood hazard for the Project site and its surrounding floodplain has been defined based on the composite six-tiered hazard classification in the 'Australian Disaster Resilience Handbook 7 Managing the Floodplain: A Guide to Best Practice in Flood Risk Management in Australia' (AIDR, 2017) and reproduced in Figure 4.1. These hazard classifications are based on adopted thresholds of flood depth, velocity and velocity-depth product that identify when flood conditions are likely to present a risk to people, vehicles and buildings. A description of each hazard threshold is provided in Table 4.2.

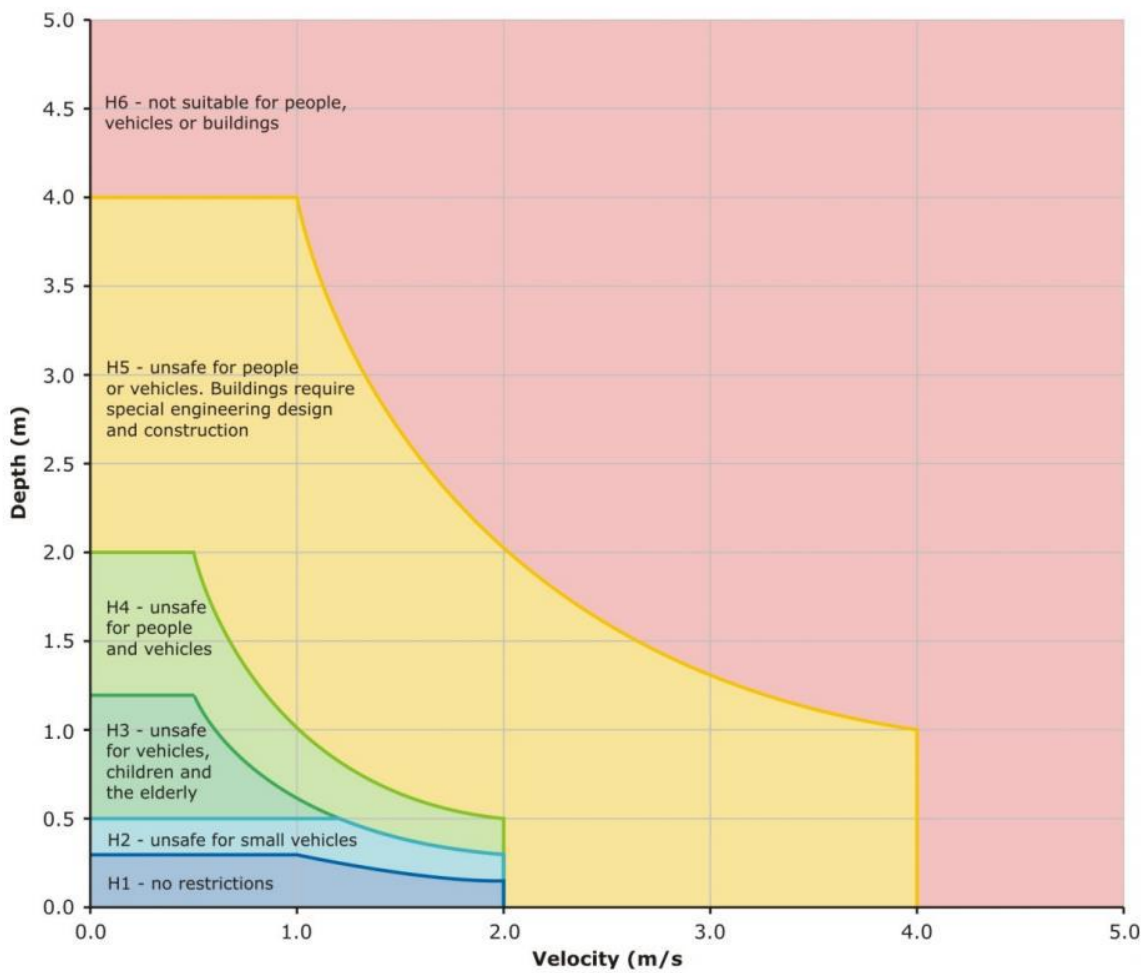


Figure 4.1 Flood Hazard Curves (AIDR, 2017)

Table 4.2 Flood Hazard Classification Thresholds (AIDR, 2017)

Hazard Classification	Description
H1	Relatively benign flow conditions. No vulnerability constraints.
H2	Unsafe for small vehicles.
H3	Unsafe for all vehicles, children and the elderly.
H4	Unsafe for all people and vehicles.
H5	Unsafe for all people and vehicles. Buildings require special engineering design and construction.
H6	Unconditionally dangerous. Not suitable for any type of development or evacuation access. All building types considered vulnerable to failure.

4.2 Hydraulic Categories

Flood function categories (also referred to as hydraulic categories) defined in the 'Floodplain Development Manual: Flood Risk Management Guideline FB02' (DPE, 2023) are:

- **Floodway:** Areas that convey a significant portion of the flow. These are areas that, even if partially blocked, would cause a significant increase in flood levels or a significant redistribution of flood flows, which may adversely affect other areas.
- **Flood Storage:** Areas that are important in the temporary storage of the floodwater during the passage of the flood. If the area is substantially removed by levees or fill it will result in elevated water levels and/or elevated discharges. Flood Storage areas, if completely blocked would cause peak flood levels to increase by 0.1 m and/or would cause the peak discharge to increase by more than 10%.
- **Flood Fringe:** Remaining area of flood prone land, after floodway and flood storage areas have been defined. Blockage or filling of this area will not have any significant effect on the flood pattern or flood levels.

Hydraulic categorisation was determined according to the combination of flood depths, velocities and velocity-depth product (VxD), as shown in Table 4.3.

Table 4.3 Flood Categorisation Criteria

Classification	Criteria	Description
Floodway	[$VxD > 0.25 \text{ m}^2/\text{s}$ AND Velocity $> 0.25 \text{ m/s}$] OR [Velocity $> 1.0 \text{ m/s}$]	Areas and flow paths where a significant proportion of floodwaters are conveyed (including all bank-to-bank creek sections).
Flood Storage	Area outside floodway where depth $> 0.5 \text{ m}$	Areas where floodwaters accumulate before being conveyed downstream. These areas are important for detention and attenuation of flood peaks.
Flood Fringe	Remaining flood extent	Areas that are low-velocity backwaters within the floodplain. Filling of these areas generally has little consequence to overall flood behaviour.

As requested by the SEARs (and following the above criteria), post flood function maps for the site are shown in Annex D based on the 1% AEP event. Due to the very slow moving water in the catchment, it is observed that the Site comprises of only Flood Storage and Flood Fringe regions. No significant changes to flood function is expected as a result of the proposal, as indicated by pre and post flood function maps presented in this report and previous assessments. Flood functions and their extents are considered generally compatible with the proposal.

4.3 Climate Change

As requested by the SEARs, the 0.5% and 0.2% AEP flood events have been modelled as proxies for increased rainfall intensity in a 1% AEP due to climate change. As would be expected, results indicate an increase in flood depths and extents for the proxies modelled. A corresponding increase in flood hazard is also observed, although no significant increase in flood velocity is expected in the climate change scenarios modelled.

4.4 Emergency Management

As indicated in the hazard maps derived for this assessment, the site is subject to hazards of H3 and above from the 5% AEP event. Although most of the site remains flood free in this event (and in all events except for the PMF), access throughout the site would be considered limited from the 5% AEP event due to these hazards, with most of the site becoming inundated in a PMF. As such, the risk of isolation during significant flood events (from the 5% AEP or greater) requires mitigation through appropriate emergency management.

It is proposed that the NSW Hazards Near Me app is monitored for warnings of extreme weather. This includes severe weather warnings and severe thunderstorm warnings issued by the Bureau of Meteorology and which may include warnings for possible flooding. These warnings are also disseminated via various media outlets and are available of the Bureau of Meteorology website. In the event of a local warning advising of the potential for flooding it is recommended that the Site is closed and evacuated.

Given the large catchment area upstream of the site, the time of concentration (i.e. time taken for rainfall to generate runoff at the site) is relatively long. This is reflected in the critical durations determined in this assessment which range from 3 to 7 days. Therefore it is expected that in the event of a major event occurring, there will be ample opportunity for any staff on site to evacuate prior to the onset of flooding. It is recommended that the site remain closed until floodwaters have receded entirely and safe access restored before reopening the site.

All site staff should be made aware of the potential flood risk during site induction. In the event of site closure, a safety bulletin should be sent to all workers via SMS. A staff member should be nominated to the role of chief flood warden and ensure that the Site is fully evacuated in the event of a site closure.

4.5 SEARs and Agency Responses

Project specific SEARs were received in a letter dated 4 April 2022, with those relevant to flooding and how they have been addressed with respect to the proposed development is summarised in Table 4.4. Additionally, Item 2.1 of the BCS & NPWS letter (DOC24/399724, dated 15 July 2024 was also assessed.

Table 4.4 Response to SEARs

SEAR	Response
2.1 (BCS & NPWS) Investigate the potential riverine risk posed to the project site because of breakout flows originating from the Murrumbidgee River during the extreme event case.	Regional catchment modelling (Section 3.2) and FFFA (Section 3.2.2) have been outlined in this report. Base case, developed case and changes in flood levels results presented with scenario "with Regional Inflows" in Annexes.
7. The EIS must map the following features relevant to flooding as described in the Floodplain Development Manual 2005 (NSW Government 2005) including: a. Flood prone land. b. Flood planning area, the area below the flood planning level. c. Hydraulic categorisation (floodways and flood storage areas). d. Flood hazard.	Relevant flood maps are provided in Annexes of this report.

SEAR	Response
8. The EIS must describe flood assessment and modelling undertaken in determining the design flood levels for events, including a minimum of the 5% Annual Exceedance Probability (AEP), 1% AEP flood levels and the probable maximum flood, or an equivalent extreme event.	Flood assessment approach is described in Section 3 of this report.
9. The EIS must model the effect of the proposed development (including fill) on the flood behaviour under the following cases: a. Current flood behaviour for a range of design events as identified in 7 above. This includes the 0.5% and 0.2% AEP year flood events as proxies for assessing sensitivity to an increase in rainfall intensity of flood producing rainfall events due to climate change.	Flood impacts have been estimated for all requested design storm events, refer Annex C.
10. Modelling in the EIS must consider and document: a. Existing council flood studies in the area and examine consistency to the flood behaviour documented in these studies. b. The impact on existing flood behaviour for a full range of flood events including up to the probable maximum flood. c. Impacts of the development on flood behaviour resulting in detrimental changes in potential flood affection of other developments or land. This may include redirection of flow, flow velocities, flood levels, hazards and hydraulic categories. d. Relevant provisions of the NSW Floodplain Development Manual 2005.	There are no existing council flood studies in the area. Flood impacts have been estimated for all requested design storm events, refer Annex C. Any changes to flood extents, velocities, levels, hazards and hydraulic categories are highlighted in baseline and developed case maps and discussed in Section 4. Relevant provisions in the NSW Floodplain Development Manual 2005 have been considered in this assessment.
11. The EIS must assess the impacts on the proposed development on flood behaviour, including: a. Whether there will be detrimental increases in the potential flood affection of other properties, assets and infrastructure. b. Consistency with Council Floodplain Risk Management Plans. c. Consistency with any Rural Floodplain Management Plans. d. Compatibility with the flood hazard of the land. e. Compatibility with the hydraulic functions of flow conveyance in floodways and storage in flood storage areas of the land. f. Whether there will be adverse effect to beneficial inundation of the floodplain environment, on, adjacent to or downstream of the site. g. Whether there will be direct or indirect increase in erosion, siltation, destruction of riparian vegetation or a reduction in the stability of river banks or watercourses. h. Any impacts the development may have upon existing community emergency management	The proposal does not result in detrimental increases to flood affection as discussed in Section 4. There are no Council Floodplain Risk Management Plans in the study area. There are no Rural Floodplain Management Plans in the study area. Flood hazards and their extents are considered generally compatible with the proposal as indicated in mapping provided. Hydraulic functions and their extents are considered generally compatible with the proposal as indicated in mapping provided. The proposal does not result in detrimental increases to flood affection as discussed in Section 4. Given the relatively low flood velocities across the site (and that these are not expected to change), no increases to erosion, siltation, or bank instability are expected. There are no existing community emergency management arrangements for flooding at the site. Recommended emergency management measures are discussed in Section 4.4. SES did not provide a

SEAR	Response
arrangements for flooding. These matters are to be discussed with the SES and Council. i. Whether the proposal incorporates specific measures to manage risk to life from flood. These matters are to be discussed with the SES and Council. j. Emergency management, evacuation and access, and contingency measures for the development considering the full range of flood risk (based upon the probable maximum flood or an equivalent extreme flood event). These matters are to be discussed with and have the support of Council and the SES. k. Any impacts the development may have on the social and economic costs to the community as consequence of flooding.	submission during EIS exhibition. Councils submission did not identify any matters related to flooding. As above. Based on the non-detrimental nature of estimated impacts, no social or economic impacts are expected as a consequence of flooding.

5 Conclusions & Recommendations

An addendum to the flood assessment was undertaken for the proposed Site in Keri Keri. The following key observations were made on the flood risk to the Site:

- Local overland flows traversing the site observed which are observed to be of low velocity.
- It is observed that low hazards (Hazard Category from H1 to H3) in regions affected by Abercrombie Creek flow path.
- Flood impacts observed due to the proposed development considered to be non-detrimental following AustRoads (2023) guidelines.
- In the PMF events, significant proportion of the proposed development is observed to be affected by the volume of water coming to the Site. Similar to more frequent events, generally low velocities (less than 0.4 m/s) observed for majority of the Site. Proposed developments (as shown on flood maps) are subject to depths of 0.5-1 m, and Hazard Category H3. Depths of 1-2 m and Hazard Category H4 are estimated at some WTG locations.
- Emergency management measures may be required to mitigate risks associated with access or isolation during flood events.
- Breakout flows from Murrumbidgee River in the extreme event do not affect water levels or increase flood risk within the Site. As such, smaller events such as the 1% AEP are not expected to impact water levels within the site.

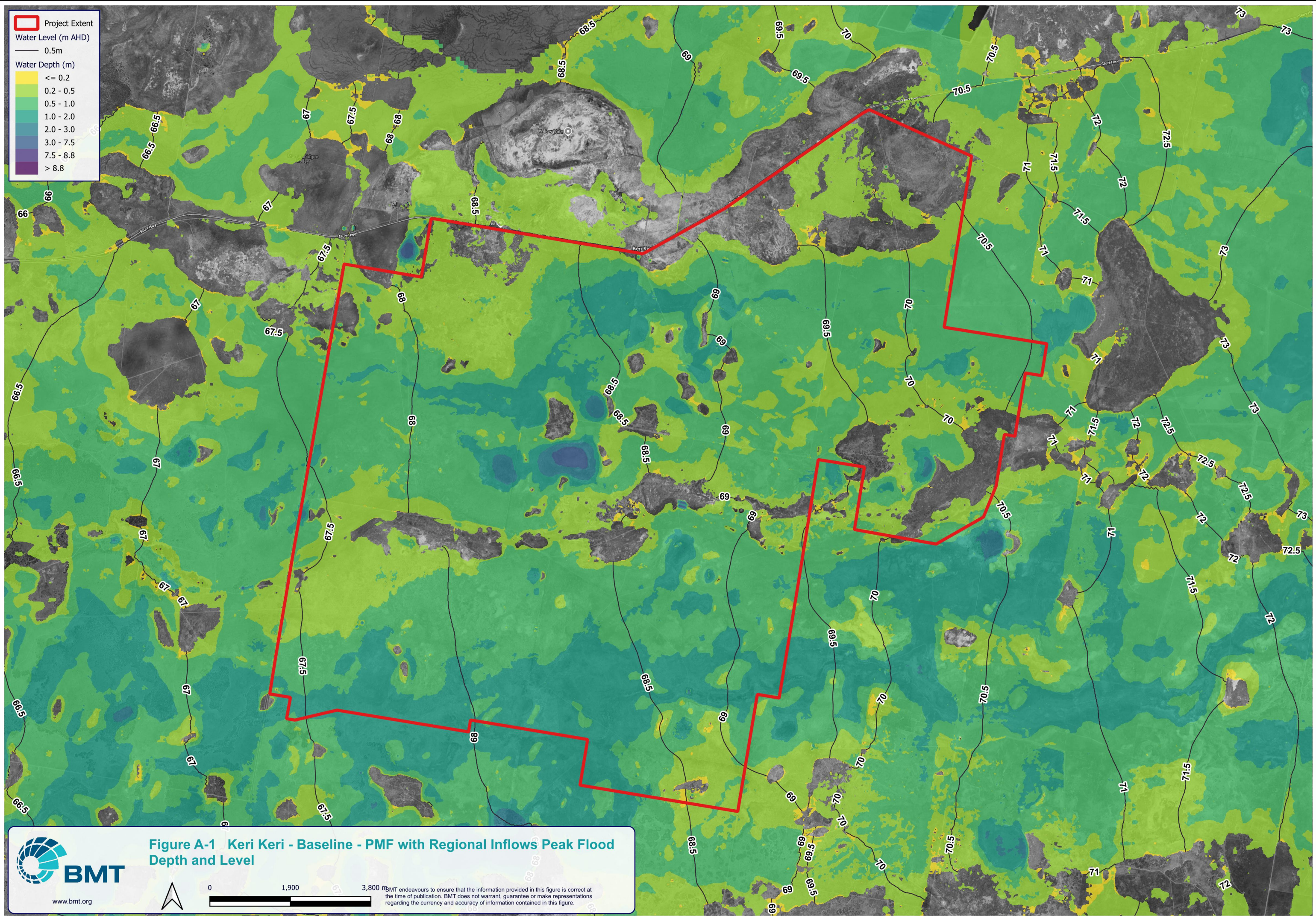
Based on the outcomes of this assessment, the following recommendations are suggested for consideration:

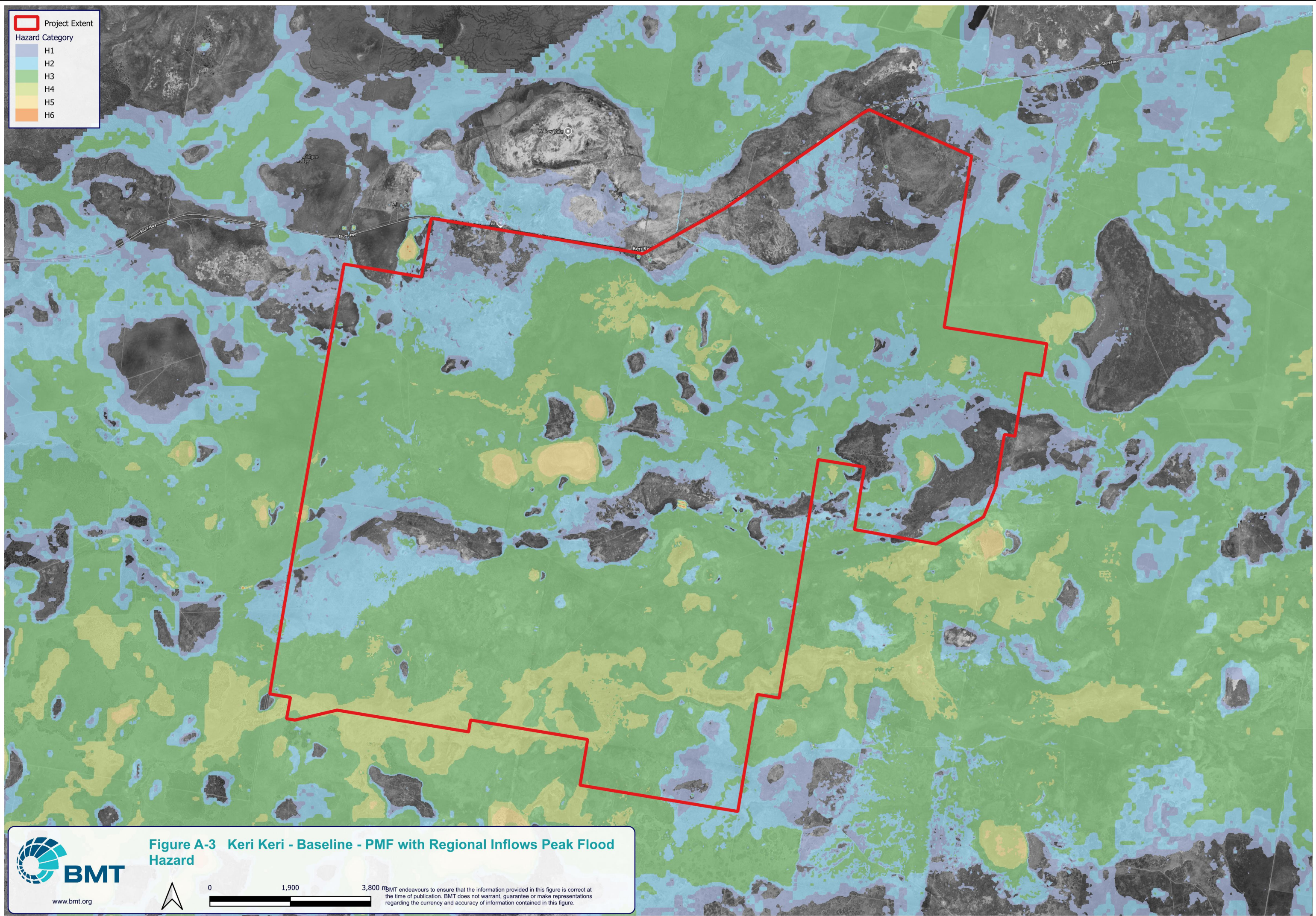
- Incorporate a 3D design surface into the model terrain to reflect any changes, should any be proposed in subsequent design phases.
- Inclusion of relevant cross-drainage structures into the model may further enhance model accuracy during subsequent design phases.

6 References

- Australian Institute for Disaster Resilience (2017), Australian Disaster Resilience Handbook 7 Managing the Floodplain: A Guide to Best Practice in Flood Risk Management in Australia.
- Austroads. (2023). Guide to Road Design Part 5: Drainage-General and Hydrology Considerations (Publication no. AGRD05-23) (4th ed.). ISBN: 978-1-922700-76-6. Published 30 January 2023.
- 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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- Bureau of Meteorology (2003), The Estimation of Probable Maximum Precipitation in Australia: Generalised Short-Duration Method.
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- Chow V.T. (1959), Open Channel Hydraulics.
- Department of Planning and Environment (NSW) 2023, *Flood Risk Management Guideline FB02: Flood Function*, Environment & Heritage Group, NSW Government, Parramatta.
- NSW OEH (2019), Review of ARR Design Inputs for NSW.
- Webb, McKeown and Associates Pty Ltd (2008), Murrumbidgee River Floodplain Hay to Maude Phase A – Flood Study and Data Collection.

Annex A Baseline Case Flood Maps





Annex B Developed Case Flood Maps

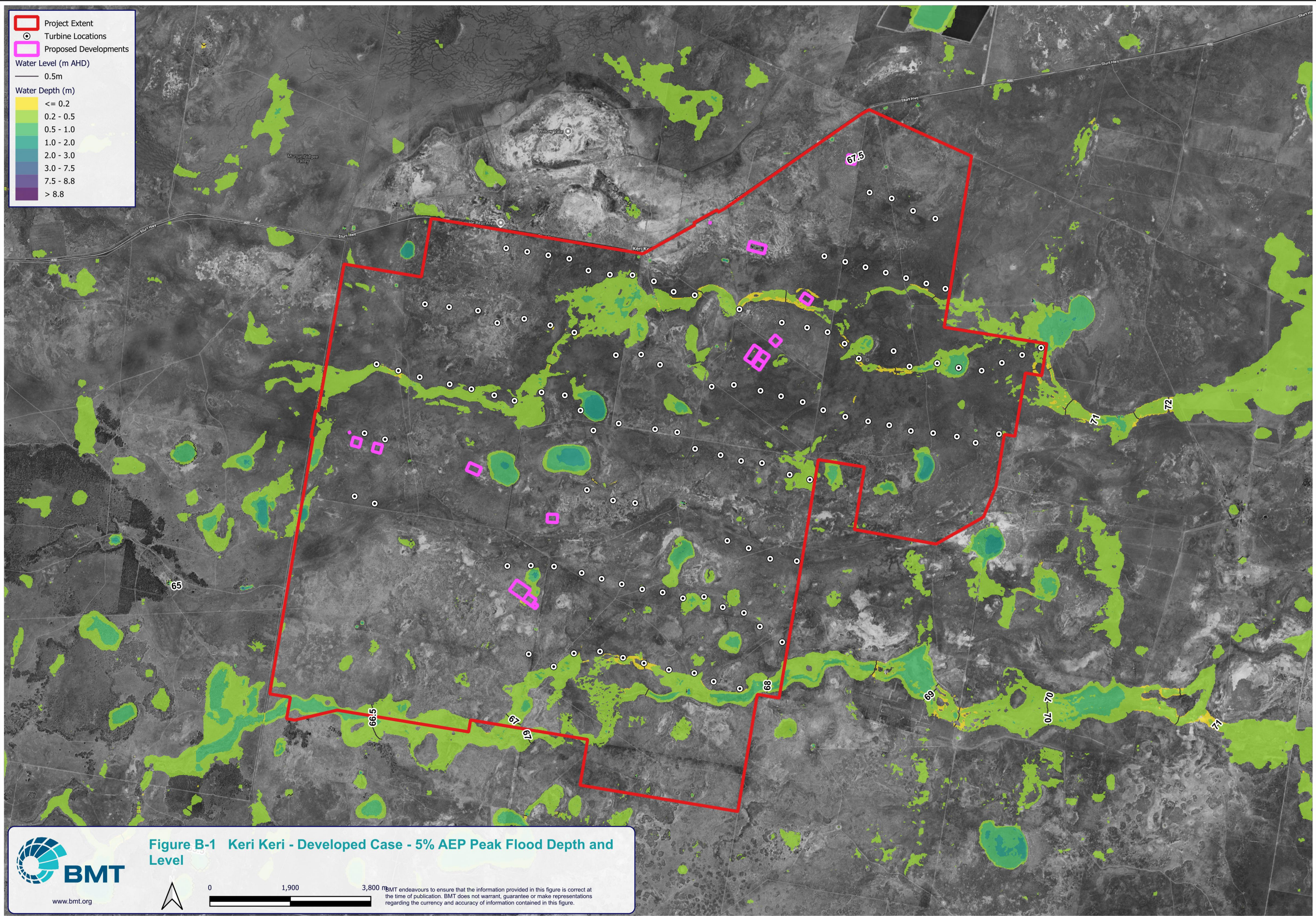


Figure B-1 Keri Keri - Developed Case - 5% AEP Peak Flood Depth and Level

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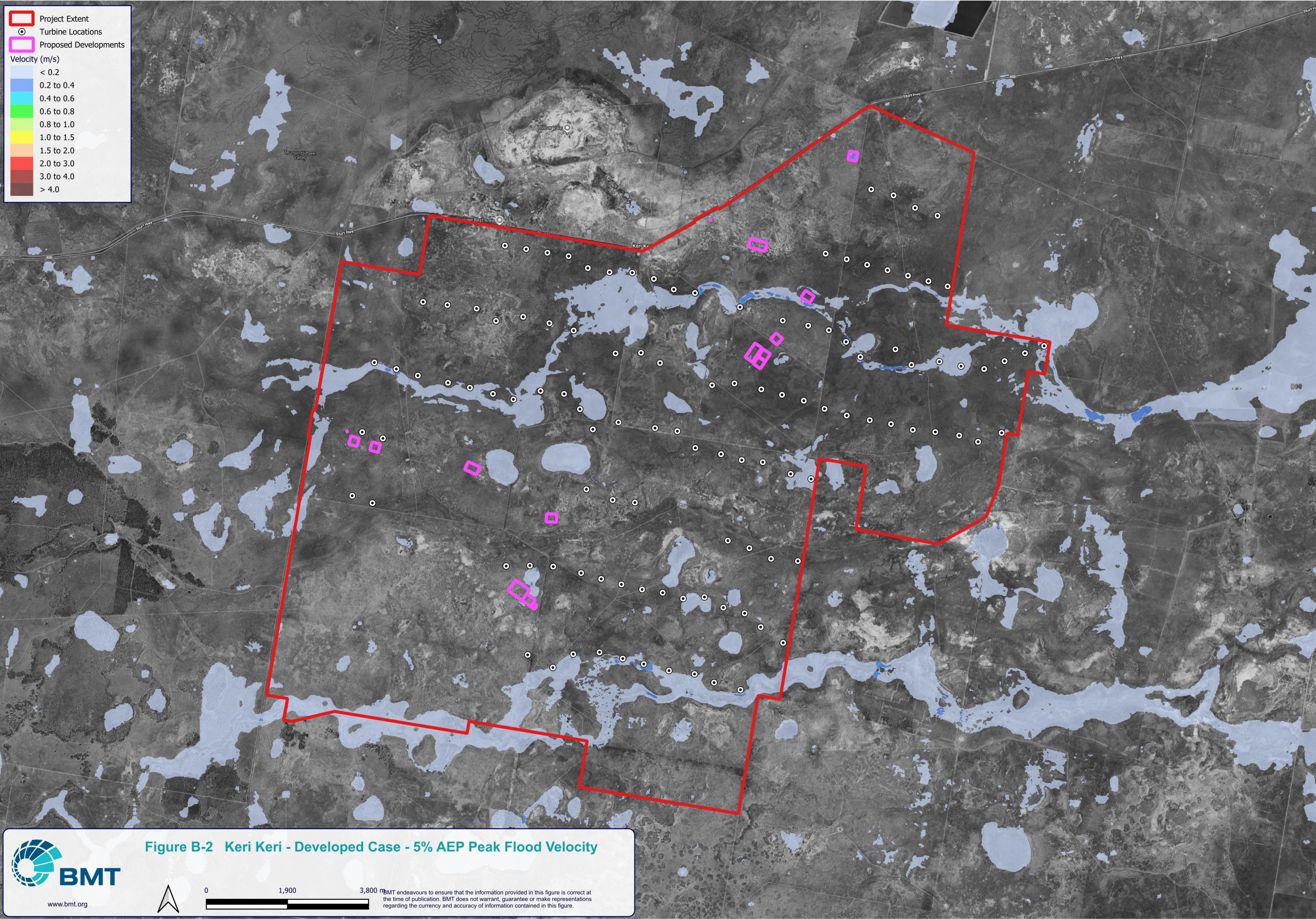
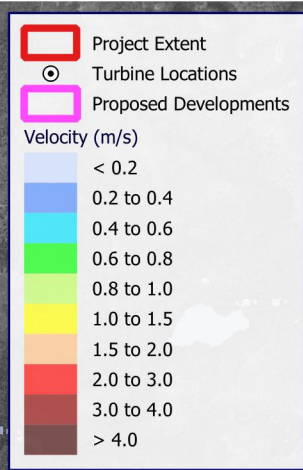
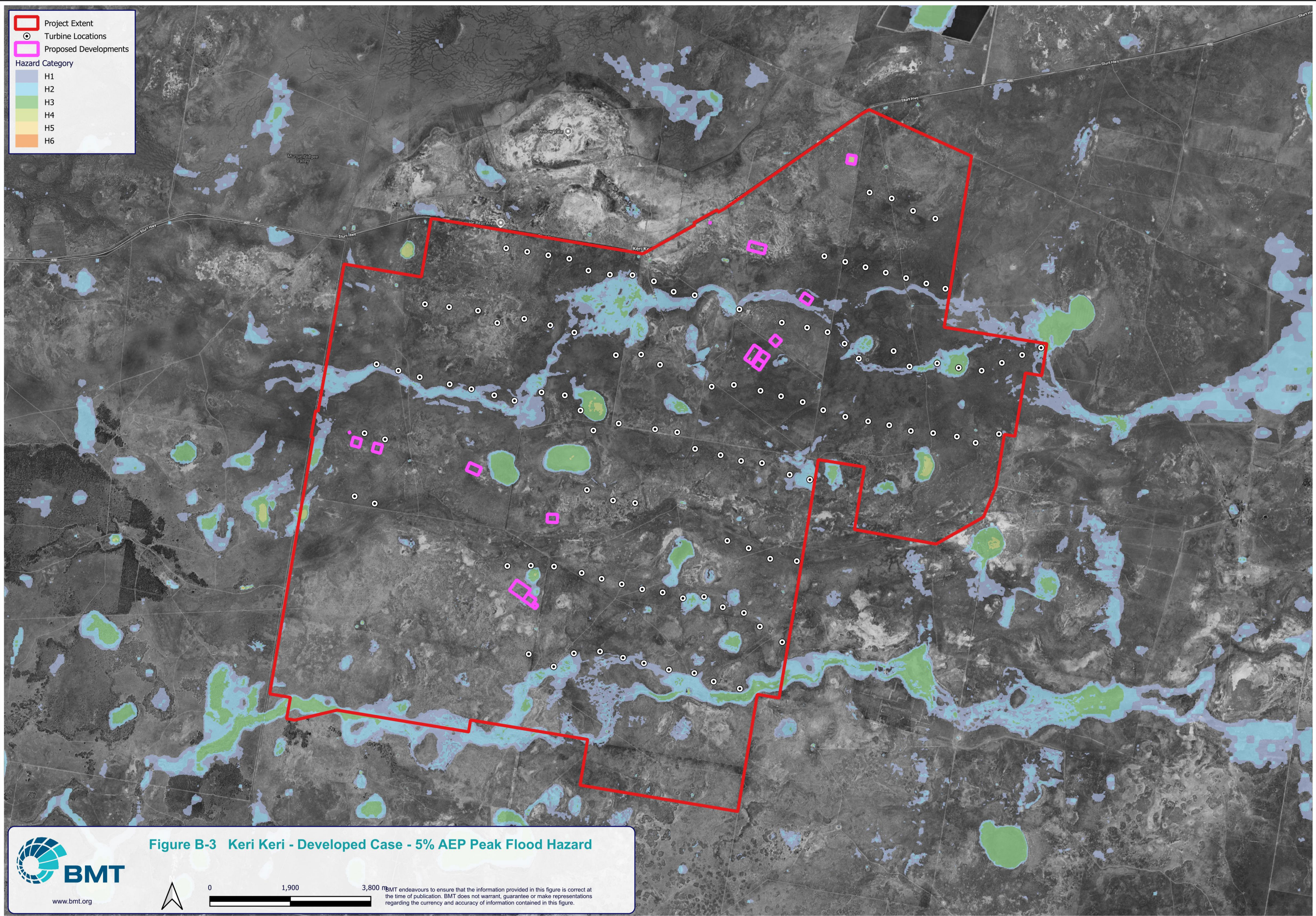


Figure B-2 Keri Keri - Developed Case - 5% AEP Peak Flood Velocity





Project Extent

Turbine Locations

Proposed Developments

Hazard Category

H1

H2

H3

H4

H5

H6



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Figure B-3 Keri Keri - Developed Case - 5% AEP Peak Flood Hazard

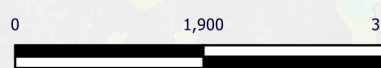
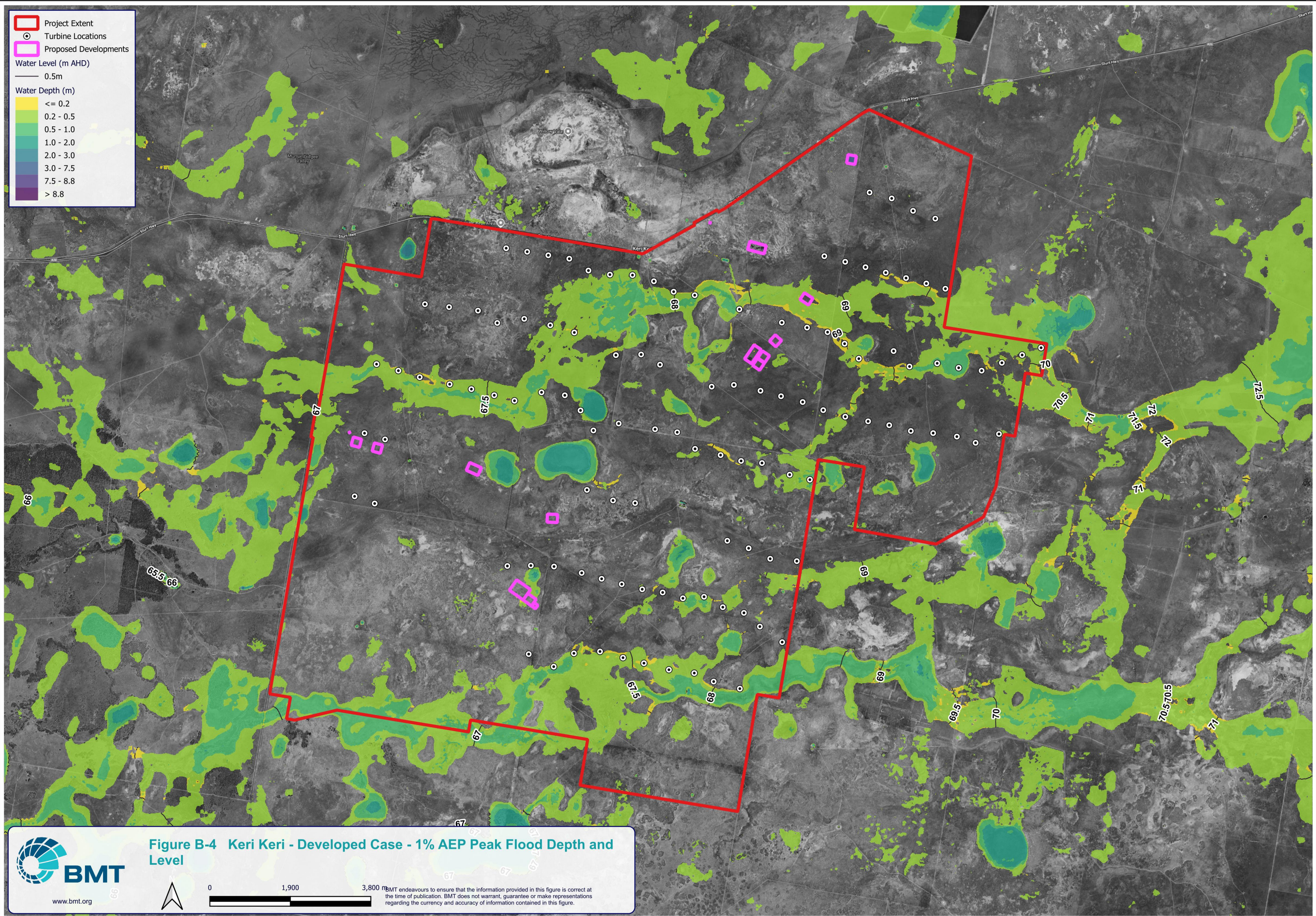
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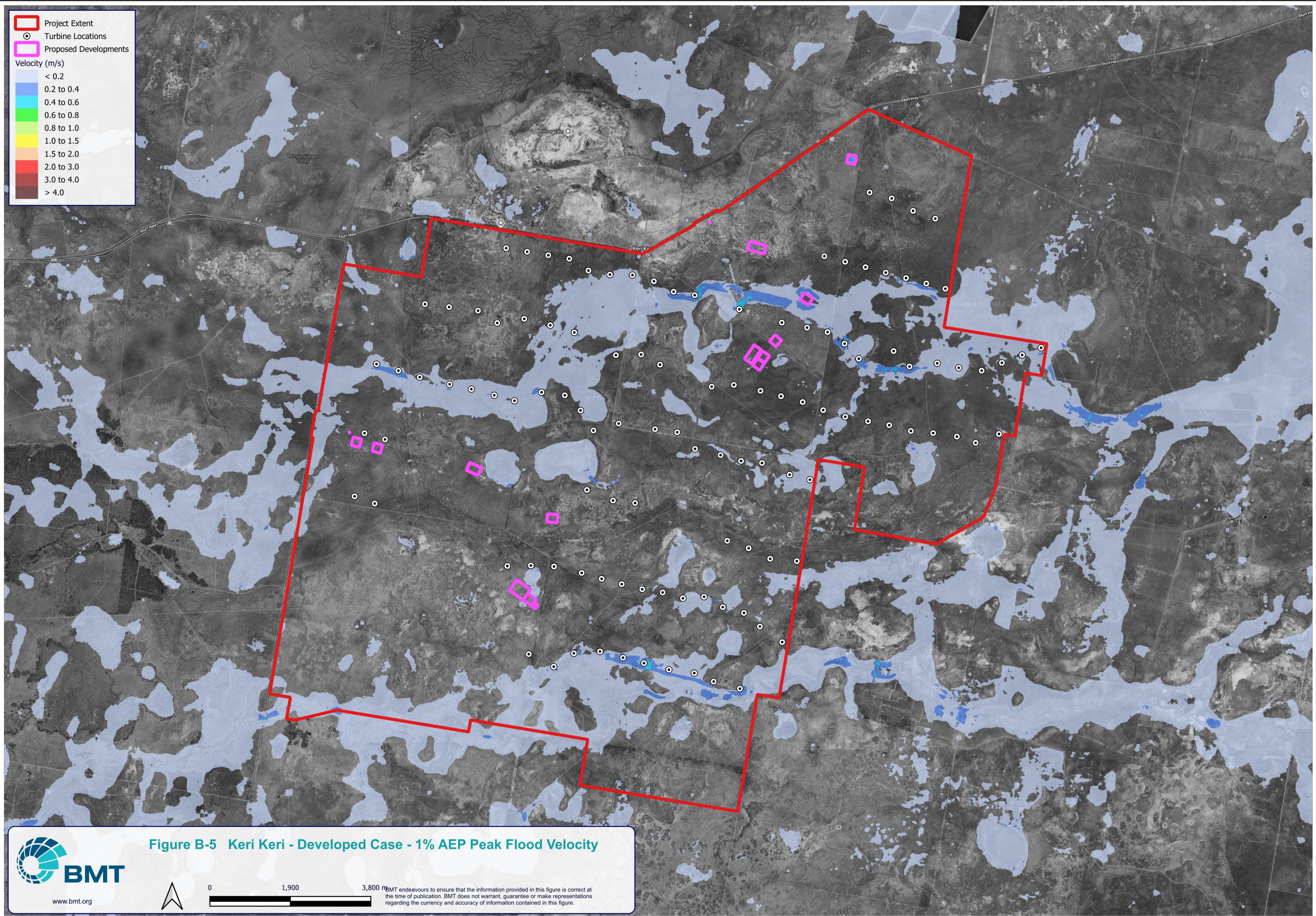
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Project Extent

Turbine Locations

Proposed Developments

Velocity (m/s)

< 0.2

0.2 to 0.4

0.4 to 0.6

0.6 to 0.8

0.8 to 1.0

1.0 to 1.5

1.5 to 2.0

2.0 to 3.0

3.0 to 4.0

> 4.0

Figure B-5 Keri Keri - Developed Case - 1% AEP Peak Flood Velocity



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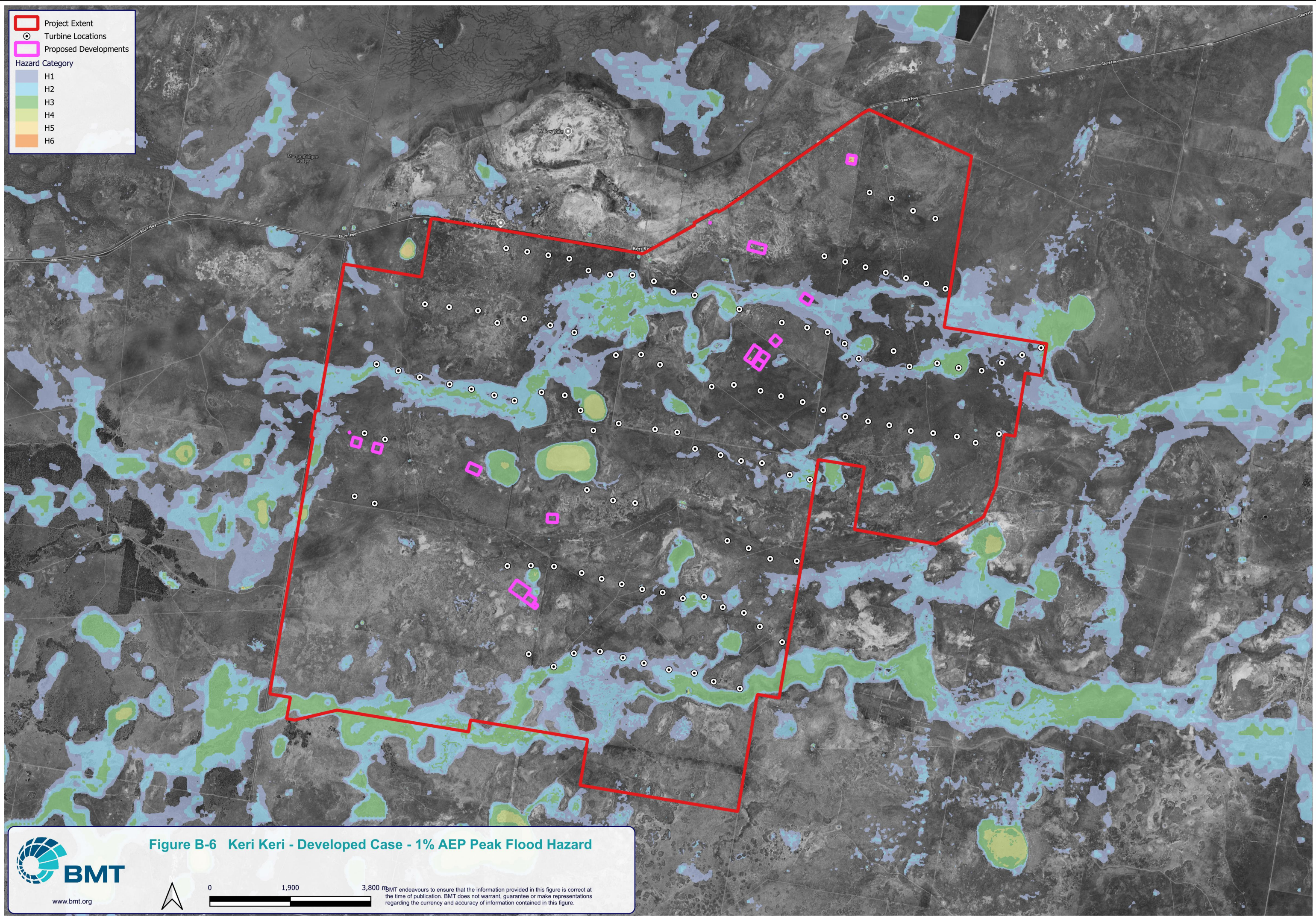


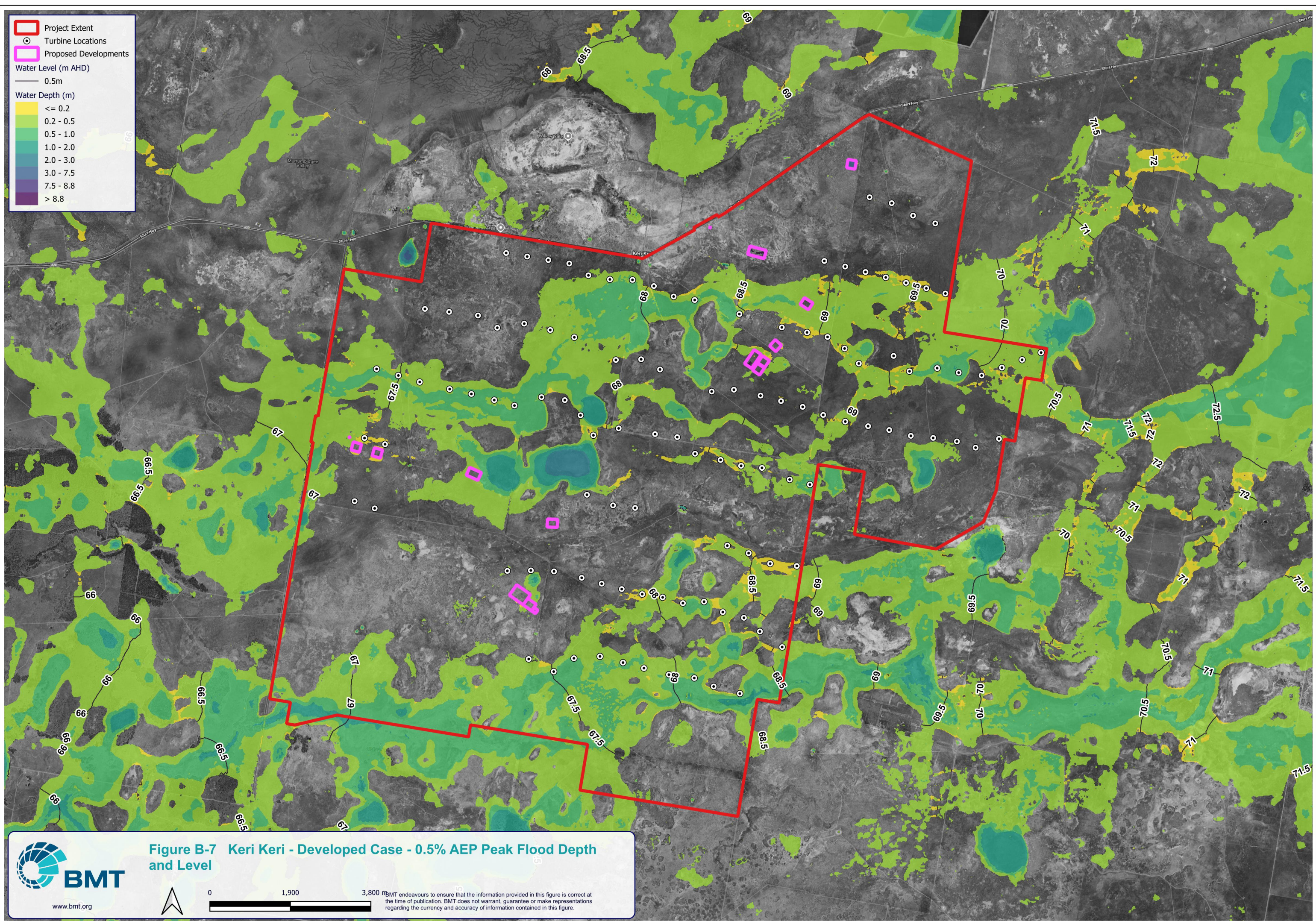
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1,900

3,800

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Project Extent

Turbine Locations

Proposed Developments

Water Level (m AHD)

0.5m

Water Depth (m)

<= 0.2

0.2 - 0.5

0.5 - 1.0

1.0 - 2.0

2.0 - 3.0

3.0 - 7.5

7.5 - 8.8

> 8.8

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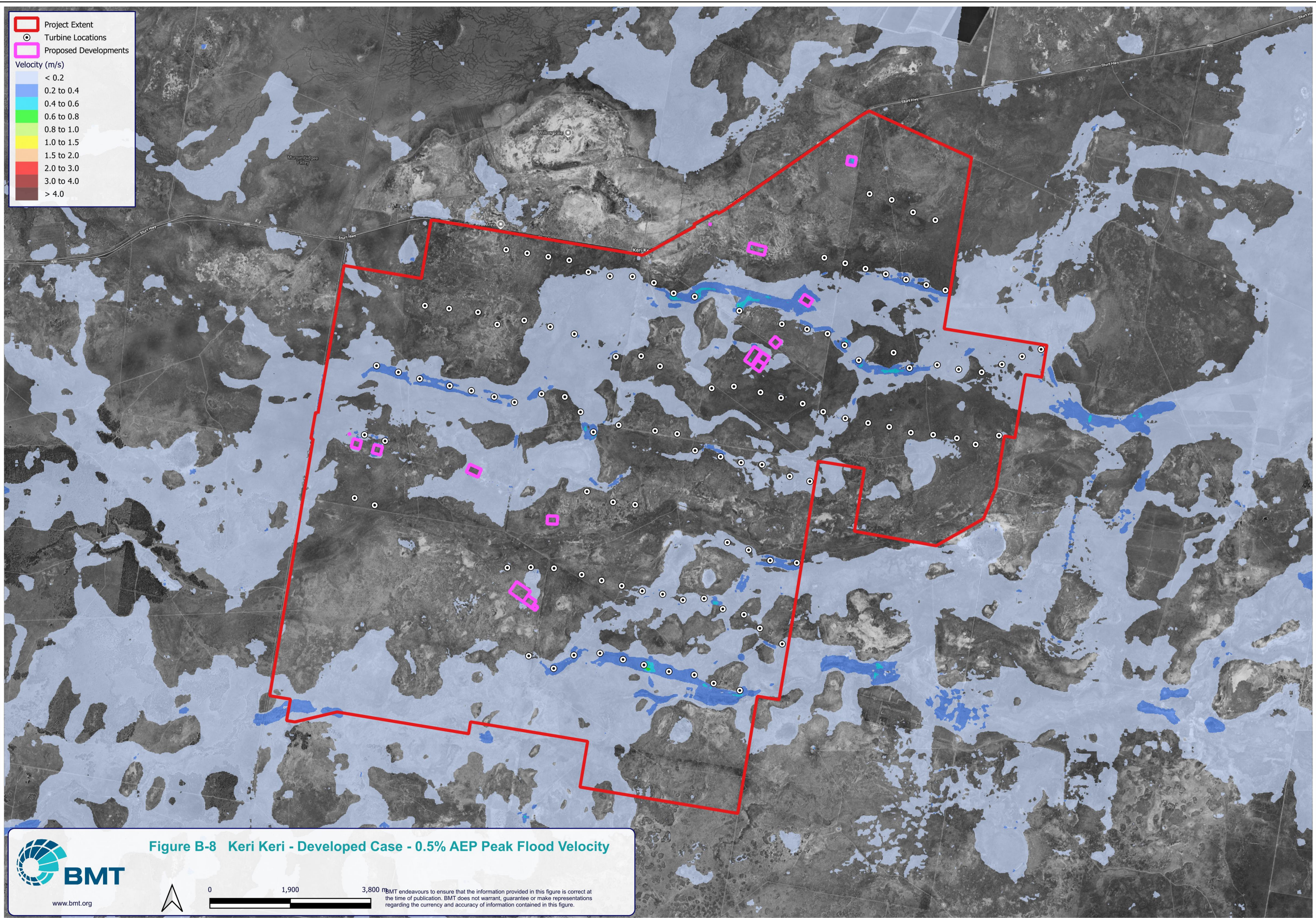
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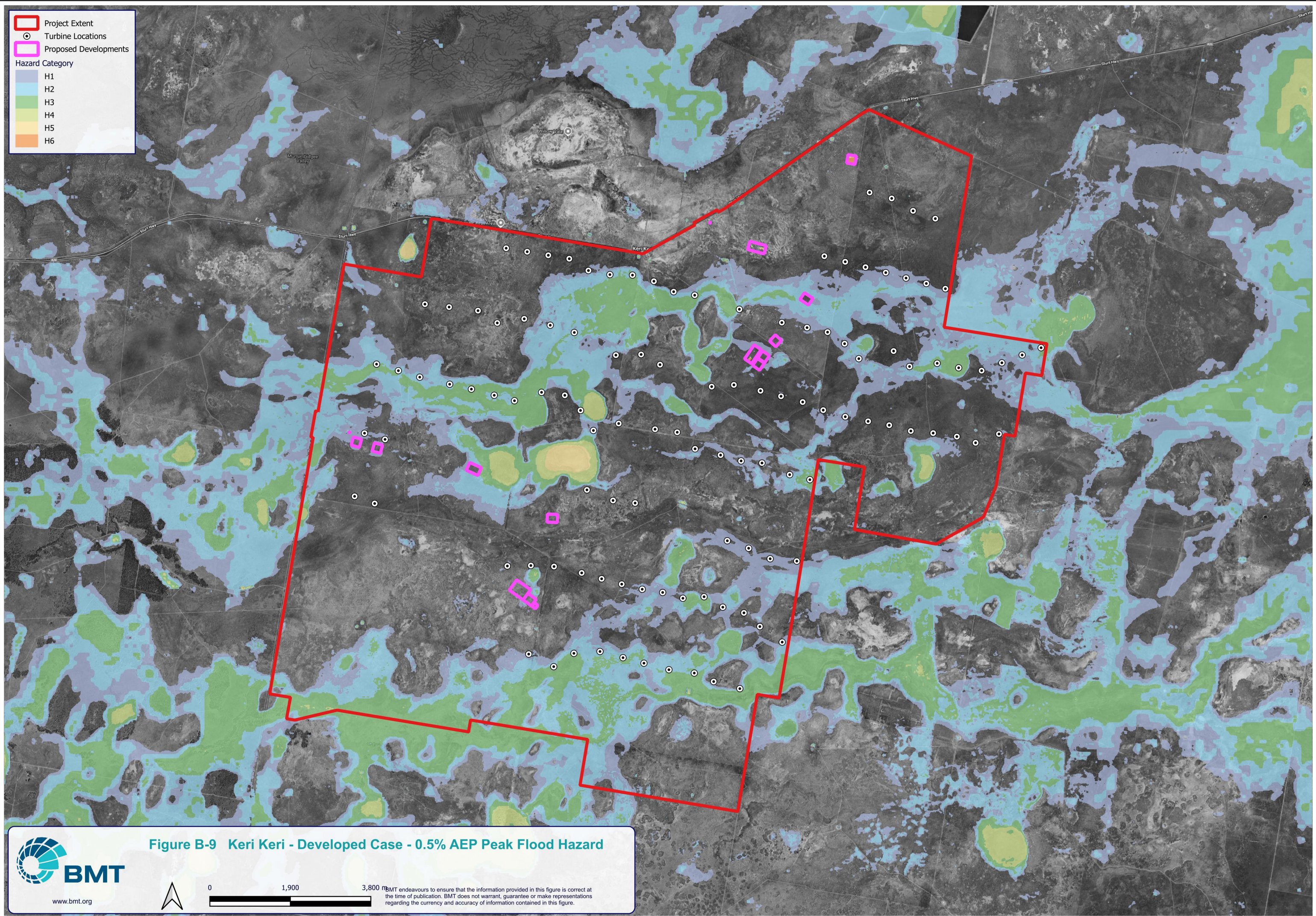
Figure B-7 Keri Keri - Developed Case - 0.5% AEP Peak Flood Depth and Level

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Project Extent

Turbine Locations

Proposed Developments

Hazard Category

H1

H2

H3

H4

H5

H6



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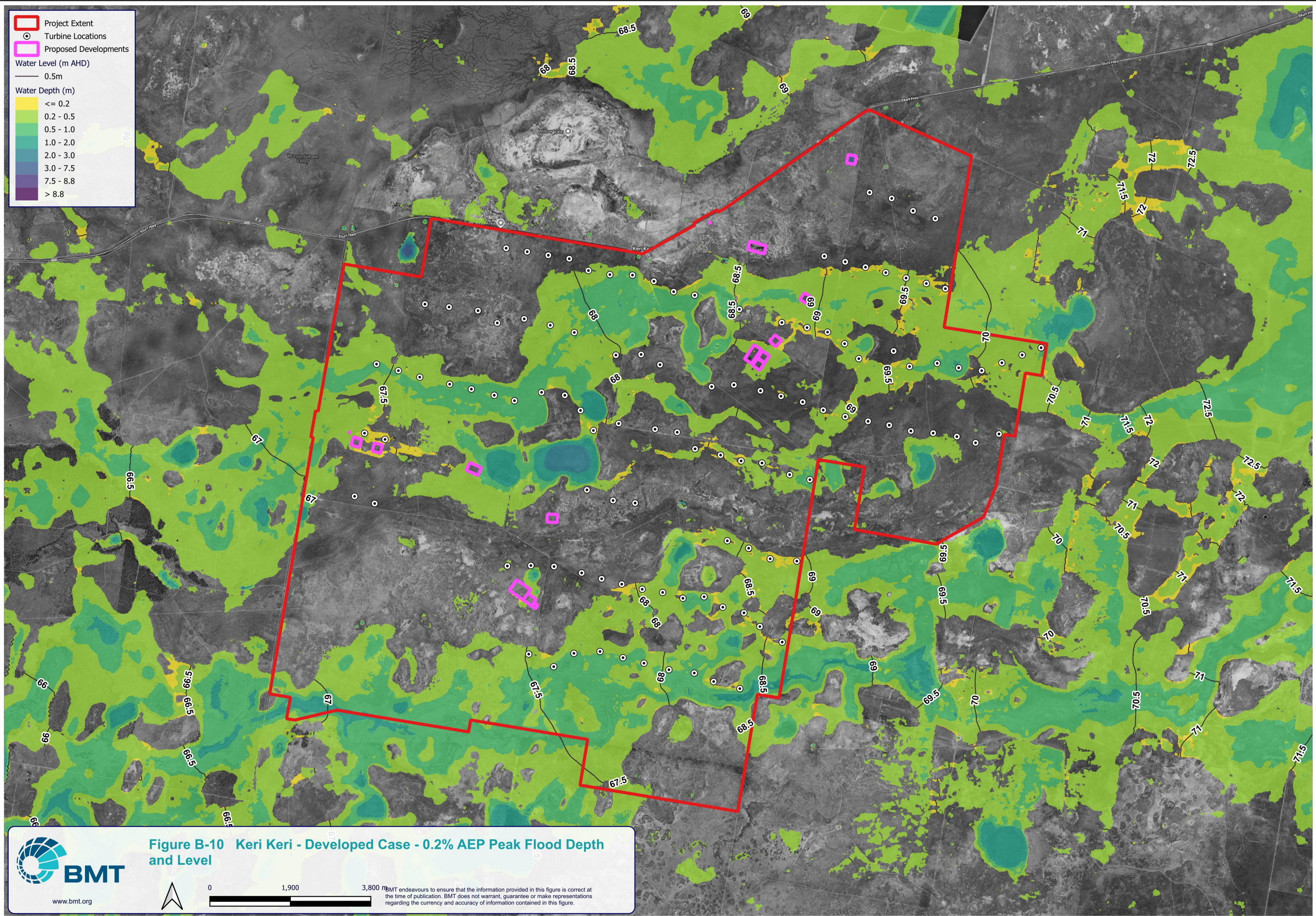
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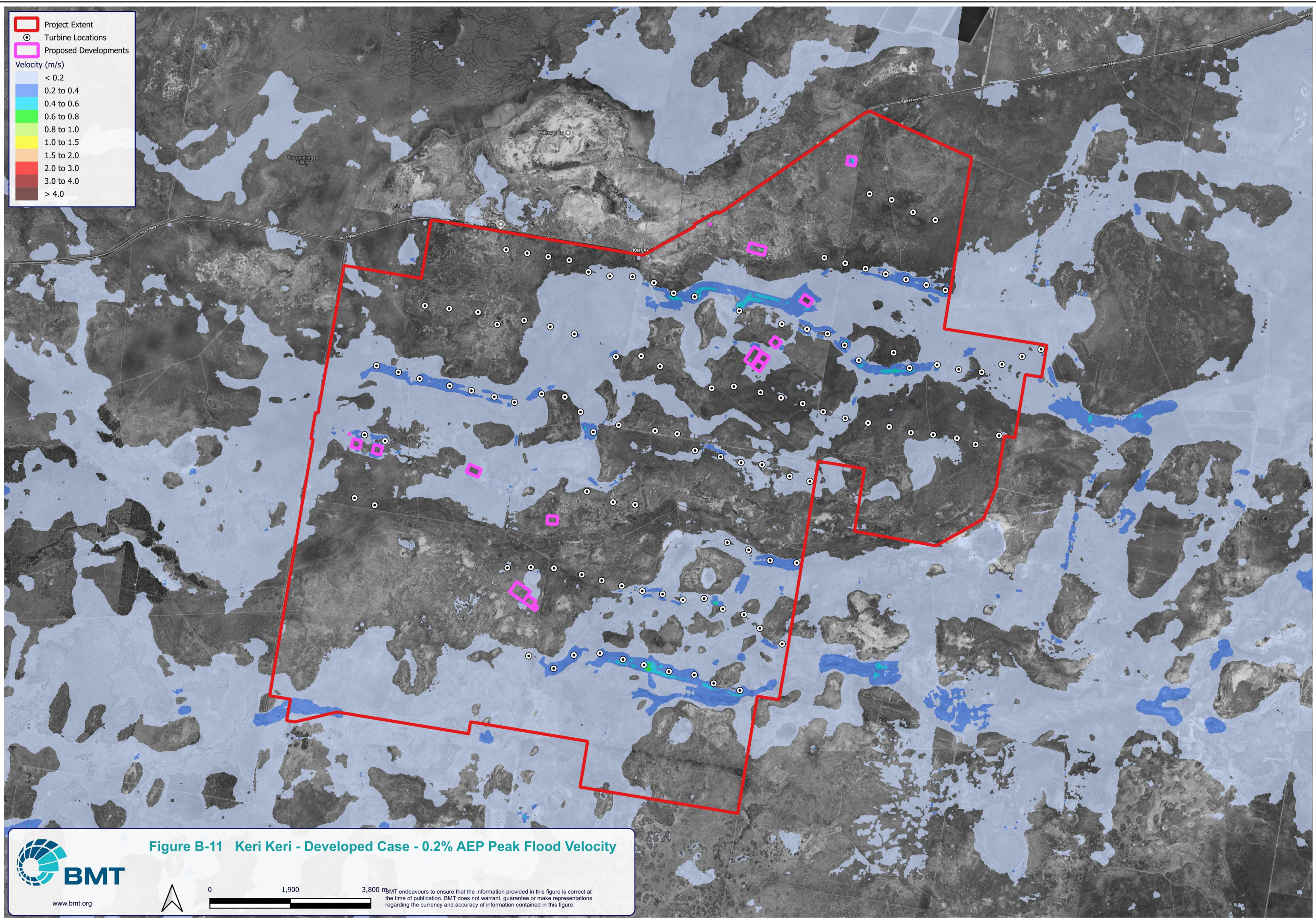
Figure B-9 Keri Keri - Developed Case - 0.5% AEP Peak Flood Hazard

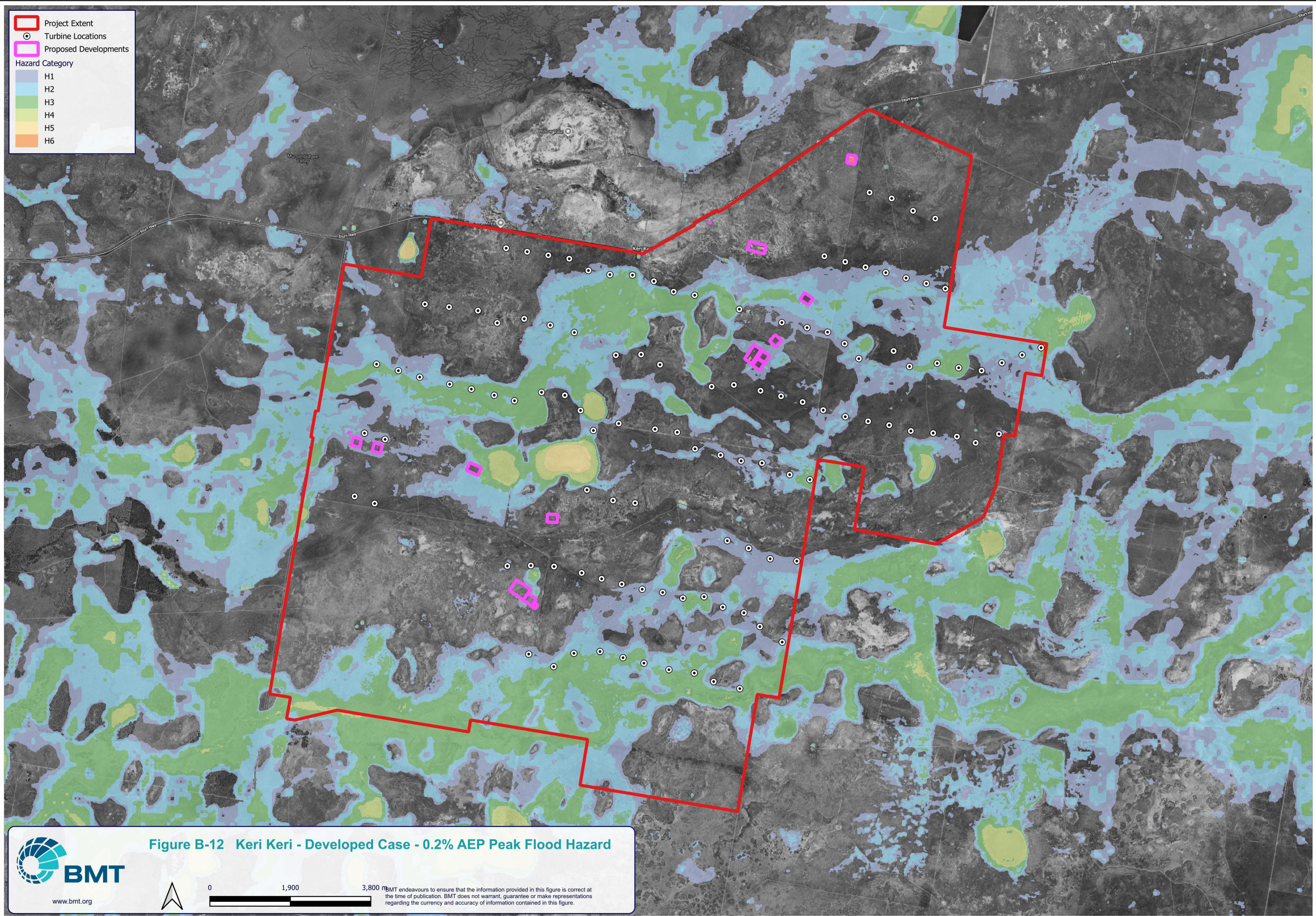
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Project Extent

Turbine Locations

Proposed Developments

Hazard Category

H1

H2

H3

H4

H5

H6



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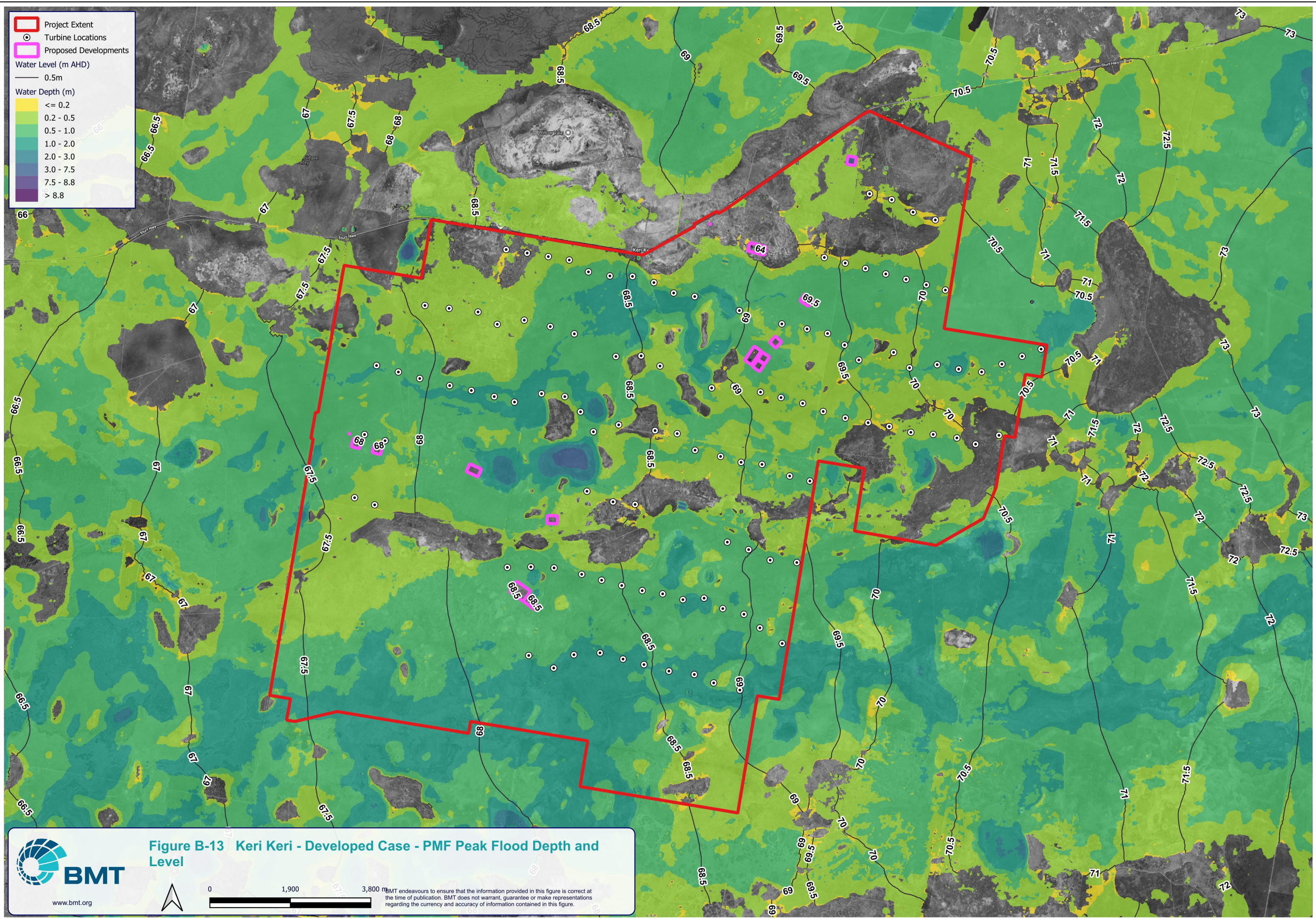
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Figure B-12 Keri Keri - Developed Case - 0.2% AEP Peak Flood Hazard

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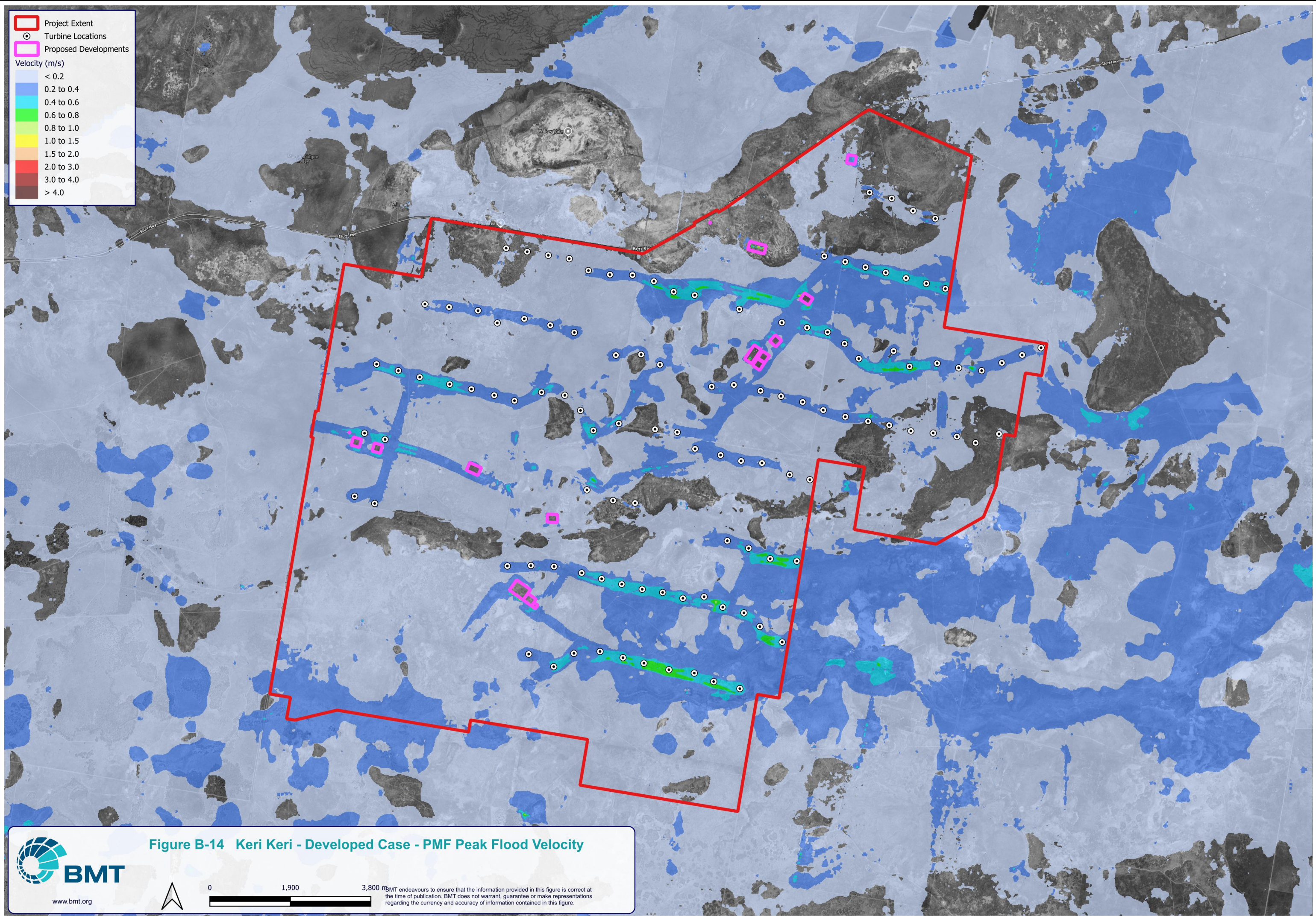
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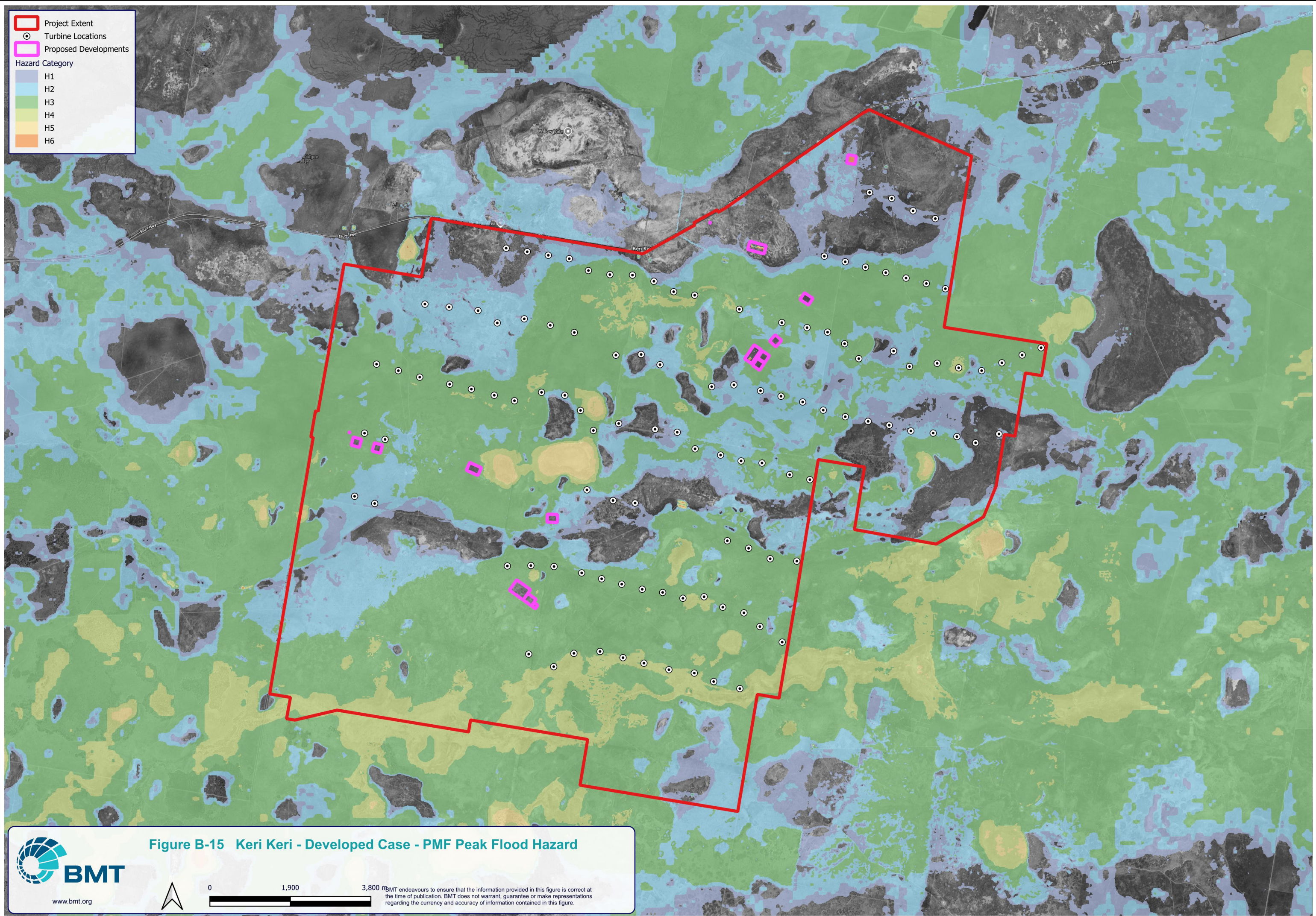


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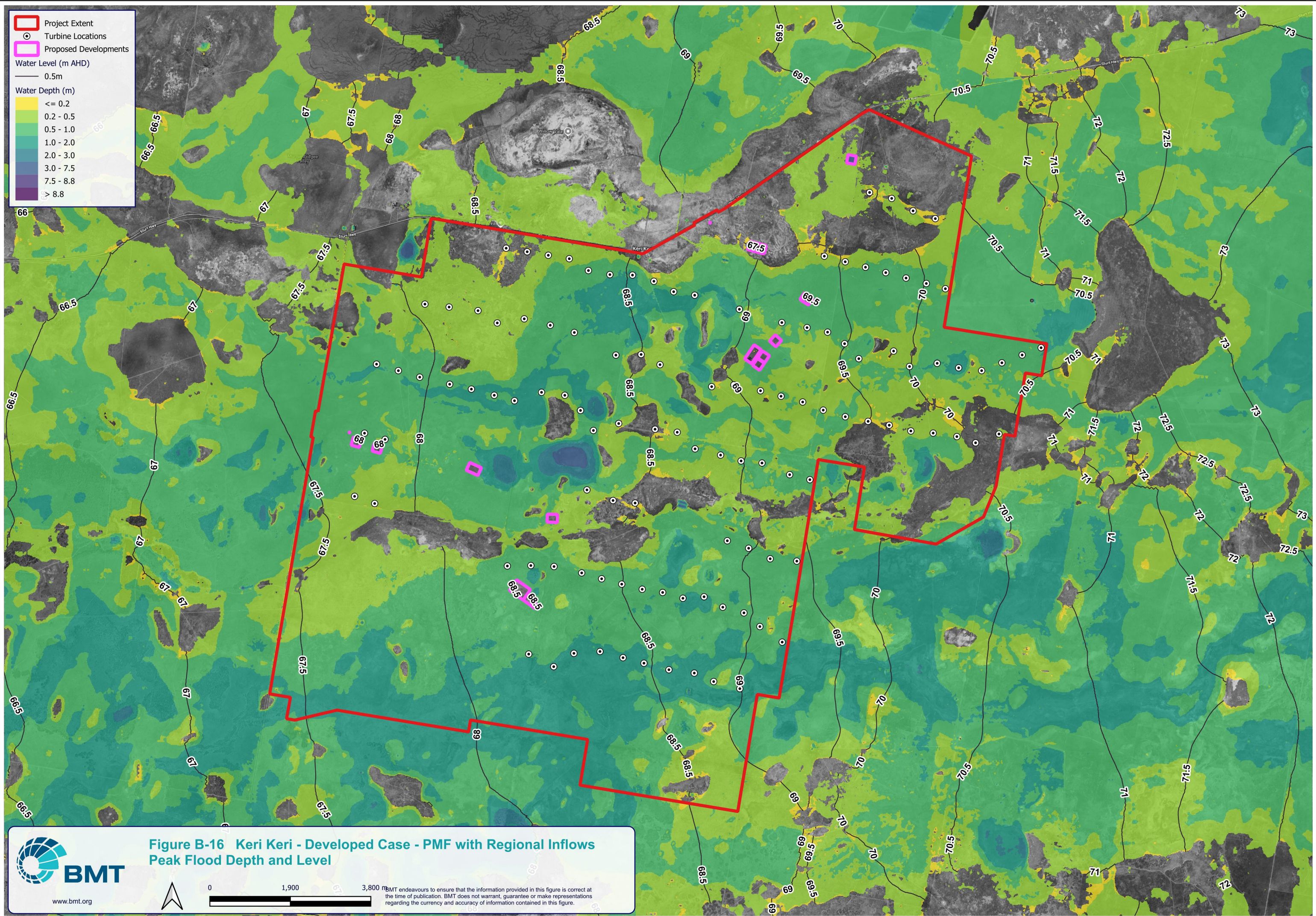
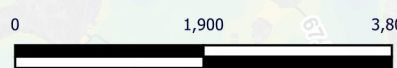
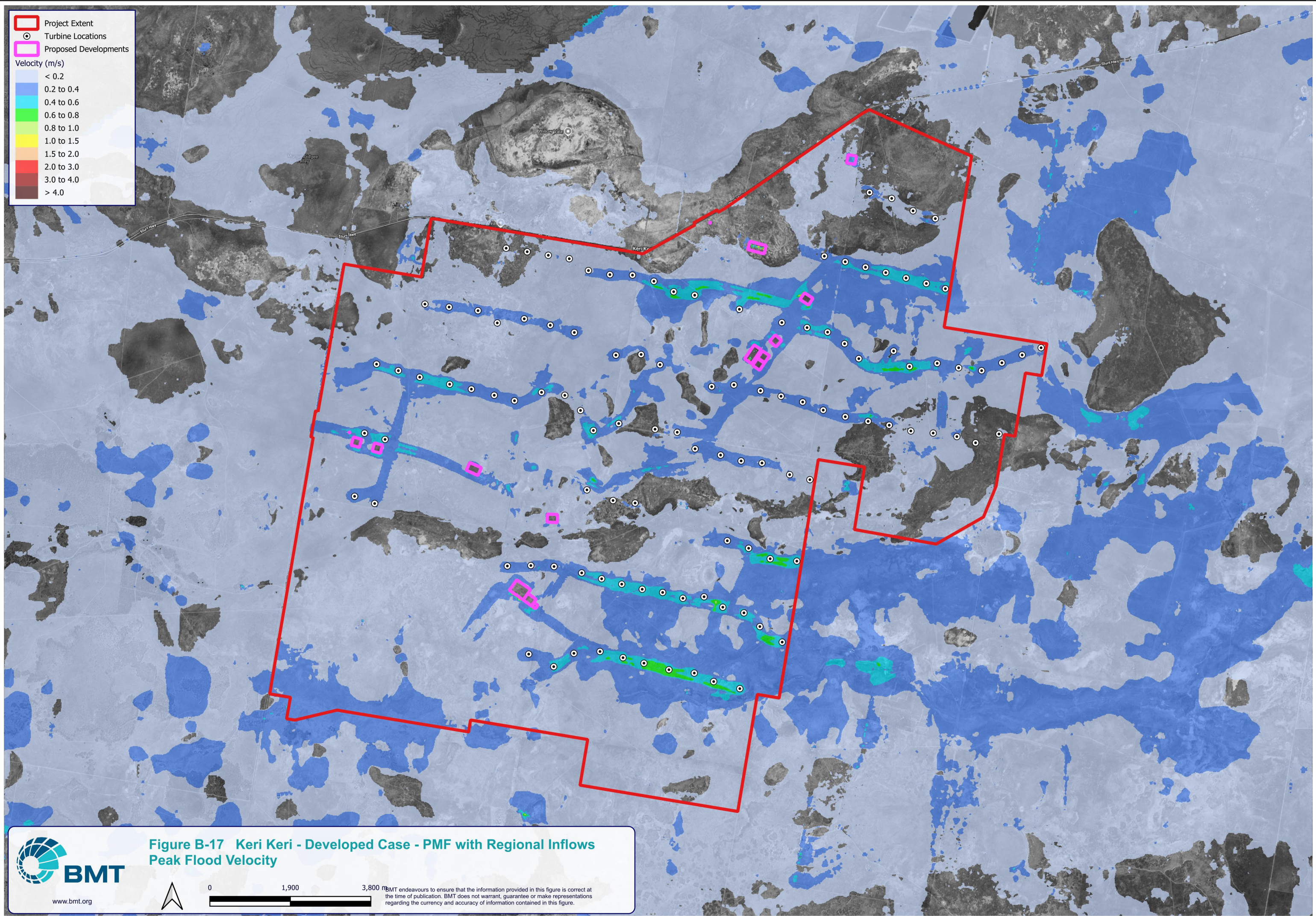


Figure B-16 Keri Keri - Developed Case - PMF with Regional Inflows
Peak Flood Depth and Level



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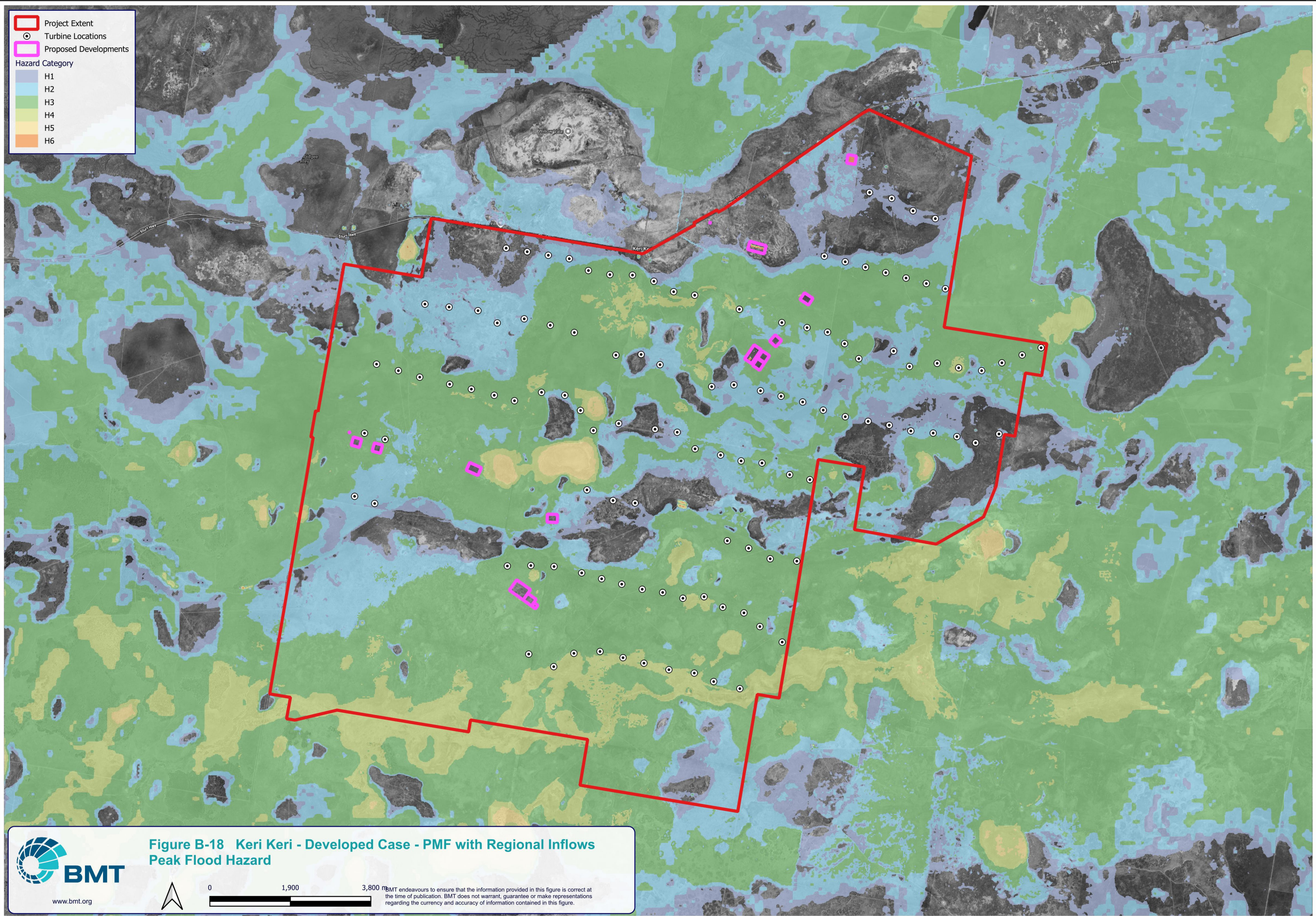


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**Figure B-17 Keri Keri - Developed Case - PMF with Regional Inflows
Peak Flood Velocity**



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Project Extent

Turbine Locations

Proposed Developments

Hazard Category

H1

H2

H3

H4

H5

H6



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Figure B-18 Keri Keri - Developed Case - PMF with Regional Inflows

Peak Flood Hazard

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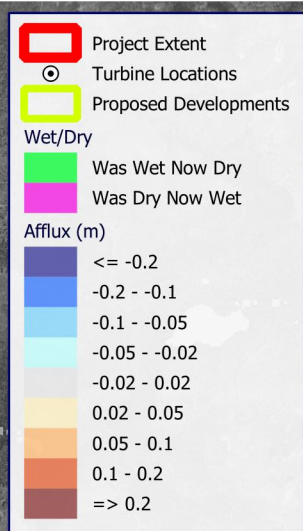
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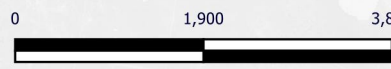
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Annex C Flood Impact Maps

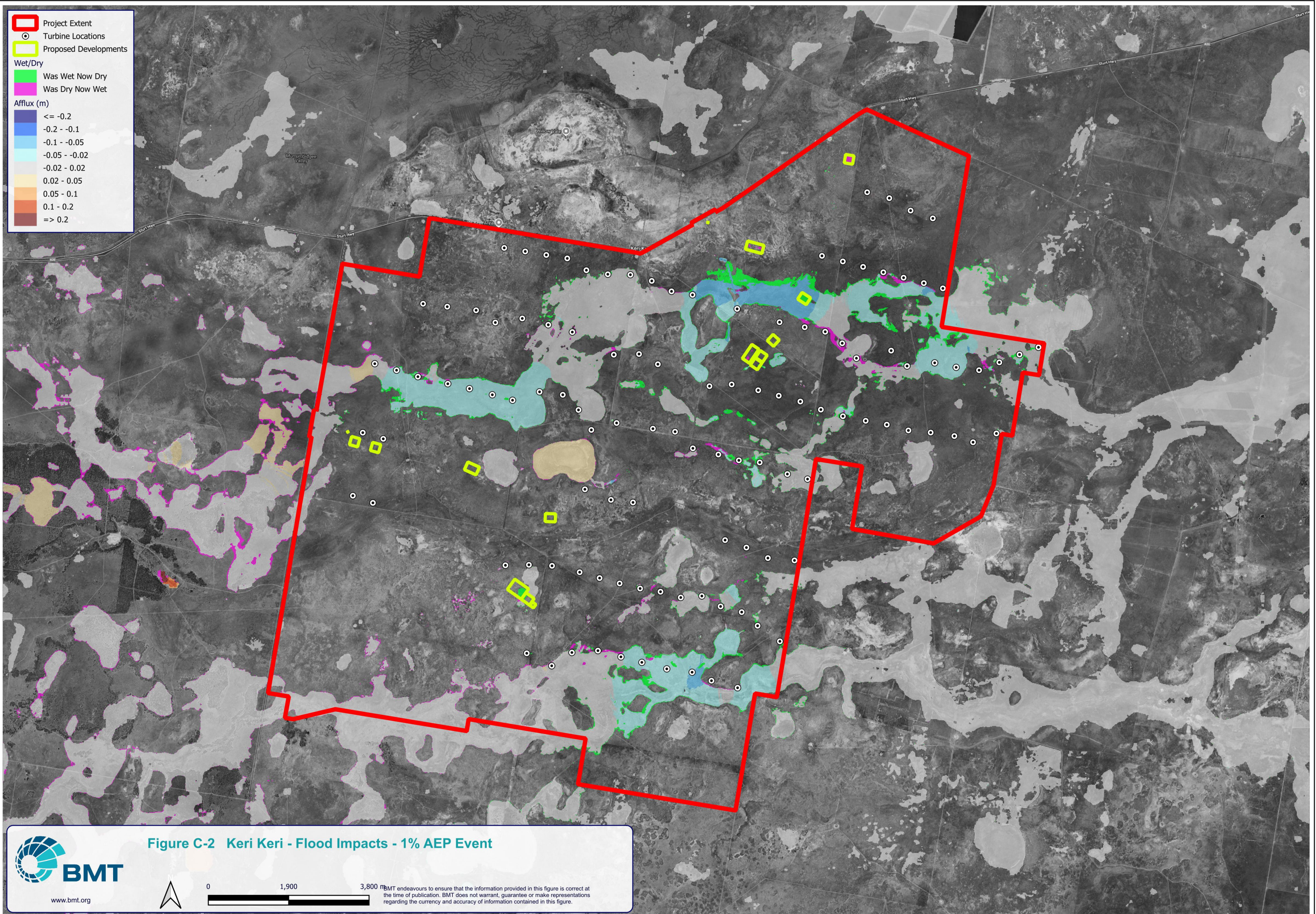


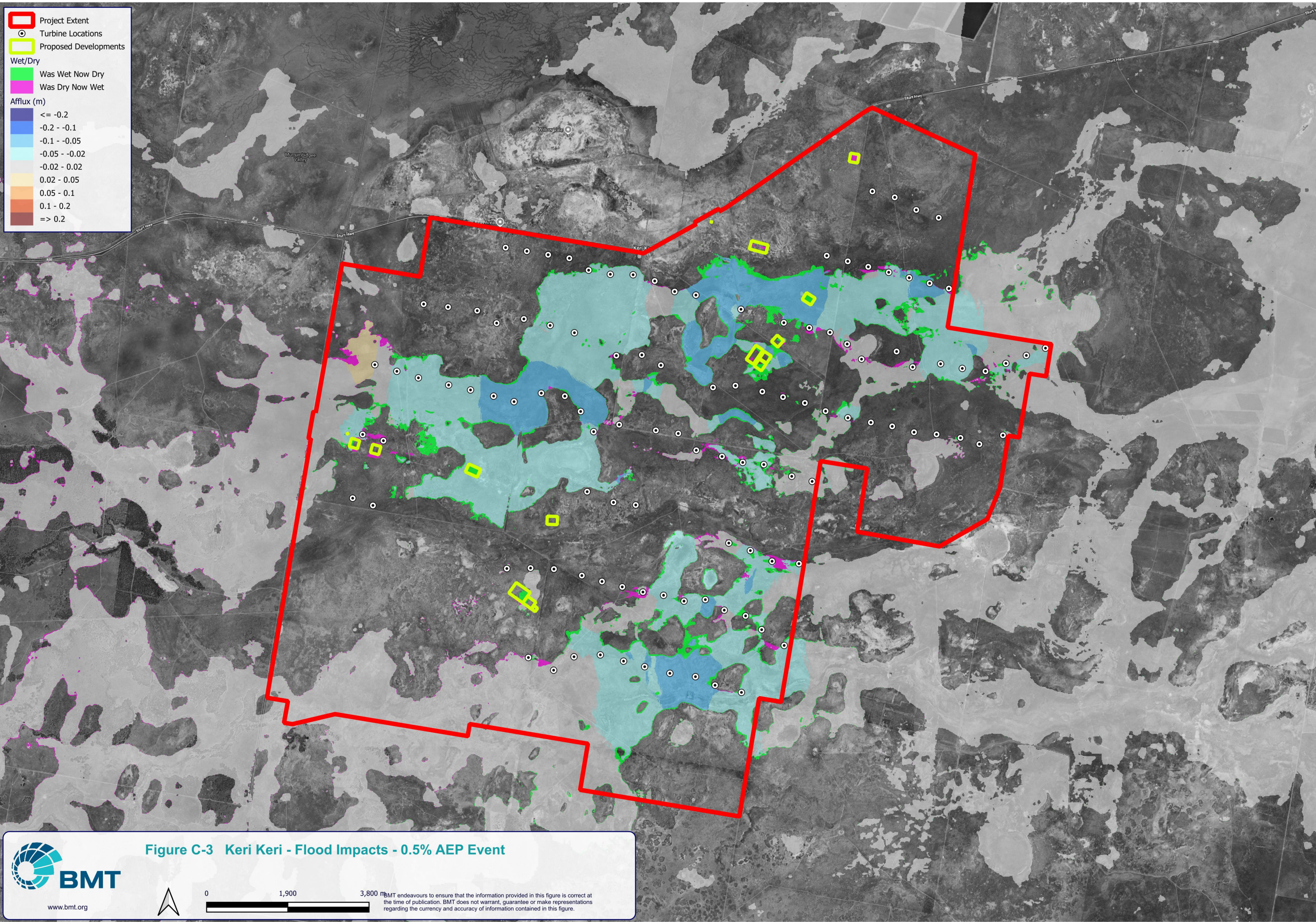
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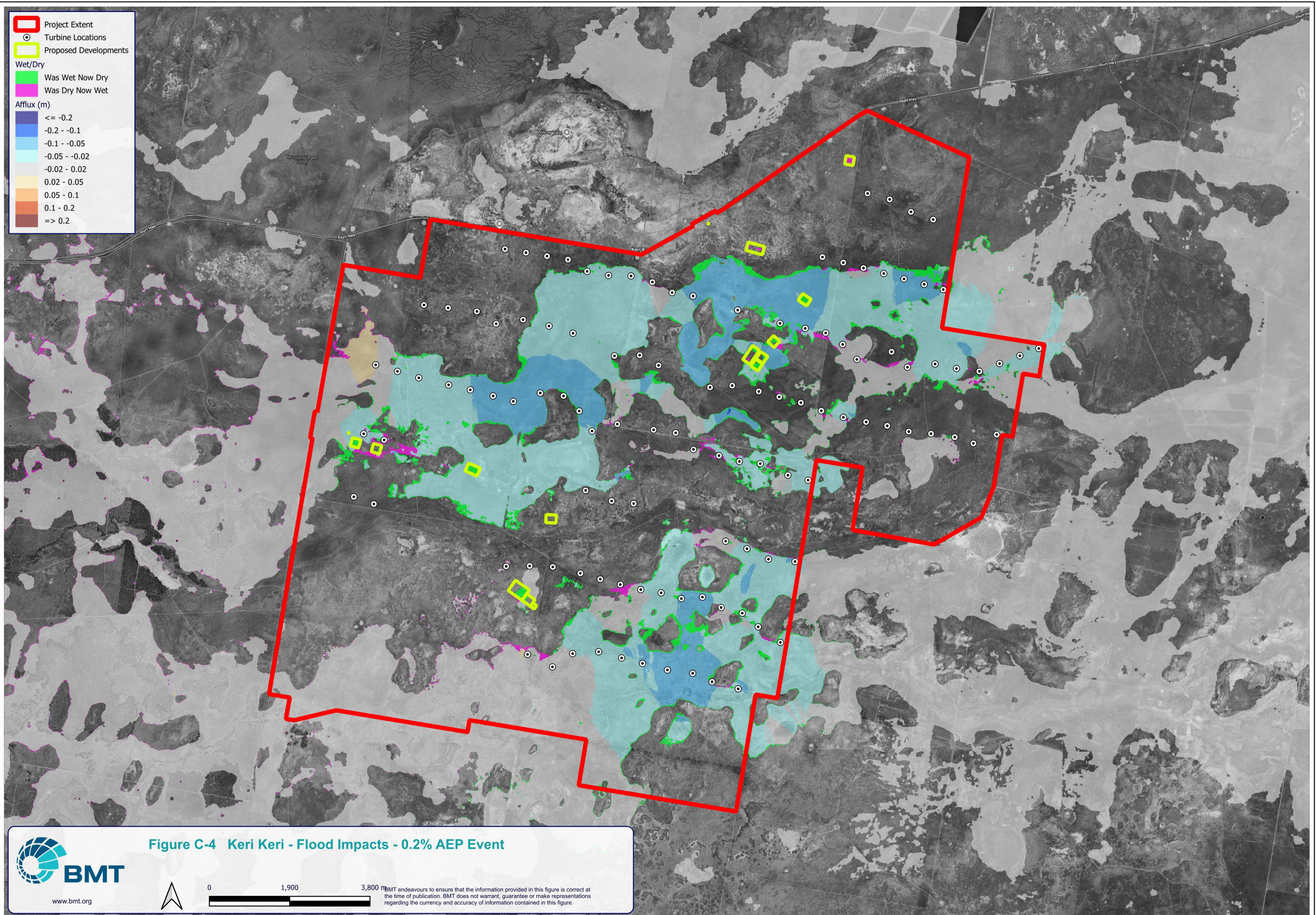
Figure C-1 Keri Keri - Flood Impacts - 5% AEP Event

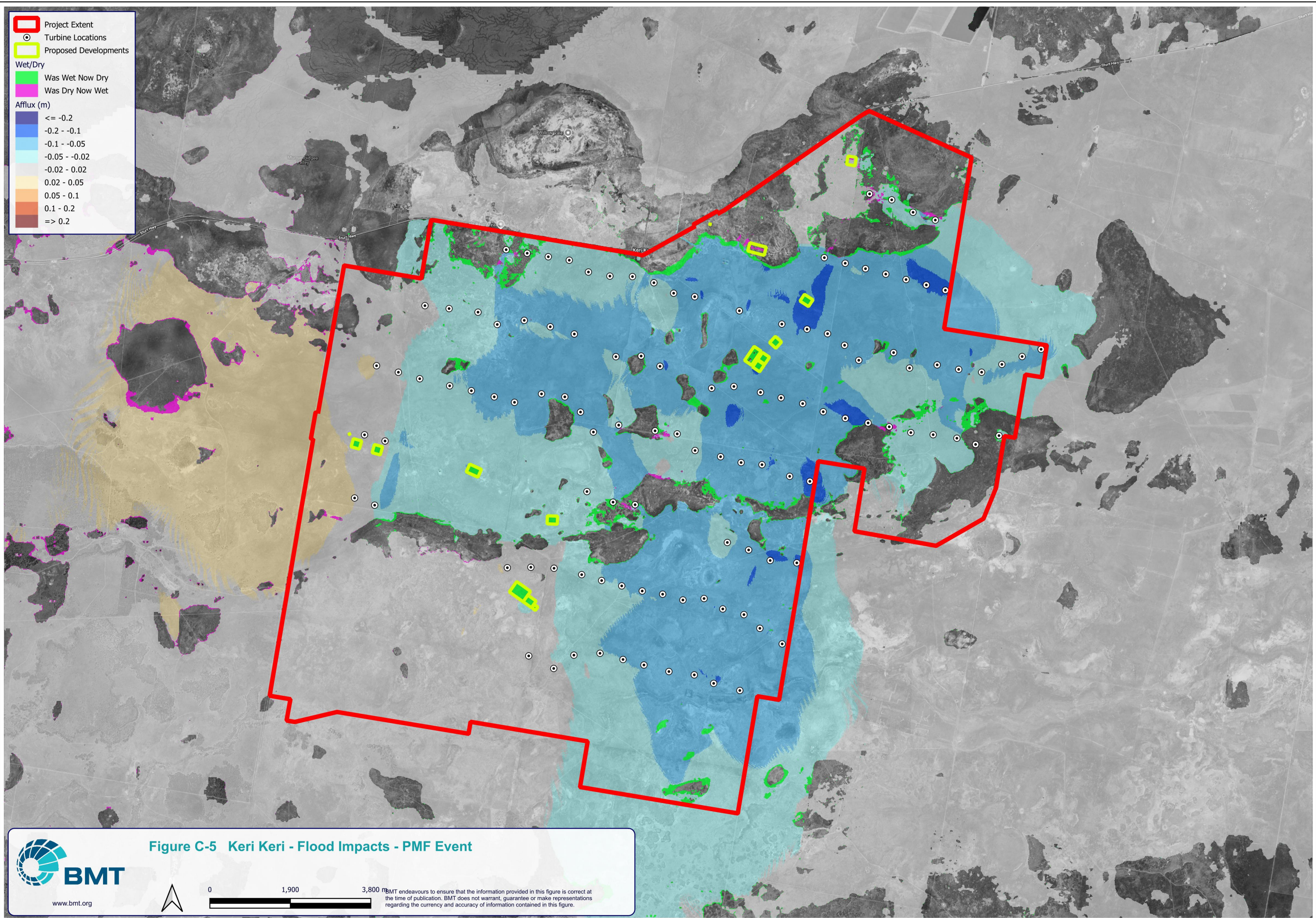


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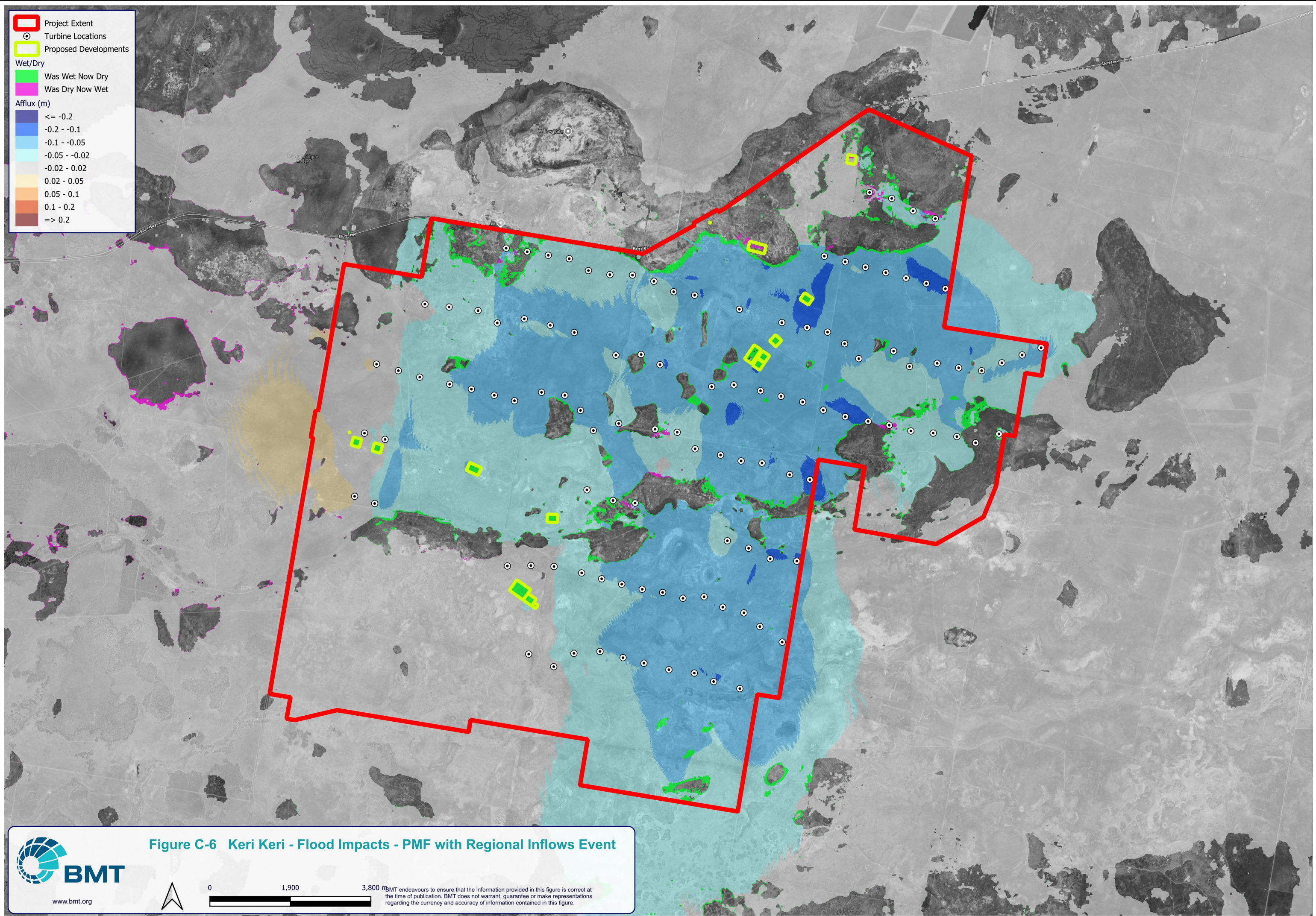


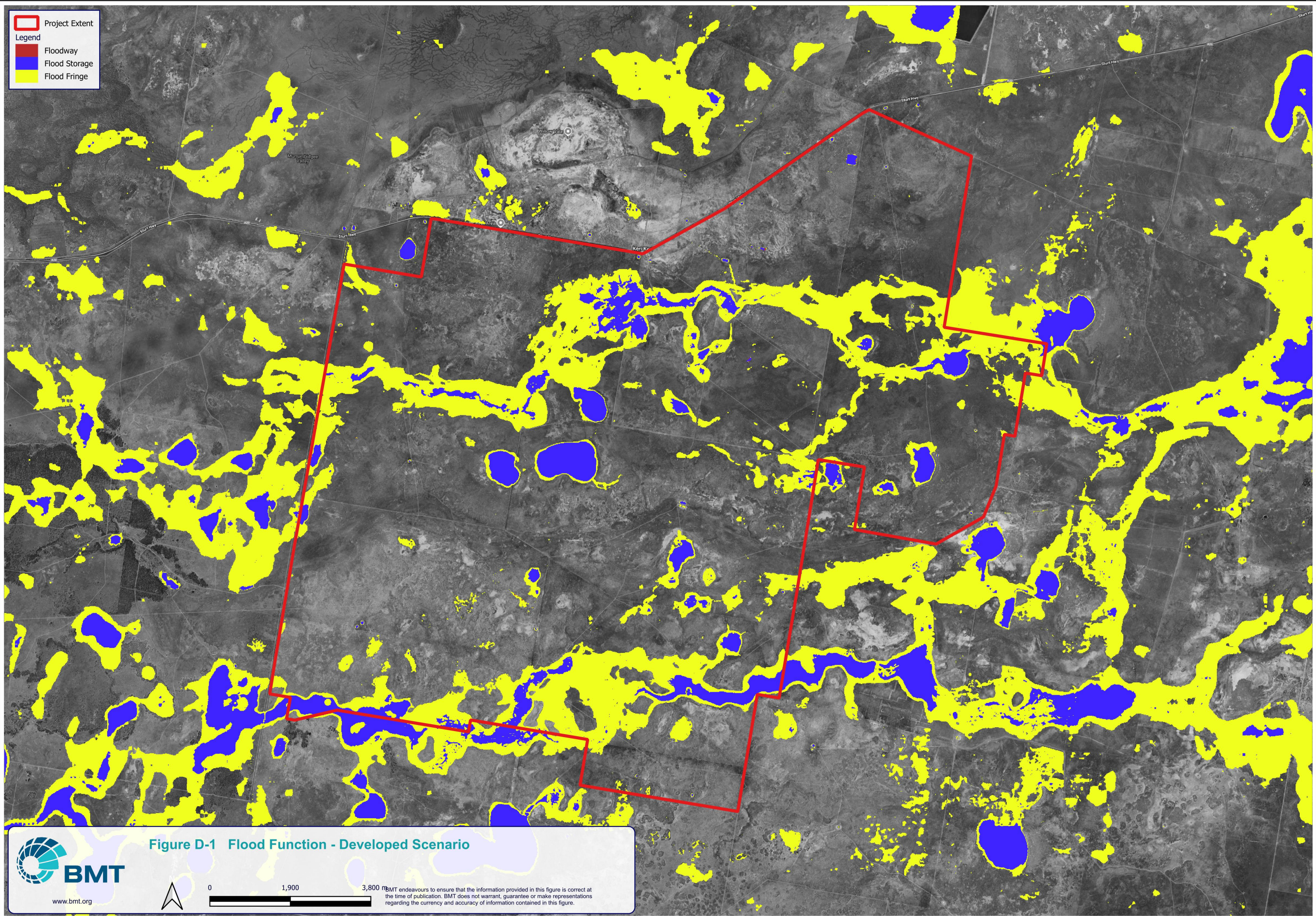
Figure C-6 Keri Keri - Flood Impacts - PMF with Regional Inflows Event

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Annex D Flood Function Maps



Project Extent

Legend

Floodway

Flood Storage

Flood Fringe



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Figure D-1 Flood Function - Developed Scenario



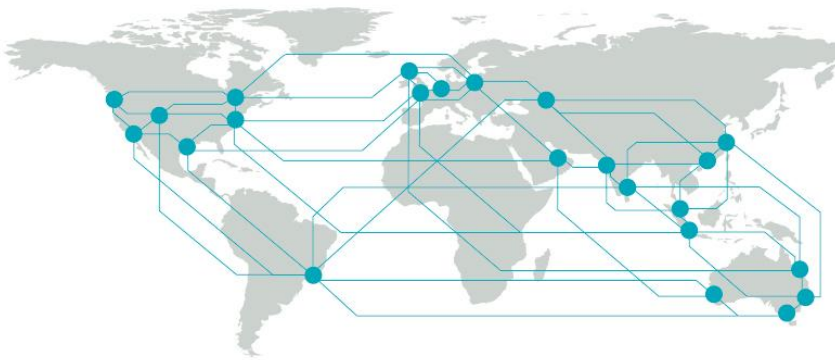
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1,900

3,800

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