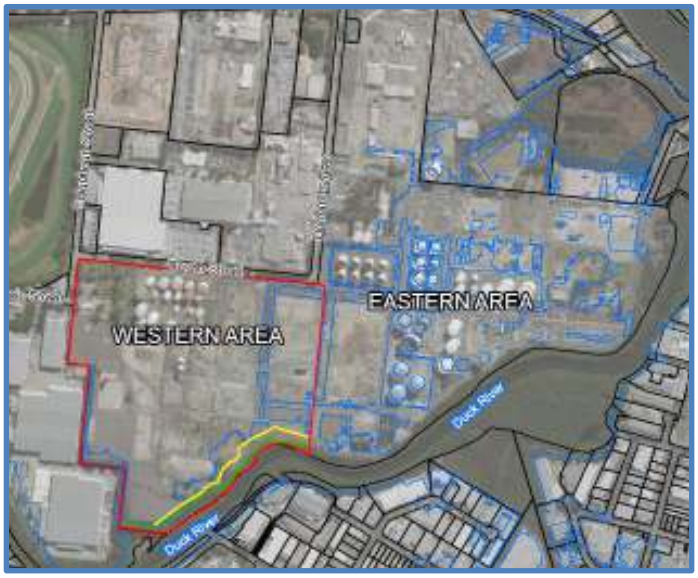
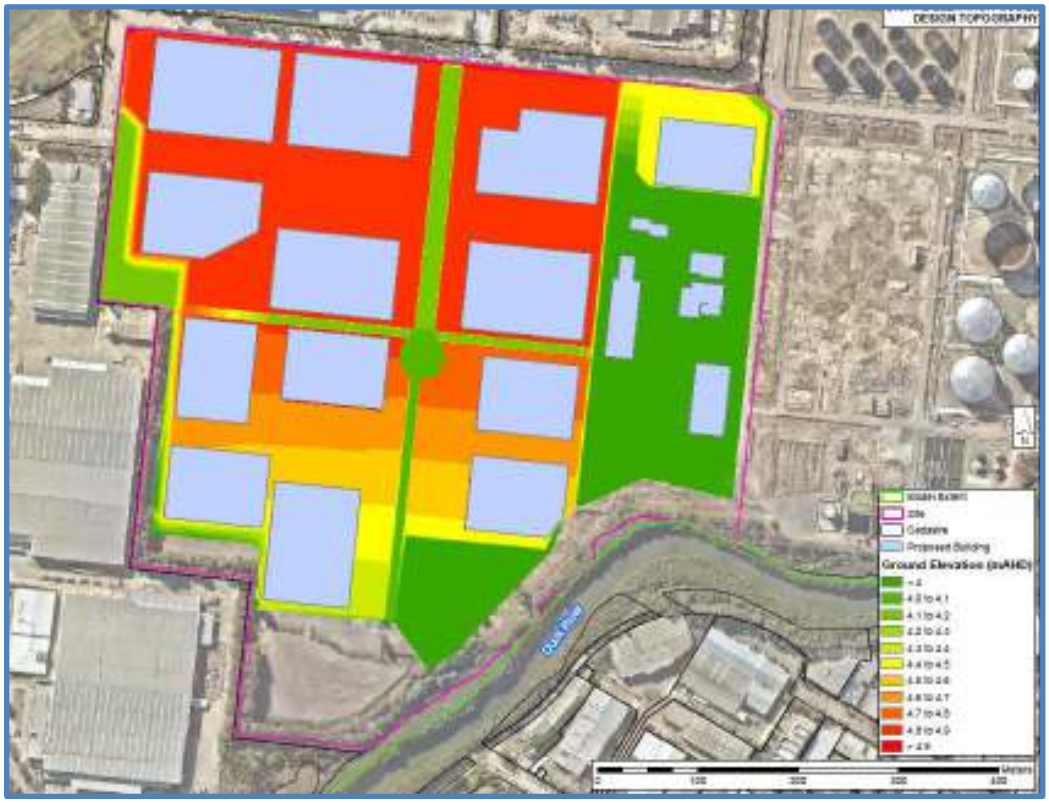
APPENDIX G

FLOOD IMPACT ASSESSMENT REPORT

VE PROPERTY PTY LTD Pty Ltd

CENTRAL SYDNEY INDUSTRIAL ESTATE INCORPORATING DOWNER SUSTAINABLE ROAD RESOURCE CENTRE FLOODING ASSESSMENT





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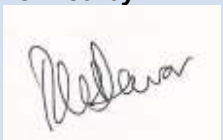
CENTRAL SYDNEY INDUSTRIAL ESTATE INCORPORATING DOWNER SUSTAINABLE ROAD RESOURCE CENTRE FLOODING ASSESSMENT

AUGUST 2020

Project **Central Sydney Industrial Estate Incorporating Downer Sustainable Road Resource Centre Flooding Assessment**	**Project Number** **119043**
Client **VE PROPERTY PTY LTD**	**Client's Representative** J Lord - DBL Property Pty Ltd
Authors Fabien Joly Rhys Hardwick - Jones Richard Dewar	**Prepared by** 
Date **21 AUGUST 2020**	**Verified by** 

Revision	Description	Distribution	Date
1	Draft Flood Assessment Report	J Lord	3 August 2020
2	Draft Flood Assessment Report	J Lord	19 August 2020
3	Flood Assessment Report	J Lord	21 August 2020

CENTRAL SYDNEY INDUSTRIAL ESTATE INCORPORATING DOWNER SUSTAINABLE ROAD RESOURCE CENTRE FLOODING ASSESSMENT

TABLE OF CONTENTS

LIST OF APPENDICES

LIST OF IMAGES

LIST OF ACRONYMS

AEP	Annual Exceedance Probability
AHD	Australian Height Datum
AR&R	Australian Rainfall and Runoff (note there is a 1987, 2016 and 2019 version - released in May 2019)
ALS	Airborne Laser Scanning sometimes known as LiDAR
BoM	Bureau of Meteorology
CSSI	Critical State Significant Infrastructure
DPIE	Department of Planning, Industry and Environment
DTM	Digital Terrain Model
EES	Environment, Energy and Science Group
EIS	Environmental Impact Statement
ELVIS	Elevation Information System provided by the Federal Government
EPA	Environment Protection Authority
GIS	Geographic Information System
IFD	Intensity, Frequency and Duration of Rainfall
m	metre
m^3/s	cubic metres per second (flow measurement)
m/s	metres per second (velocity measurement)
PMF	Probable Maximum Flood
SEARS	Secretary of DPIE Environmental Assessment Requirements
SSD	State Significant Development
tpa	tonnes per annum
TUFLOW	one-dimensional (1D) and two-dimensional (2D) flood and tide simulation software program (hydraulic computer model)
1D	One dimensional hydraulic computer model
2D	Two dimensional hydraulic computer model

LIST OF FIGURES

APPENDIX B Overland Flow Flooding

APPENDIX C Mainstream Flooding

EXECUTIVE SUMMARY

Background: State Significant Development Approval No SSD 5147 was approved in 2015 comprising conversion of the former Oil Refinery at Clyde into a finished petroleum product import, storage and distribution terminal. Works were approved to improve terminal efficiency and to consolidate the operational footprint including demolition and clearing of the old refinery. The Western Area lands were identified as future surplus industrial land for future reuse. The works the subject of this report are on the Western Area lands (Figure 1 to Figure 4).

State Significant Development Approval No SSD 9302 was lodged in 2018 for the Western Area Remediation Project. This application has been determined and will result in the remediation and issuance of site audit certification of the site.

A Report was prepared in February 2016 by WMAwater (Reference 1) which provided an assessment of the impact that the proposed development at the time (minor works in the Eastern Area) would have on surrounding flood levels as well as discussion on the floodplain management issues and compliance with Parramatta City Council's guidelines for development in the floodplain.

Scope of Present Report: The present report is intended to address the flood impacts of subdividing the Western Area into eight new lots. This includes the Stage 1 development of the Downer Sustainable Road Resource Centre and assuming typical buildings for the land use zoning are constructed on the remaining lots. The Eastern Area (Figure 1 to Figure 4) would remain owned by Viva Energy whilst the Western Area would be used for the new industrial estate.

Both overland flooding from the upstream catchments entering the site and from mainstream flooding from overtopping of Duck River have been analysed. The outcome of the present report is to confirm that the proposed development of the Western Area (for the Central Sydney Industrial Estate) can occur without adverse flood impacts on surrounding properties and in compliance with Parramatta City Council's flood related development controls.

Outcome: Both overland and mainstream flood modelling have been undertaken with results shown in Appendix B and Appendix C respectively. A sea level rise due to climate change has not been investigated as the site is too far upstream and on relatively high ground (ground levels of 4m AHD) to be affected by say a 0.9m sea level rise. Climate change due to rainfall increase has been investigated. The proposed design has not specifically considered a climate change rainfall increase as any increase can be accommodated within the freeboard allowance for building floors.

The results (Figure B14 to Figure B17 for overland flooding and Figure C13 to Figure C16 for mainstream flooding) indicate no increases in design flood levels greater than 10mm outside the subject site in events up to the 0.2% annual exceedance probability (AEP) (500 year annual recurrence interval). There are small increases in probable maximum flood (PMF) peak levels for

both overland and mainstream flooding as shown on Figure B17, Figure B18, Figure C16 and Figure C17. As floods larger than the 0.2% AEP event and smaller than the PMF were not analysed it is not possible to determine the magnitude of the event which first produces impacts greater than 10mm outside the subject property.

As the existing site is inundated in the PMF (by up to 2m) it is impossible to completely negate increases in PMF peak levels unless all earthworks and structures are built above the PMF, or the scale of the works (which are typical for the current zoning) are significantly reduced so the increases are confined to the subject site. Balancing the cut and fill on the site has been achieved at the 1% AEP flood level but cannot be achieved for the PMF for the scale of works and fill typical for the current zoning.

Flood hazard maps for the proposed design conditions are shown on Figure C18 to Figure C21.

1. PROJECT OVERVIEW

1.1. Existing Activities – Viva Energy

State Significant Development (SSD) Approval No SSD 5147 was approved in 2015 comprising conversion of the former Oil Refinery at Clyde into a finished petroleum product import, storage and distribution terminal. Works were approved to improve terminal efficiency and to consolidate the operational footprint including demolition and clearing of the old refinery. The Western Area lands were identified as surplus industrial land for future reuse. The works the subject of this report are on Western Area lands (Figure 1 to Figure 4).

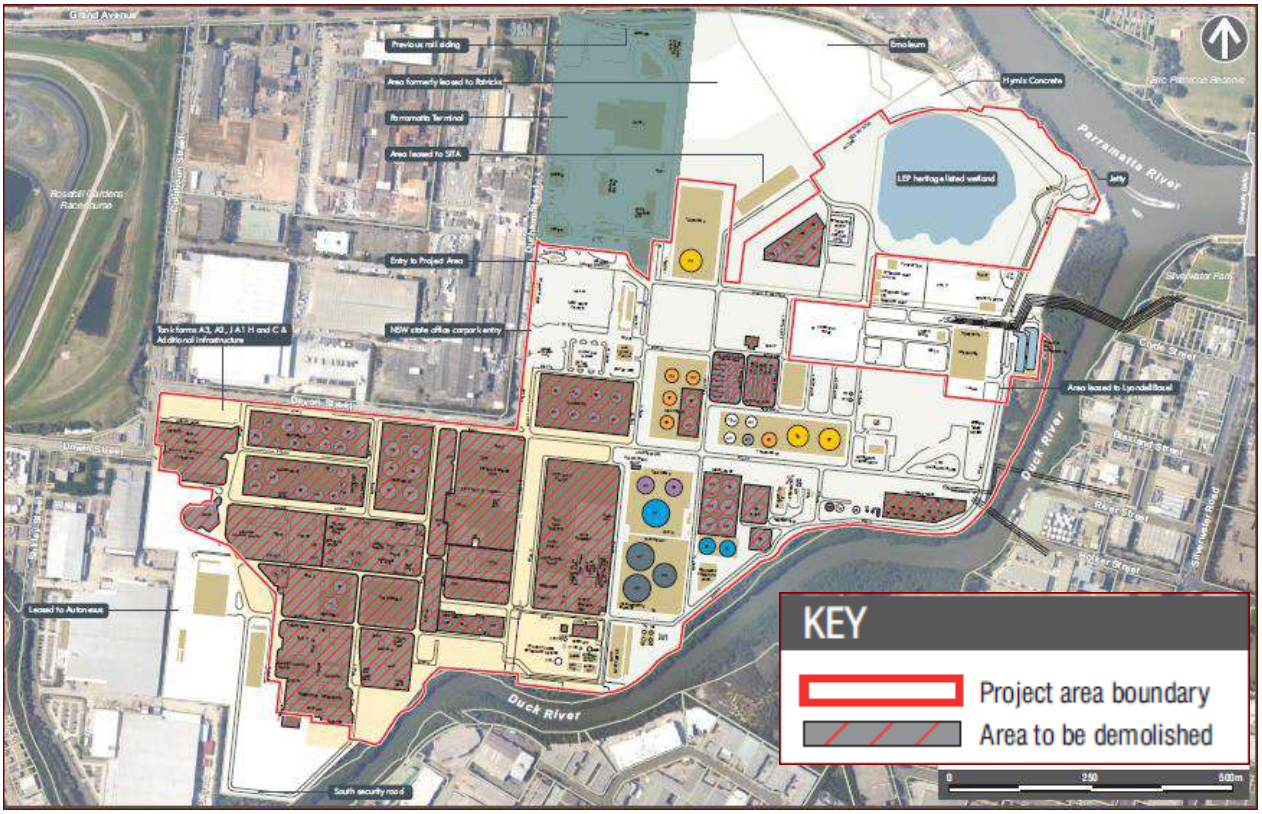
State Significant Development Approval No SSD 9302 was lodged in 2018 for the Western Area Remediation Project. This application has been determined and will result in the remediation and issuance of site audit certification of the site. The activities described in Section 1.2 will progressively occur on remediated areas once they are certified as appropriate for development.

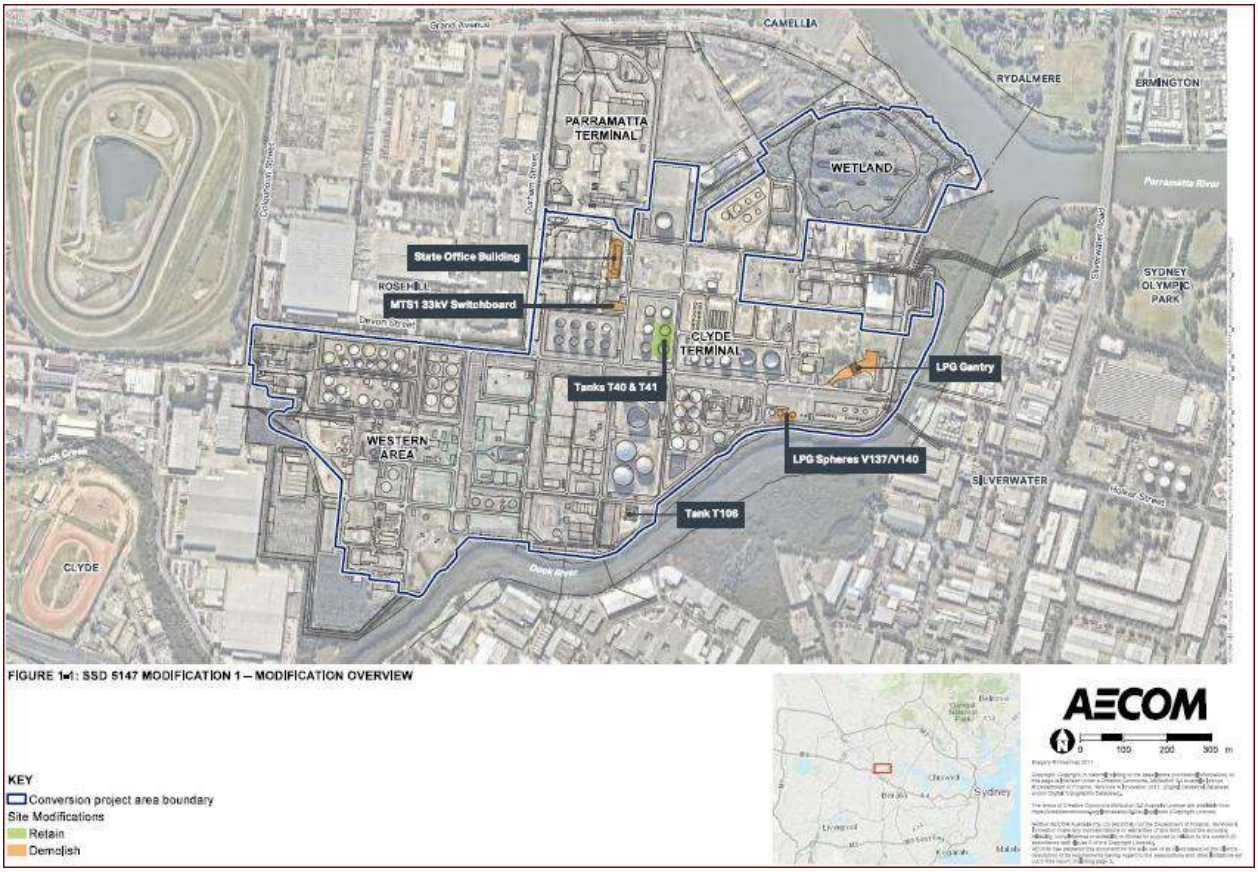
The plan below (Image 1 from the EIS to SSD 5147) shows the extent of the conversion works including demolition works and new facilities (this has been subject to one minor modification - refer Image 1). The other new works are pipes and electricity cables which will have no impact on flooding.

VE Property Pty Ltd (a related party to Viva Energy) now wishes to carry out an 8 lot subdivision of the Western Area (Figure 1 to Figure 4) for the Central Sydney Industrial Estate incorporating the Stage 1 Downer Sustainable Road Resource Centre on Lot 6. The objective of the present report is to confirm that the proposed development of the Western Area can occur without adverse flood impacts on surrounding properties and in compliance with Parramatta City Council's flood related development controls.

As the site is a high priority infrastructure project essential to the State for economic, social or environmental reasons it has been deemed a SSD project. As such the Secretary of the Department of Planning, Industry and Environment (DPIE) is required to consult with relevant government agencies to issue environmental assessment requirements (SEARs).

Image 1 - Plan of Proposed Works and Subsequent Modification from the EIS to SSD 5147





1.2. Proposed Activities

The application proposes:

- The staged subdivision of the western area of Lot 100 DP 1168951 into eight new industrial lots.
- Prepare the lots via earthworks and civil works for future re-development (by future applications).
- Stage 1 of Downer's Sustainable Road Resource Centre which would occupy the newly created Lot 6 and construct and operate the following on the lot:
    - Reclaimed asphalt pavement processing operations;
    - Asphalt plant;
    - Reconomy facility;
    - A modern bitumen product manufacturing plant.

These project components are described below.

1.2.1. Subdivision and Lot Preparation

VE Property Pty Ltd proposes the staged development of the Central Sydney Industrial Estate on the Western Area of the former Oil Refinery at Clyde. Stage 1 of the development will also comprise the Sustainable Road Resource Centre, to be operated by Downer, described in Section 1.2.2.

VE Property proposes the following on the site:

- The staged subdivision of the site into eight lots. Development of the lots for new industrial uses (in accordance with current zoning), which will be subject to future applications. For modelling of the PMF event typical buildings have been located on all lots.
- Earthworks/filling to bench the lots to form a flat pad in the northern half of the site then gradually grading down to towards Duck River in the southern half of the site.
- Construction of a new public access road running south from an intersection with Devon Street, providing access to those lots that do not front onto Devon Street, in accordance with Parramatta Council specifications.
- Implementation of erosion and sediment controls to manage water quantity and quality over the lots until they are sold and developed, when permanent water management infrastructure will be installed.
- The extension of key municipal services to suit the needs of each of the lots comprising:
    - Potable water – potentially construction of a ring main linking the main under Colquhoun Street to the main under Durham Street (subject to separate approval by Sydney Water);
    - Wastewater (sewer) – extension of the rising main along Devon Street and minor sideline extension of the gravity sewer along Colquhoun Street (subject to separate approval by Sydney Water);
    - Electricity – supply may be required to each lot from the high voltage line along Devon Street (subject to separate approval by Endeavour Energy).
- A 30 m riparian corridor along Duck River.
- Development of Lot 6 (Stage 1) for the land uses described in Section 1.2.2.

1.2.2. Stage 1 – Downer Sustainable Road Resources Centre

The conceptual Stage 1 layout is shown in Figure 3 and Figure 4. Stage 1 will be aligned north-south as per the Lot 6 orientation and will comprise the following.

Site preparation and construction; including:

- Site establishment;
- Earthworks/filling;
- Drainage and stormwater management structures will be constructed;
- Services – water, sewer, electrical, gas and telecommunications services will be installed;
- Footings and slabs;
- Pavement areas of Lot 6 requiring extra stabilisation and strengthening;
- Barriers – aluminium, concrete and/or water filled plastic barriers will be installed;
- Line marking and signage.

The Stage 1 components will be constructed simultaneously and some activities will overlap with the civil works. Construction of the Stage 1 components will typically comprise:

- construction of concrete foundations including piled foundations for certain plant;
- construction of frames for sheds;
- erection and installation of plant;
- installation of tanks and silos;
- wall and roof cladding;
- stormwater connection.

A fixed Ammann Universal HRT Stationary asphalt plant will be constructed on Lot 6, which will produce up to 550,000 tpa of asphalt. In addition, as Downer's lease at the Camellia site is coming to an end, it is proposing to relocate the reclaimed asphalt operations to Lot 6. Up to 250,000 tpa of reclaimed asphalt pavement will be cold planed from pavements with specialist equipment and transported in tip trucks (truck and trailers or semi-trailers) to the site. It will then be stored on gravel hard stand areas.

A next generation, co-located bitumen emulsion plant is proposed on Lot 6 to produce approximately 15,000 tpa of bitumen products for use in onsite asphalt production and exporting offsite. This investment would mark a first for Downer to have not only a combined blending facility but also situating the investment on the same site as its asphalt and Reconomy plant.

Downer proposes to replicate the Reconomy facility from the Unwin Street site at Lot 6. The facility will process up to 40,000 tpa of road sweepings, gully waste and mud from non-destructive excavation.

1.2.3. Downer Asphalt, Reclaimed Asphalt Pavement and Reconomy Operations

Reclaimed asphalt pavement is asphalt which is removed from road and other surfaces during maintenance and reconstruction of those surfaces and requires crushing and/or screening to size to allow recycling into new asphalt.

Downer EDI Works Pty Ltd (Downer) operates a facility in Camellia that receives reclaimed asphalt pavement from road construction and maintenance projects and processes these materials by crushing and screening to produce up to 235,000 tonnes per annum (tpa) of recycled road products. A large portion of this processed material is transported to Downer's Unwin Street site (the Rosehill site) for use in manufacturing asphalt.

Downer's lease at the Camellia site is coming to an end and Downer is seeking to more closely integrate reclaimed asphalt pavement processing and asphalt production on a single site along with its other sustainable road product ventures.

The Rosehill site is subject to compulsory acquisition by the NSW Government for use by the Sydney Metro West project. Loss of continuity of operations at the Rosehill site would have adverse consequences for the Government due to the significant compensation which would arise and delays in government road programs due to the loss of more than 25% of the road product manufacturing capacity in Sydney. Transport for New South Wales is working closely with Downer to avoid such disruption but seeks possession of the site in early 2022.

1.3. Scope of Current Flood Assessment Report

The scope of work for this Flood Assessment broadly relies upon addressing the following:

- Issues highlighted in a pre-lodgement meeting (PL/64/2018) on Wednesday 30 May 2018 (not attended by WMAwater);
- Points raised in Council's letter of 25 October 2018 addressed to Project Surveyors ABN: 20268433974 regarding:

  Application No.: **DA/665/2018**
  Property: **Lot 398 DP41324 Lot 2 DP 224288 Lot 1 DP 383675 Lot 101 DP 809340 Lot 1 DP 109739 & Misc MSB Leases, 9 Devon Street, ROSEHILL NSW 2142**
  Proposal: **Torrens title subdivision into 2 lots.**

  These are listed below with comments in red provided as part of the present assessment.

  1. The Flood Assessment Report must be updated from the 2016 WMA report to represent the situation post-subdivision, including a review of the respective flood affectations for each of the two new lots and applicable development constraints and flood risk management practices for each lot. It must update the application of conditions C37 – C 42 from the DPE approval (refer Section 1.4) and relevant Council DCP 2011 controls (these can only fully be addressed once the nature of the proposed activities on the site have been determined).

2. The proposal requires an updated environmental management plan and system and EIS that responds to the separation of the site into two lots and the ongoing development and management of those two lots (the proposal is now for 8 lots and this is outside the scope of the present flooding investigation but we understand that other issues such as remediation, ecology, traffic, stormwater, erosion and sediment control, servicing etc. are being dealt with separately).
3. It is recommended that the applicant make a formal Flood Enquiry Application to Council to confirm the fluvial flood levels and hazard conditions on the lot (undertaken refer Appendix D).
4. The proposed development site is identified as being affected by overland flow. To ensure that overland flow can be managed appropriately on the site up to 1:100 ARI event, an overland flow impact report that addresses the criteria contained within *Council's Local Floodplain Risk Management Policy 2006 is required to be prepared* (undertaken as part of the present study). Additional information can be obtained by *contacting Council's Catchment Management Engineers unit*.
5. The proposal must be supported by a comprehensive flood management report and flood emergency risk plan addressing how both fluvial and overland flow flooding will be managed, how land use across the site will be consistent with Council's DCP 2011, Council's Floodplain Risk Management Plan, Council's Floodplain Risk Management Policy and the NSW Floodplain Development Manual (a comprehensive flood assessment report has been provided but flood management and flood risk associated with the new development on the proposed Western Area lots will be provided in subsequent applications for the development of each of the 8 lots).
6. The proposal must address the condition and functioning of the existing gas and stormwater pipelines and their current capacity within the subdivided lots. Normally Council would require such infrastructure to be brought up to full operating function by the developer as part of the subdivision development (All existing oil lines and infrastructure (including existing stormwater infrastructure) will be removed as part of the conversion and remediation works on the Western Area. An existing Council stormwater line on the western side of the property will be retained as will the Sydney Water main that crosses the site. Existing stormwater pipelines within the proposed Eastern Area lot will remain as is and have not been investigated as part of the present study. At this stage no stormwater pipelines are assumed for the proposed Western Area as the assessment has assumed these would be 100% blocked (refer below).
7. If remediation requires the removal of either the gas or stormwater pipes temporarily, full plans of what is intended must accompany the proposal. The proposal must also be supported by an overland flow study for the stormwater pipes in the event that they are 100% blocked (the extent of the pre 2019 stormwater network on the proposed Western Area is unknown and if present has or will be removed as part of the remediation works. The only exception is the network shown on Figure B1 which is largely outside the Western Area. All design overland flow analysis assumes no pit and pipe network is present (i.e all the to be designed and constructed pit and pipe network is assumed to be blocked).

- Responses to SEARS issues (pertaining to flooding) provided by Parramatta City Council, DPIE, EPA, Sydney Water. These are discussed in detail in Section 4.

1.4. Department of Planning and Environment Conditions of Consent Relating to Flooding

Approval for the conversion works was provided on 14th January 2015 and Conditions C37 to C42 of the approval (refer below) relate to flooding. All issues relating to flooding were addressed in Reference 1.

FLOODING

Flood Design and Structural Certification

C37. The Applicant shall ensure that all new buildings and structures, and additions to existing buildings and structures are constructed in accordance with the relevant requirements of the City of Parramatta's *Local Floodplain Risk Management Policy, June 2006*.

C38. New electrical substations shall be constructed above the 1% Annual Exceedance Probability (AEP) flood level with an appropriate freeboard determined in consultation with Council and to the satisfaction of the Secretary.

Flood Study

C39. Within 2 months of the date of this consent, the Applicant shall provide detailed site data, to the satisfaction of Council, to update the *Duck River and Duck Creek Flood Study Review, 2013*. The Applicant shall:

(a) provide details of all floodplain obstructions on the site, including bund locations and heights;
(b) fund the work required to update Council's flood model with the site specific data; and
(c) provide details of all construction and demolition works that would be carried out within areas defined as 'high hydraulic hazard'.

C40. Within 1 month of completing the updates to the flood study, the Applicant shall review the outcomes of the updated study and detail any additional flood management measures to be implemented during construction, demolition and operation. The outcomes of the study shall also inform any revisions to the Flood Emergency Response Plan as required by Condition C42.

Flood Warning Signs

C41. The Applicant shall ensure that flood warning signs are maintained throughout the site, during construction, demolition and operation. The flood warning signs shall indicate the site is prone to flooding and shall show the location of assembly and evacuation points, which are above the 1% AEP.

Flood Emergency Response Plan

C42. The Applicant shall update and implement the Emergency Response Plan for the site to include procedures for flood emergency response during construction, demolition and operation. The Plan must:

(a) be prepared by a suitably qualified and experienced expert;
(b) be prepared in consultation with Council;
(c) be submitted to the Secretary for approval at least 1 month prior to the commencement of construction or demolition, or as otherwise agreed with the Secretary;
(d) detail the procedures for managing flood risks during construction, demolition and operation, including flood recovery measures, sufficient warning time for flash flooding and procedures for ensuring the protection of infrastructure and human safety; and
(e) identify assembly points, emergency evacuation routes, flood warning alarms and evacuation procedures.

1.5. Study Area

The subject site is located to the immediate north west of Duck River and immediately prior to the confluence of Duck River with the Parramatta River (Image 2). Prior to development the land would probably have been low lying mangrove inhabited wetlands. Subsequent filling and construction of the storage facilities, pipes and other works and related refinery plant means that ground levels varied from approximately 2m AHD to 5m AHD. The ground had nearly 100% impervious ground coverage thus minimal infiltration occurred and there would be near 100% runoff during rain events. However, there were several low-lying areas as well as "bunded" areas which may have temporarily stored rainwater runoff.

Since approval of the works to improve terminal efficiency and to consolidate the operational footprint a considerable amount of clearing of the site has occurred and this is shown in the comparison of aerial photographs in Image 2. These clearing and rehabilitation works are on-going in 2020.

The bunded areas shown in Image 2 are required to retain the contents of the storage tanks in the event of tank failure. It is presumed that the bunds have been designed to also not structurally fail prior to an overtopping flood event. Apart from the bunded areas there are several small buildings, raised areas and extensive pipe networks.

Parts of the study area will have been inundated in the past by floodwaters from overland flow and from flooding of Duck River, however there are no comprehensive records of the extent of inundation or damages that occurred.

Image 2 - Aerial Photograph of Site (courtesy of Google Maps)

2. DESIGN FLOOD ANALYSIS

2.1. Approach

A key objective of this present study is to define the existing flood behaviour within the study area in terms of flood levels, flows and velocities and the change in flood behaviour following the approved demolition and subsequent construction works outlined in this report. Existing flood conditions were taken as approximately 2015 in the Western Area refinery.

This flooding assessment has required investigation of the potential affectation on flooding in Duck River (termed mainstream flooding) and from upstream runoff entering the site along Unwin Street, Devon Street and Durham Street (termed overland flow). The WMAwater February 2016 (Reference 1) report commissioned by Viva Energy only considered flooding from Duck River and did not consider overland flow.

Thus, a separate TUFLOW model has been setup for mainstream and overland flow flood modelling. Whilst these could have been combined it was simpler to keep them separate due to the different techniques adopted in each model.

2.2. Available Data

2.2.1. Included as part of the September 2016 Assessment by WMAwater (Reference 1)

All the data that was used in the Parramatta City Council's Duck River and Duck Creek Flood Study (Reference 2) undertaken by WMAwater was available for use in this present study. A summary of that data is provided below with a more detailed description provided in the Flood Study:

- design rainfalls obtained from the Bureau of Meteorology (BoM);
- design Parramatta River levels adopted for this study as per Reference 2;
- ground surface elevations defined by Airborne Laser Scanning (ALS) provided by Parramatta City Council which was used to construct a Digital Terrain Model (DTM);
- spatial datasets provided by Council include, a property cadastre layer, geo-referenced aerial photography and various GIS layers relating to the study area.

In addition, Viva Energy provided detailed survey (October 2015) of the storage tank bunds. In summary there are 10 bunds of varying sizes with the largest over 2 hectares. The crests of the bunds vary from 3.5 to 6.4 mAHD and thus will be inundated by floodwaters at different times during an event or not at all if the flood waters do not reach the crest level.

2.2.2. Included as part of the Current Assessment

The main additional data as part of the current assessment was to include the pit and pipe drainage network in the upstream catchment and detailed survey along the road system, this included:

- available survey of Council's upstream pit and pipe system;
- updated aerial laser survey (ALS) obtain from ELVIS (acronym for Elevation Information System provided by the Federal Government);
- detailed survey along Unwin Street, Devon Street and Durham Street provided by Land Partners in August 2019;
- a plan based on an aerial photographic drone survey of the storage tanks that existed prior to demolition was provided by VE Property;
- design rainfall data obtained from the Datahub in accordance with Australian Rainfall and Runoff 2019 (Reference 3).

2.2.3. Limitations of the Hydraulic Modelling

A key limitation of the hydraulic modelling in this study is the lack of detail on the structures which existed on the site prior to demolition. The aerial photographic survey of the storage tanks that VE Property provided in July 2020 picks up the large structures but not the small pipe systems which covered large parts of the site. These small pipe systems would have little impact on mainstream flooding but could impact on overland flooding across the site.

It is acknowledged therefore that the overland flow paths, flood depths and flood extents for pre demolition (termed existing) conditions across the Western and Eastern Areas cannot be established with a high degree of accuracy.

For PMF mainstream and overland flooding assessment of pre demolition (termed existing) conditions the aerial photographic survey of the storage tanks has been adopted as it was assumed that any bunds would be overtopped. This approach was adopted to take into account the temporary floodplain storage occupied by storage tanks and buildings pre demolition.

2.3. Hydrologic / Hydraulic Modelling

2.3.1. Overview

The integrated one-dimensional/two-dimensional (1D/2D) TUFLOW hydrodynamic modelling package set up for Parramatta City Council's Duck River and Duck Creek Flood Study (Reference 2) and a newly created Overland Flow model were used to determine existing design flood conditions and evaluate flood impacts of the proposed development.

Subsequently these two models were used to undertake a flood impact assessment to ensure that the following design works:

- subdivision of the study area into a Western and Eastern Area;
- earthworks and building works shown on Figure 3 and Figure 4;

would not increase flood levels outside the Western Area. The existing and design topographies and hypothetical building footprints are shown on Figure 2, Figure 3 and Figure 4. It should be noted that the buildings shown on all lots, except for Downer's works on Lot 6, are indicative and will change when development applications are submitted for these Lots.

2.3.2. Australian Rainfall and Runoff

Australian Rainfall and Runoff (AR&R) is a national guideline document, data and software suite that can be used for the estimation of design flood characteristics in Australia. There have been four editions (1958, 1987, 2016 and 2019). The 2016 edition provides significant changes to the 1987 edition in terms of design rainfall intensities, patterns, loss rates and methodology for design flood estimation. The 2019 edition provides only minor updates to the 2016 edition.

A comparison between the 1987 and 2019 edition rainfall Intensity Frequency Duration data (IFD) for the study area is provided on Image 3.

Image 3 - Reduction in 2019 AR&R Edition IFD Data compared to 1987 AR&R Edition

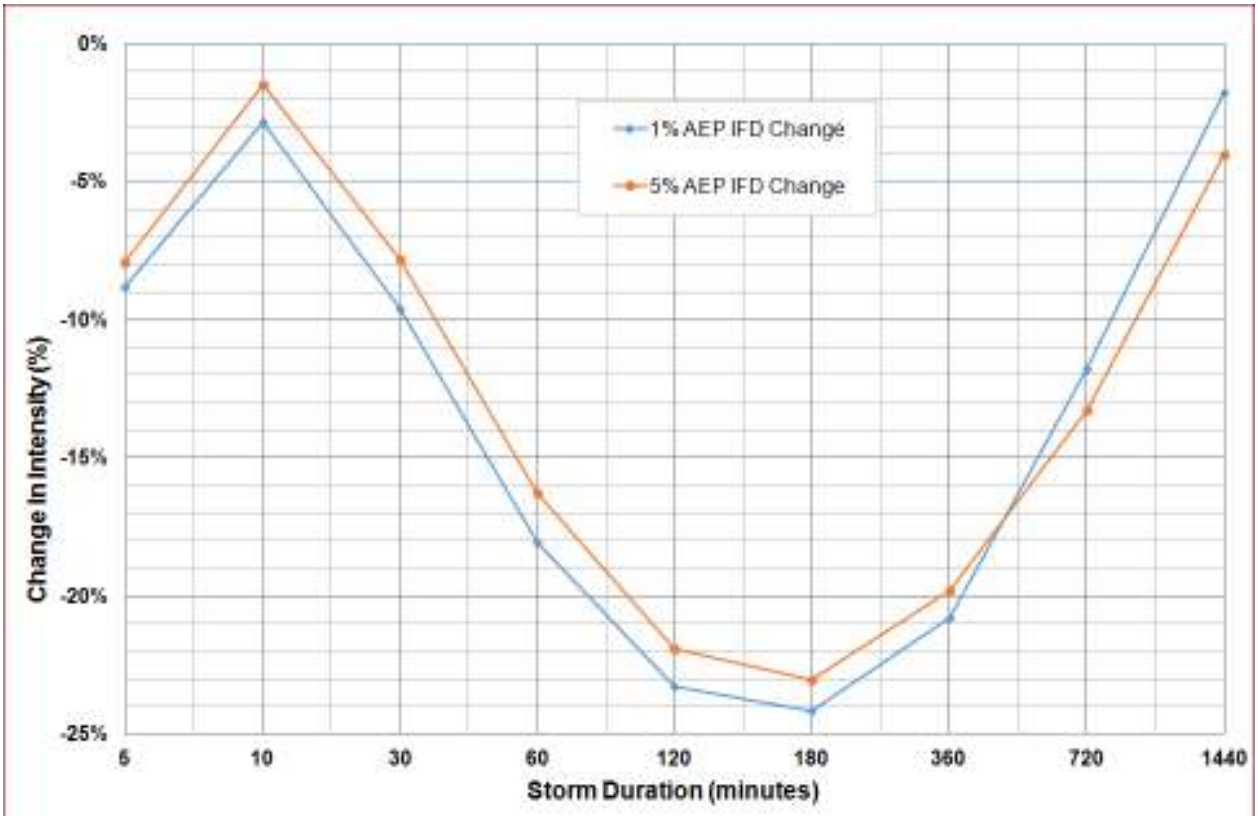


Image 3 indicates that the 2019 edition of AR&R has reduced rainfall intensities compared to the 1987 edition of AR&R over the 5 to 1440 minute (24 hours) period with the greatest reduction occurring (up to 25%) in the 2 to 3 hour period. This reduction in intensities has occurred as a result of significantly more sub daily rainfall records from pluviometers being available for assessment (there is approximately 30 years of additional data from the time of the analysis for the 1987 edition to the time of analysis for the 2016) by the BoM in the 2016 / 2019 editions. Thus, a more accurate assessment of sub daily rainfalls has been determined. It is expected therefore that design flood levels would be lower with the adoption of AR&R 2019 IFD data as opposed to using the AR&R 1987 IFD data.

This present study has used the AR&R 1987 IFD data and design flood estimation methodology for the following reasons:

- based on the outcomes of Image 3 the design flood levels would likely be lower with the

adoption of AR&R 2019 IFD data and thus adopting the AR&R 1987 approach is slightly conservative;

- the 2012 Duck River and Duck Creek Flood Study (Reference 2) was based on the AR&R 1987 approach and this is still the Parramatta City Council "adopted" design flood level report for Duck River. There is considerable difficulty in updating the Duck River inflows as the 2012 study included inflows from Bankstown LGA which were obtained from a different flood study and this modelling would therefore have to be updated;
- Parramatta City Council is currently undertaking a Flood Study of the Parramatta River, Duck River and tributary catchments using the AR&R 2019 methodology. Results from this Council study will change flood levels in all rivers and creeks within the study area. If this study is completed prior to construction it may be possible to update the proposed design to incorporate the outcomes from the Parramatta City Council Flood Study;
- consideration was given at the start of this project in early 2019 to use the AR&R 2019 methodology. However, it was decided to use the AR&R 1987 approach as at that time the flood impact assessment was only to consider the subdivision into two lots. It was presumed that Council's updated Flood Study of the Parramatta River using the AR&R 2019 methodology would then be available for setting flood planning levels;
- for a flood impact assessment it is not critical that an "exact 1% AEP (or other event)" is adopted as the impacts are relative to the existing condition and thus would be similar if a slightly smaller or larger event to the "exact" event was adopted.

2.3.3. Duck River Mainstream Flooding – Modelling of Existing Conditions

WMAwater Pty Ltd undertook the Duck River and Duck Creek Flood Study (Reference 2) in 2012 for Parramatta City Council and the study area included the subject site. This study established a computer model (termed TUFLOW) that was used to establish design flood levels, flood hazard and flood extents. This model has been used in the present study for analysis of flood impacts for a range of design flood events. The 2012 Duck River Catchment Floodplain Risk Management Study and Plan (Reference 4 and 5) made no mention of specific management measures for the subject site but provided general floodplain management measures which are applicable in the floodplain.

The TUFLOW hydraulic model established in the Duck River and Duck Creek Flood Study (Reference 2) covers the whole of the creek system within the Auburn and Parramatta local government areas. It incorporated both major subsurface drainage features (but not the pit and pipe system upstream of the study area) and overland flow paths (streets, rivers, swales etc.) within the model extent. The two components are dynamically linked such that the model accounted for the interactions between the drainage system and overland flow behaviour.

A detailed description of model inputs, model parameters, boundary conditions and adopted tail water levels are provided in Reference 2. The critical storm duration adopted in Reference 2 was the 2 hour event.

The study undertook a comprehensive investigation into flooding and produced design flood extent and hazard maps. In Reference 2 the bunds around the fuel tanks (refer Image 4) were

not included (predominantly these were in the Eastern Area) and it was assumed that only the tanks themselves were not inundated (see example as Image 5 showing only the tanks included as "dry"). Subsequently as part of the WMAwater February 2016 (Reference 1) report the bunds were accurately located and accounted for in the modelling (thus many are shown as not inundated) and an example is shown as Image 6. Also, as part of that study some minor adjustments to the existing footprints of the plant were undertaken.

It should be noted that the topographic detail of the Western and Eastern Areas can only be approximated in the TUFLOW model. For example, there are (or were) extensive pipe and tank structures which are not totally impermeable, thus the model must allow floodwaters to pass through. This is achieved by approximating the permeability using the tools that are available in the model. In summary, TUFLOW is designed for broad floodplain use with large obstructions (houses or the bunds and individual tanks) and cannot accurately define fine detail complex structures that are or were present on the site (also refer Section 2.2.3).

Image 4 - Example of Bund around Fuel Tanks

Image 5 - Example of Original Flood Modelling which did not include the Bunds

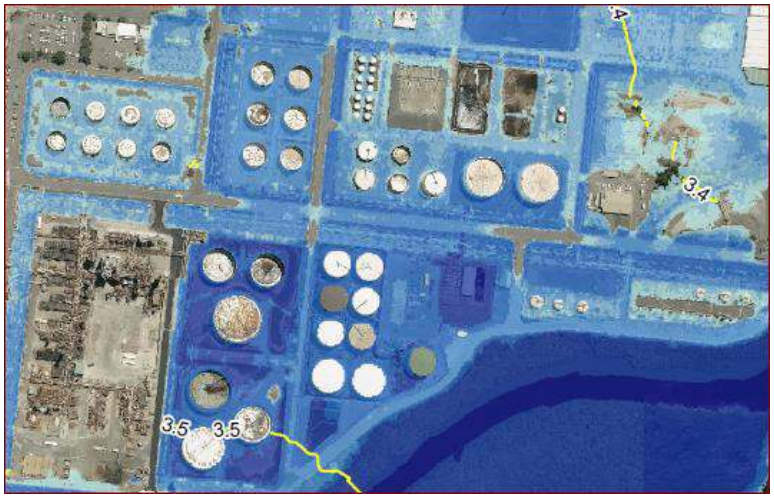
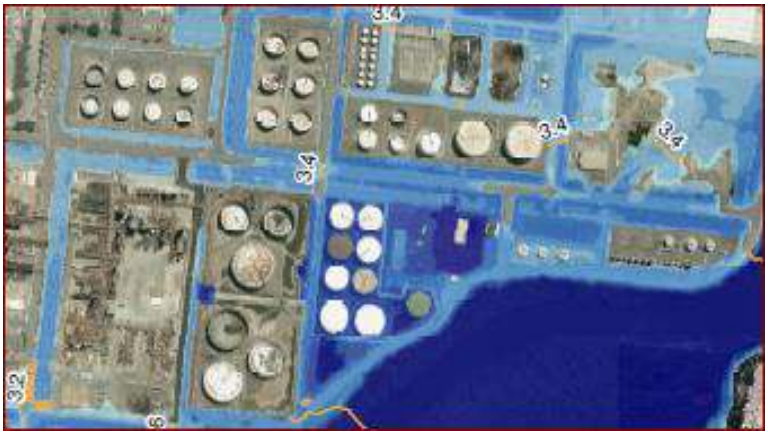


Image 6 - Example of Updated Flood Modelling in Reference 1 which now includes the Bunds



Existing condition (assumed as approximately 2015) design flood depths, levels, extents, velocity, hydraulic hazard and hydraulic categorisation are provided for the 1%, 0.5%, 0.2% AEP events and the PMF on Figure C1 to Figure C12.

Smaller events than the 1% AEP were modelled but as the site is largely flood free in these events (flooding only occurs in the riparian zone) these have not been included in this report.

2.3.4. Overland Flow Model – Modelling of Existing Conditions

A requirement of the present assessment is to undertake an Overland Flow Flood Study (Section 1.3 Point 4). This has been provided in the present study and the key features of the approach are summarised below:

- A TUFLOW "Direct Rainfall" or "Rainfall on the Grid" one / two dimensional hydraulic model was established based on the aerial laser survey and field survey as described in Section 2.2.2. The "Direct Rainfall" approach rather than the more traditional approach of determining inflows from a runoff routing was adopted due to:
    - the upstream catchment being very small (20 ha) thus the peak flows and depths are small;
    - the relatively flat terrain in the catchment which means it is not possible to determine where flows from upstream would concentrate;
    - the limited pit and pipe system in the upstream roads into which upstream runoff could be applied using a separate runoff routing model;
    - because the design needs to assume 100% blockage of any pipe system and this can more effectively be modelled using the "Direct Rainfall" approach;
- the existing condition model assumes all pits and pipes as shown on Figure B1. However, for design it is assumed that there are no pits and pipes within the Western Area but existing pipes upstream. This is to meet the Section 1.3 Point 7 requirements;
- it should be noted that due to the ongoing demolition and contamination remediation works it is impossible to accurately determine the overland flow paths for pre demolition conditions. However, for design we have assumed that all the runoff that would have entered the site from the upstream catchment continues to enter the site and is discharged to Duck River without entering the surrounding properties;
- the analysis assumes a 20% AEP peak water level in Duck River in conjunction with the

design rainfall event across the upstream overland flow catchment;

- AR&R1987 design rainfalls and temporal patterns have been adopted for consistency with the mainstream flooding results;
- all overland flow mapping results exclude areas of flow depth less than 50mm. This is undertaken as with the Direct Rainfall approach the entire study area is inundated.

The study area is shown on Figure B1 which indicates the very limited upstream pit and pipe network. There is only one pipe which enters the Western Area at the intersection of Unwin and Colquhoun Streets. Figure B2 indicates the TUFLOW hydraulic model layout for existing conditions with the Manning's "n" roughness values shown on Figure B3.

Initially the critical storm duration (the duration producing the greatest peak level) was determined by running durations from 25 to 360 minutes for the 1% AEP event. The results are shown on Figure B4 indicating that the majority of the site has either the 60, 120 or 360 minute duration as critical. However, the difference in peak level for these three events is small and is generally less than 0.1m except in low lying areas as shown on Figure B5. On this basis the 120 minute event was adopted as the critical storm duration.

A comparison between the blocked and unblocked stormwater network within the Western Area is shown on Figure B6 and indicates that peak levels are increased by up to 0.1m within the Western Area and on land adjacent to Shirley Street. Figure B7, Figure B8, Figure B9 and Figure B10 show the 1% AEP design flood depths, levels, extents, velocity, hydraulic hazard and hydraulic categorisation across the Western Area for existing conditions with all the existing stormwater drainage system unblocked.

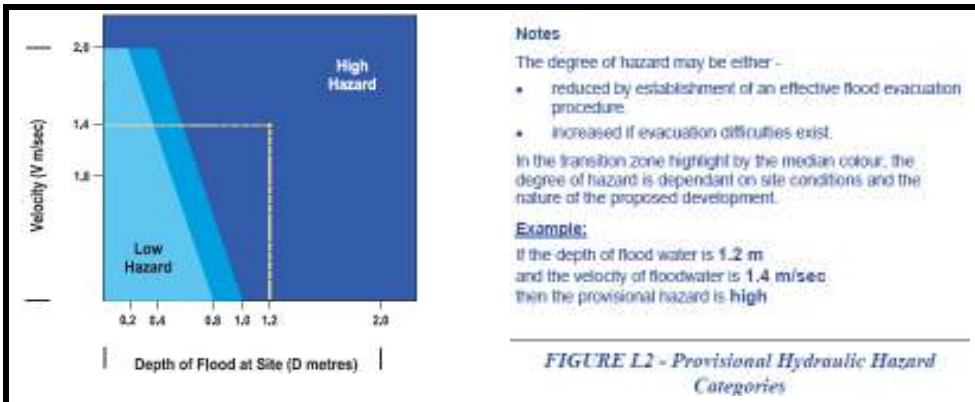
Figure B11, Figure B12 and Figure B13 indicate the increases in the 1% AEP flood depth if the design rainfalls increase (as a result of climate change) by 10%, 20% and 30% respectively. The increase in peak level is variable across the Western Area depending on whether the land is graded or is in a depression with limited exit points.

2.4. Flood Hazard and Hydraulic Categorisation

2.4.1. Hydraulic Hazard Categorisation

The Flood Study defined provisional flood hazard categories in accordance with the NSW Floodplain Development Manual (Reference 6). Provisional hazards only take account of the hydraulic aspects of flood hazard; depth and velocity (Image 7), while true hazard takes into account additional factors such as size of flood, effective warning time, flood readiness, rate of rise of floodwaters, duration of flooding, evacuation problems, effective flood access, type of development within the floodplain, complexity of the stream network and the inter-relationship between flows.

Image 7 - Provisional Hydraulic Hazard Categories (Reference 6)



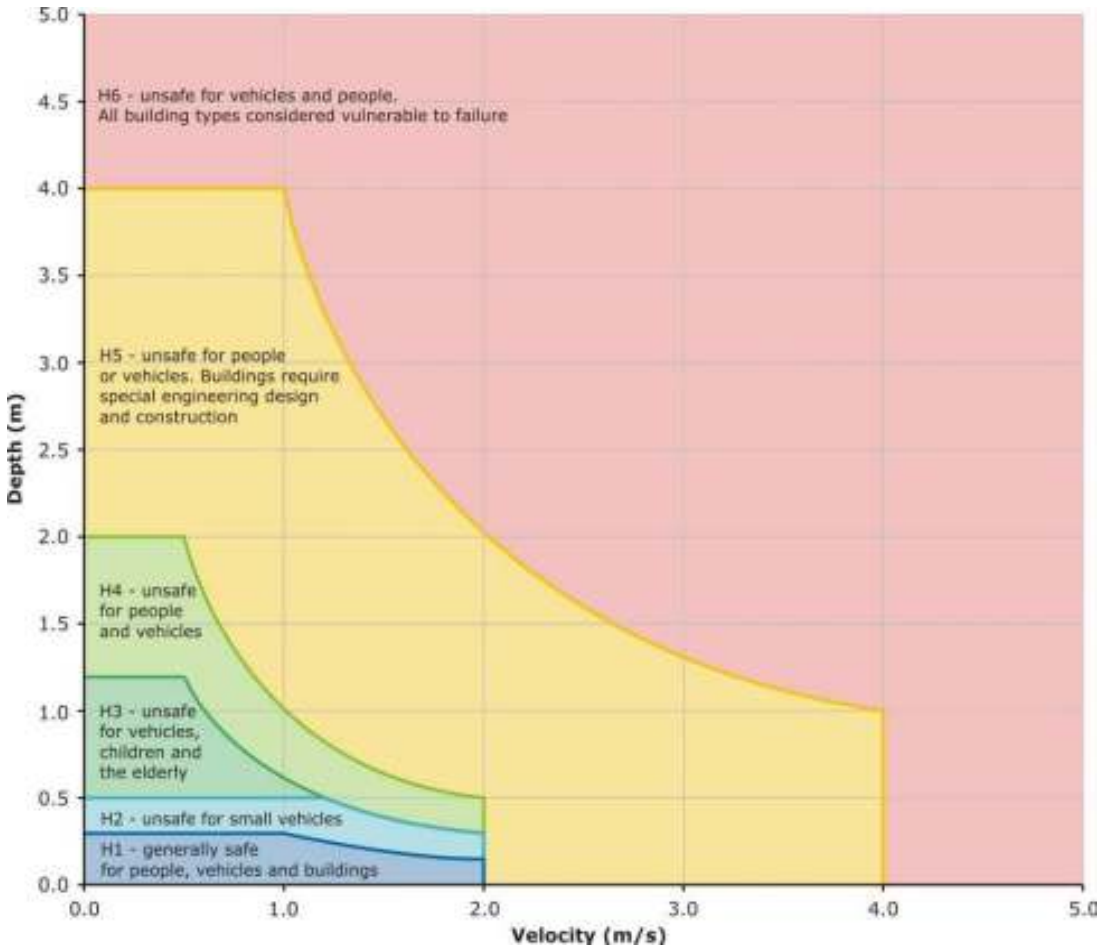
Extracted from The Floodplain Development Manual (Reference 6)

In recent years there has been a number of developments in the classification of hazard. Managing the floodplain: a guide to best practice in flood risk management in Australia (Reference 7) provides revised hazard classifications. These add clarity to the description of hazard categories and what they mean in practice. This new methodology for determining hazard has been used in this study.

The hazard classifications are divided into six categories (Image 8) which indicate the restrictions on people, buildings and vehicles:

- H1 - Generally safe for vehicles, people and buildings;
- H2 - Unsafe for small vehicles;
- H3 - Unsafe for vehicles, children and the elderly;
- H4 - Unsafe for people and vehicles;
- H5 - Unsafe for people or vehicles. Buildings require special engineering design and construction; and
- H6 - Unsafe for vehicles and people. All buildings types considered vulnerable to failure.

Image 8 - Hazard Classifications (Reference 7)



2.4.2. Hydraulic Categorisation

The NSW Government's Floodplain Development Manual 2005 (Reference 6) defines three hydraulic categories which could be applied to the study area, namely floodway, flood storage or flood fringe.

Floodways

*"those areas of the floodplain w*here a significant discharge of water occurs during floods. They are often aligned with naturally defined channels. Floodways are areas that, even if only partially blocked, would cause a significant redistribution of flood flow, or a significant increase in flood *levels."*

Flood storage areas

"those parts of the floodplain that are important for the temporary storage of floodwaters during the passage of a flood. The extent and behaviour of flood storage areas may change with flood severity, and loss of flood storage can increase the severity of flood impacts by reducing natural flood attenuation. Hence, it is necessary to investigate a range of flood sizes before defining flood storage areas."

Flood fringe

"the remaining area of flood prone land after floodway and flood storage areas have been defined"

There is no precise definition of floodway, flood storage and flood fringe or accepted approach to differentiate between these areas. In this study hydraulic categorisation was defined according to the following approach, namely:

Floodway = Velocity * Depth > 0.25m^2/s AND Velocity > 0.25m/s OR Velocity > 1m/s

The remainder of the floodplain outside the Floodway becomes either Flood Storage or Flood Fringe. Flood Storage was defined as the land outside the Floodway if the depth is greater than 0.5m and Flood Fringe if the depth is less than 0.5m. As noted in Reference 8 *"it is impossible to* provide explicitly quantitative criteria for defining floodways and flood storage areas, as the significance of such areas is site specif*ic"*.

3. DESIGN CONDITIONS

3.1. Overview

The key aims of the design from a flooding perspective were as follows:

- optimise use of the land for future development;
- ensure that all new buildings will have building floors at or above the 1% AEP + 0.5m overland or mainstream flood level;
- ensure that the existing overland flow runoff for all design events up to the PMF that enters the site does not exit the site onto adjoining lands;
- ensure that there will be no increase in design flood levels for Duck River mainstream flooding by greater than 0.01m in adjoining lands in events up to the 0.2% AEP event;
- ensure that there will be minimal increase in design flood levels in adjoining lands for all events up to the PMF;
- undertake no works within the vegetated area or riparian corridor as shown on Figure 1;
- any works within the existing Duck River 1% AEP flood extent and the limit of the riparian corridor, as shown on Figure 1, will not include importation of fill and if undertaken (to replace contaminated or other unsuitable material) will ensure no change in the Duck River 1% AEP temporary floodplain storage capacity;
- in the PMF flood event the temporary floodplain storage capacity within the site has been reduced due to the importation of fill for the creation of building pads, the storage volume contained within each of the proposed buildings on Lot 6 and the hypothetical future industrial building footprints that are likely to be constructed on the remainder of the industrial lots (subject to future development applications and approvals). For modelling it is typically assumed that each proposed and potential future building is a solid structure. This is a conservative assumption as in reality this is unlikely to be correct as floodwaters will enter the building through openings.

Design conditions were developed by Costin Roe Consulting and are provided on Figure 3 and Figure 4. These assume importation of approximately 30,000m^3 of fill to the Western Area. This fill is required for building pads and site presentation. All the imported fill is located on land that is above the 0.2% AEP flood level.

Cut and fill works are proposed between the boundary of the riparian corridor and the 1% AEP flood extent in Duck River to optimise use of the land. This has been achieved with no nett change in temporary floodplain storage at the 1% AEP Duck River flood extent. No importation of fill will therefore be undertaken within this area unless required to replace unsuitable excavated material which will be removed from the site.

These design conditions were then incorporated into the Overland Flow and Duck River TUFLOW model and the design events re-run. The results are described in the following sections.

3.2. Impacts on Flooding Extents and Depths

3.2.1. Overland Flooding

The potential impacts of the existing versus the design topography are shown on Figure B14 to Figure B17. The changes in peak flood levels are represented by different colours. These figures indicate that there is no increase in flood level (greater than 10mm) outside the subject property in events up to the 0.2% AEP event. In the PMF event (Figure B17) there is an increase at the corner of Devon Street / Durham Street and within the Eastern Area of up to 0.05m.

3.2.2. Mainstream Flooding

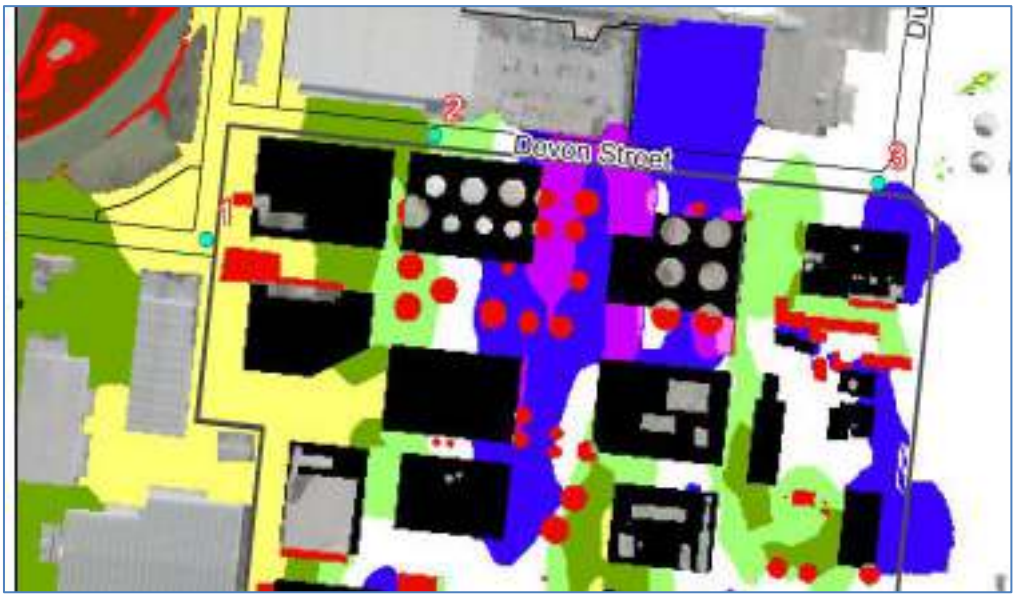
The potential impacts of the existing versus the design topography are shown on Figure C13 to Figure C16. The changes in peak flood levels are represented by different colours. These figures indicate that there is no increase in flood level (greater than 10mm) outside the subject property in events up to the 0.2% AEP event. In the PMF event (Figure C16) there is an increase at the corner of Devon, Colquhoun and Unwin Streets of up to 0.2m.

3.3. Impacts on Flood Evacuation Routes

A key issue in all floodplains is the evacuation of people from the affected area. However, it should be noted that evacuation should be undertaken prior to inundation of the road network as the SES advises that driving or walking through floodwaters of any depth of floodwaters is not to be undertaken.

Evacuation routes are Durham, Devon, Colquhoun and Unwin Streets. In events up to the 0.2% AEP there is no increase in flood levels (greater than 10mm) on these streets. However, in the PMF (Figure C16) there are increases along Devon, Colquhoun and Unwin Streets of up to 0.2m. Stage (water level) and velocity hydrographs at three locations as shown in Image 9 are provided on Figure B18 for overland flooding and on Figure C17 for mainstream flooding.

Image 9 - Location of Hydrographs (taken from Figure C16)



3.4. Conclusions

The proposed 8 lot subdivision earthworks as shown on Figure 3 and layout on Figure 4 will produce no increase in flood level (greater than 10mm) outside the subject property up to the 0.2% AEP event for both overland and mainstream flooding. There is up to 0.05m increase in the overland flow PMF event and 0.2m increase in the mainstream PMF event.

The effect on flood evacuation routes is nil in events up to the 0.2% AEP event. In a PMF there will be some slight increase in peak depth and duration of flooding. Evacuation by road during the peak of a PMF event will likely be impossible as floodwaters from the Parramatta River and Duck River will enter the site and much of the Rosehill/Camellia industrial precinct. A PMF event has a probability of occurrence in any year of say 1 in 100,000. Dams and similar essential structures such as power stations are designed to withstand a PMF but not residential or commercial and industrial buildings. It is therefore important that evacuation should be undertaken prior to inundation of the road network as the SES advises that driving or walking through floodwaters of any depth of floodwaters is not to be undertaken.

4. COMPLIANCE WITH SEARS ISSUES

The SEARS issues pertaining to flooding were provided by Parramatta City Council, DPIE, EPA, Sydney Water as indicated in Section 1.1 and are shown in red below and responses provided.

4.1. Parramatta City Council

> 3. No significant adverse impacts on adjoining land, the locality and the environment (including Duck Creek and the riparian zone) caused by the development in all floods up to the Probable Maximum Flood from both riparian flooding and overland flow and including an allowance for climate change.

Both overland and mainstream flood modelling have been undertaken with results shown in Appendix B and Appendix C respectively. A sea level rise due to climate change has not been investigated as the site is too far upstream and on relatively high ground (ground levels of 4m AHD) to be affected by say a 0.9m sea level rise.

Climate change due to rainfall increase has also been investigated. For overland flooding this has been undertaken by considering a 10%, 20% and 30% rainfall increase. For mainstream flooding flood levels for the 0.5% and 0.2% AEP events have been adopted as a proxy. However, the proposed development has not been specifically designed to include a climate change rainfall increase as it is assumed that any increase in peak level would be within the freeboard allowance.

The results (Figure B14 to Figure B17 for overland flooding and Figure C13 to Figure C16 for mainstream flooding) indicate no increases in design flood levels greater than 10mm outside the subject site in events up to the 0.2% AEP (500 year ARI). There are small increases in PMF peak levels for both overland and mainstream flooding as shown on Figure B17, Figure B18, Figure C16 and Figure C17. As floods larger than the 0.2% AEP event and smaller than the PMF were not analysed it is not possible to determine the magnitude of the event which first produces impacts greater than 10mm outside the subject property.

As the existing site is inundated in the PMF (by up to 2m) it is impossible to completely negate increases in PMF peak levels unless all earthworks and structures are built above the PMF, or the scale of the works are significantly reduced so the increases are confined to the subject site. Balancing the cut and fill on the site has been achieved at the 1% AEP flood level but cannot be achieved for the PMF for the scale of works and fill proposed, these being typical for the land use zoning.

> 4. No significant adverse cumulative impacts on adjoining land, the locality and the environment from similar development in the locality. Within the local area there is no known proposed development, or site which can accommodate a similar scale development to that proposed, which will produce significant flood impacts and thus contribute to a significant cumulative impact.

The means of achieving the above Parramatta City Council Design Principles pertaining to flooding (not exclusive) are:

e) Filling in the floodplain that causes unacceptable displacement of floodwaters and loss of storage or conveyance capacity is not acceptable and alternative forms of construction may be required such as elevated floor slabs supported on piers above ground level flood and flow paths. As noted above a balance of cut and fill is achieved at the 1% AEP flood level but a balance has not been achieved at the PMF for the reasons provided above. Constructing large industrial buildings typical for this land use zone on piers approximately 2m above the ground is impractical.

f) Flood conveyance from overland and riparian flooding through the site must be safely provided for without creating "high hazard" conditions that put occupants and neighbours at risk. This may require wider shallower flow paths. Underground drainage must not be relied on to resolve this. All modelling has assumed that there is no underground drainage (although in reality it will be installed and thus will marginally lower flood levels, notably for overland flooding, to the results provided). Flood hazard maps for the proposed design conditions are shown on Figure C18 to Figure C21.

For mainstream flooding there is no conveyance of floodwaters across the site in events up to the 0.2% AEP. For overland flooding, flood conveyance has been addressed in all events by creating flow paths along the main roadways, this includes the swales on the west and east side of the Western Area.

g) A substantial proportion of the site must be set aside for the management of surface water for low flows under WSUD principles and of high flows under safe flood management principles. Note low and high flow paths need not be the same. WSUD has not been addressed in this report, but is dealt with elsewhere in the EIS;

h) Any proposal for a building that "blocks out" the storage or conveyance of floodwaters up to the PMF must be supported by an assessment demonstrating how this displacement of floodwaters will be mitigated so that there are no significant impacts. Aside from the proposed Downer Sustainable Road Resource Centre on Lot 6 no new buildings are proposed as part of this Application. Buildings have been assumed on the other lots and will be subject to later approval. Refer responses above.

Parramatta City Council indicate that a Flood and Water Management Strategy must be prepared to address all of this for the entire site so that all the future developments may be accommodated within the overarching strategy. This present report provides the Flood Management Strategy which includes swales on the east and west side of the Western Area. The design topography includes the filling and compensatory excavation areas. The Water Management Strategy (WSUD, stormwater strategy, OSD, riparian zones etc.) is provided in a separate report provided with the EIS.

A video meeting was held on 13 May 2020 between the various consultants and Parramatta City Council. The outcomes of this meeting (pertaining to flooding) have been considered in the reporting.

4.2. DPIE – EES

The DPIE advised that a detailed flood assessment must be undertaken and identified the following issues (DPIE numbering system in letter of 06:05:20):

27. The EIS must map the following features relevant to flooding as described in the Floodplain Development Manual 2005 (NSW Government 2005) including:
    - Flood prone land;
    - Flood planning area, the area below the flood planning level;
    - Hydraulic categorisation (floodways and flood storage areas);
    - Flood hazard.

    Refer figures in Appendix B and Appendix C.
28. 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. The flood assessment has included events up to the PMF. Events smaller than the 1% AEP have not been investigated as they do not inundate the site from mainstream flooding.
29. The EIS must model the effect of the proposed development (including fill) on the flood behaviour under the following scenarios:
    - Current flood behaviour for a range of design events as identified 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. For overland flooding this has been undertaken by considering a 10%, 20% and 30% rainfall increase. For mainstream flooding, flood levels for the 0.5% and 0.2% AEP events have been adopted as a proxy.
30. Modelling in the EIS must consider and document:
    - Existing Council flood studies in the area and examine consistency to the flood behaviour documented in these studies. The TUFLOW model adopted in the Council 2012 Duck River and Duck Creek Flood Study has been adopted in this study.
    - The impact on existing flood behaviour for a full range of flood events including up to the probable maximum flood, or an equivalent extreme flood. Refer above.
    - 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, hazard categories and hydraulic categories. Refer above.
    - Relevant provisions of the NSW Floodplain Development Manual 2005. Refer above.
31. The EIS must assess the impacts on the proposed development on flood behaviour, including:
    - Whether there will be detrimental increases in the potential flood affectation of other properties, assets and infrastructure. Refer above.
    - Consistency with Council floodplain risk management plans. Refer above.
    - Consistency with any Rural Floodplain Management Plans. There is no Rural Floodplain Management Plan.
    - Compatibility with the flood hazard of the land. Refer above.
    - Compatibility with the hydraulic functions of flow conveyance in floodways and storage in flood storage areas of the land. Refer above.

- Whether there will be adverse effect to beneficial inundation of the floodplain environment, on, adjacent to or downstream of the site. The frequency and extent of inundation within the riparian zone has not changed significantly as the design flood levels have not changed (refer Figure B14 to Figure B16 for overland flooding and Figure C13 to Figure C15 for mainstream flooding).
- Whether there will be direct or indirect increase in erosion, siltation, destruction of riparian vegetation or a reduction in the stability of riverbanks or watercourses. The frequency and extent of inundation within the riparian zone has not changed significantly as the design flood levels have not changed (refer Figure B14 to Figure B16 for overland flooding and Figure C13 to Figure C15 for mainstream flooding).
- Any impacts the development may have upon existing community emergency management arrangements for flooding. These matters are to be discussed with the NSW SES and Council. In all events up to the 0.2% AEP (and larger events between the 0.2% AEP and the PMF) the existing flood emergency access routes are unaffected as the design flood levels have not changed (refer Figure B14 to Figure B16 for overland flooding and Figure C13 to Figure C15 for mainstream flooding). A Flood Emergency Plan will be prepared for each land use activity on each lot.
- Whether the proposal incorporates specific measures to manage risk to life from flood. These matters are to be discussed with the NSW SES and Council. In all events up to the 0.2% AEP (and larger events between the 0.2% AEP and the PMF) the existing flood emergency access routes are unaffected as the design flood levels have not changed (refer Figure B14 to Figure B16 for overland flooding and Figure C13 to Figure C15 for mainstream flooding). A Flood Emergency Plan will be prepared for each land use activity on each lot.
- Emergency management, evacuation and access, and contingency measures for the development considering the full range or 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 NSW SES. In all events up to the 0.2% AEP (and larger events between the 0.2% AEP and the PMF) the existing flood emergency access routes are unaffected as the design flood levels have not changed (refer Figure B14 to Figure B16 for overland flooding and Figure C13 to Figure C15 for mainstream flooding). A Flood Emergency Plan will be prepared for each land use activity on each lot.
- Any impacts the development may have on the social and economic costs to the community as consequence of flooding. The works will have no significant effect on the social and economic costs to the community as a consequence of flooding up to the 0.2% AEP event (and larger events between the 0.2% AEP and the PMF) as the design flood levels have not changed significantly (refer Figure B14 to Figure B16 for overland flooding and Figure C13 to Figure C15 for mainstream flooding).

4.3. EPA

- Identify potential impacts associated with geomorphological activities with potential to increase surface water and sediment runoff or to reduce surface runoff and sediment transport. Also consider possible impacts such as bed lowering, bank lowering, instream siltation, floodplain erosion and floodplain siltation. WSUD has not been investigated in

this report. There are no changes proposed within the riparian corridor and the design flood levels have not changed significantly up to the 0.2% AEP event (refer Figure B14 to Figure B16 for overland flooding and Figure C13 to Figure C15 for mainstream flooding). Thus works and outcomes of this proposed development will not impact upon the geomorphology within the riparian corridor.

- Describe hydrological impact mitigation measures including: a) site selection (avoiding sites prone to flooding and waterlogging, actively eroding or affected by deposition). As far as possible these issues have been considered in development of the site with land subject to regular inundation, water logging, erosion or affected by deposition excluded from development. The proposed earthworks have been designed to ensure that all proposed buildings can be constructed in accordance with Parramatta City Council's flood related development controls. Many of the proposed buildings are sited on land outside the mainstream flood planning area of the 1% AEP + 0.5m (refer Figure C1 and Figure C13).

4.4. Sydney Water

- The proponent should consider taking measures to minimise or eliminate potential flooding, degradation of water quality, and avoid adverse impacts on any heritage items, and create pipeline easements where required. Flooding has been assessed as part this study. The other issues are assessed in separate studies as part of the EIS.

5. REFERENCES

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Figures

FIGURE 1
LOCALITY MAP

Parramatta River
Colquhoun Street
Durham Street
Devon Street
Unwin Street
Shirley Street
WESTERN AREA
EASTERN AREA
Duck River
Duck River
N
Site
Cadastre
Riparian Corridor
Tree Line
1% AEP flood extent, Duck River
Meters
0 100 200 300 400
Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
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FIGURE 2
DIGITAL ELEVATION MODEL
EXISTING TOPOGRAPHY

Parramatta River
Colquhoun Street
Durham Street
Devon Street
Unwin Street
Shirley Street
Duck River
Duck River

N

Model Extent
Site
Cadastre

Ground Elevation (mAHD)
High : 10
Low : 0

0 100 200 300 400 Meters

Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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FIGURE 3
DIGITAL ELEVATION MODEL
DESIGN TOPOGRAPHY

Devon Street
Unwin Street
Shirley Street
Duck River

N

Model Extent
Site
Cadastre
Proposed Building

Ground Elevation (mAHD)

- < 4
- 4.0 to 4.1
- 4.1 to 4.2
- 4.2 to 4.3
- 4.3 to 4.4
- 4.4 to 4.5
- 4.5 to 4.6
- 4.6 to 4.7
- 4.7 to 4.8
- 4.8 to 4.9
- > 4.9

0 100 200 300 400 Meters

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FIGURE 4a

PLAN OF LOT SUBDIVISION

Figure 1.2
The project

Central Sydney Industrial Estate Incorporating Downer Sustainable Road Resource Centre
STATE SIGNIFICANT DEVELOPMENT - ENVIRONMENTAL IMPACT STATEMENT

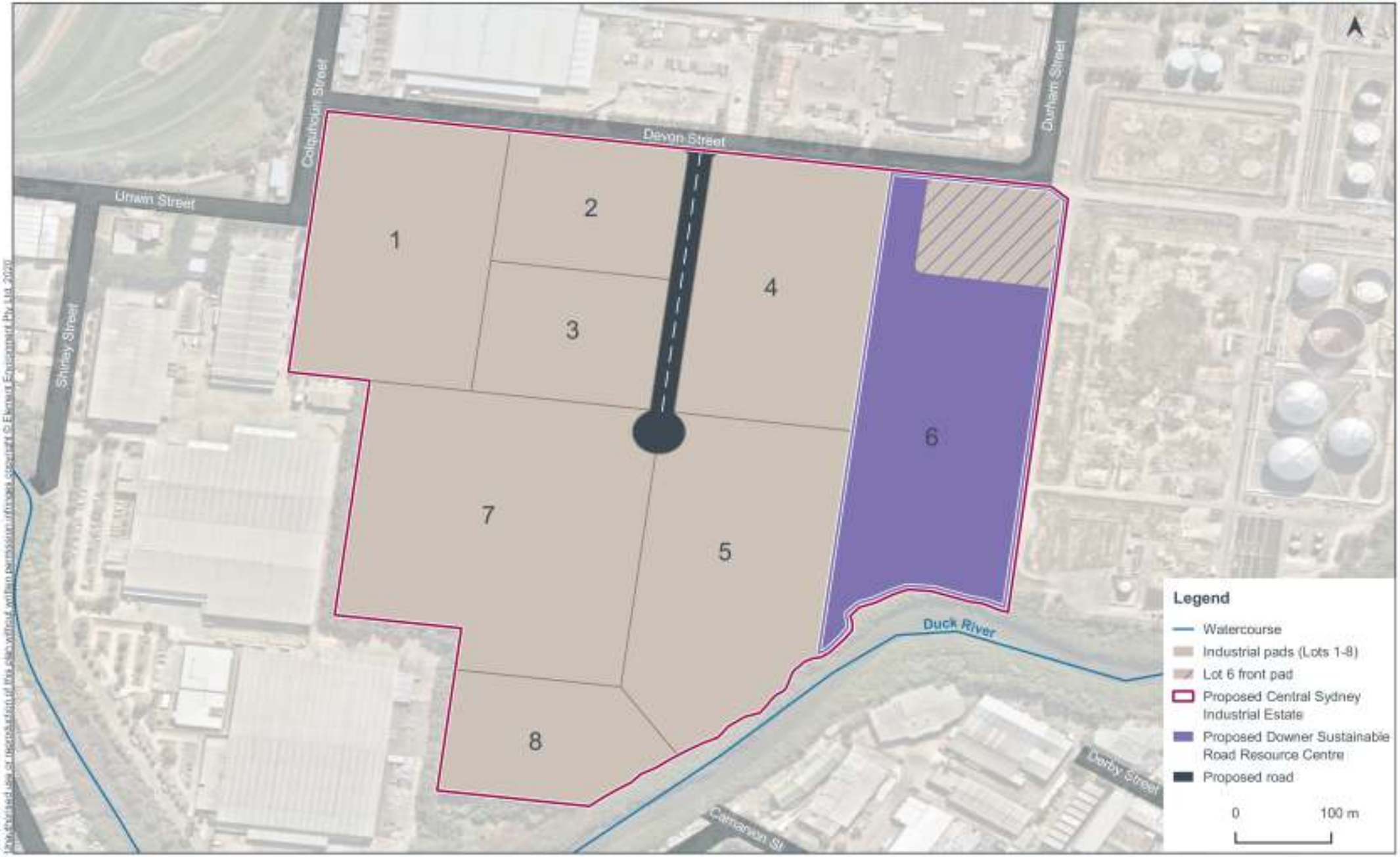
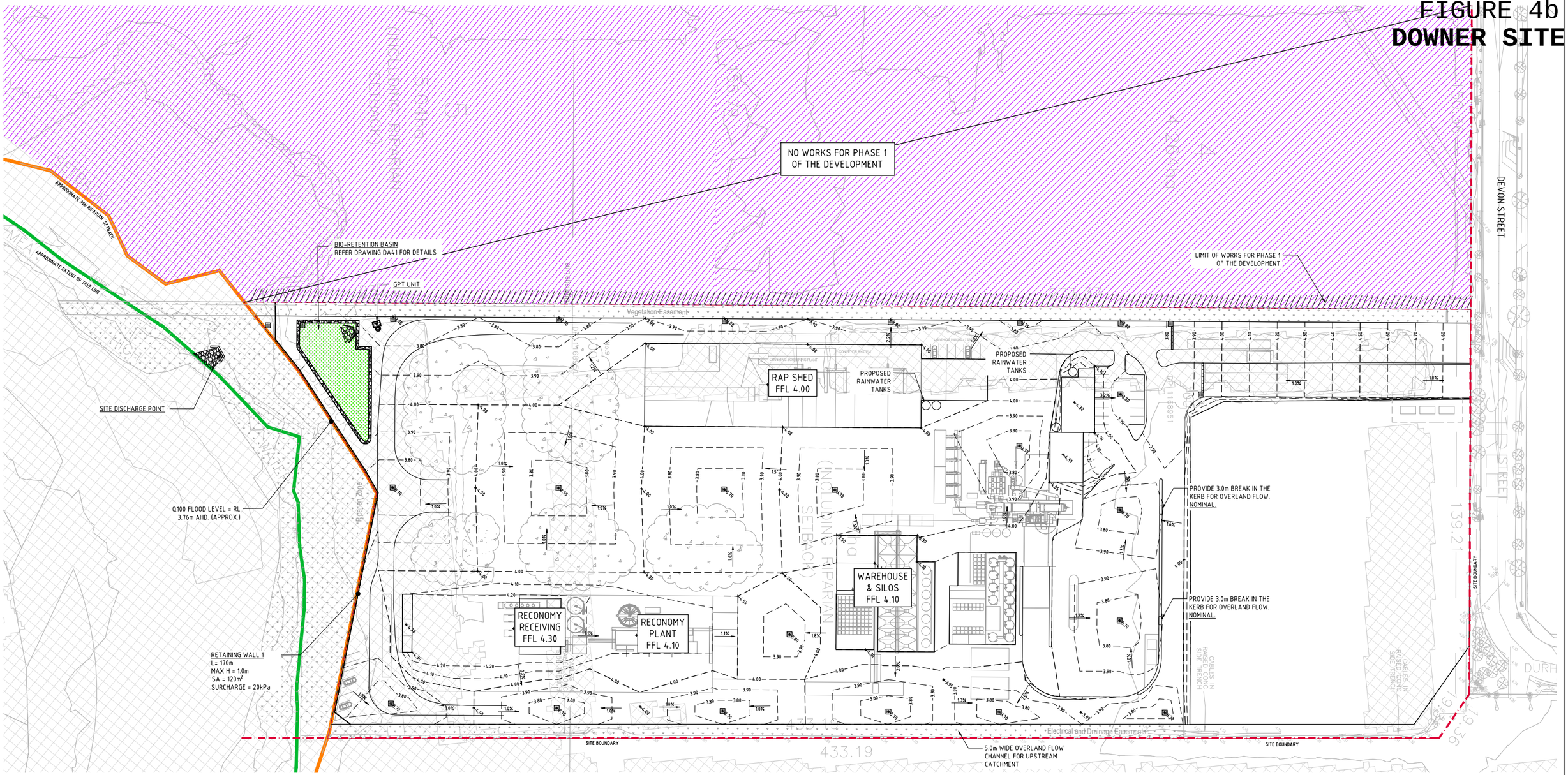


FIGURE 4b

DOWNER SITE



CONCEPT FINISHED LEVELS PLAN - PHASE 1

SCALE 1:500

LEGEND:

LEVELS DATUM IS AHD.

EXISTING SITE LEVELS AND DETAILS BASED ON SURVEY INFORMATION PROVIDED BY LANDPARTNERS TITLED AS0205 Clyde_BE_200620 TIN DATED 08/07/20.

- 4.00 - DESIGN CONTOUR (MAJOR 0.5m)
- 3.90 - DESIGN CONTOUR (MINOR 0.1m)
- 4.00 - EXISTING CONTOUR (0.25m INTERVALS)
- SINGLE GRATED GULLY PIT (SGGP)
- Q100 FLOOD EXTENT
- APPROXIMATE EXTENT OF TREE LINE
- RIPARIAN SETBACK

5m 0 10 20 30 40 50m

SCALE 1:1000 AT A0 SHEET SIZE

FOR INFORMATION

AMENDMENTS	DATE	ISSUE
ISSUED FOR INFORMATION	12.08.20	C
REVISED AS CLOUDED	21.07.20	B
ISSUED FOR INFORMATION	08.07.20	A

ARCHITECT

CLIENT

PROJECT
SUSTAINABLE ROAD RESOURCE CENTRE (PHASE 1)
9 DEVON STREET, CLYDE NSW

DESIGNED	DRAWN	DATE	CHECKED	SIZE	SCALE	CAD REF:
XC	HU	MAY 20		A0	AS SHOWN	C013919.01- DA51

Costin Roe Consulting Pty Ltd.
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PRECISION | COMMUNICATION | ACCOUNTABILITY

DRAWING TITLE
CONCEPT FINISHED LEVELS PLAN - PHASE 1

DRAWING No C013919.01- DA51

ISSUE C

Appendix A: Glossary of Flood Related Terms

Appendix A

APPENDIX A: GLOSSARY OF FLOOD RELATED TERMS

Taken from the Floodplain Development Manual (April 2005 edition)

acid sulfate soils	Are sediments which contain sulfidic mineral pyrite which may become extremely acid following disturbance or drainage as sulfur compounds react when exposed to oxygen to form sulfuric acid. More detailed explanation and definition can be found in the NSW Government Acid Sulfate Soil Manual published by Acid Sulfate Soil Management Advisory Committee.
Annual Exceedance Probability (AEP)	The chance of a flood of a given or larger size occurring in any one year, usually expressed as a percentage. For example, if a peak flood discharge of 500 m^3/s has an AEP of 5%, it means that there is a 5% chance (that is one-in-20 chance) of a 500 m^3/s or larger event occurring in any one year (see ARI).
Australian Height Datum (AHD)	A common national surface level datum approximately corresponding to mean sea level.
Average Annual Damage (AAD)	Depending on its size (or severity), each flood will cause a different amount of flood damage to a flood prone area. AAD is the average damage per year that would occur in a nominated development situation from flooding over a very long period of time.
Average Recurrence Interval (ARI)	The long term average number of years between the occurrence of a flood as big as, or larger than, the selected event. For example, floods with a discharge as great as, or greater than, the 20 year ARI flood event will occur on average once every 20 years. ARI is another way of expressing the likelihood of occurrence of a flood event.
caravan and moveable home parks	Caravans and moveable dwellings are being increasingly used for long-term and permanent accommodation purposes. Standards relating to their siting, design, construction and management can be found in the Regulations under the LG Act.
catchment	The land area draining through the main stream, as well as tributary streams, to a particular site. It always relates to an area above a specific location.
consent authority	The Council, Government agency or person having the function to determine a development application for land use under the EP&A Act. The consent authority is most often the Council, however legislation or an EPI may specify a Minister or public authority (other than a Council), or the Director General of DIPNR, as having the function to determine an application.
development	Is defined in Part 4 of the Environmental Planning and Assessment Act (EP&A Act). **infill development:** refers to the development of vacant blocks of land that are generally surrounded by developed properties and is permissible under the current zoning of the land. Conditions such as minimum floor levels may be imposed on infill development. **new development:** refers to development of a completely different nature to that associated with the former land use. For example, the urban subdivision of an area previously used for rural purposes. New developments involve rezoning and typically require major extensions of existing urban services, such as roads, water supply, sewerage and electric power. **redevelopment:** refers to rebuilding in an area. For example, as urban areas age, it may become necessary to demolish and reconstruct buildings on a relatively large scale. Redevelopment generally does not require either rezoning or major extensions to urban services.
disaster plan (DISPLAN)	A step by step sequence of previously agreed roles, responsibilities, functions, actions and management arrangements for the conduct of a single or series of connected emergency operations, with the object of ensuring the coordinated response by all agencies having responsibilities and functions in emergencies.

discharge	The rate of flow of water measured in terms of volume per unit time, for example, cubic metres per second (m^3/s). Discharge is different from the speed or velocity of flow, which is a measure of how fast the water is moving for example, metres per second (m/s).
ecologically sustainable development (ESD)	Using, conserving and enhancing natural resources so that ecological processes, on which life depends, are maintained, and the total quality of life, now and in the future, can be maintained or increased. A more detailed definition is included in the Local Government Act 1993. The use of sustainability and sustainable in this manual relate to ESD.
effective warning time	The time available after receiving advice of an impending flood and before the floodwaters prevent appropriate flood response actions being undertaken. The effective warning time is typically used to move farm equipment, move stock, raise furniture, evacuate people and transport their possessions.
emergency management	A range of measures to manage risks to communities and the environment. In the flood context it may include measures to prevent, prepare for, respond to and recover from flooding.
flash flooding	Flooding which is sudden and unexpected. It is often caused by sudden local or nearby heavy rainfall. Often defined as flooding which peaks within six hours of the causative rain.
flood	Relatively high stream flow which overtops the natural or artificial banks in any part of a stream, river, estuary, lake or dam, and/or local overland flooding associated with major drainage before entering a watercourse, and/or coastal inundation resulting from super-elevated sea levels and/or waves overtopping coastline defences excluding tsunami.
flood awareness	Flood awareness is an appreciation of the likely effects of flooding and a knowledge of the relevant flood warning, response and evacuation procedures.
flood education	Flood education seeks to provide information to raise awareness of the flood problem so as to enable individuals to understand how to manage themselves and their property in response to flood warnings and in a flood event. It invokes a state of flood readiness.
flood fringe areas	The remaining area of flood prone land after floodway and flood storage areas have been defined.
flood liable land	Is synonymous with flood prone land (i.e. land susceptible to flooding by the probable maximum flood (PMF) event). Note that the term flood liable land covers the whole of the floodplain, not just that part below the flood planning level (see flood planning area).
flood mitigation standard	The average recurrence interval of the flood, selected as part of the floodplain risk management process that forms the basis for physical works to modify the impacts of flooding.
floodplain	Area of land which is subject to inundation by floods up to and including the probable maximum flood event, that is, flood prone land.
floodplain risk management options	The measures that might be feasible for the management of a particular area of the floodplain. Preparation of a floodplain risk management plan requires a detailed evaluation of floodplain risk management options.
floodplain risk management plan	A management plan developed in accordance with the principles and guidelines in this manual. Usually includes both written and diagrammatic information describing how particular areas of flood prone land are to be used and managed to achieve defined objectives.

flood plan (local)	A sub-plan of a disaster plan that deals specifically with flooding. They can exist at State, Division and local levels. Local flood plans are prepared under the leadership of the State Emergency Service.
flood planning area	The area of land below the flood planning level and thus subject to flood related development controls. The concept of flood planning area generally supersedes the flood liable land concept in the 1986 Manual.
Flood Planning Levels (FPLs)	FPLs are the combinations of flood levels (derived from significant historical flood events or floods of specific AEPs) and freeboards selected for floodplain risk management purposes, as determined in management studies and incorporated in management plans. FPLs supersede the standard flood event in the 1986 manual.
flood proofing	A combination of measures incorporated in the design, construction and alteration of individual buildings or structures subject to flooding, to reduce or eliminate flood damages.
flood prone land	Is land susceptible to flooding by the Probable Maximum Flood (PMF) event. Flood prone land is synonymous with flood liable land.
flood readiness	Flood readiness is an ability to react within the effective warning time.
flood risk	Potential danger to personal safety and potential damage to property resulting from flooding. The degree of risk varies with circumstances across the full range of floods. Flood risk in this manual is divided into 3 types, existing, future and continuing risks. They are described below. **existing flood risk:** the risk a community is exposed to as a result of its location on the floodplain. **future flood risk:** the risk a community may be exposed to as a result of new development on the floodplain. **continuing flood risk:** the risk a community is exposed to after floodplain risk management measures have been implemented. For a town protected by levees, the continuing flood risk is the consequences of the levees being overtopped. For an area without any floodplain risk management measures, the continuing flood risk is simply the existence of its flood exposure.
flood storage areas	Those parts of the floodplain that are important for the temporary storage of floodwaters during the passage of a flood. The extent and behaviour of flood storage areas may change with flood severity, and loss of flood storage can increase the severity of flood impacts by reducing natural flood attenuation. Hence, it is necessary to investigate a range of flood sizes before defining flood storage areas.
floodway areas	Those areas of the floodplain where a significant discharge of water occurs during floods. They are often aligned with naturally defined channels. Floodways are areas that, even if only partially blocked, would cause a significant redistribution of flood flows, or a significant increase in flood levels.
freeboard	Freeboard provides reasonable certainty that the risk exposure selected in deciding on a particular flood chosen as the basis for the FPL is actually provided. It is a factor of safety typically used in relation to the setting of floor levels, levee crest levels, etc. Freeboard is included in the flood planning level.
habitable room	**in a residential situation:** a living or working area, such as a lounge room, dining room, rumpus room, kitchen, bedroom or workroom. **in an industrial or commercial situation:** an area used for offices or to store valuable possessions susceptible to flood damage in the event of a flood.
hazard	A source of potential harm or a situation with a potential to cause loss. In relation to this manual the hazard is flooding which has the potential to cause damage to

	the community. Definitions of high and low hazard categories are provided in the Manual.
hydraulics	Term given to the study of water flow in waterways; in particular, the evaluation of flow parameters such as water level and velocity.
hydrograph	A graph which shows how the discharge or stage/flood level at any particular location varies with time during a flood.
hydrology	Term given to the study of the rainfall and runoff process; in particular, the evaluation of peak flows, flow volumes and the derivation of hydrographs for a range of floods.
local overland flooding	Inundation by local runoff rather than overbank discharge from a stream, river, estuary, lake or dam.
local drainage	Are smaller scale problems in urban areas. They are outside the definition of major drainage in this glossary.
mainstream flooding	Inundation of normally dry land occurring when water overflows the natural or artificial banks of a stream, river, estuary, lake or dam.
major drainage	Councils have discretion in determining whether urban drainage problems are associated with major or local drainage. For the purpose of this manual major drainage involves: • the floodplains of original watercourses (which may now be piped, channelised or diverted), or sloping areas where overland flows develop along alternative paths once system capacity is exceeded; and/or • water depths generally in excess of 0.3 m (in the major system design storm as defined in the current version of Australian Rainfall and Runoff). These conditions may result in danger to personal safety and property damage to both premises and vehicles; and/or • major overland flow paths through developed areas outside of defined drainage reserves; and/or • the potential to affect a number of buildings along the major flow path.
mathematical/computer models	The mathematical representation of the physical processes involved in runoff generation and stream flow. These models are often run on computers due to the complexity of the mathematical relationships between runoff, stream flow and the distribution of flows across the floodplain.
merit approach	The merit approach weighs social, economic, ecological and cultural impacts of land use options for different flood prone areas together with flood damage, hazard and behaviour implications, and environmental protection and well being of the State's rivers and floodplains. The merit approach operates at two levels. At the strategic level it allows for the consideration of social, economic, ecological, cultural and flooding issues to determine strategies for the management of future flood risk which are formulated into Council plans, policy and EPIs. At a site specific level, it involves consideration of the best way of conditioning development allowable under the floodplain risk management plan, local floodplain risk management policy and EPIs.
minor, moderate and major flooding	Both the State Emergency Service and the Bureau of Meteorology use the following definitions in flood warnings to give a general indication of the types of problems expected with a flood: **minor flooding:** causes inconvenience such as closing of minor roads and the submergence of low level bridges. The lower limit of this class of flooding on the reference gauge is the initial flood level at which landholders and townspeople begin to be flooded.

	moderate flooding: low-lying areas are inundated requiring removal of stock and/or evacuation of some houses. Main traffic routes may be covered. **major flooding:** appreciable urban areas are flooded and/or extensive rural areas are flooded. Properties, villages and towns can be isolated.
modification measures	Measures that modify either the flood, the property or the response to flooding. Examples are indicated in Table 2.1 with further discussion in the Manual.
peak discharge	The maximum discharge occurring during a flood event.
Probable Maximum Flood (PMF)	The PMF is the largest flood that could conceivably occur at a particular location, usually estimated from probable maximum precipitation, and where applicable, snow melt, coupled with the worst flood producing catchment conditions. Generally, it is not physically or economically possible to provide complete protection against this event. The PMF defines the extent of flood prone land, that is, the floodplain. The extent, nature and potential consequences of flooding associated with a range of events rarer than the flood used for designing mitigation works and controlling development, up to and including the PMF event should be addressed in a floodplain risk management study.
Probable Maximum Precipitation (PMP)	The PMP is the greatest depth of precipitation for a given duration meteorologically possible over a given size storm area at a particular location at a particular time of the year, with no allowance made for long-term climatic trends (World Meteorological Organisation, 1986). It is the primary input to PMF estimation.
probability	A statistical measure of the expected chance of flooding (see AEP).
risk	Chance of something happening that will have an impact. It is measured in terms of consequences and likelihood. In the context of the manual it is the likelihood of consequences arising from the interaction of floods, communities and the environment.
runoff	The amount of rainfall which actually ends up as streamflow, also known as rainfall excess.
stage	Equivalent to water level. Both are measured with reference to a specified datum.
stage hydrograph	A graph that shows how the water level at a particular location changes with time during a flood. It must be referenced to a particular datum.
survey plan	A plan prepared by a registered surveyor.
water surface profile	A graph showing the flood stage at any given location along a watercourse at a particular time.
wind fetch	The horizontal distance in the direction of wind over which wind waves are generated.

Overland Flow Flooding

Appendix B

FIGURE B1
STUDY AREA

EASTERN AREA

WESTERN AREA

Colquhoun Street

Durham Street

Devon Street

Unwin Street

Shirley Street

Duck River

Duck River

Duck River

N

Site
Cadastre
Pits
Pipe

0 100 200 300 400 Meters

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FIGURE B2
HYDRAULIC MODEL LAYOUT

Parramatta River

Colquhoun Street

Durham Street

Devon Street

Unwin Street

Shirley Street

Duck River

Duck River

N

Cadastre
Survey Extent
Pits
Pipe
levee Breakline
Channel Breakline
Kerb Breakline
Buildings
Model Extent
Site

0 200 400 600 800 Meters

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FIGURE B3
MANNING'S ROUGHNESS

Parramatta River

Colquhoun Street

Durham Street

Devon Street

Unwin Street

Shirley Street

Duck River

Duck River

N

Cadastre
Model Extent
Site
Road 0.02
Grassed Aea 0.04
Mangrove 0.08
River 0.025
Lots 0.05

0 200 400 600 800 Meters

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FIGURE B4
CRITICAL DURATION
25 TO 360 MIN DURATION
1% AEP EVENT
OVERLAND FLOODING

Colquhoun Street
Durham Street
Devon Street
Unwin Street
Shirley Street
Duck River
Duck River

N

Site
Cadastre

Critical duration
1% AEP 25 min
1% AEP 60 min
1% AEP 120 min
1% AEP 180 min
1% AEP 270 min
1% AEP 360 min

Meters
0 100 200 300 400

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FIGURE B5
CHANGE IN PEAK FLOOD LEVEL
1% AEP EVENT
120 MINUTES DURATION V ENVELOPE
OVERLAND FLOODING

Colquhoun Street
Durham Street
Devon Street
Unwin Street
Shirley Street
Duck River
Duck River
N
Model Extent
Site
Cadastre
Impact (m)
< -0.3
-0.3 to -0.2
-0.2 to-0.1
-0.1 to 0
Meters
0 100 200 300 400

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FIGURE B6

CHANGE IN PEAK FLOOD LEVEL
1% AEP EVENT, EXISTING CASE
STORMWATER NETWORK BLOCKED ON SITE V UNBLOCKED OVERLAND FLOODING

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Colquhoun Street

Durham Street

Shirley Street

Duck River

Duck River

0.86
1.13
0.19
0.36
0
0
0
0
1.97
2
0.56
0.69
0.17
0.08
0.49
0.15
0.01
0
0.77
1.37

N

8.4m³/s Peak Flow (Existing)
7.6m³/s Peak Flow (Blocked Scenario)
Flow Line
Model Extent
Site
Cadastre

Impact (m)

< -0.1
-0.1 to -0.05
-0.05 to -0.01
-0.01 to 0.01
0.01 to 0.05
0.05 to 0.1
> 0.1
Newly Flooded
No Longer Flooded

0 100 200 300 400 Meters

FIGURE B7

PEAK FLOOD DEPTH AND LEVEL CONTOUR
1% AEP EVENT, EXISTING CASE
STORMWATER NETWORK UNBLOCKED
OVERLAND FLOODING

Colquhoun Street
Durham Street
Unwin Street
Shirley Street
Duck River
Duck River

0.86
0.19
0
1.97
0.56
0.77
0.01
0.49

34m³/s Peak Flow (Existing)
Model Extent
Site
Cadastre
Flood Level Major Contours (1.0m Intervals)
Flood Level Minor Contours (0.2m Intervals)

Depth (m)
0 to 0.1
0.1 to 0.25
0.25 to 0.5
0.5 to 0.75
0.75 to 1
> 1

N

0 100 200 300 400 Meters

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FIGURE B8

PEAK FLOOD VELOCITY
1% AEP EVENT, EXISTING CASE
STORMWATER NETWORK UNBLOCKED
OVERLAND FLOODING

Colquhoun Street
Durham Street
Devon Street
Unwin Street
Shirley Street
Duck River
Duck River
Duck River

N

Model Extent
Site
Cadastre

Velocity (m/s)
0 to 0.1
0.1 to 0.25
0.25 to 0.5
0.5 to 1
> 1

0 100 200 300 400 Meters

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FIGURE B9

PEAK FLOOD HAZARD
1% AEP EVENT, EXISTING CASE
STORMWATER NETWORK UNBLOCKED
OVERLAND FLOODING

Colquhoun Street
Durham Street
Devon Street
Unwin Street
Shirley Street
Duck River
Duck River
Duck River

N

- Model Extent
- Site
- Cadastre
- H1 - Generally safe for people, vehicles and buildings
- H2 - Unsafe for small vehicles
- H3 - Unsafe for vehicles, children and the elderly
- H4 - Unsafe for people and vehicles.
- H5 - Unsafe for vehicles and people. All buildings vulnerable to structural damage. Some less robust building types vulnerable to failure.
- H6 - Unsafe for vehicles and people. All building types considered vulnerable to failure.

0 100 200 300 400 Meters

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FIGURE B10

HYDRAULIC CATEGORISATION
1% AEP EVENT, EXISTING CASE
STORMWATER NETWORK UNBLOCKED
OVERLAND FLOODING

Colquhoun Street
Durham Street
Devon Street
Unwin Street
Shirley Street
Duck River
Duck River

N

Model Extent
Site
Cadastre

Hydraulic Categorisation
Floodway
Flood Storage
Flood Fringe

0 100 200 300 400 Meters

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FIGURE B11

CHANGE IN PEAK FLOOD LEVEL
1% AEP EVENT, EXISTING CASE
10% INCREASE RAINFALL
OVERLAND FLOODING

Colquhoun Street

Durham Street

Shirley Street

Duck River

Duck River

0.86
1.11
0.19
0.3
0
0
0.56
0.75
0.17
0.32
0.49
0.71
0.01
0.02
0.77
0.87
0
0.02
1.97
2.45

N

Model Extent
Site
Cadastre
84m³/s Overland Peak Flow (Existing)
76m³/s Overland Peak Flow (10% Increase Rainfall)
Flow Line

Impact (m)

< 0.01
0.01 - 0.05
0.05 - 0.1
0.1 - 0.25
0.25 - 0.5
0.5 - 0.75
>0.75
Newly Flooded
No Longer Flooded

Meters
0 100 200 300 400

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FIGURE B12

CHANGE IN PEAK FLOOD LEVEL
1% AEP EVENT, EXISTING CASE
20% INCREASE RAINFALL
OVERLAND FLOODING

Colquhoun Street

Durham Street

Shirley Street

Duck River

Duck River

0.86
1.25
0.19
0.37
0
0
0
0.05
1.97
2.85
0.56
0.75
0.17
0.45
0.49
0.85
0.01
0.05
0.77
0.99

N

Model Extent
Site
Cadastre
84m³/s Overland Peak Flow (Existing)
76m³/s Overland Peak Flow (20% Increase Rainfall)
Flow Line

Impact (m)

< 0.01
0.01 - 0.05
0.05 - 0.1
0.1 - 0.25
0.25 - 0.5
0.5 - 0.75
>0.75
Newly Flooded
No Longer Flooded

0 100 200 300 400 Meters

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FIGURE B13

CHANGE IN PEAK FLOOD LEVEL
1% AEP EVENT, EXISTING CASE
30% INCREASE RAINFALL
OVERLAND FLOODING

Colquhoun Street

Durham Street

Shirley Street

Duck River

Duck River

0.86
1.4
0.19
0.44
0
0
0
0.09
1.97
3.2
0.56
0.73
0.17
0.64
0.49
0.99
0.01
0.07
0.77
1

Model Extent
Site
Cadastre
84m³/s Overland Peak Flow (Existing)
76m³/s Overland Peak Flow (30% Increase Rainfall)
Flow Line

Impact (m)

< 0.01
0.01 - 0.05
0.05 - 0.1
0.1 - 0.25
0.25 - 0.5
0.5 - 0.75
>0.75
Newly Flooded
No Longer Flooded

N

0 100 200 300 400 Meters

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FIGURE B14

CHANGE IN PEAK FLOOD LEVEL
PROPOSED DESIGN, STORMWATER NETWORK BLOCKED ON SITE
1% AEP EVENT, OVERLAND FLOODING

Colquhoun Street
Durham Street
Devon Street
Unwin Street
Shirley Street
Duck River
Duck River

N

Model Extent
Site
Cadastre

Impact (m)

< -0.1
-0.1 -0.05
-0.05 -0.01
-0.01 - 0.01
0.01 - 0.05
0.05 - 0.1
0.1 - 0.5
Newly Flooded
No Longer Flooded

0 100 200 300 400 Meters

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FIGURE B15

CHANGE IN PEAK FLOOD LEVEL
PROPOSED DESIGN, STORMWATER NETWORK BLOCKED ON SITE
0.5% AEP EVENT, OVERLAND FLOODING

Colquhoun Street
Durham Street
Devon Street
Unwin Street
Shirley Street
Duck River
Duck River
N

Model Extent
Site
Cadastre

Impact (m)

< -0.1
-0.1 -0.05
-0.05 -0.01
-0.01 - 0.01
0.01 - 0.05
0.05 - 0.1
0.1 - 0.5
Newly Flooded
No Longer Flooded

Meters
0 100 200 300 400

J:\Jobs\119043\ArcGIS\Arcmap\200727 report\Appendix B_Overland\FigureB15 Change in Peak Flood Level 0p5pc AEP EventDesignStormwater Network Blocked on Site.mxd

FIGURE B16

CHANGE IN PEAK FLOOD LEVEL
PROPOSED DESIGN, STORMWATER NETWORK BLOCKED ON SITE
0.2% AEP EVENT, OVERLAND FLOODING

Colquhoun Street
Durham Street
Devon Street
Unwin Street
Shirley Street
Duck River
Duck River

N

Model Extent
Site
Cadastre

Impact (m)

< -0.1
-0.1 -0.05
-0.05 -0.01
-0.01 - 0.01
0.01 - 0.05
0.05 - 0.1
0.1 - 0.5
Newly Flooded
No Longer Flooded

0 100 200 300 400 Meters

J:\Jobs\119043\ArcGIS\Arcmap\200727_report\Appendix_B_Overland\FigureB16_Change_in_Peak_Flood_Level_0p2pc_AEP_EventDesignStormwater_Network_Blocked_on_Site.mxd

FIGURE B17

CHANGE IN PEAK FLOOD LEVEL
PROPOSED DESIGN, STORMWATER NETWORK BLOCKED ON SITE
PMF EVENT, OVERLAND FLOODING

J:\Jobs\119043\ArcGIS\Arcmap\200727_report\Appendix_B_Overland\FigureB17_Change_in_Peak_Flood_Level_PMF_EventDesignStormwater_Network_Blocked_on_Site.mxd

Colquhoun Street
Durham Street
Devon Street
Unwin Street
Shirley Street
Duck River
Duck River
1
2
3
N

Model Extent
Site
Cadastre
Hydrographs

Impact (m)

< -0.1
-0.1 -0.05
-0.05 -0.01
-0.01 - 0.01
0.01 - 0.05
0.05 - 0.1
0.1 - 0.5
Newly Flooded
No Longer Flooded

0 100 200 300 400 Meters

J:\Jobs\119043\Excel\Hydrograph\119043_Redistributed_Flow_revised.xlsx

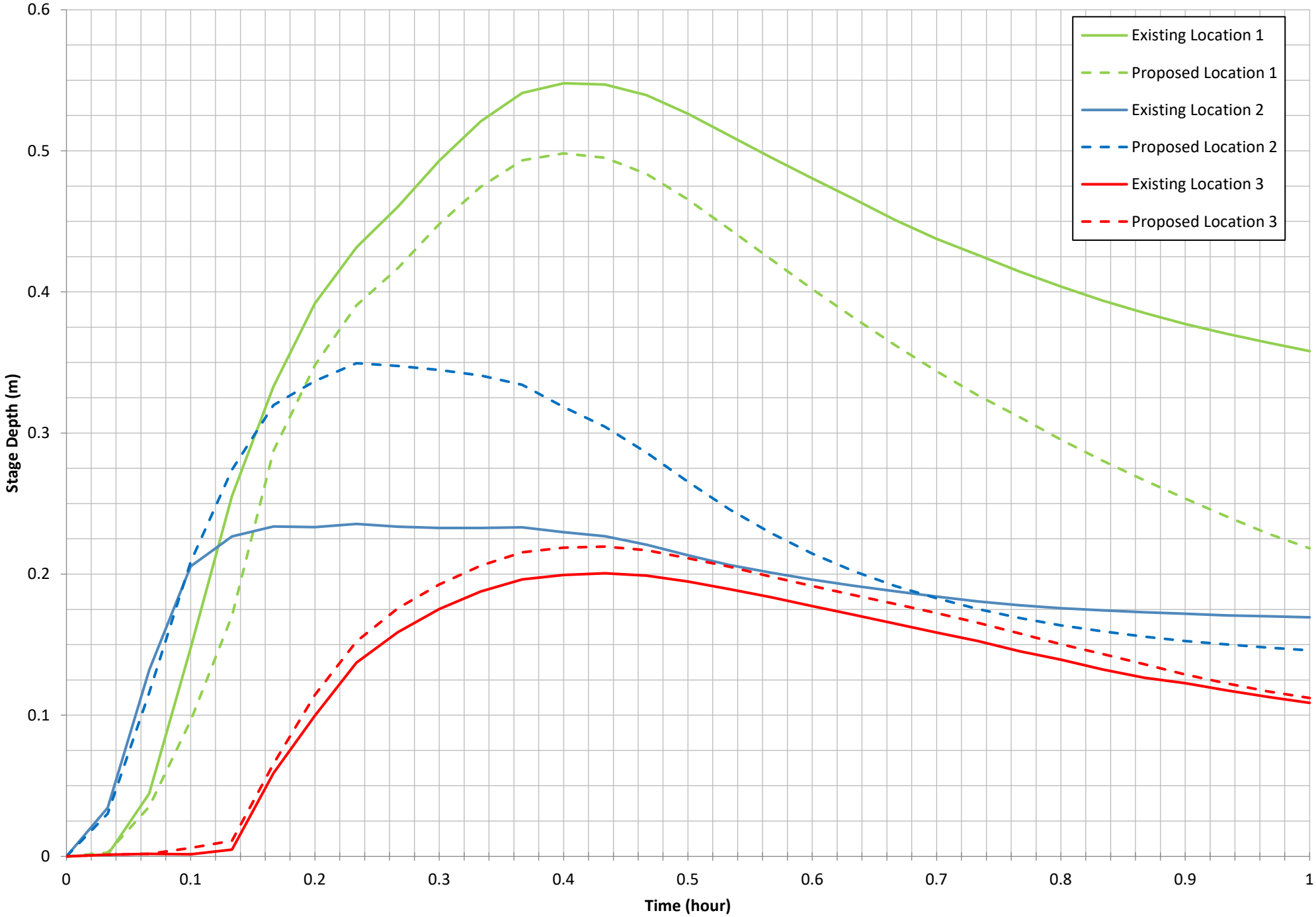


FIGURE B18A
STAGE HYDROGRAPHS
PMF EVENT OVERLAND FLOODING

J:\Jobs\119043\Excel\Hydrograph\119043_Redistributed_Flow_revised.xlsx

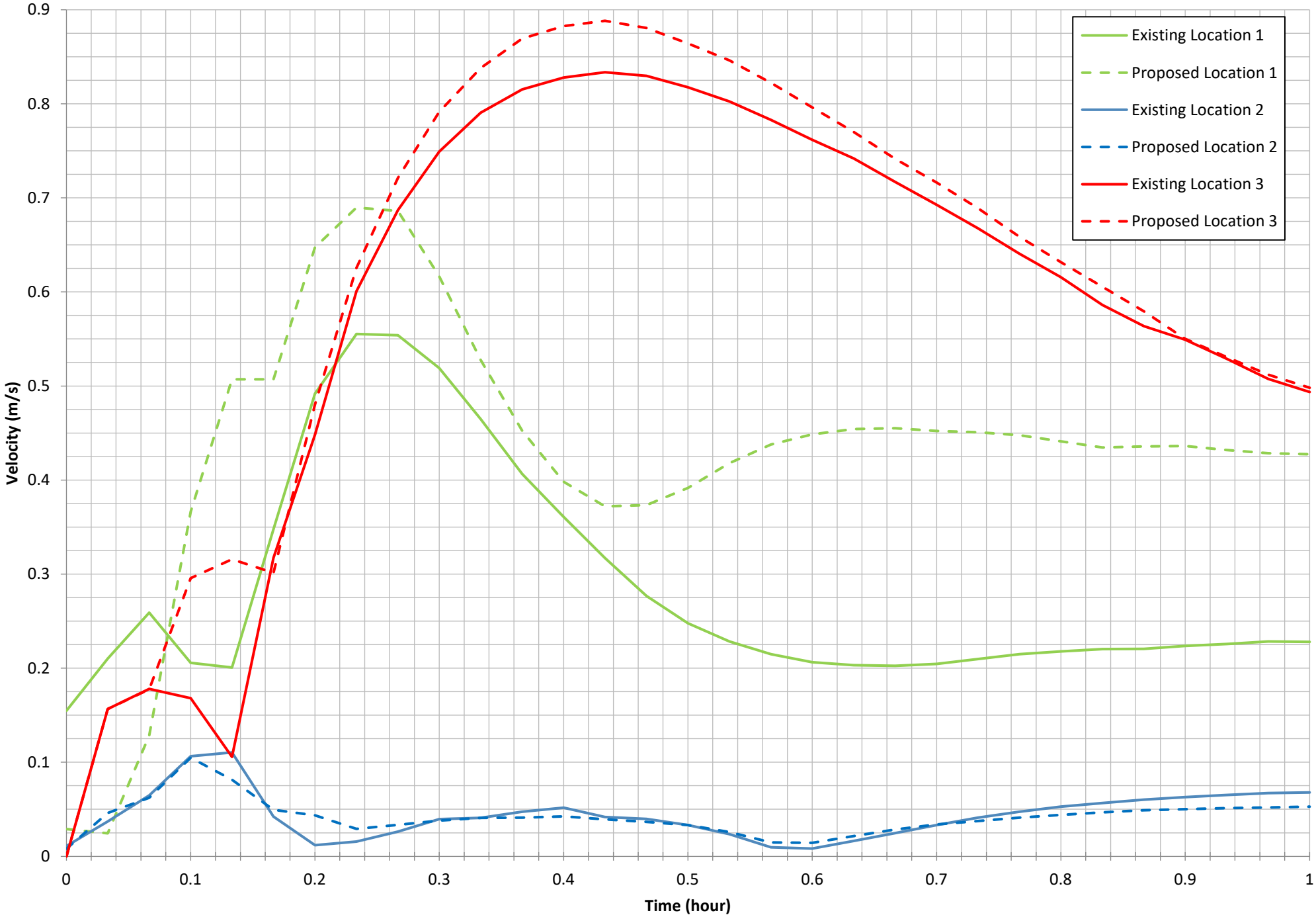


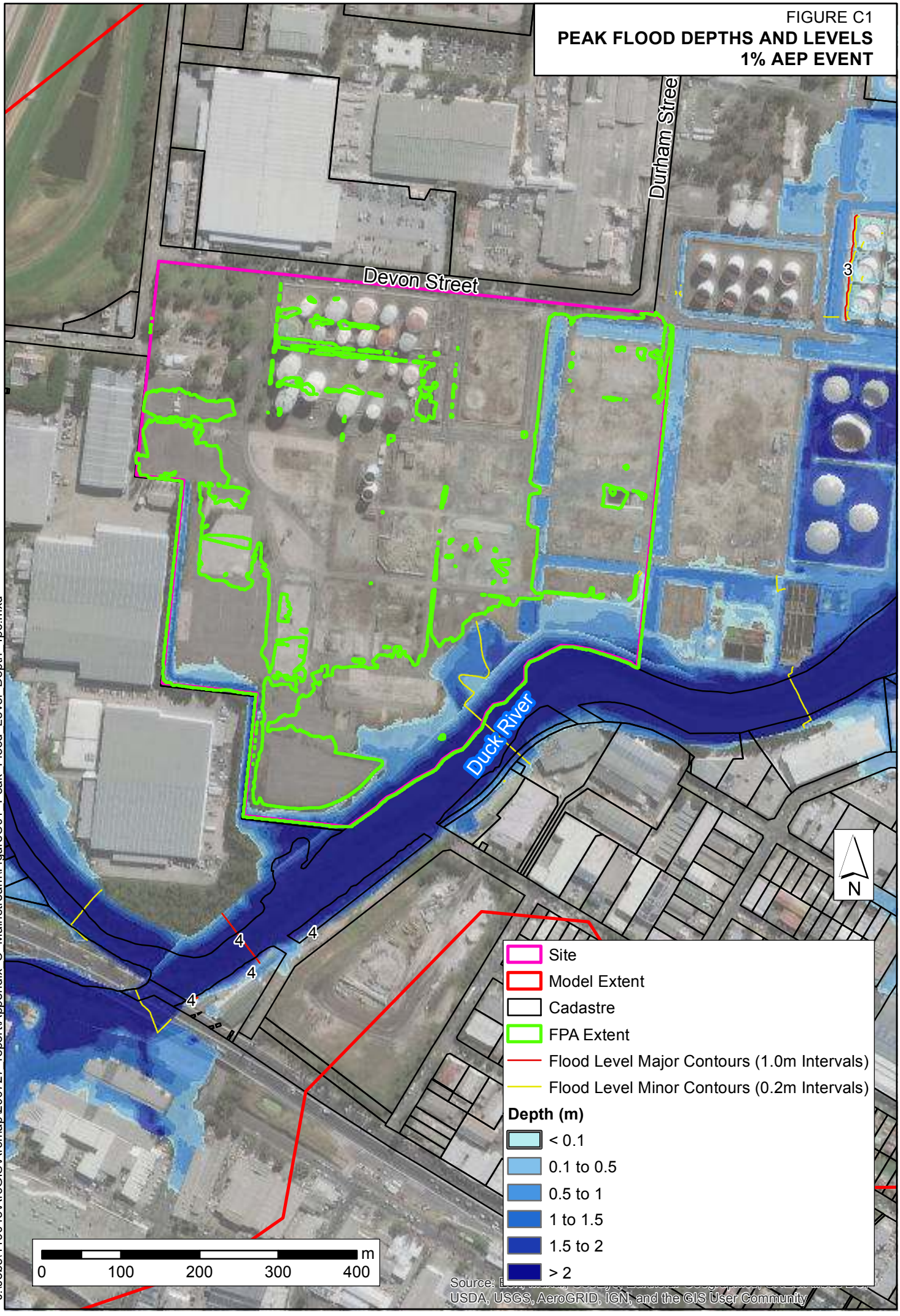
FIGURE B18B
VELOCITY HYDROGRAPHS
PMF EVENT OVERLAND FLOODING

Mainstream Flooding

Appendix C

FIGURE C1

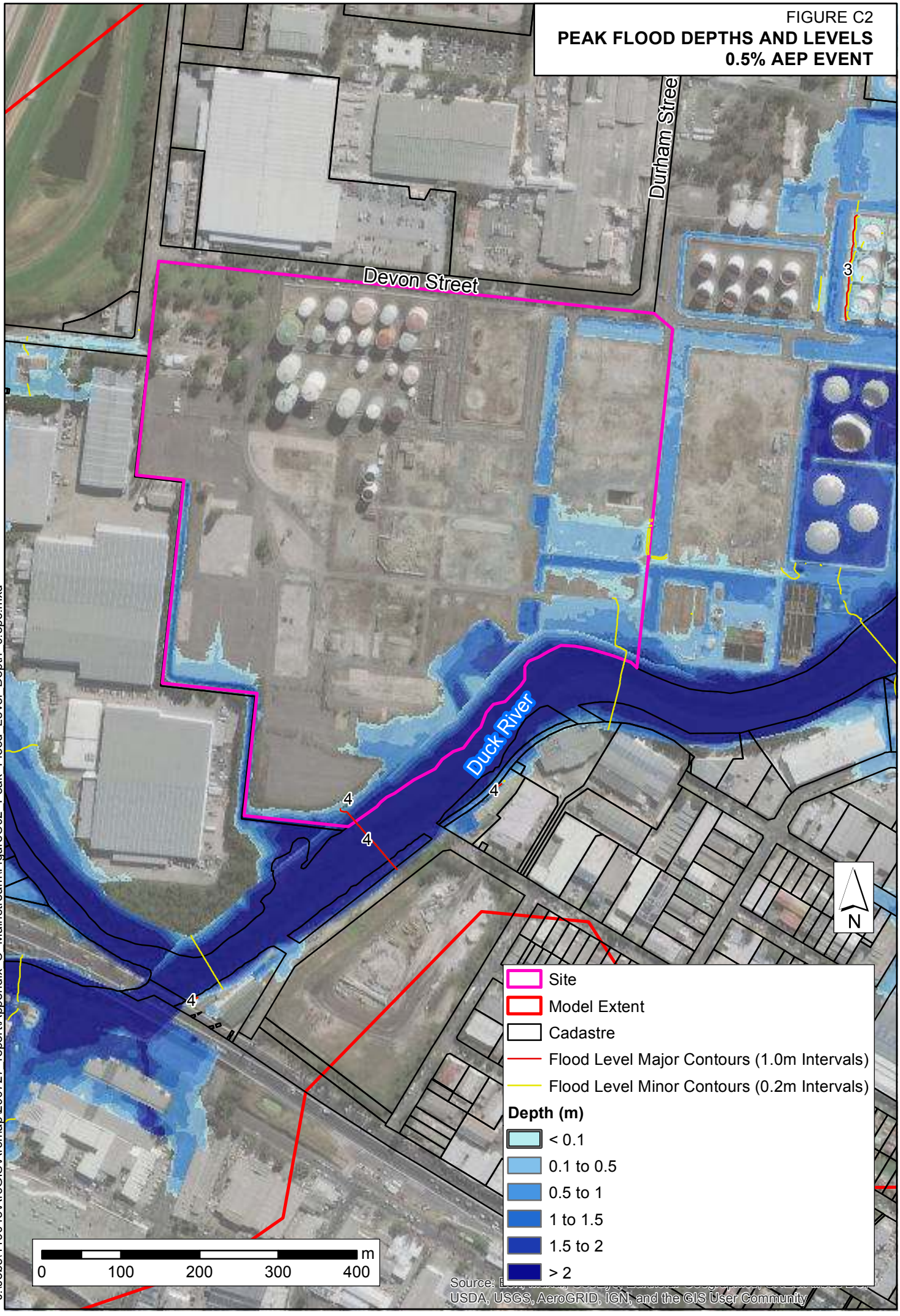
PEAK FLOOD DEPTHS AND LEVELS
1% AEP EVENT



J:\Jobs\119043\ArcGIS\Arcmap\200727_report\Appendix_C_Mainstream\FigureC01_Peak_Flood_Level_Depth_1pc.mxd

FIGURE C2

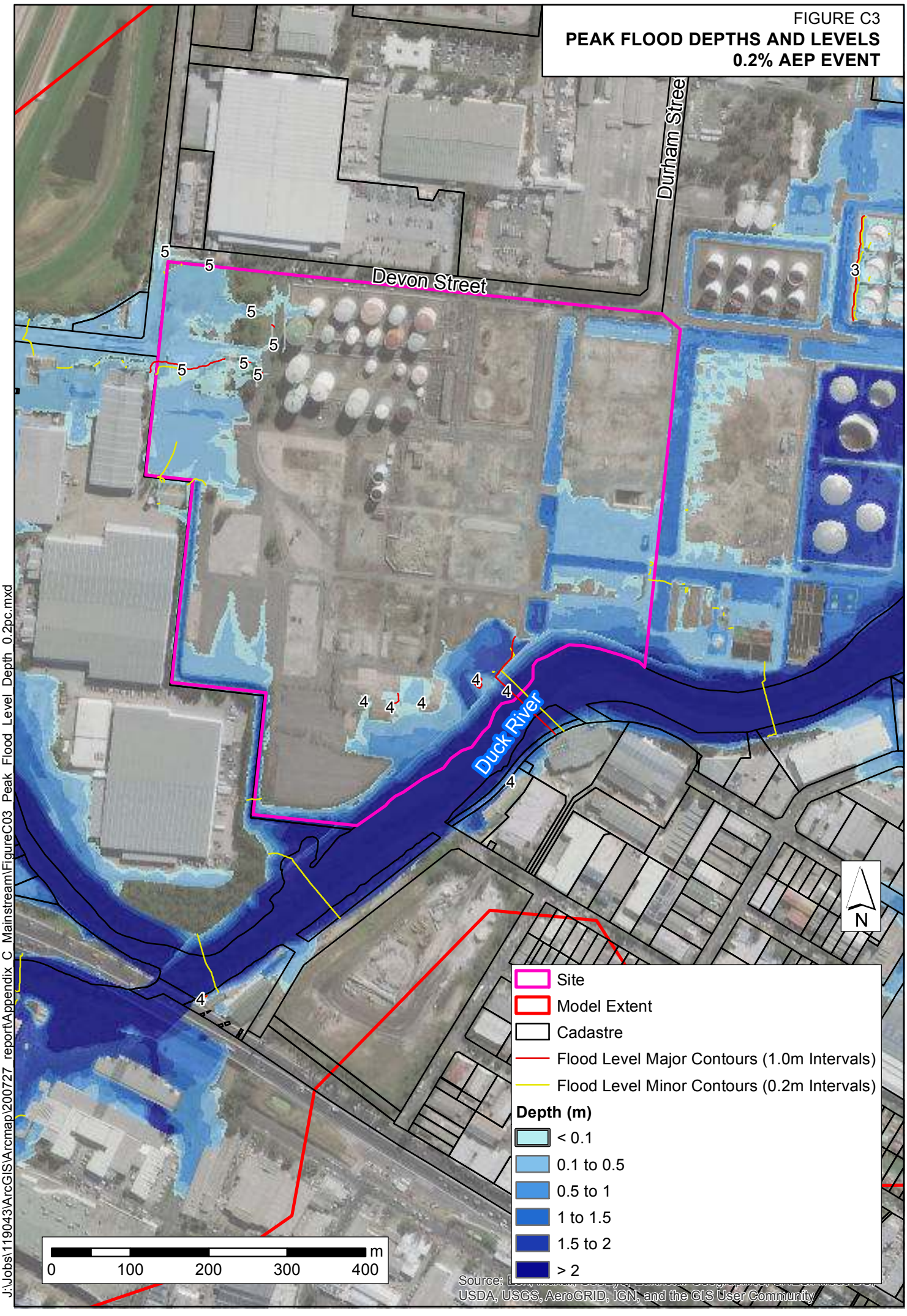
PEAK FLOOD DEPTHS AND LEVELS
0.5% AEP EVENT



J:\Jobs\119043\ArcGIS\Arcmap\200727_report\Appendix_C_Mainstream\FigureC02_Peak_Flood_Level_Depth_0.5pc.mxd

FIGURE C3

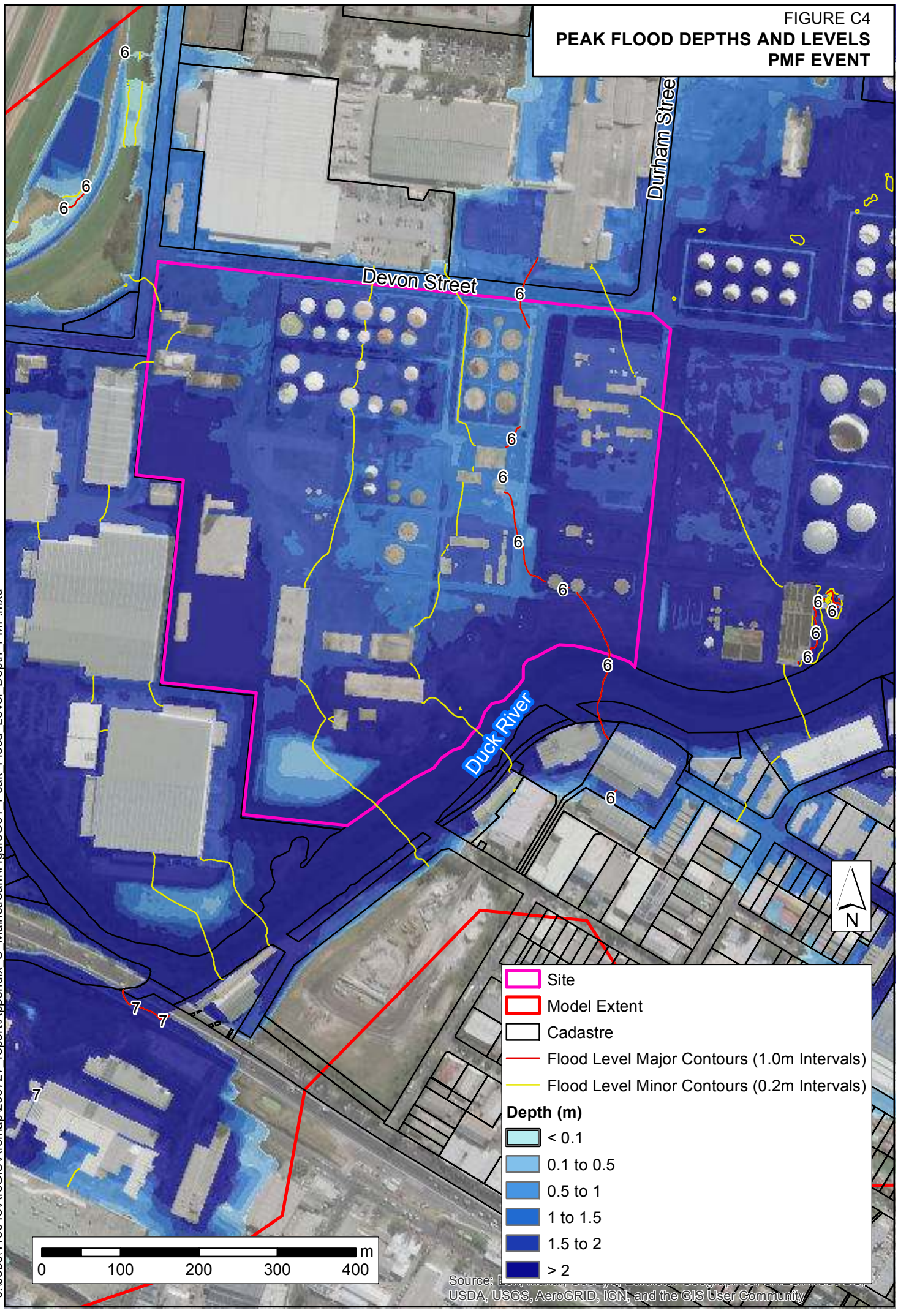
PEAK FLOOD DEPTHS AND LEVELS
0.2% AEP EVENT



J:\Jobs\119043\ArcGIS\Arcmap\200727_report\Appendix_C_Mainstream\FigureC03_Peak_Flood_Level_Depth_0.2pc.mxd

FIGURE C4

PEAK FLOOD DEPTHS AND LEVELS
PMF EVENT



J:\Jobs\119043\ArcGIS\Arcmap\200727_report\Appendix_C_Mainstream\FigureC04_Peak_Flood_Level_Depth_PMF.mxd

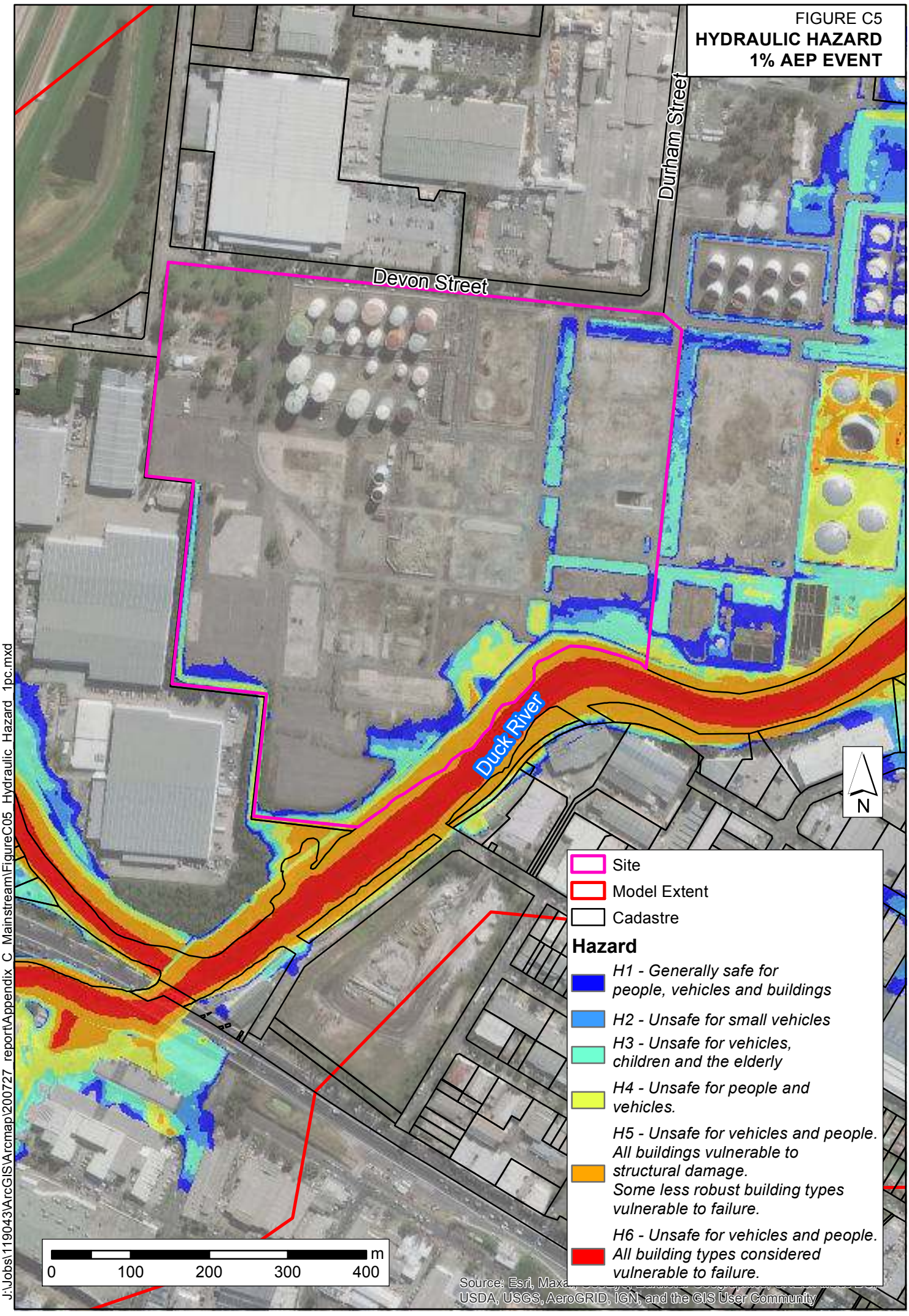


FIGURE C5
HYDRAULIC HAZARD
1% AEP EVENT
Durham Street
Devon Street
Duck River
N
Site
Model Extent
Cadastre
Hazard
H1 - Generally safe for people, vehicles and buildings
H2 - Unsafe for small vehicles
H3 - Unsafe for vehicles, children and the elderly
H4 - Unsafe for people and vehicles.
H5 - Unsafe for vehicles and people. All buildings vulnerable to structural damage. Some less robust building types vulnerable to failure.
H6 - Unsafe for vehicles and people. All building types considered vulnerable to failure.
0
100
200
300
400
m
Source: Esri, Maxar, Geo
USDA, USGS, AeroGRID, IGN, and the GIS User Community
J:\Jobs\119043\ArcGIS\Arcmap\200727_report\Appendix_C_Mainstream\FigureC05_Hydraulic_Hazard_1pc.mxd

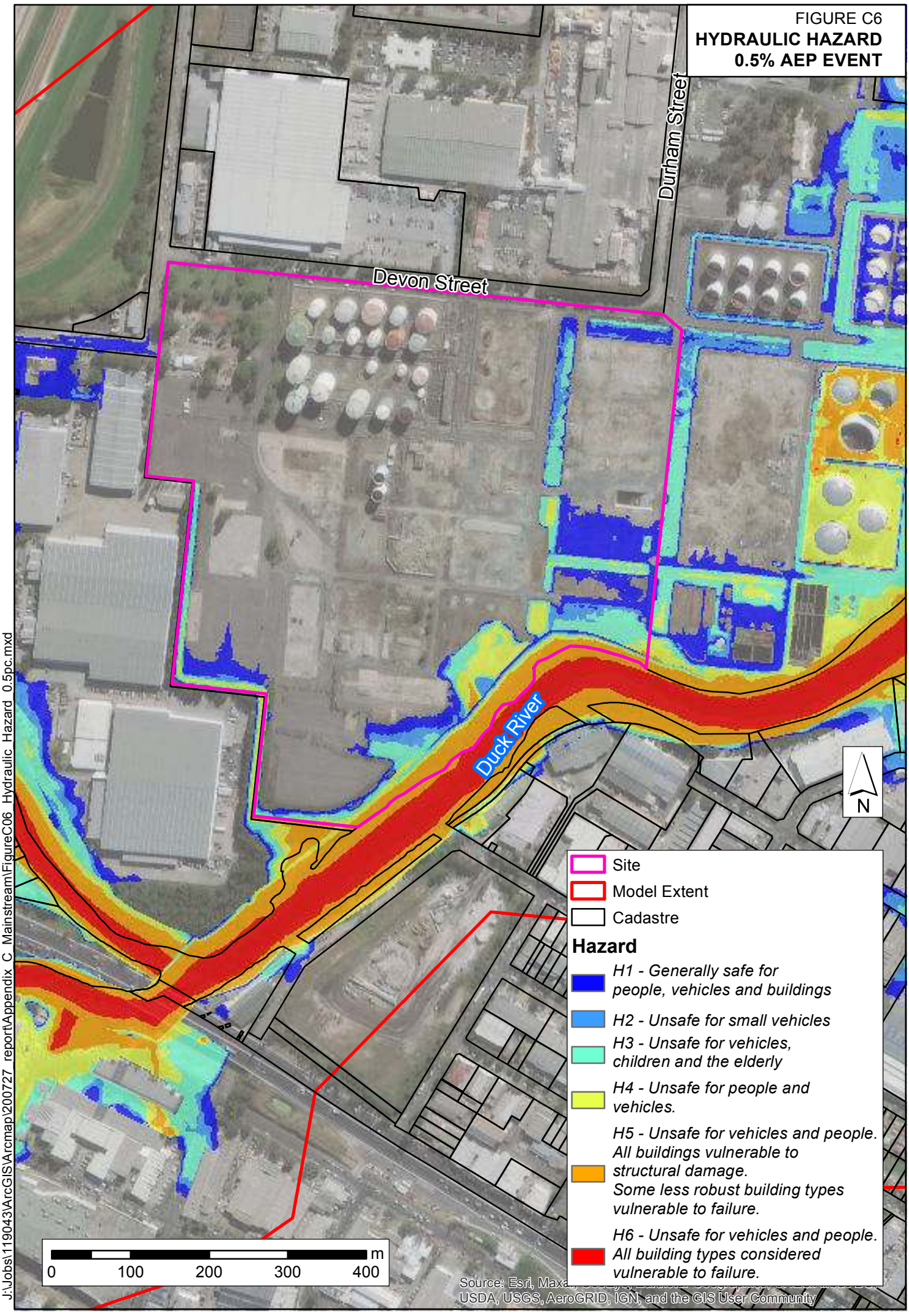


FIGURE C6
HYDRAULIC HAZARD
0.5% AEP EVENT
Durham Street
Devon Street
Duck River
N
Site
Model Extent
Cadastre
Hazard
H1 - Generally safe for people, vehicles and buildings
H2 - Unsafe for small vehicles
H3 - Unsafe for vehicles, children and the elderly
H4 - Unsafe for people and vehicles.
H5 - Unsafe for vehicles and people. All buildings vulnerable to structural damage. Some less robust building types vulnerable to failure.
H6 - Unsafe for vehicles and people. All building types considered vulnerable to failure.
0
100
200
300
400
m
Source: Esri, Maxar, Geo
USDA, USGS, AeroGRID, IGN, and the GIS User Community
J:\Jobs\119043\ArcGIS\Arcmap\200727_report\Appendix_C_Mainstream\FigureC06_Hydraulic_Hazard_0.5pc.mxd

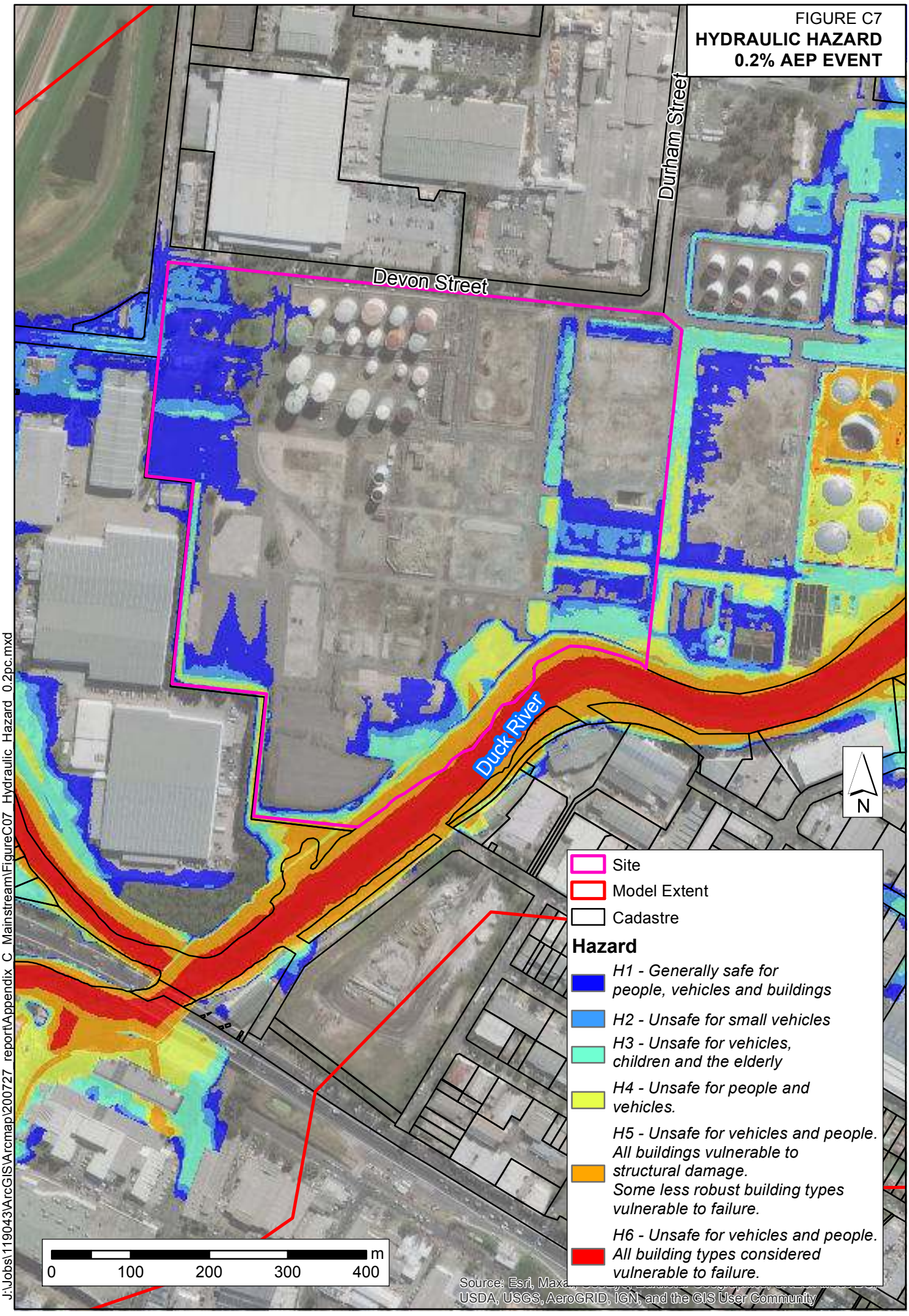
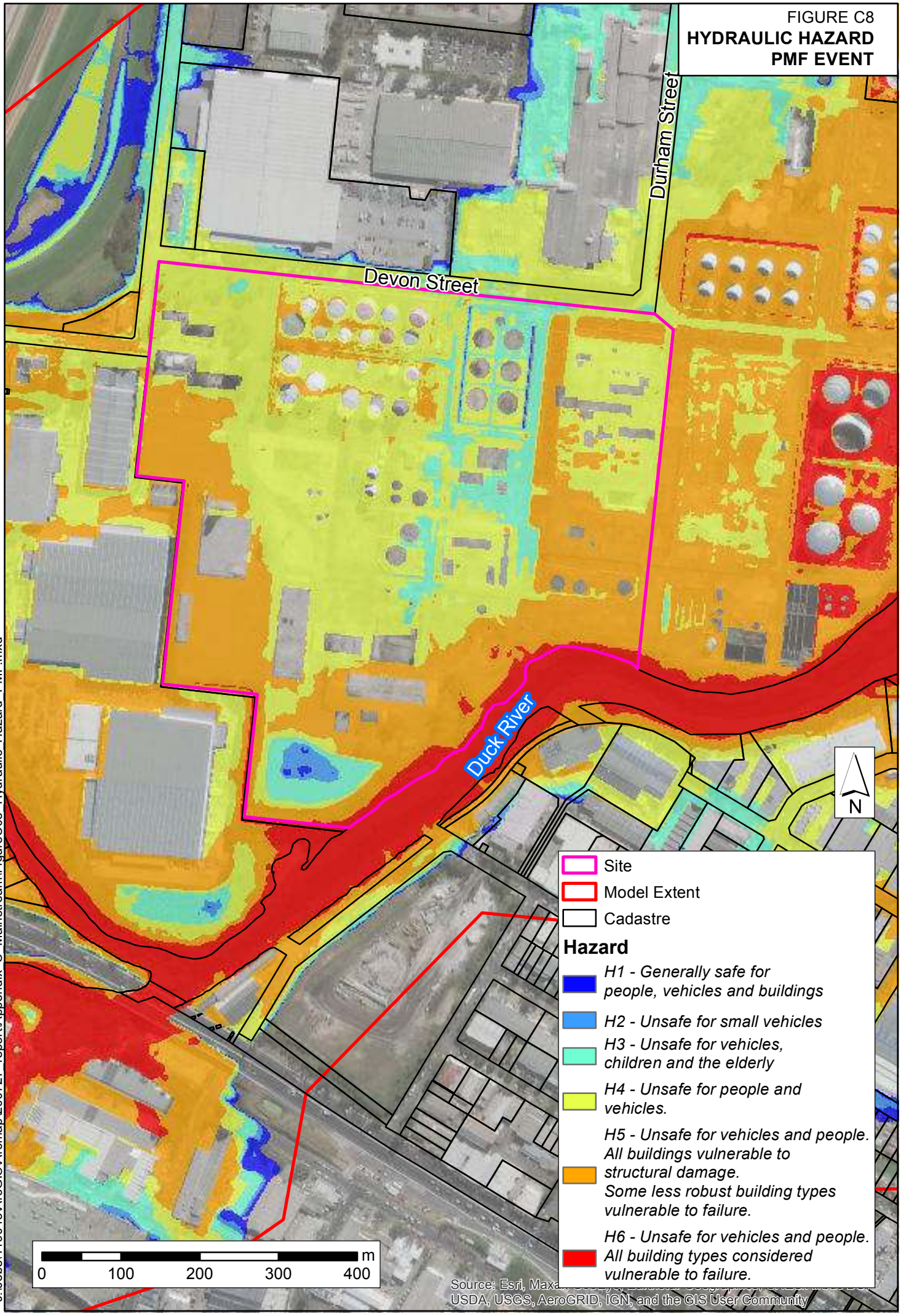


FIGURE C7
HYDRAULIC HAZARD
0.2% AEP EVENT
Durham Street
Devon Street
Duck River
N
Site
Model Extent
Cadastre
Hazard
H1 - Generally safe for people, vehicles and buildings
H2 - Unsafe for small vehicles
H3 - Unsafe for vehicles, children and the elderly
H4 - Unsafe for people and vehicles.
H5 - Unsafe for vehicles and people. All buildings vulnerable to structural damage. Some less robust building types vulnerable to failure.
H6 - Unsafe for vehicles and people. All building types considered vulnerable to failure.
0
100
200
300
400
m
Source: Esri, Maxar, USDA, USGS, AeroGRID, IGN, and the GIS User Community
J:\Jobs\119043\ArcGIS\Arcmap\200727_report\Appendix_C_Mainstream\FigureC07_Hydraulic_Hazard_0.2pc.mxd

FIGURE C8
HYDRAULIC HAZARD
PMF EVENT



J:\Jobs\119043\ArcGIS\Arcmap\200727_report\Appendix_C_Mainstream\FigureC08_Hydraulic_Hazard_PMF.mxd

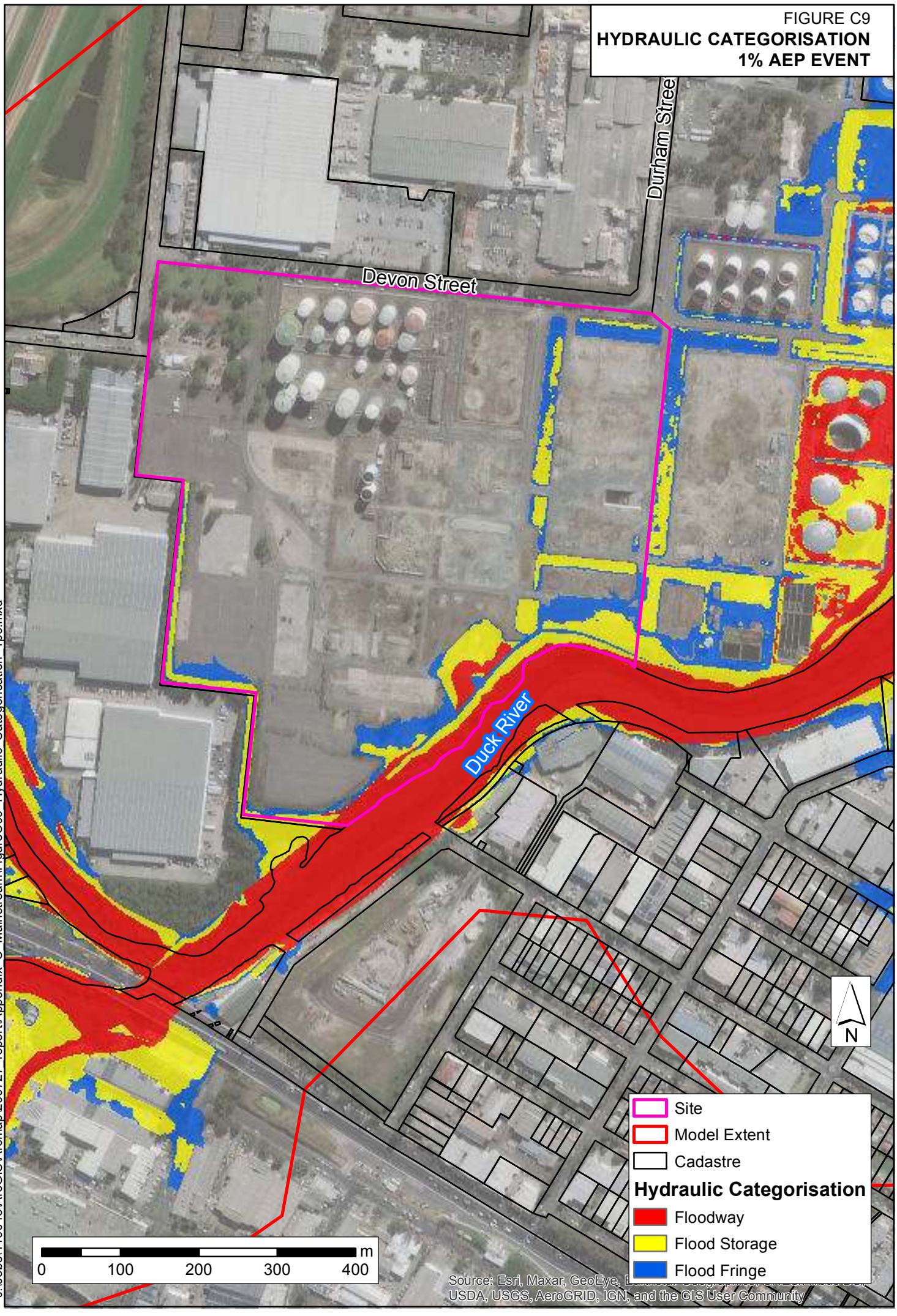


FIGURE C9
HYDRAULIC CATEGORISATION
1% AEP EVENT
Durham Stree
Devon Street
Duck River
N
Site
Model Extent
Cadastre
Hydraulic Categorisation
Floodway
Flood Storage
Flood Fringe
0
100
200
300
400
m
Source: Esri, Maxar, GeoEye,
USDA, USGS, AeroGRID, IGN, and the GIS User Community
J:\Jobs\119043\ArcGIS\Arcmap\200727_report\Appendix_C_Mainstream\FigureC09_Hydraulic_Categorisation_1pc.mxd

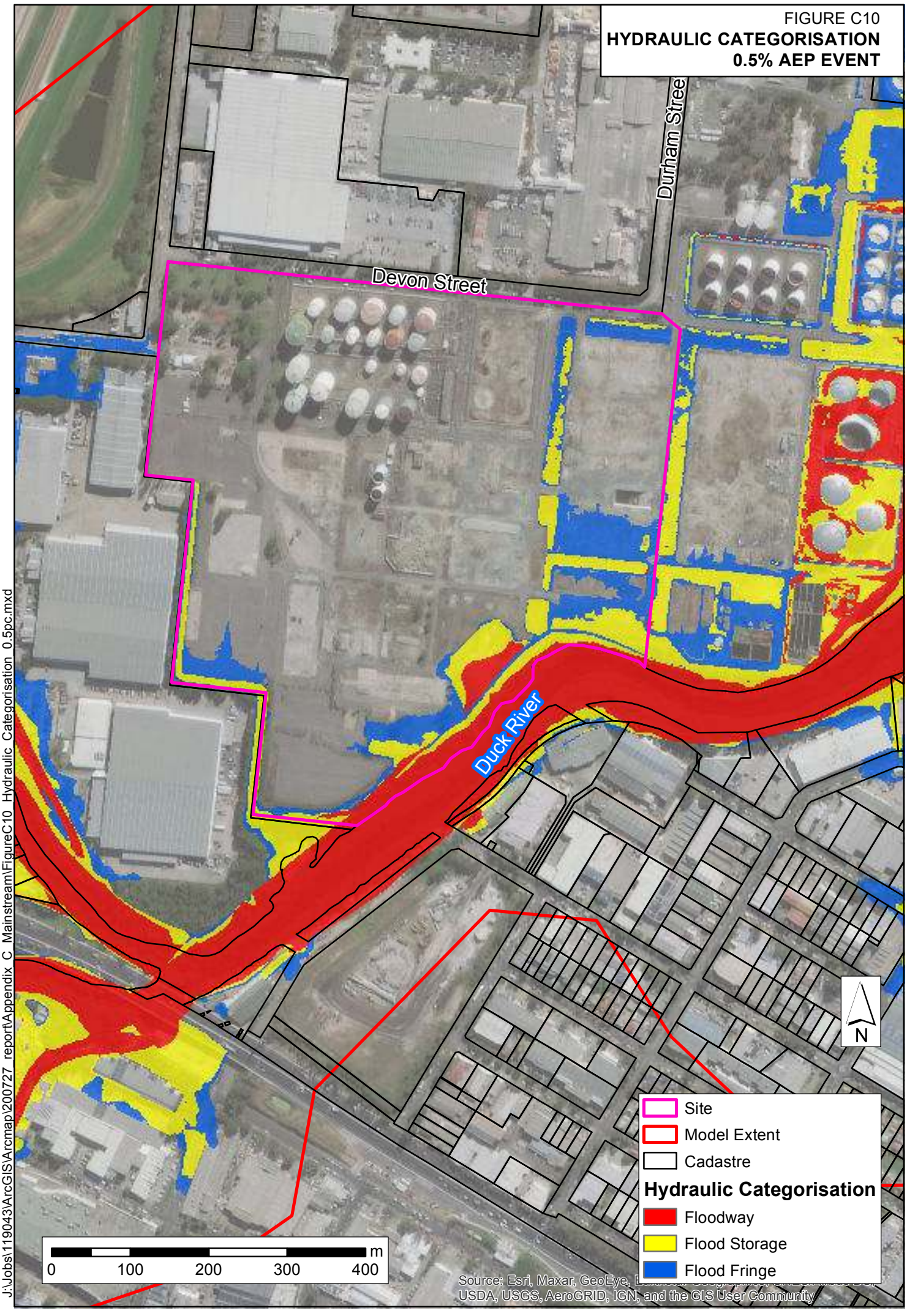


FIGURE C10
HYDRAULIC CATEGORISATION
0.5% AEP EVENT
Devon Street
Durham Stree
Duck River
N
Site
Model Extent
Cadastre
Hydraulic Categorisation
Floodway
Flood Storage
Flood Fringe
0
100
200
300
400
m
Source: Esri, Maxar, GeoEye,
USDA, USGS, AeroGRID, IGN, and the GIS User Community
J:\Jobs\119043\ArcGIS\Arcmap\200727_report\Appendix_C_Mainstream\FigureC10_Hydraulic_Categorisation_0.5pc.mxd

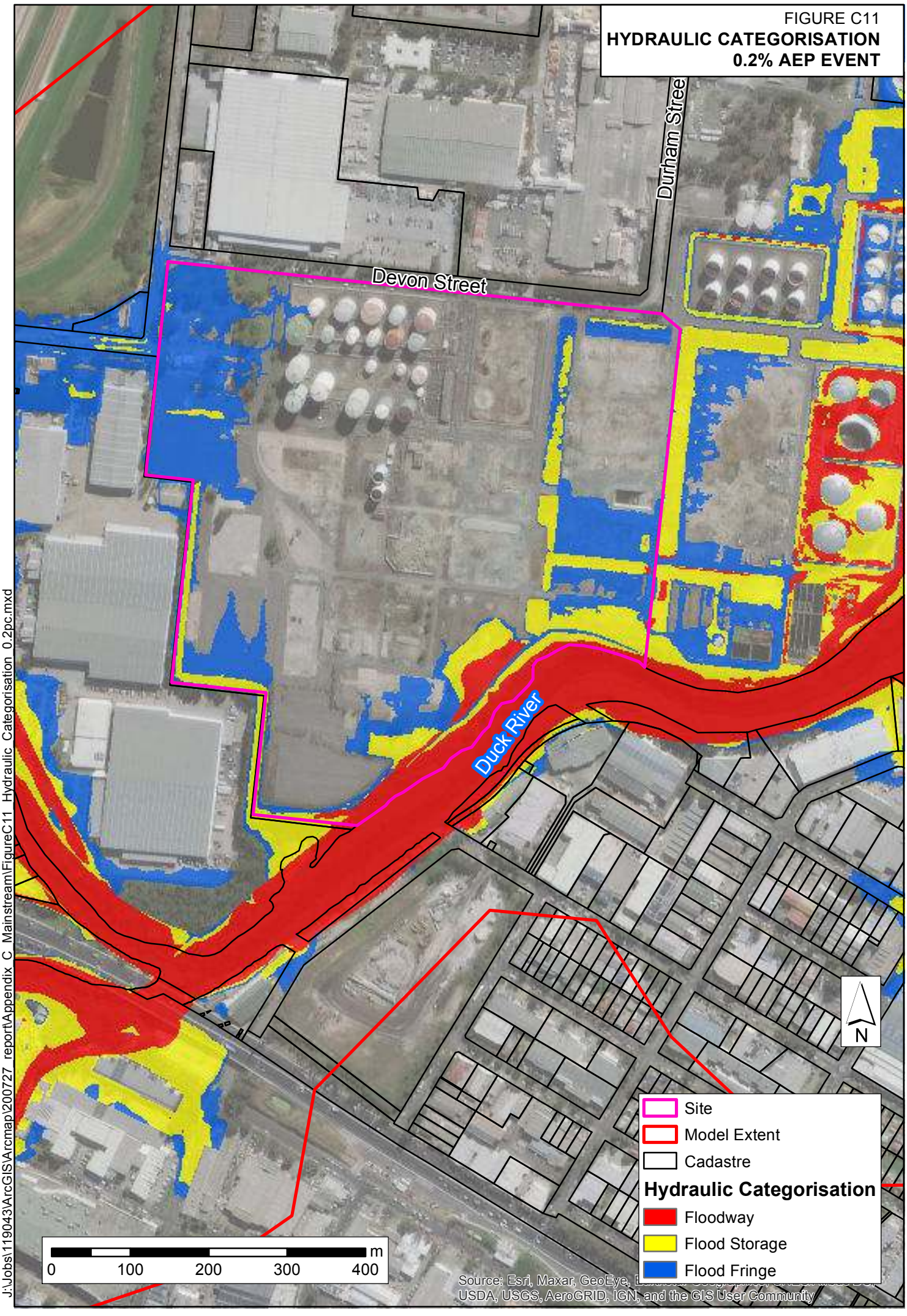


FIGURE C11
HYDRAULIC CATEGORISATION
0.2% AEP EVENT
Durham Stree
Devon Street
Duck River
N
Site
Model Extent
Cadastre
Hydraulic Categorisation
Floodway
Flood Storage
Flood Fringe
0
100
200
300
400
m
Source: Esri, Maxar, GeoEye,
USDA, USGS, AeroGRID, IGN, and the GIS User Community
J:\Jobs\119043\ArcGIS\Arcmap\200727_report\Appendix_C_Mainstream\FigureC11_Hydraulic_Categorisation_0.2pc.mxd

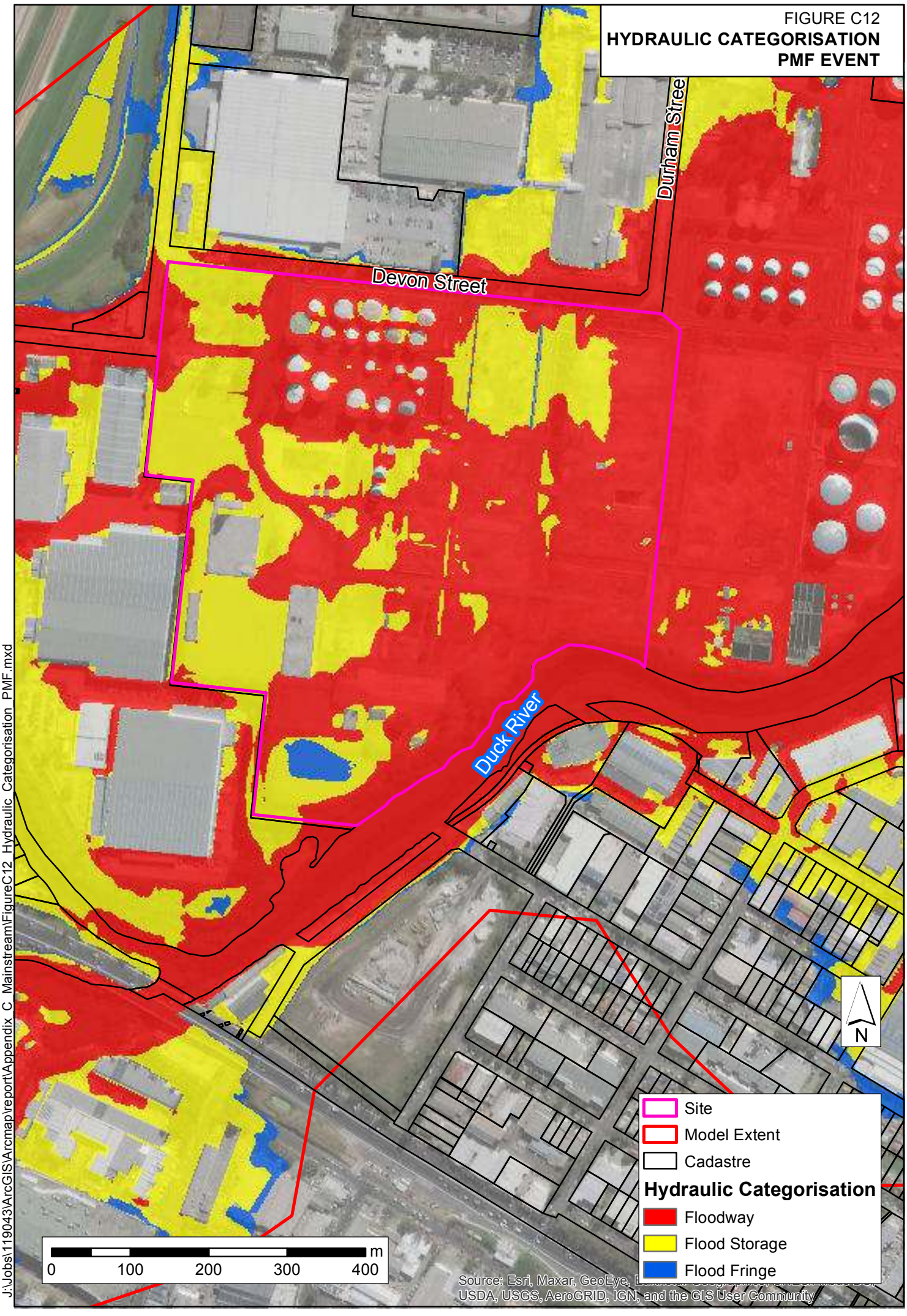


FIGURE C12
HYDRAULIC CATEGORISATION
PMF EVENT
Devon Street
Durham Stree
Duck River
N
Site
Model Extent
Cadastre
Hydraulic Categorisation
Floodway
Flood Storage
Flood Fringe
0
100
200
300
400
m
Source: Esri, Maxar, GeoEye,
USDA, USGS, AeroGRID, IGN, and the GIS User Community
J:\Jobs\119043\ArcGIS\Arcmap\report\Appendix_C_Mainstream\FigureC12_Hydraulic_Categorisation_PMF.mxd

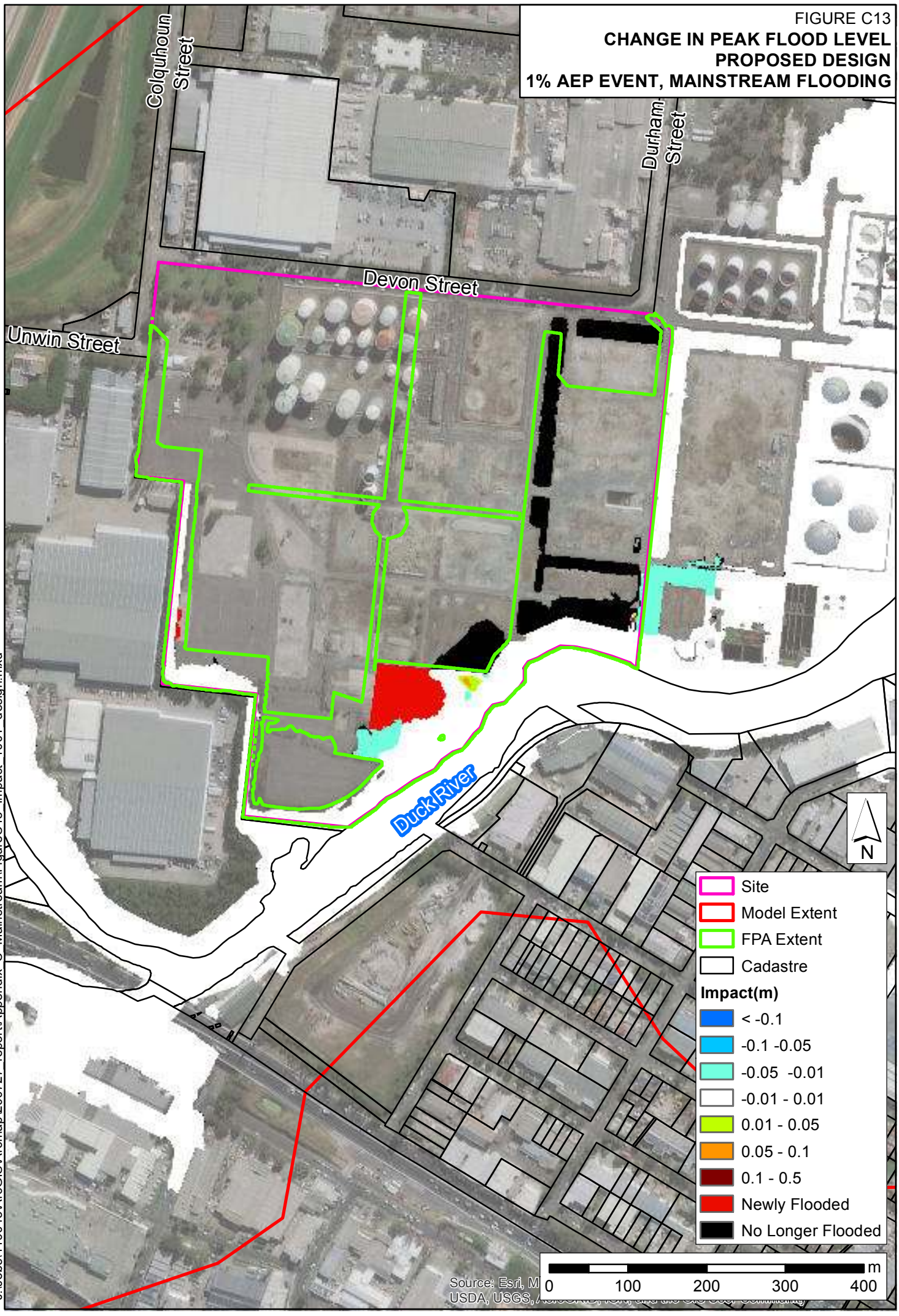


FIGURE C13
CHANGE IN PEAK FLOOD LEVEL
PROPOSED DESIGN
1% AEP EVENT, MAINSTREAM FLOODING
Colquhoun Street
Durham Street
Devon Street
Unwin Street
Duck River
N
Site
Model Extent
FPA Extent
Cadastre
Impact(m)
< -0.1
-0.1 -0.05
-0.05 -0.01
-0.01 - 0.01
0.01 - 0.05
0.05 - 0.1
0.1 - 0.5
Newly Flooded
No Longer Flooded
0
100
200
300
400
m
Source: Esri, M
USDA, USGS,
J:\Jobs\119043\ArcGIS\Arcmap\200727_report\Appendix_C_Mainstream\FigureC13_Impact_100Y_design.mxd

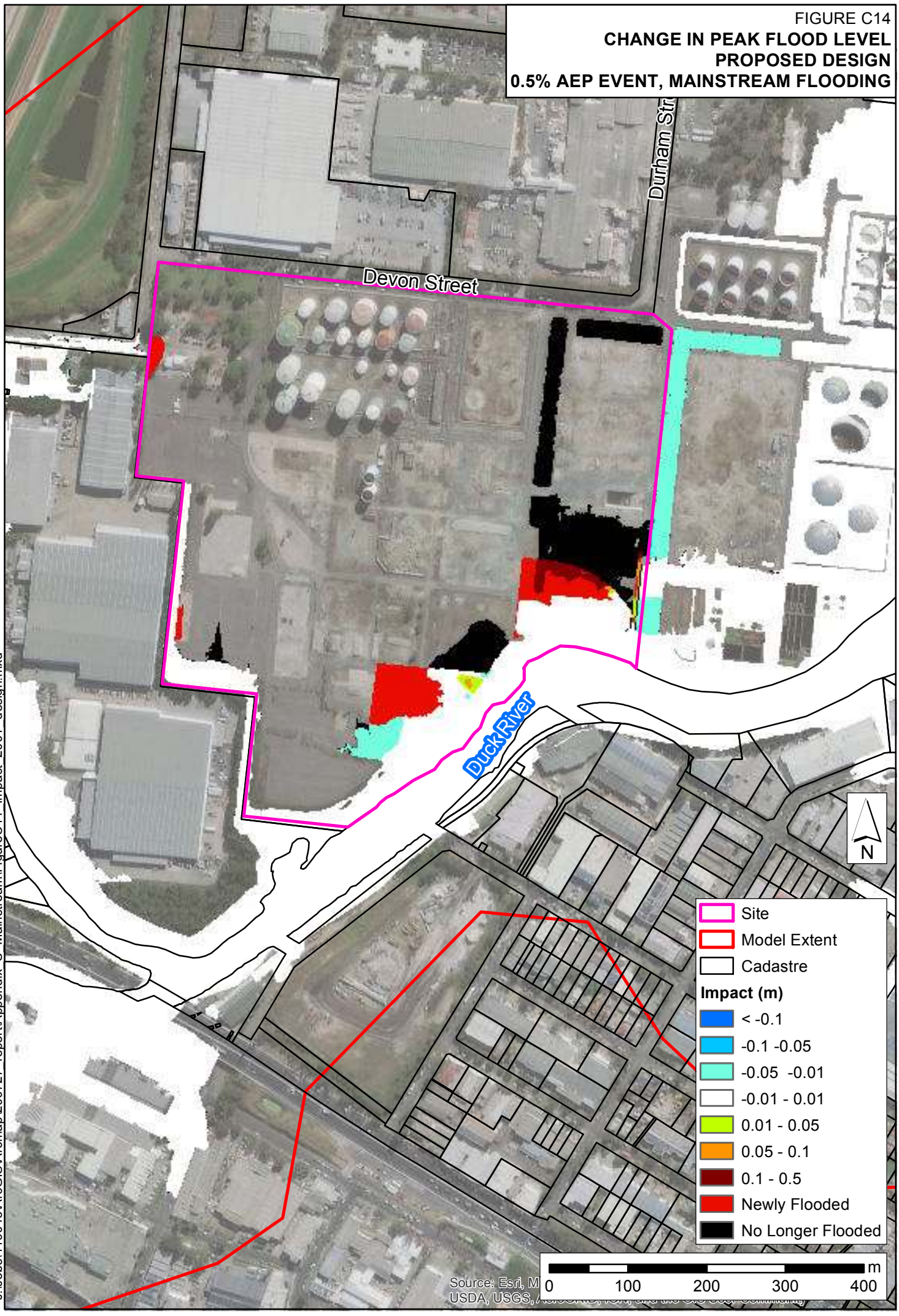
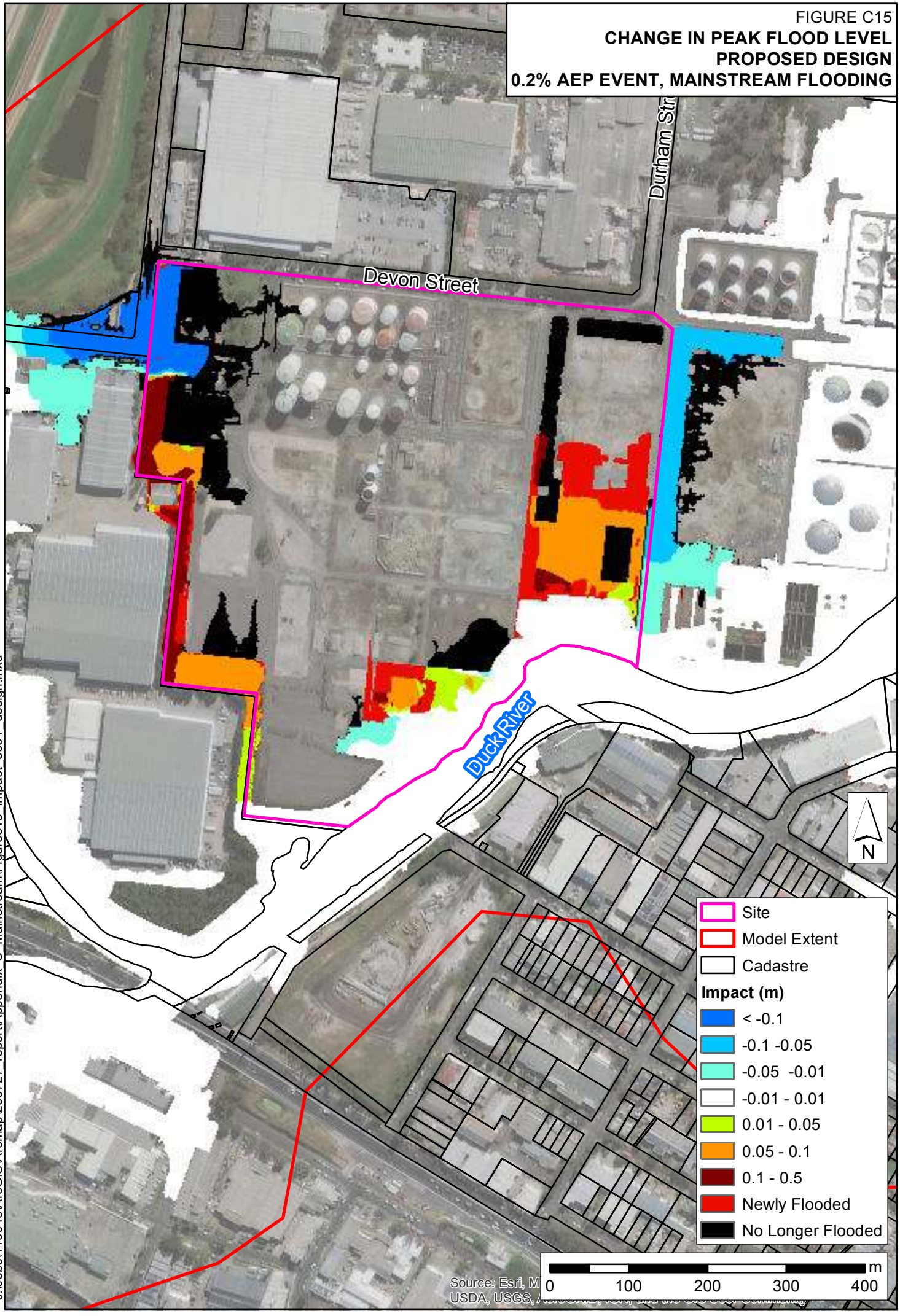


FIGURE C14
CHANGE IN PEAK FLOOD LEVEL
PROPOSED DESIGN
0.5% AEP EVENT, MAINSTREAM FLOODING
Devon Street
Durham Str
Duck River
N
Site
Model Extent
Cadastre
Impact (m)
< -0.1
-0.1 -0.05
-0.05 -0.01
-0.01 - 0.01
0.01 - 0.05
0.05 - 0.1
0.1 - 0.5
Newly Flooded
No Longer Flooded
0
100
200
300
400
m
Source: Esri, M
USDA, USGS,
J:\Jobs\119043\ArcGIS\Arcmap\200727_report\Appendix_C_Mainstream\FigureC14_Impact_200Y_design.mxd

FIGURE C15

CHANGE IN PEAK FLOOD LEVEL
PROPOSED DESIGN
0.2% AEP EVENT, MAINSTREAM FLOODING



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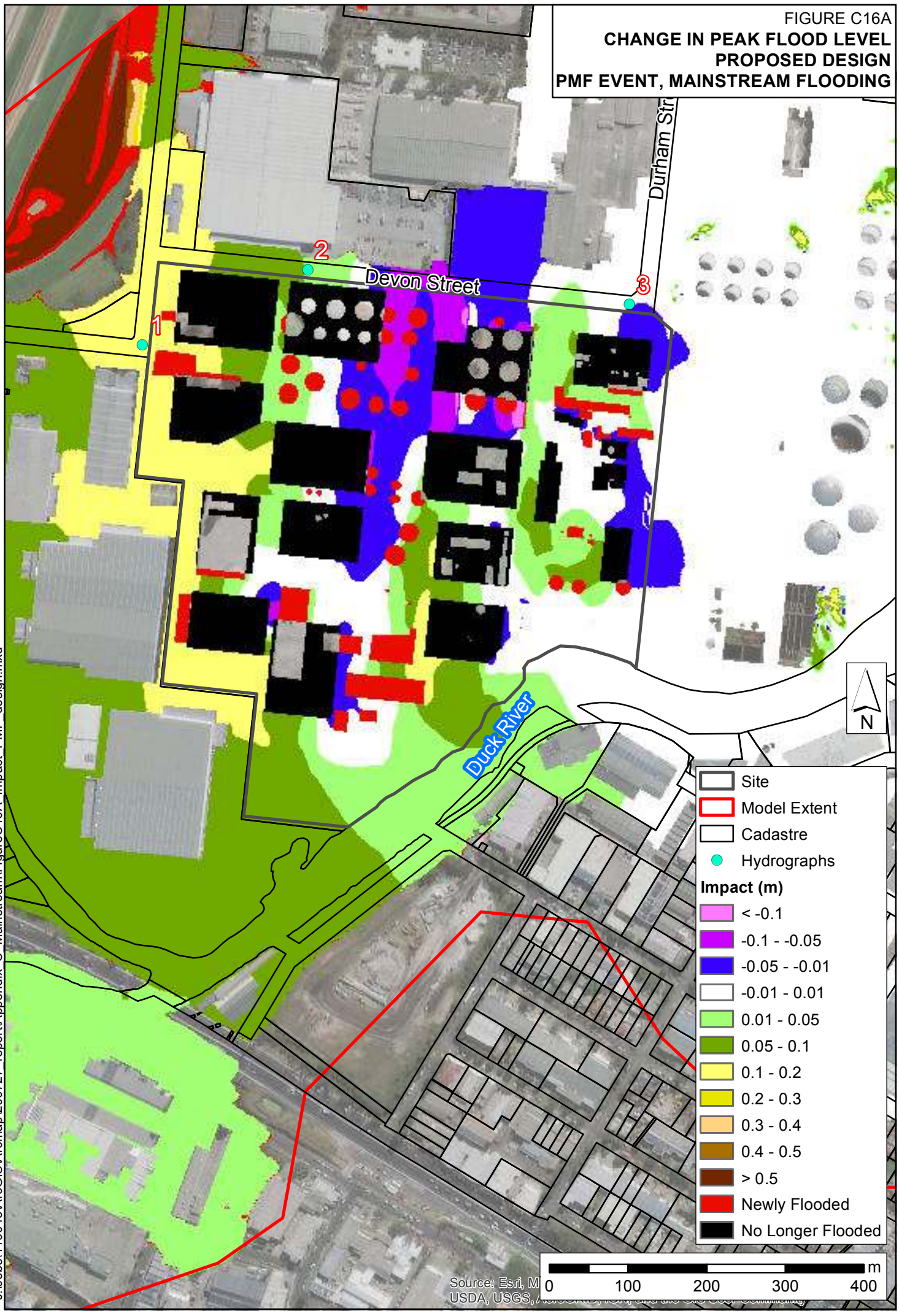
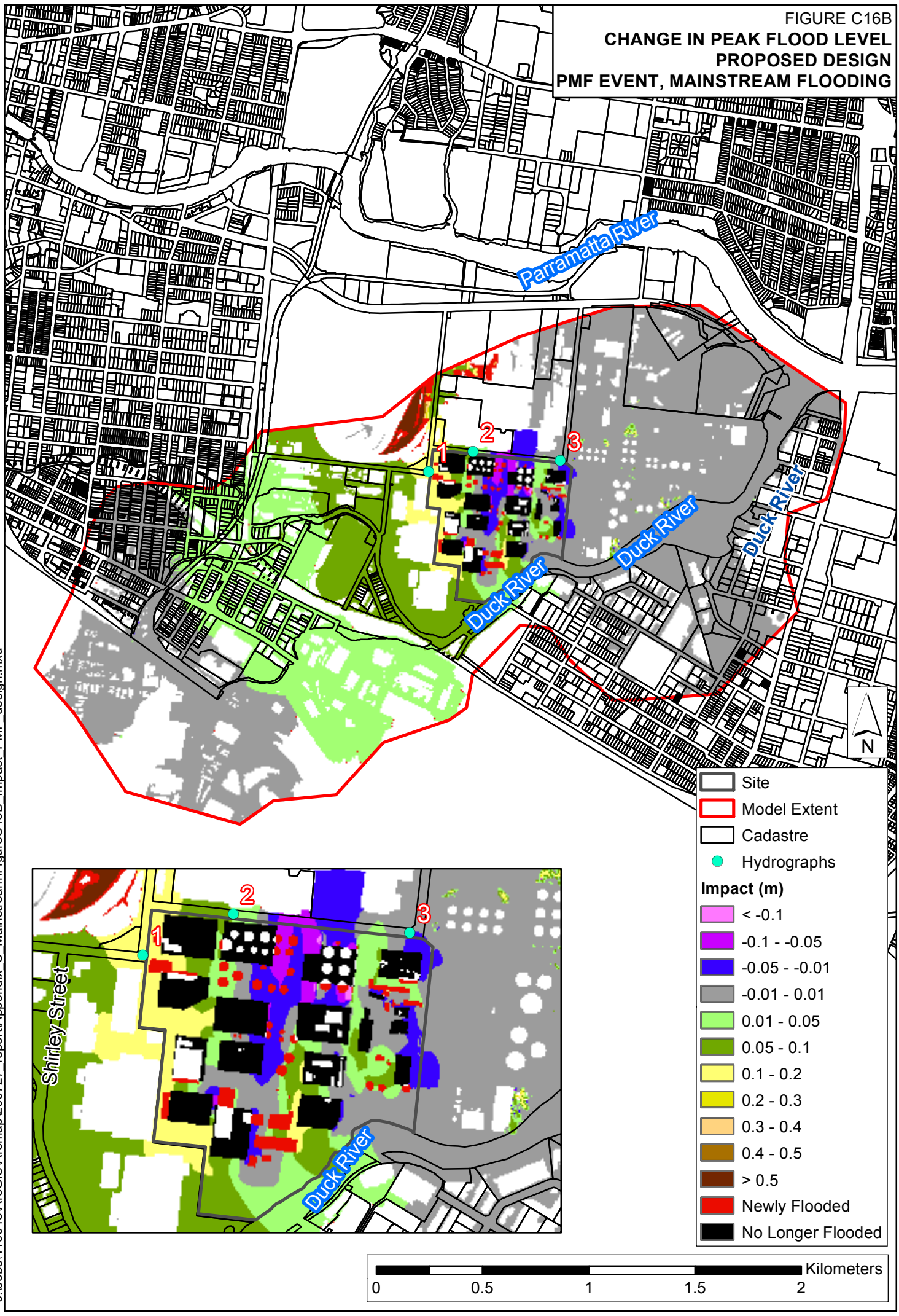


FIGURE C16A
CHANGE IN PEAK FLOOD LEVEL
PROPOSED DESIGN
PMF EVENT, MAINSTREAM FLOODING
Devon Street
Durham Str
Duck River
1
2
3
N
Site
Model Extent
Cadastre
Hydrographs
Impact (m)
< -0.1
-0.1 - -0.05
-0.05 - -0.01
-0.01 - 0.01
0.01 - 0.05
0.05 - 0.1
0.1 - 0.2
0.2 - 0.3
0.3 - 0.4
0.4 - 0.5
> 0.5
Newly Flooded
No Longer Flooded
0
100
200
300
400
m
Source: Esri, M
USDA, USGS,
J:\Jobs\119043\ArcGIS\Arcmap\200727_report\Appendix_C_Mainstream\FigureC16A_Impact_PMF_design.mxd

FIGURE C16B

CHANGE IN PEAK FLOOD LEVEL
PROPOSED DESIGN
PMF EVENT, MAINSTREAM FLOODING



J:\Jobs\119043\ArcGIS\Arcmap\200727_report\Appendix_C_Mainstream\FigureC16B_Impact_PMF_design.mxd

J:\Jobs\119043\Excel\Hydrograph\119043_Redistributed_Flow_revised.xlsx

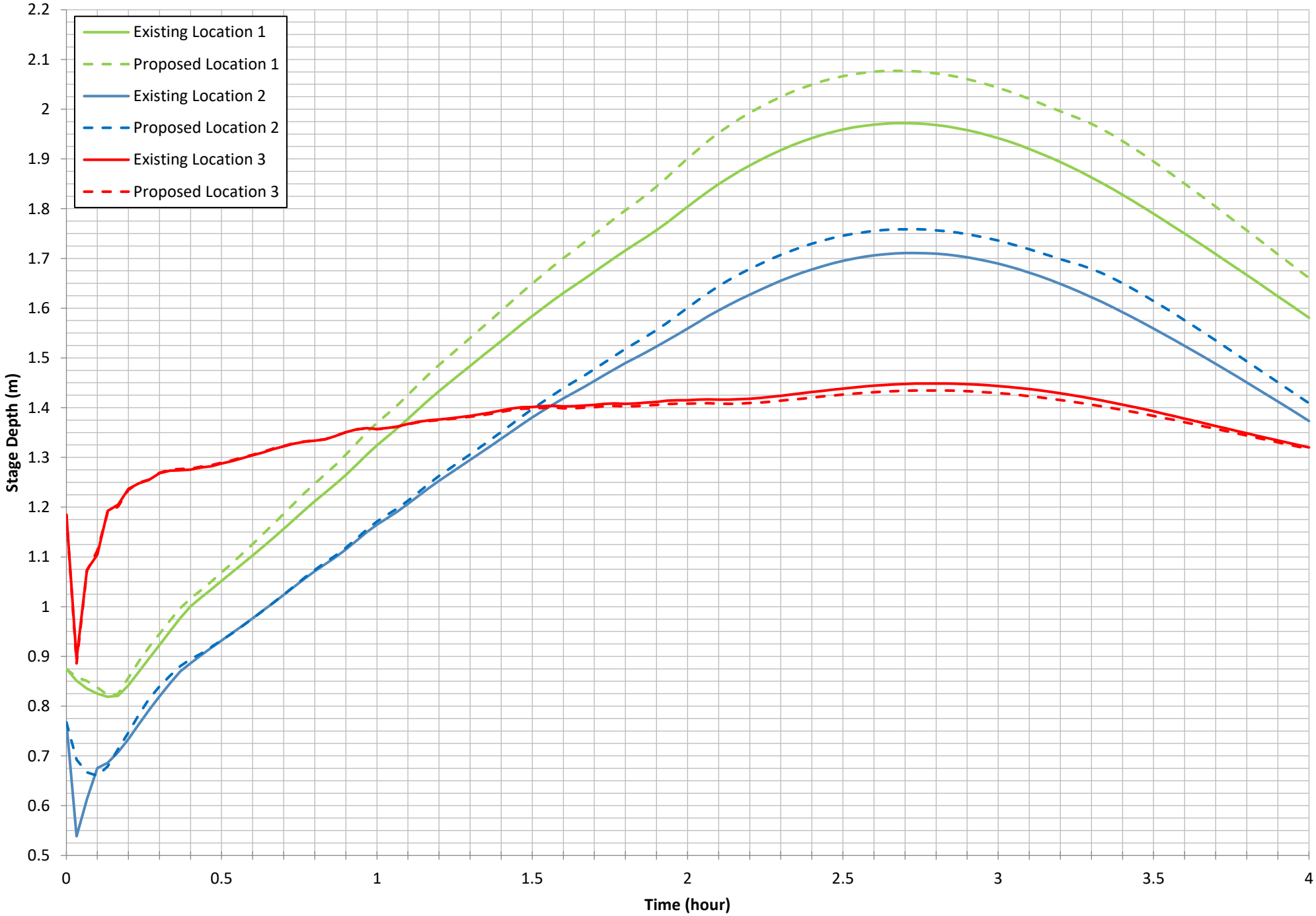


FIGURE C17A
STAGE HYDROGRAPHS
PMF EVENT MAINSTREAM FLOODING

J:\Jobs\119043\Excel\Hydrograph\119043_Redistributed_Flow_revised.xlsx

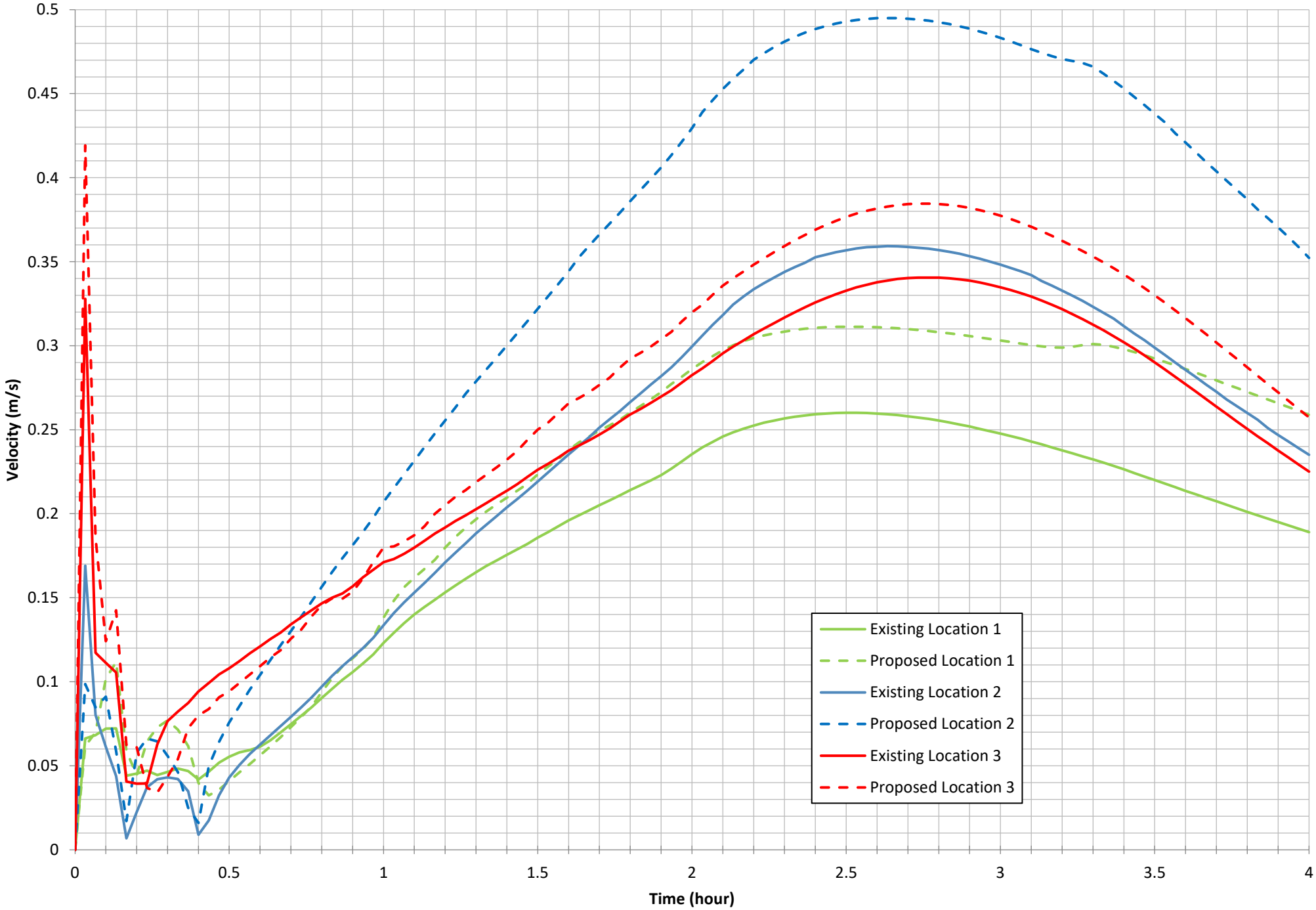


FIGURE C17B
VELOCITY HYDROGRAPHS
PMF EVENT MAINSTREAM FLOODING

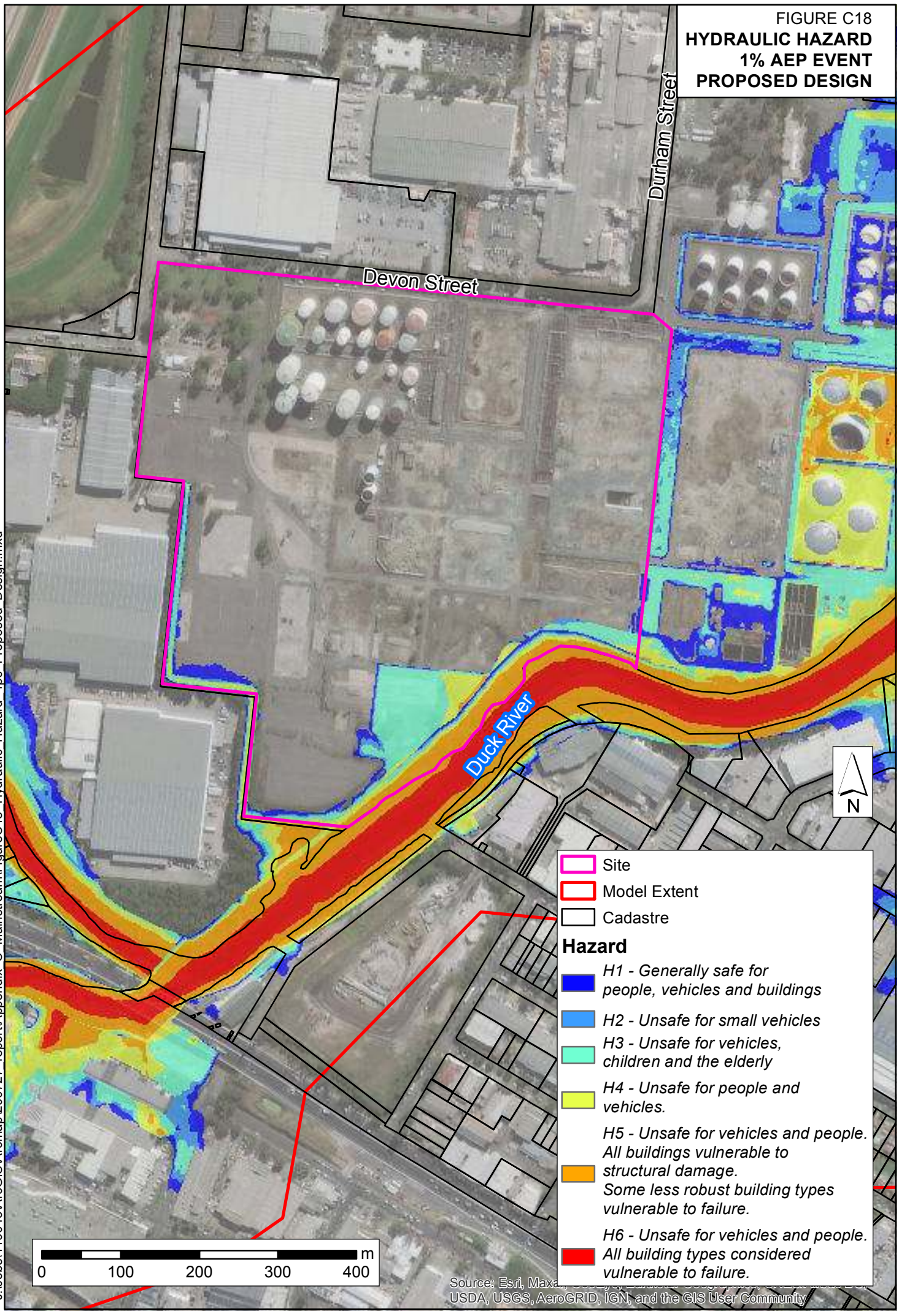


FIGURE C18
HYDRAULIC HAZARD
1% AEP EVENT
PROPOSED DESIGN
Durham Street
Devon Street
Duck River
N
Site
Model Extent
Cadastre
Hazard
H1 - Generally safe for people, vehicles and buildings
H2 - Unsafe for small vehicles
H3 - Unsafe for vehicles, children and the elderly
H4 - Unsafe for people and vehicles.
H5 - Unsafe for vehicles and people. All buildings vulnerable to structural damage. Some less robust building types vulnerable to failure.
H6 - Unsafe for vehicles and people. All building types considered vulnerable to failure.
0
100
200
300
400
m
Source: Esri, Maxar, Geo
USDA, USGS, AeroGRID, IGN, and the GIS User Community
J:\Jobs\119043\ArcGIS\Arcmap\200727_report\Appendix_C_Mainstream\FigureC18_Hydraulic_Hazard_1pc_Proposed_Design.mxd

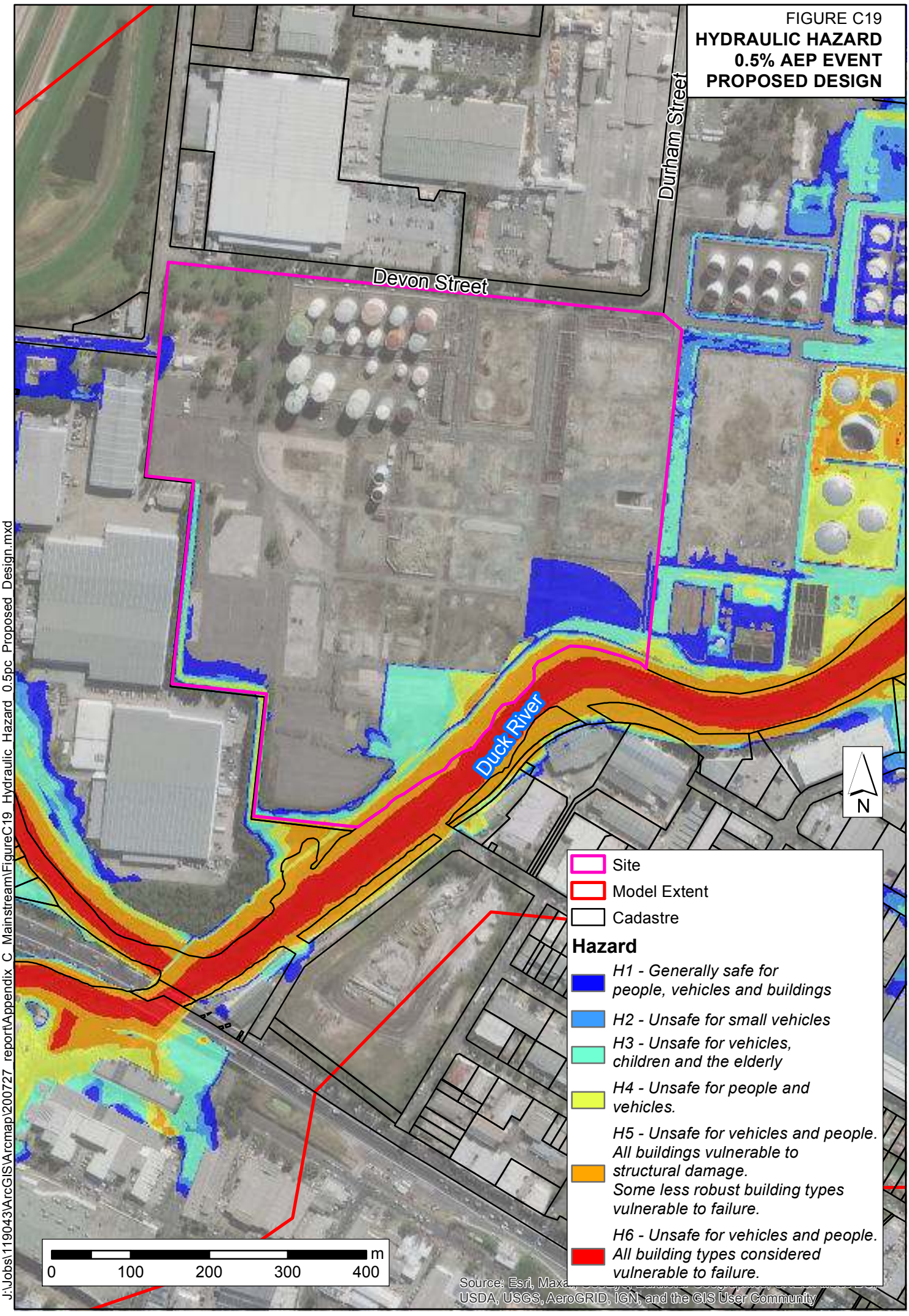


FIGURE C19
HYDRAULIC HAZARD
0.5% AEP EVENT
PROPOSED DESIGN
Durham Street
Devon Street
Duck River
N
Site
Model Extent
Cadastre
Hazard
H1 - Generally safe for people, vehicles and buildings
H2 - Unsafe for small vehicles
H3 - Unsafe for vehicles, children and the elderly
H4 - Unsafe for people and vehicles.
H5 - Unsafe for vehicles and people. All buildings vulnerable to structural damage. Some less robust building types vulnerable to failure.
H6 - Unsafe for vehicles and people. All building types considered vulnerable to failure.
0
100
200
300
400
m
Source: Esri, Maxar, USDA, USGS, AeroGRID, IGN, and the GIS User Community
J:\Jobs\119043\ArcGIS\Arcmap\200727_report\Appendix_C_Mainstream\FigureC19_Hydraulic_Hazard_0.5pc_Proposed_Design.mxd

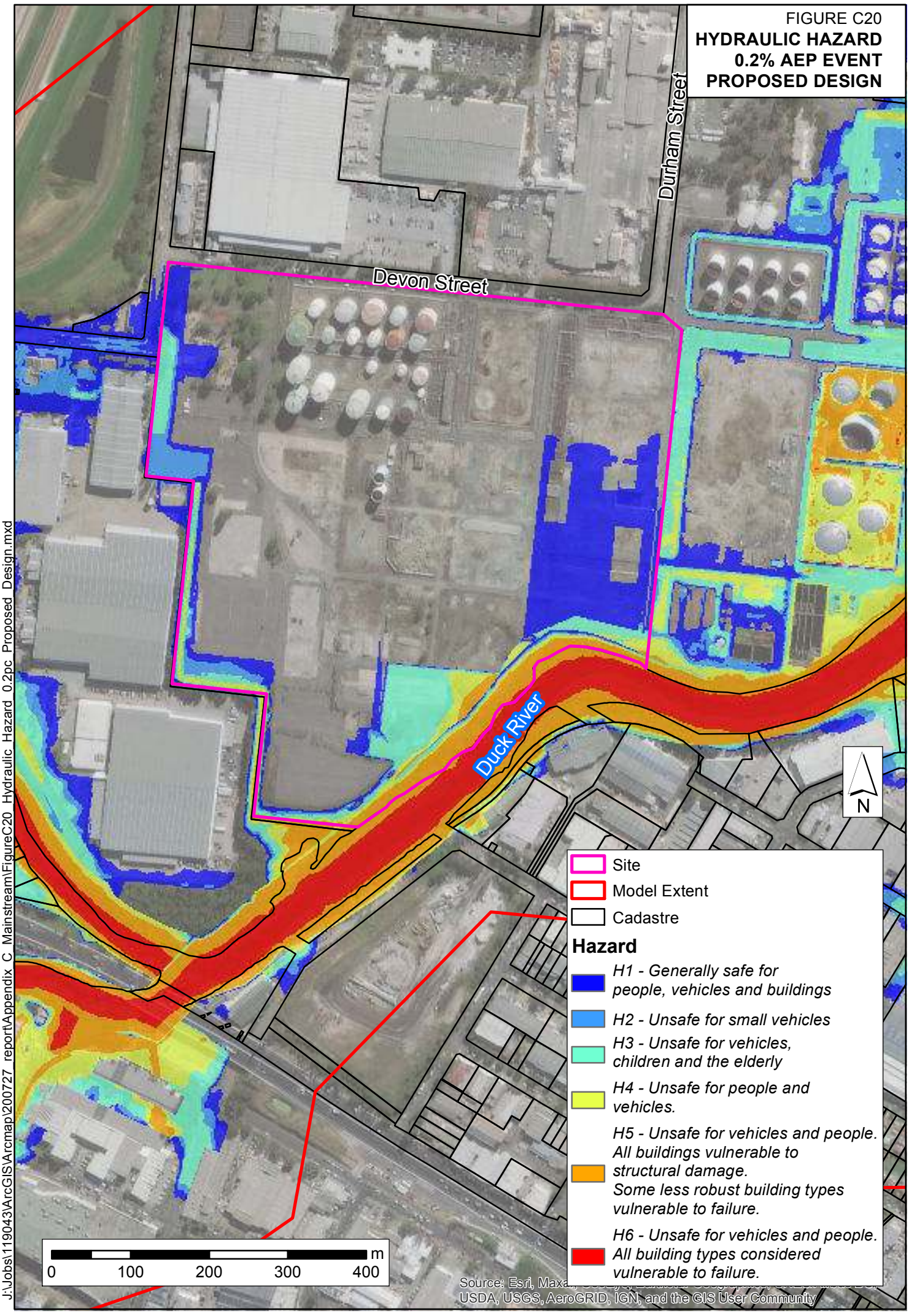


FIGURE C20
HYDRAULIC HAZARD
0.2% AEP EVENT
PROPOSED DESIGN
Durham Street
Devon Street
Duck River
N
Site
Model Extent
Cadastre
Hazard
H1 - Generally safe for people, vehicles and buildings
H2 - Unsafe for small vehicles
H3 - Unsafe for vehicles, children and the elderly
H4 - Unsafe for people and vehicles.
H5 - Unsafe for vehicles and people. All buildings vulnerable to structural damage. Some less robust building types vulnerable to failure.
H6 - Unsafe for vehicles and people. All building types considered vulnerable to failure.
0
100
200
300
400
m
Source: Esri, Maxar, USDA, USGS, AeroGRID, IGN, and the GIS User Community
J:\Jobs\119043\ArcGIS\Arcmap\200727_report\Appendix_C_Mainstream\FigureC20_Hydraulic_Hazard_0.2pc_Proposed_Design.mxd

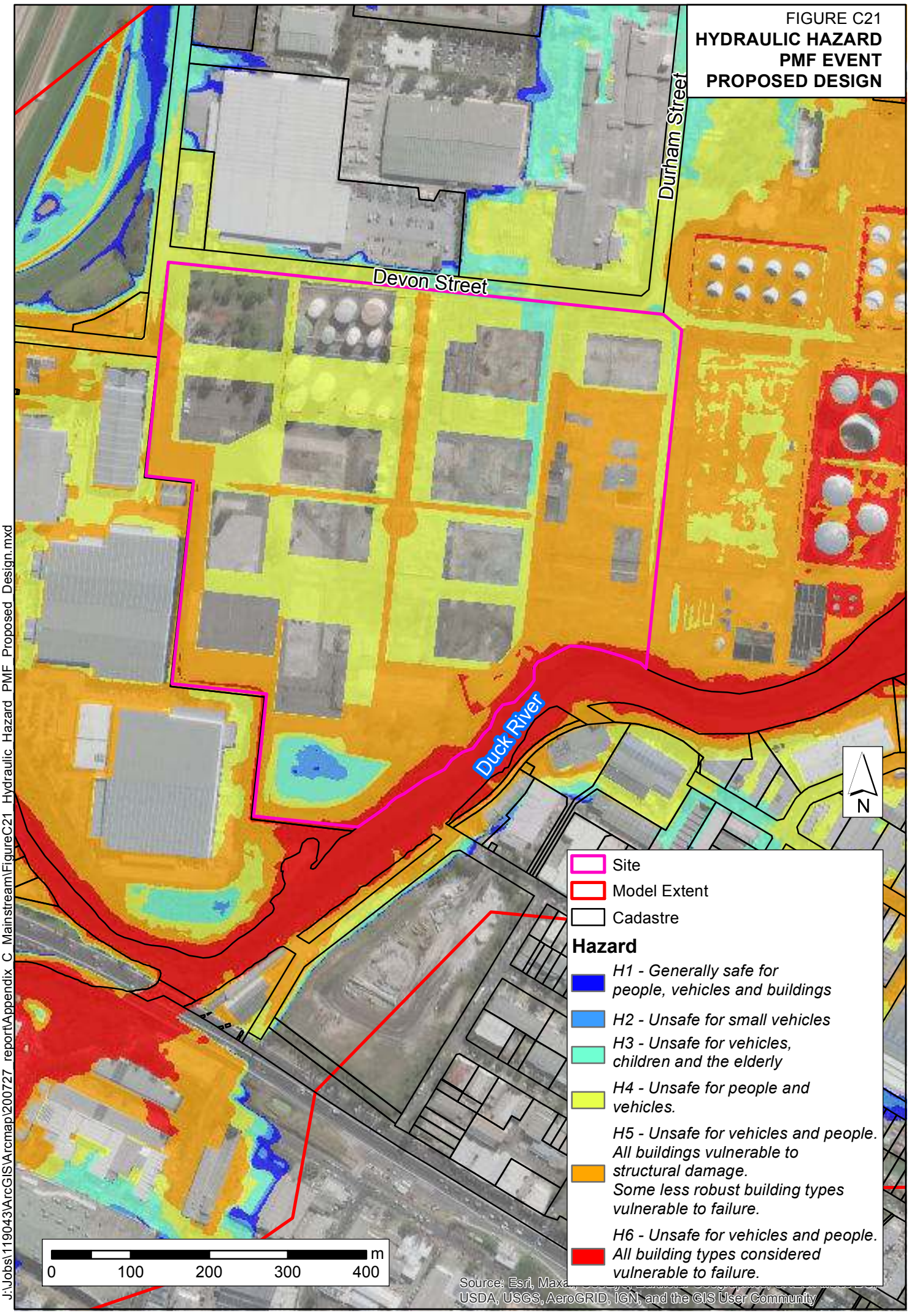


FIGURE C21
HYDRAULIC HAZARD
PMF EVENT
PROPOSED DESIGN
Durham Street
Devon Street
Duck River
N
Site
Model Extent
Cadastre
Hazard
H1 - Generally safe for people, vehicles and buildings
H2 - Unsafe for small vehicles
H3 - Unsafe for vehicles, children and the elderly
H4 - Unsafe for people and vehicles.
H5 - Unsafe for vehicles and people. All buildings vulnerable to structural damage. Some less robust building types vulnerable to failure.
H6 - Unsafe for vehicles and people. All building types considered vulnerable to failure.
0
100
200
300
400
m
Source: Esri, Maxar, Geo
USDA, USGS, AeroGRID, IGN, and the GIS User Community
J:\Jobs\119043\ArcGIS\Arcmap\200727_report\Appendix_C_Mainstream\FigureC21_Hydraulic_Hazard_PMF_Proposed_Design.mxd

Flood Information from Council

Appendix D

Our Reference: FL/164/2018
Contact: Peter Sirianni
Telephone: 02 9806 8250
Fax: 02 9806 5906

Project Surveyors ABN: 20268433974
405/14 Lexington Dr
BELLA VISTA NSW 2153

5 December 2018

FLOOD ENQUIRY APPLICATION

Property Details

Address	9 Devon Street, ROSEHILL NSW 2142
	This form applies for up to three adjoining sites relating to the same development. A separate Flood Enquiry form and fee will be required for more than 3 or separate lots.

Delivery Preference

asaxon@projectsuveyors.com.au

Reason for Enquiry

Property Type

***** GST not applicable from 1 July 2013*****

Flooding Application - Commercial	$496.45

Disclaimer: Flood levels and flood extent lines are based on current information held by Council. Council does not accept responsibility for the accuracy of this information. Any pipe sizes and location of pits and pipe lines should be confirmed by site investigation.
The flood levels shown on the back of this form are only an approximate guide and have been derived using the current computer simulated model.
The information provided in this document is presented in good faith to assist the public in understanding Council's drainage requirements that apply within the Parramatta Local Government Area. It is the responsibility of each individual using this information to undertake their own checks and confirm this information prior to its use.
City of Parramatta Council, its agents and employees are not liable (whether by reason of negligence, lack of care or otherwise) to any person for any damage or loss whatsoever which has occurred or may occur in relation to that person taking or not taking (as the case may be) action in respect of any representation, statement, or advice referred to above.

Refer to back of this form for level information issued

Flood Enquiry Information Issued - 5 December 2018

Mainstream Flooding

Is this property affected by mainstream flooding? **9 Devon Street, Rosehill**		☒ Yes ☐ No
Flood Levels	Closest Cross Sections: *(Please refer to Flood Study):* **Refer to Flood Map**	
☒ 5% AEP	Refer to Flood Map – 5% AEP	**Comments**: **See Note on Flood Map/Hazard Maps**
☒ 1% AEP	Refer to Flood Map – 1% AEP	
☒ PMF	Refer to Flood Map – PMF	
☒ Refer to flood maps provided for detailed flood levels.		
Flood information is obtained from the following flood study report: 1. **Lower Parramatta River Floodplain Risk Management Study – Flood Study Review, 2005 (SKM)** 2. **Duck River and Duck Creek Flood Study Review, 2012 (WMA Water** 3. **A'Becketts Creek Master Drainage Plan, 2009 – DRAFT (GHD)** 4. **Parramatta Drainage, 1990 (Sinclair Knight & Partners)**		

Note: Flood inundation can be verified by detail survey to AHD undertaken by a Registered Surveyor.

Local Flooding

Is the property located within a Hatched Grey Area? *Properties located within a **Hatched Grey Area** are subjected to flooding from the local catchment.*	☐ Yes ☒ No
Is the property located within a Grey Area? *Properties located within a **Grey Area** are subjected to additional site drainage controls to manage flooding in the local catchment.*	☐ Yes ☒ No
Is the property likely to be affected by overland stormwater run-off from the local catchment? ***Note:** No site inspection conducted for this assessment. Based solely on the information supplied for this flood enquiry application.*	☐ Yes ☒ Subject to Detailed Investigation
***Note:** You are required to contact Council's Development Service Engineer for any details and requirements relating to development that is affected by local flooding.*	

Additional Recommended Actions

☒	The Applicant needs to discuss the proposal to re-develop this site with Council's Town Planner and Development Services Engineer.
☒	The Applicant needs to contact Council's Town Planner and organise a pre-lodgement meeting to discuss any proposal to redevelop this property.
☒	The Applicant needs to refer to Council's Local Floodplain Risk Management policy for details relating to developing a land affected by flooding.

Definitions: (As per NSW Floodplain Development Manual dated April 2005)

1. **AHD** – a common national surface level datum approximately corresponding to mean sea level.
2. **ARI** – the long term average number of years between the occurrences of a flood as big as or larger than, the selected event.
3. **PMF** – is the largest flood that could conceivably occur at a particular location, usually estimated from probable maximum precipitation.
4. **AEP** – Annual Exceedance Probability is the chance of a flood of a given or larger size occurring in any one year, usually expressed as a percentage.

NOTE: The Lower Parramatta River Floodplain Risk Management Study and Plan is currently being updated. Flood levels in this area may change.

Chainage	Flood Level (metre AHD)	Chainage	Flood Level (metre AHD)
	5% AEP		5% AEP
0	2.73	6167	3.24
156	2.73	6256	3.14
304	2.73	6304	3.16
5278	3.65	6387	3.13
5353	3.61	6598	3.04
5490	3.55	6775	2.92
5653	3.51	6960	2.81
5795	3.46	7179	2.72
5931	3.35	7352	2.71

Legend

- Ground Contours (metre AHD)
- Stormwater Pit
- Stormwater Pipe Network
- 5% AEP Flood Surface Contour (m AHD)
- Lower Parramatta River Cross Section
- 5% AEP FLOOD (Duck River Catchment)
- 5% AEP Flood (Lower Parramatta River)
- 5% AEP Flood (A'Becketts Creek)
- Grey Area
- Hatched Grey Area

N

1:8,000

City of Parramatta Council Flood Map - 5% AEP

Printed 3/12/2018

NOTE: The Lower Parramatta River Floodplain Risk Management Study and Plan is currently being updated. Flood levels in this area may change.

Chainage	Flood Level (metre AHD) 1% AEP	Chainage	Flood Level (metre AHD) 1% AEP
0	3.24	6167	3.78
156	3.24	6256	3.67
304	3.24	6304	3.70
5278	4.23	6387	3.67
5353	4.18	6598	3.57
5490	4.12	6775	3.44
5653	4.08	6960	3.33
5795	4.03	7179	3.24
5931	3.90	7352	3.23

City of Parramatta Council Flood Map - 1% AEP

N

1:8,000

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Legend

- Ground Contours (metre AHD)
- Stormwater Pit
- Stormwater Pipe Network
- 1% AEP Flood Surface Contour (m AHD)
- Lower Parramatta River Cross Section
- 1% AEP FLOOD (Duck River Catchment)
- 1% AEP Flood (Lower Parramatta River)
- 1% AEP Flood (A'Becketts Creek)
- Grey Area
- Hatched Grey Area

Printed 3/12/2018

NOTE: 1. The Lower Parramatta River Floodplain Risk Management Study and Plan is currently being updated. Flood levels in this area may change.

2. Insufficient aerial laser survey ground data for inundation determination for this enclosed white area. Ground level may not necessarily be above indicated flood level.

3. PMF extent for A'Becketts Creek not shown.

Chainage	Flood Level (metre AHD)	Chainage	Flood Level (metre AHD)
	PMF		PMF
0	5.56	6167	7.40
156	5.56	6256	7.17
304	5.56	6304	7.3
5278	8.00	6387	6.12
5353	7.89	6598	6.00
5490	7.83	6775	5.79
5653	7.74	6960	5.65
5795	7.75	7179	5.56
5931	7.48	7352	5.61

See Note 2

See Note 2

Legend

- Ground Contours (metre AHD)
- Stormwater Pit
- Stormwater Pipe Network
- PMF Flood Surface Contour
- Lower Parramatta River Cross Section
- PMF (Lower Parramatta River)
- PMF (Duck River Catchment)
- PMF mapping extent (Duck River Catchment)
- Grey Area
- Hatched Grey Area

N

1:8,000

City of Parramatta Council Flood Map - PMF

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NOTE: 1. The Lower Parramatta River Floodplain Risk Management Study and Plan is currently being updated. Hydraulic hazard extents in this area may change.

2. Hazard extents for A'Becketts Creek not shown.

City of Parramatta Council Hydraulic Hazard Map

N

1:8,000

Legend

- Ground Contours (metre AHD)
- Stormwater Pit
- Stormwater Pipe Network
- Lower Parramatta River Cross Section
- High Hazard - 1% AEP (Lower Parramatta River)
- Low Hazard (Lower Parramatta River)
- Low Hazard (Duck River Catchment)
- High Hazard - 1% AEP (Duck River Catchment)
- Grey Area
- Hatched Grey Area

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