BMT WBM Pty Ltd
Suite G2, 13-15 Smail Street
Ultimo, Sydney, NSW, 2007
Australia
PO Box 1181, Broadway NSW 2007

Tel: +61 2 8960 7755
Fax: +61 2 8960 7745

ABN 54 010 830 421

www.bmt.org

Our Ref: L.S20344.002

15 March 2018

Lindsay Dynan Consulting Engineers
5 Newton Street
Broadmeadow NSW 2292

Attention: Mathew McNamara

Dear Mathew,

RE: 71 GAN GAN ROAD ANNA BAY FLOOD ASSESSMENT

BMT was requested to undertake a flood impact assessment for a proposed development at 71 Gan Gan Road, Anna Bay. Specifically, the assessment comprised the determination of the peak flood levels and flood behaviour at the site for the 1% Annual Exceedance Probability (AEP) design event, and a preliminary assessment of the impact of the proposed development on existing design flood behaviour. The following provides a summary of the analysis and results.

Study Area and Catchment

The locality of the site is shown in Figure 1. The site is a 32 ha rural plot, bound by Gan Gan road on its south-western border and Nelson Bay road on its northern border. The eastern and western neighbouring plots are rural, with the exception of the south-eastern corner which is adjacent to the Anna Bay urban area with medium density housing plots.

Local topography in the vicinity of the site, as defined by the available topographic data, is shown in Figure 2. The site consists of low-lying floodplain at elevations less than 2 m AHD, as well as undulating steeper areas formed by the sandy hills and rocky outcrops. Two drainage channels run across the site – the Anna Bay Main Drain in the northern portion, and the tributary drain, Ferntree Drain, in the southern portion. A ridge-line with a peak elevation of 14.7m crosses the central portion of the site. Additionally, the portion of land along the south-western border of the property has an elevation of ~ 3-7 m AHD.

Flood behaviour in this region is complex, originating from tidal inundation, local catchment runoff and Hunter River overflows in rare flood events.

Model Development

Hydraulic Model

The TUFLOW model developed as part of the Anna Bay and Tilligerry Creek Flood Study (Jacobs, 2017) was utilised for this study. Three separate TUFLOW models were developed as part of the Jacobs (2017) study to define design flood conditions in different portions of the study area due to variations in flooding characteristics and catchment settings. The study site is situated in the area covered by two of the TUFLOW models. The southern portion of the site is included in the finer-scale “urban” model, which models existing urbanised areas in the vicinity of Anna Bay. The site in its entirety is then included in the course “regional” model. Both of these TUFLOW hydraulic models has been used to derive baseline (pre-development) and post-development flood conditions for the 1% AEP design event.

Title:

Study Site Location

Figure: 1

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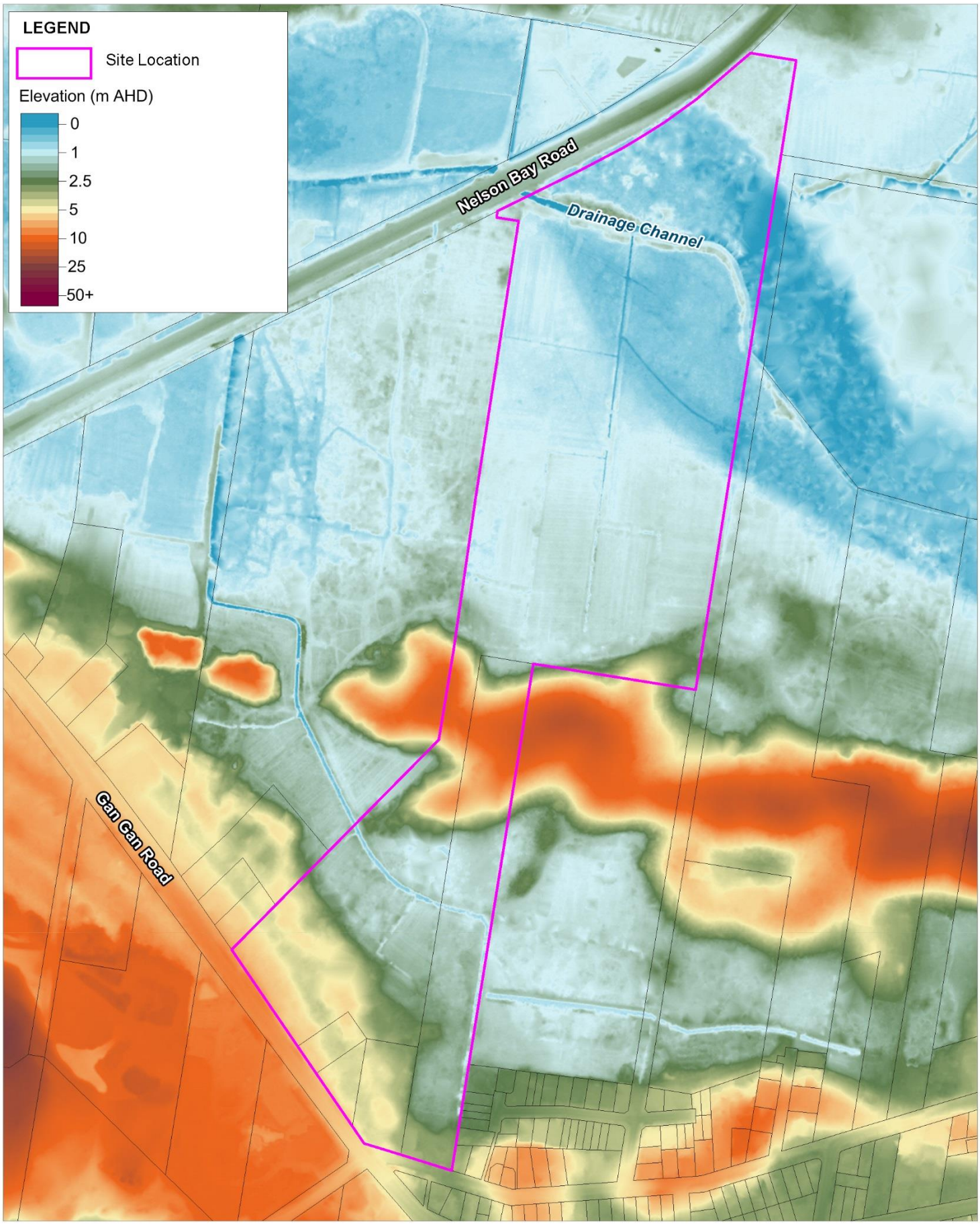

Title:

Study Site Topography

Figure: **2**

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Hydrologic Model

The hydrologic model predicts the amount of runoff from rainfall and the attenuation of the flood wave as it travels down the catchment. This process is dependent on catchment area, slope and vegetation; variation in distribution, intensity and amount of rainfall; and antecedent conditions of the catchment.

Runoff-routing software XP-RAFTS was used in the Anna Bay and Tilligerry Creek Flood Study (Jacobs, 2017) to generate flow hydrographs for each local sub-catchment to provide local catchment inflows to the study area. These hydrologic model inflows calculated in the Jacobs (2017) study were adopted for this assessment.

Local Flooding Behaviour

A combination of the 1% AEP 9-hour duration 'urban' model and the 1% AEP 48-hour 'local regional' model was found to provide for the critical flood conditions across the study site. Design flood modelling results in the form of simulated peak flood depths for the 1% AEP design event are presented in Figure 3 and Figure 4 for the 'urban' and 'local regional model' respectively, and have been used as a baseline to assess the impact of the proposed development. Hydraulic hazard category mapping, produced as part of the Anna Bay and Tilligerry Creek Flood Study, was provided by Council and is presented in Figure 5.

As shown in Figure 3 and Figure 4, a significant portion of both the northern and southern portions of the site are inundated in a 1% AEP event under existing catchment conditions. The site is primarily categorised as a combination of Low Hazard Flood Fringe and Low Hazard Flood Storage, with localised areas of High Hazard Flood Storage and High Hazard Floodway, as shown in Figure 5.

Flood Impact Assessment

The relative impact of the proposed development has been considered in terms of potential adverse impacts on existing 1% AEP flood levels. The TUFLOW models were altered to include a preliminary representation of post-development site conditions. The post-development site conditions were modelled using a fill polygon, elevated above the 1% AEP flood level as shown in Figure 6a and 6b. Under Scenario 1, the fill polygon is primarily limited to areas of low hazard flood fringe. Under Scenario 2, the fill polygon in the northern portion of the site is extended further north to encompass areas of low and high hazard flood storage.

The modelled impacts on simulated peak flood levels for the 1% AEP event are shown in Figure 7 and Figure 8. There are negligible impacts in the northern portion of the site under both raised fills scenarios simulated. There are however some minor increases (~0.02–0.03 m) in peak flood levels on the neighbouring property to the east and west of the southern portion of the site. These impacts are driven by:

(1) the blockage of floodplain flowpaths that link in to Ferntree Drain; and

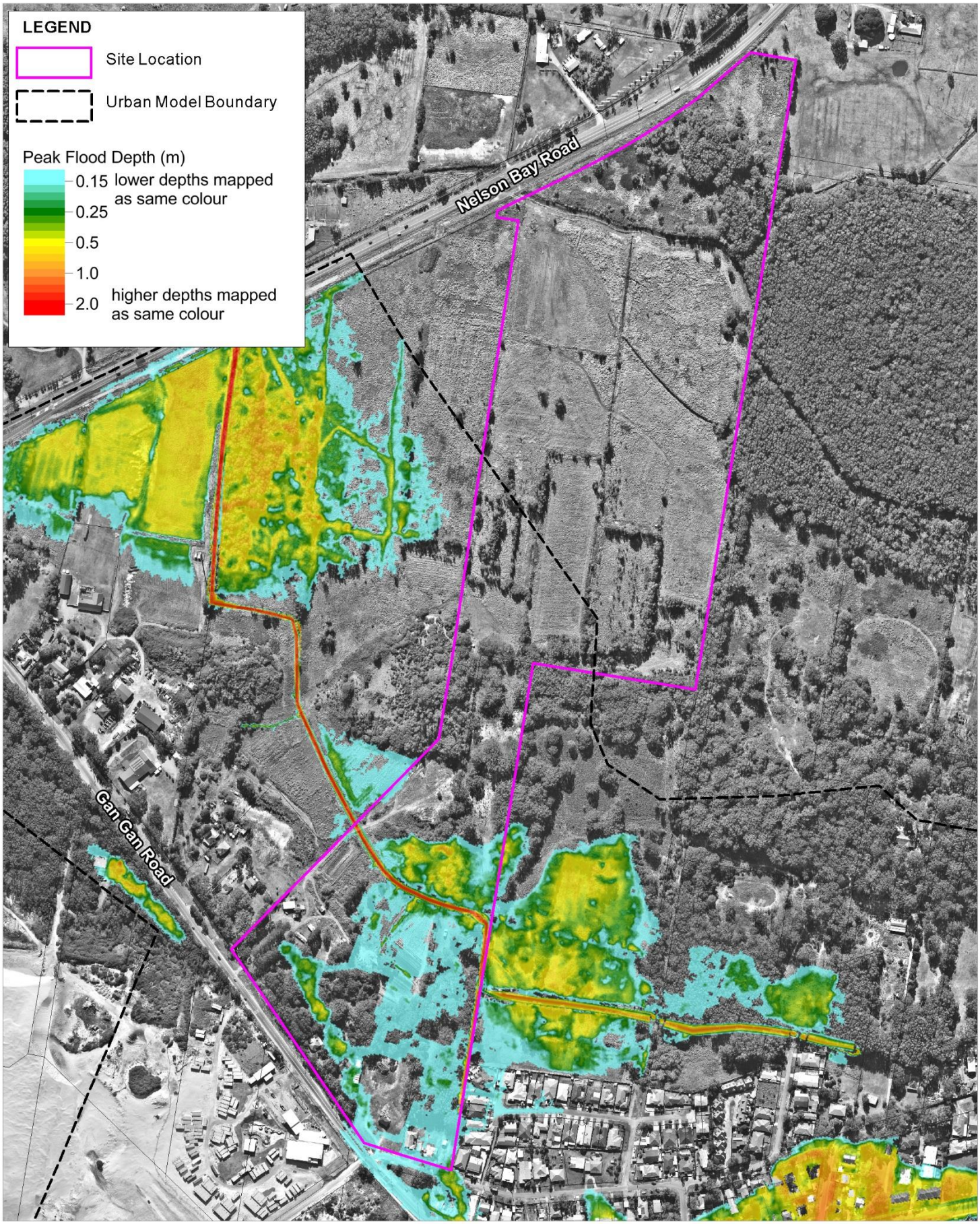
(2) the restriction of flows to the modelled drainage corridor along Ferntree Drain.

These impacts can likely be mitigated by making minor alterations to the fill polygon and/or the inclusion of some drainage infrastructure at a later stage in the development process.

We trust the above provides a suitable description of the existing 1% AEP flood behaviour at the site and the preliminary impact of the proposed development on baseline flood conditions. Please feel free to contact the undersigned to discuss further as required.

Yours Faithfully
BMT WBM

Joshua Eggleton
Senior Environmental Engineer



Title:

Peak Flood Depth - Existing Urban Scenario
1% AEP (100 yr ARI)

Figure: **3**

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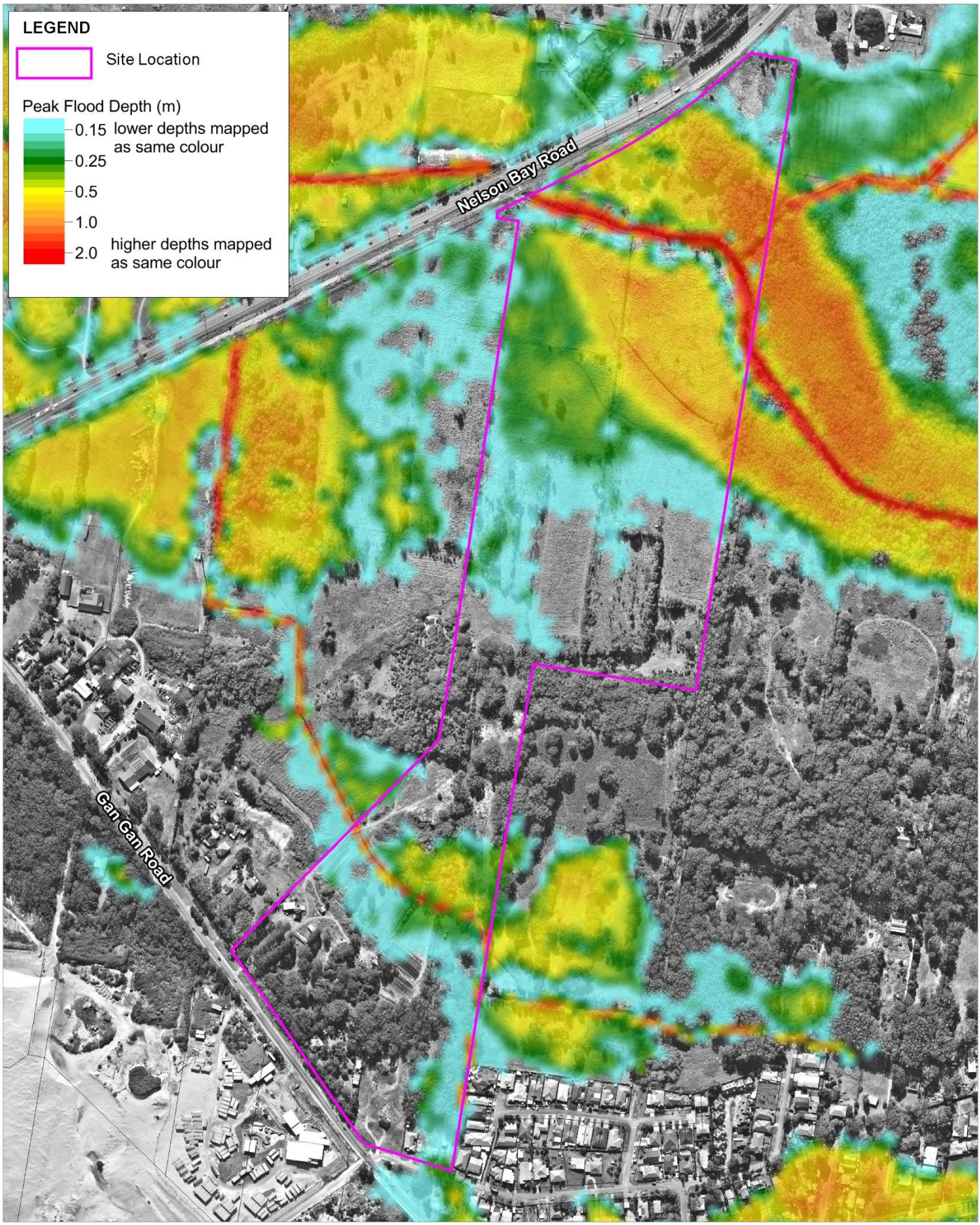

Title:

Peak Flood Depth - Existing Regional Scenario
1% AEP (100 yr ARI)

Figure: **4**

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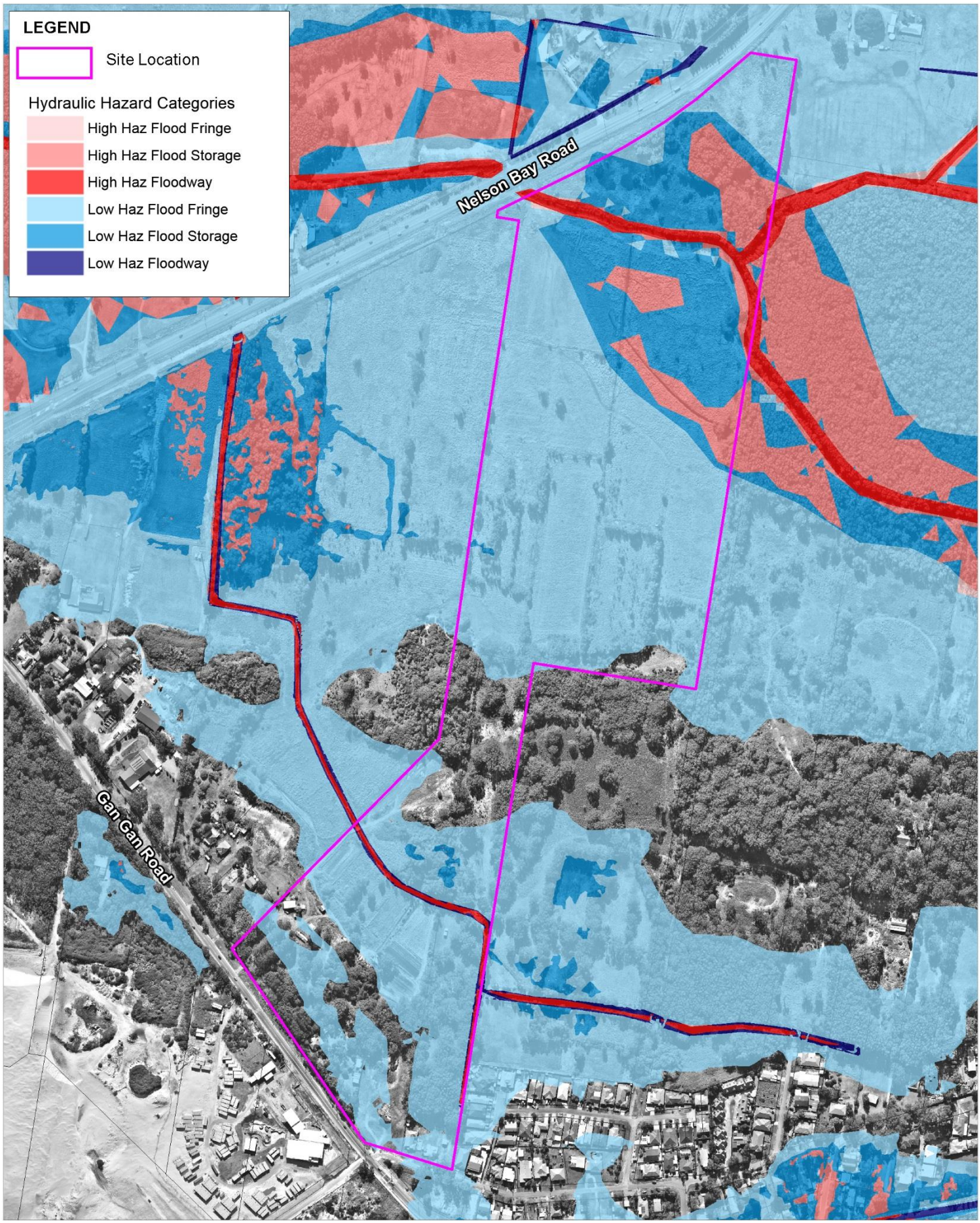

Title:

Hydraulic Hazard Categories - Existing Scenario

Figure: **5**

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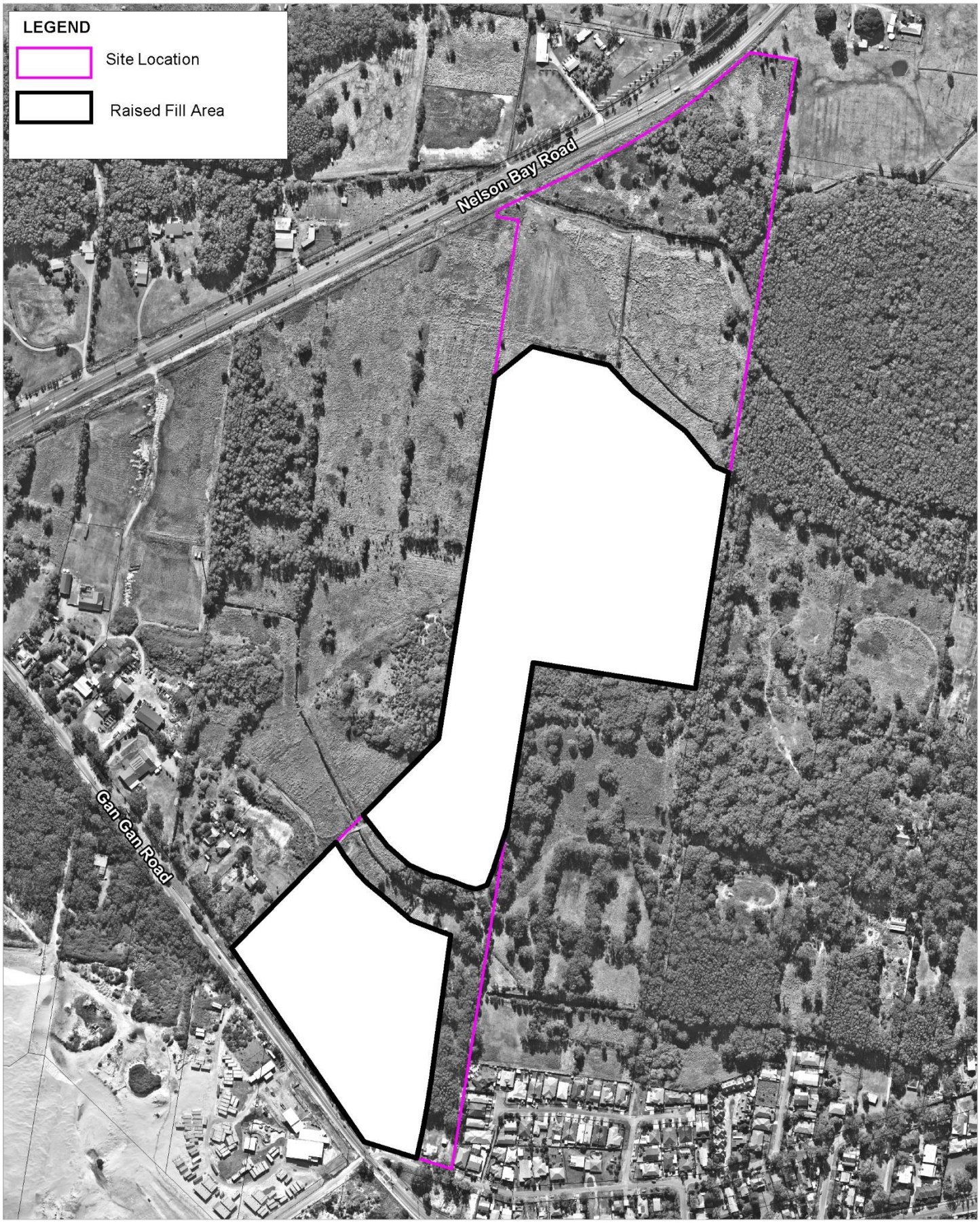

Title:

Raised Fill Area - Scenario 1 (S1)

Figure: **6a**

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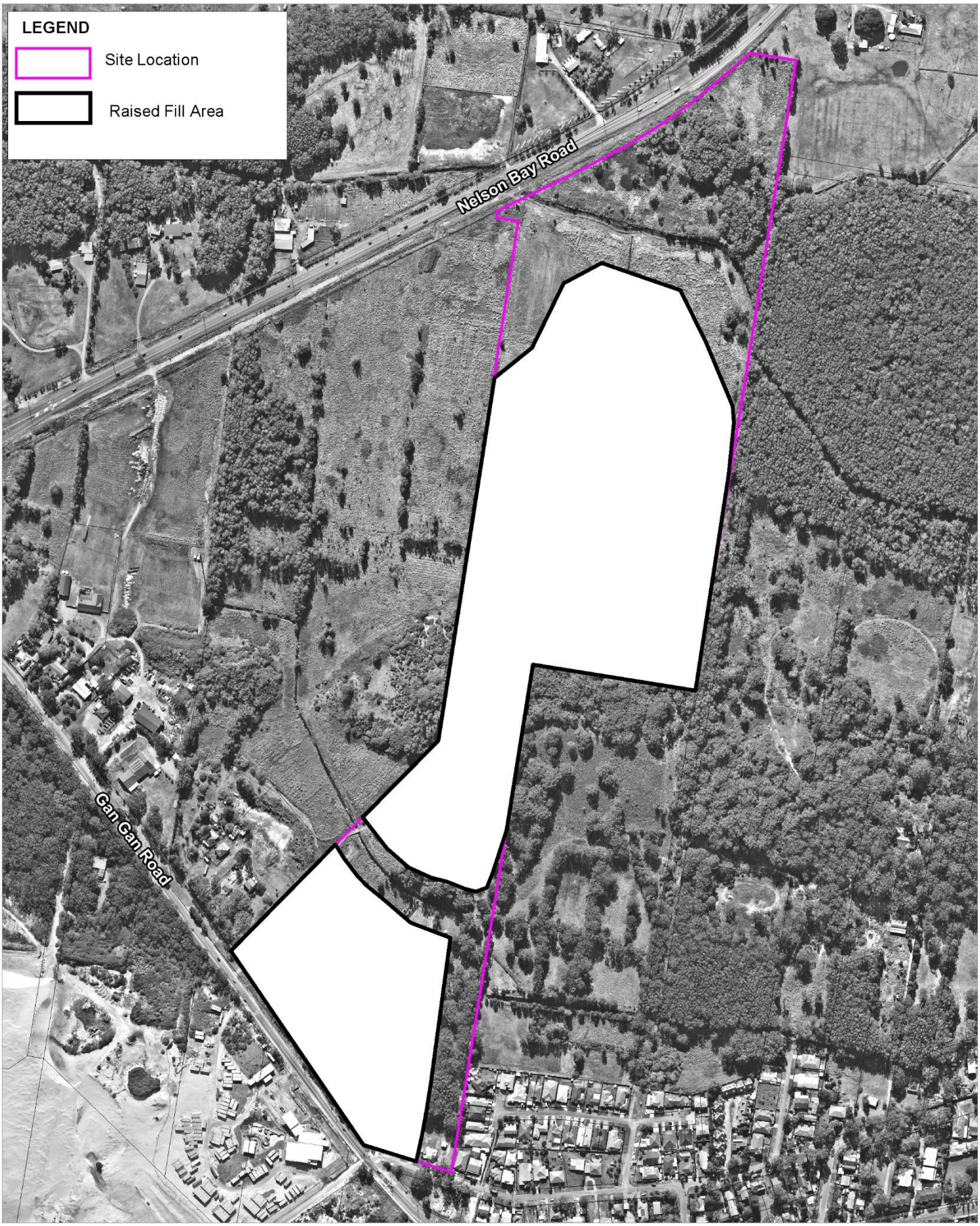

Title:

Raised Fill Area - Scenario 2 (S2)

Figure: **6b**

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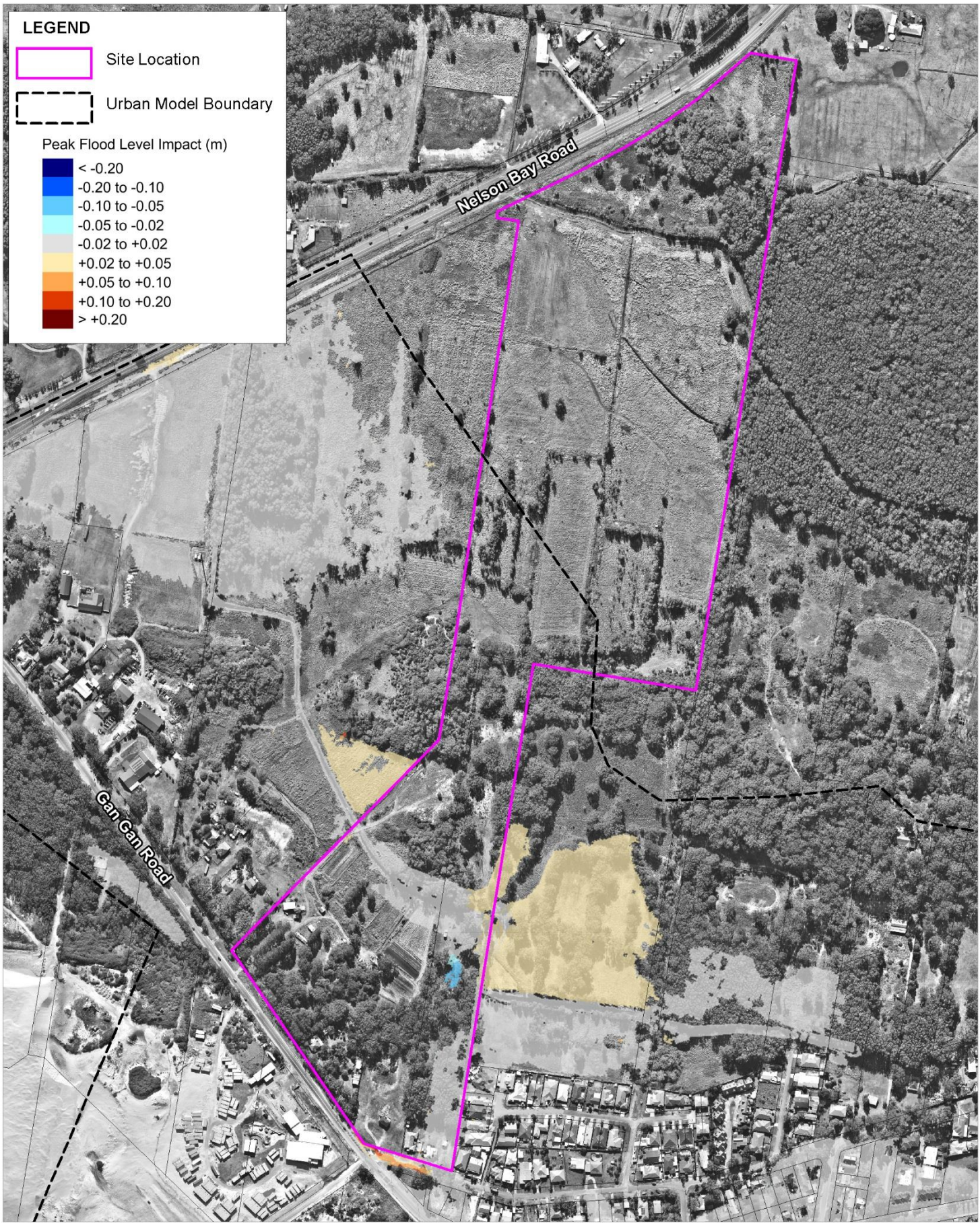

Title:

Peak Flood Level Impacts - Urban 2m Model
1% AEP (100 yr ARI)

Figure: **7**

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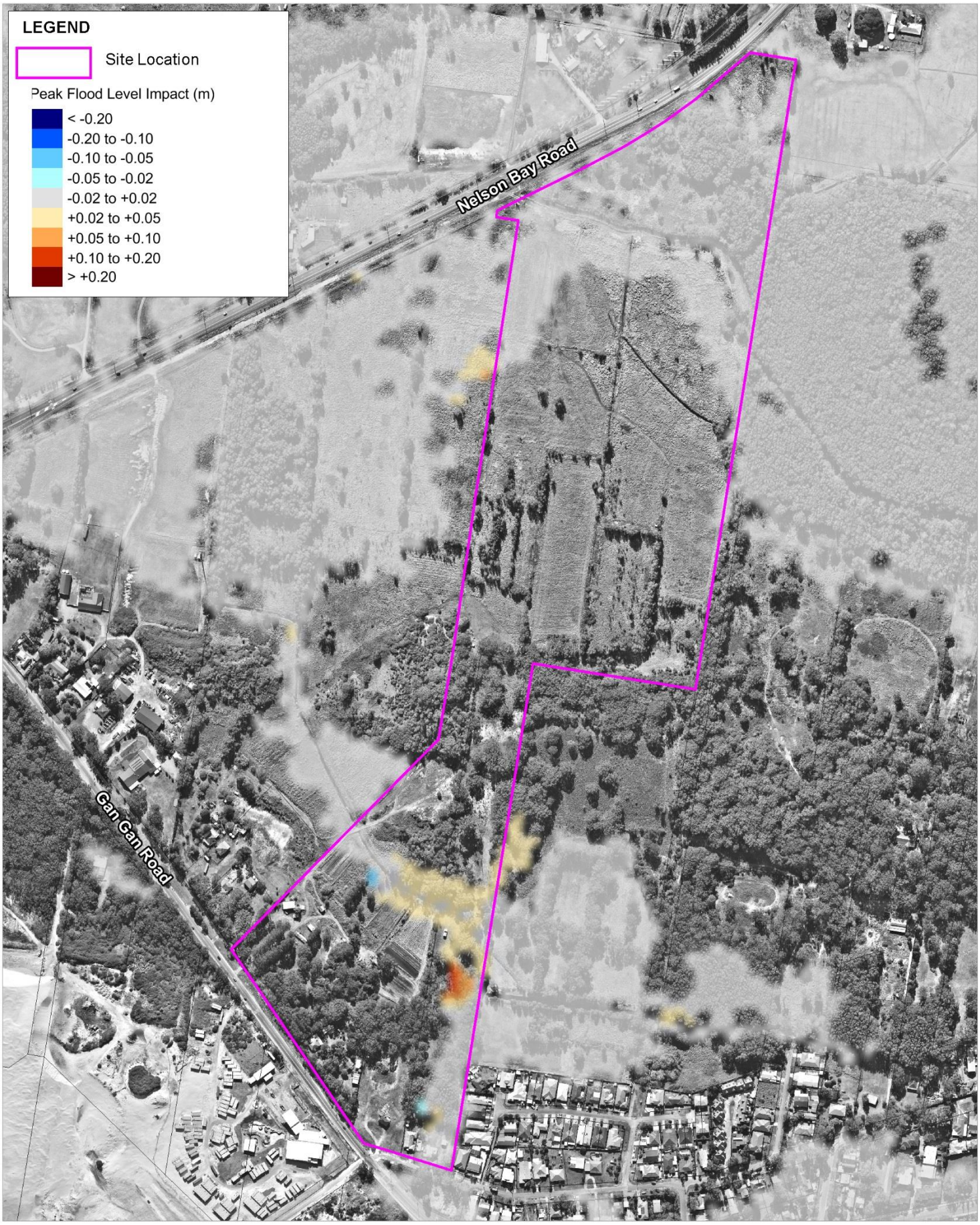

Title:

Peak Flood Level Impacts - Regional 20m Model S1 1% AEP (100 yr ARI)

Figure: 8

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Title:

Peak Flood Level Impacts - Regional 20m Model S2

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