Level 7
22 Cordelia Street
SOUTH BRISBANE QLD
4101

T 07 3844 5900

ENGINEERS

MANAGERS

INFRASTRUCTURE
PLANNERS

DEVELOPMENT
CONSULTANTS

Flood Impact Assessment

Kaludah Subdivision, Station Lane, Lochinvar

Prepared for: **McCloy Project Management Pty Ltd**

Address: **Lot 3 DP 564631, Lot 4 DP 634523, Lot 2 DP 634523, Station Lane, Lochinvar**

Project no: **BR220193 (NSW212012)**

Date: **10/06/2022**

Document no: **BR220193-RPT-CIV-001-Flood_Impact_Assessment_Rev01.docx**

Revision no: **Revision 01**

Disclaimer

This Report has been prepared in accordance with the scope of services described in the agreement between ACOR Consultants Pty Ltd and the Client. The Report relies upon data, surveys, measurements and results based on instructions from, and in consultation with, the Client. Except as otherwise stated, ACOR Consultants Pty Ltd has not attempted to verify the accuracy or completeness of any information provided by the Client. If the information is subsequently determined to be false, inaccurate or incomplete then it is possible that changes may be required to the Report. Changes in circumstances or facts, the passage of time, manifestation of latent conditions or impacts of future events may also impact on the accuracy, completeness or currency of the information or material set out in this Report. This Report has been prepared solely for use by the Client, ACOR Consultants Pty Ltd accepts no responsibility for its use by any third parties without the specific authorisation of ACOR Consultants Pty Ltd. ACOR Consultants Pty Ltd reserves the right to alter, amend, discontinue, vary or otherwise change any information, material or service at any time without subsequent notification. All access to, or use of, the information or material is at the user's risk and ACOR Consultants Pty Ltd accepts no responsibility for the results of any actions taken on the basis of information or material provided, nor for its accuracy, completeness or currency. For the reasons outlined above, however, no other warranty or guarantee, whether expressed or implied, is made as to the data, observations and findings expressed in this Report, to the extent permitted by law.

Revisions

Revision	Description	Date	Prepared by	Approved by	Signature
01	DA issue	10/06/2022	Karl Umlauff	Greg Couch	

Review Panel

Division/ office	Revision	Name
Civil/Newcastle	01	Brandon Gathercole. Greg Couch.

Table of Contents

Appendices

List of Figures

List of Tables

1 Introduction

ACOR Consultants have been engaged by McCloys Project Management Pty Ltd to prepare a Flood Impact Assessment to support the Development Application for a proposed development at Lot 3 DP 564631, Lot 4 DP 634523, Lot 2 DP 634523, Station Lane, Lochinvar, known as Kaludah Subdivision. The development will be bound by existing residential development to the north, Greedy Creek to the east, Lochinvar Creek to the west, and existing rural lots to the south.

The purpose of the Flood Impact Assessment is to determine the changes to the flood characteristics in the adjacent creeks and downstream of the development and to demonstrate the changes do not constitute a worsening to the connected systems.

2 Previous studies

The 'Lochinvar Flood Study' was undertaken for Maitland City Council by WMAwater (2019). The TUFLOW model was provided by Maitland City Council and certain elements of the model were adopted to assist in the building of a new TUFLOW model of existing and proposed development conditions for the site location.

3 Available data

The following list of data was obtained and utilised in this flood impact assessment:

- Lochinvar Flood Study TUFLOW model files provided by Maitland City Council, including:
  - 2012 LiDAR digital elevation model
  - Existing conditions culvert data
- Ground survey digital terrain model (survey date 18 December 2019 to 11 January 2020) by de Witt Consulting
- Local cadastral boundaries, street names and watercourse lines downloaded from NSW Data Portal.
- Current DA design surface model by ACOR Consultants.
- Current DA DRAINS modelling by ACOR Consultants.

4 Proposed development

The proposed development will consist of 347 residential allotments ranging from 450 m^2 to 1200 m^2, 5 Super allotments ranging from 1870 m^2 to 2100 m^2, and one large lot of approximately 1.6 ha. Further to this the development also includes a public reserve/proposed park, 4 allotments for stormwater drainage infrastructure including detention/water quality basins, and two residue allotments. In addition to the allotments there is associated road & drainage infrastructure. New transverse drainage culverts to convey flows in Lochinvar Creek and Greedy Creek beneath Terriere Drive will be required.

Access to the site will be via an extension of the existing Terriere Drive into the proposed development area to meet Station Lane (new intersection).

The total area of the proposed development including all roadworks and batters is approximately 36.36 hectares.

The figure below shows the extent of the proposed development relative to the existing watercourses and local road network. Refer to the report by ACOR Consultants *Civil Engineering Report Development Application. Kaludah Subdivision, Station Lane, Lochinvar* for further descriptions and engineering drawings. (Document no. NSW212012_ R01_Civil Engineering DA Report.docx Revision A).

Figure 4-1 Site location

5 Catchment drainage characteristics

5.1 Flood source

The source of flooding that is relevant to the site is local catchment creek flooding. The proposed development area is located between Lochinvar Creek to the west and Greedy Creek to the east. These creeks are the focus of this Flood Impact Assessment.

As described in the Lochinvar Flood Study report (WMAwater, 2019), flooding of the Hunter River can cause backwater flooding of the lower reaches and floodplain of Lochinvar Creek. High tailwater in Lochinvar Creek due to regional riverine flooding of the Hunter River has not been simulated in this flood impact assessment.

5.2 Catchment boundary and creek alignments

The existing conditions total catchment area of Lochinvar Creek to the discharge point from the site's north-west boundary measures approximately 337 hectares. The highest elevation of the catchment is approximately 120m AHD and the lowest approximately 32 m AHD. The existing conditions catchment is comprised of urban development, grassed open space and creek riparian vegetation.

The existing conditions total catchment area of Greedy Creek to the discharge point from the site's north-east boundary measures approximately 196 hectares. The highest elevation of the catchment is approximately 93 m AHD and the lowest approximately 30 m AHD. The existing conditions catchment is comprised of urban development, grassed open space and creek riparian vegetation.

The sub-catchment boundaries for existing conditions and the approximate development area are shown in the figure below.

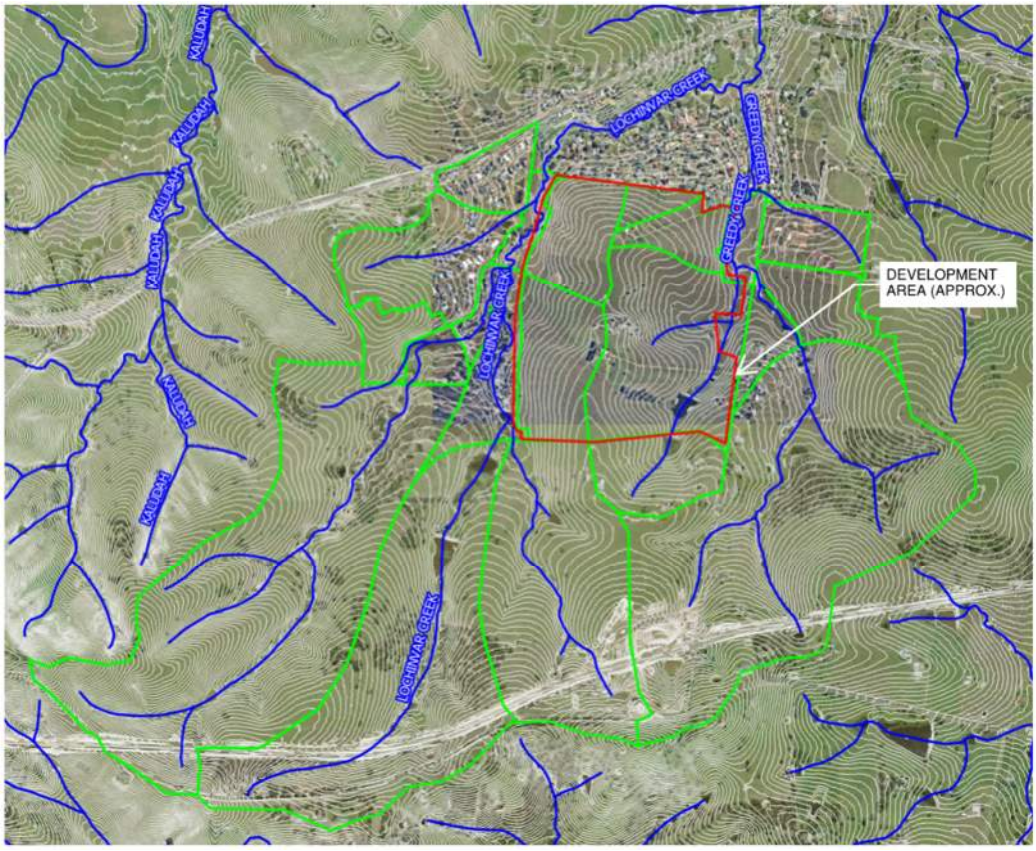


Figure 5-1 Existing conditions sub-catchment boundaries, creek alignments and ground contours

6 Hydrological and Hydraulic modelling

6.1 Hydrology

The hydrological modelling for the catchment is described in the following sections.

6.1.1 Model software

Hydrologic modelling was undertaken within DRAINS adopting the initial and continuing loss method with Australian Rainfall and Runoff (2019) rainfall intensities and ensemble temporal patterns. Refer to the report by ACOR Consultants *Civil Engineering Report Development Application. Kaludah Subdivision, Station Lane, Lochinvar* (Document no. NSW212012_ R01_Civil Engineering DA Report.docx Revision A) for further information on hydrological modelling for pre-development and post-development conditions.

6.1.2 Application of hydrology to hydraulic model

Critical duration hydrographs for each sub-catchment were exported from DRAINS for both the existing (pre-development) and proposed (post-development) conditions. They were released to the watercourses in the TUFLOW model active 2D domain using inflow boundary conditions. Proposed detention basins within the development area were sized and simulated in DRAINS, with discharge hydrographs for the critical duration event applied to the TUFLOW model active 2D domain just downstream of the basin's discharge location.

The design storm events simulated are the 20%, 10%, 5%, 2%, 1%, and 0.5% (1 in 200) Annual Exceedance Probability (AEP) events.

6.2 Hydraulics

6.2.1 Model software

A TUFLOW 1D/2D model was used to hydraulically route flows through Lochinvar Creek and Greedy Creek to derive flow characteristics for the existing and proposed scenarios. This modelling system dynamically couples the one-dimensional (culverts) and two-dimensional flow paths (terrain). This section describes the hydraulic modelling approach and hydraulic model development. Flood mapping illustrates the flood characteristics and impacts.

6.2.2 Boundary conditions

Inflow hydrographs

The model had inflow hydrographs (DRAINS output) from the sub-catchment outlets applied to the model domain.

Downstream boundary

A stage-discharge (water level versus flowrate) curve was adopted as the downstream boundary condition for Lochinvar Creek and Greedy Creek. This stage-discharge relationship was generated by TUFLOW by specifying a downstream water level slope.

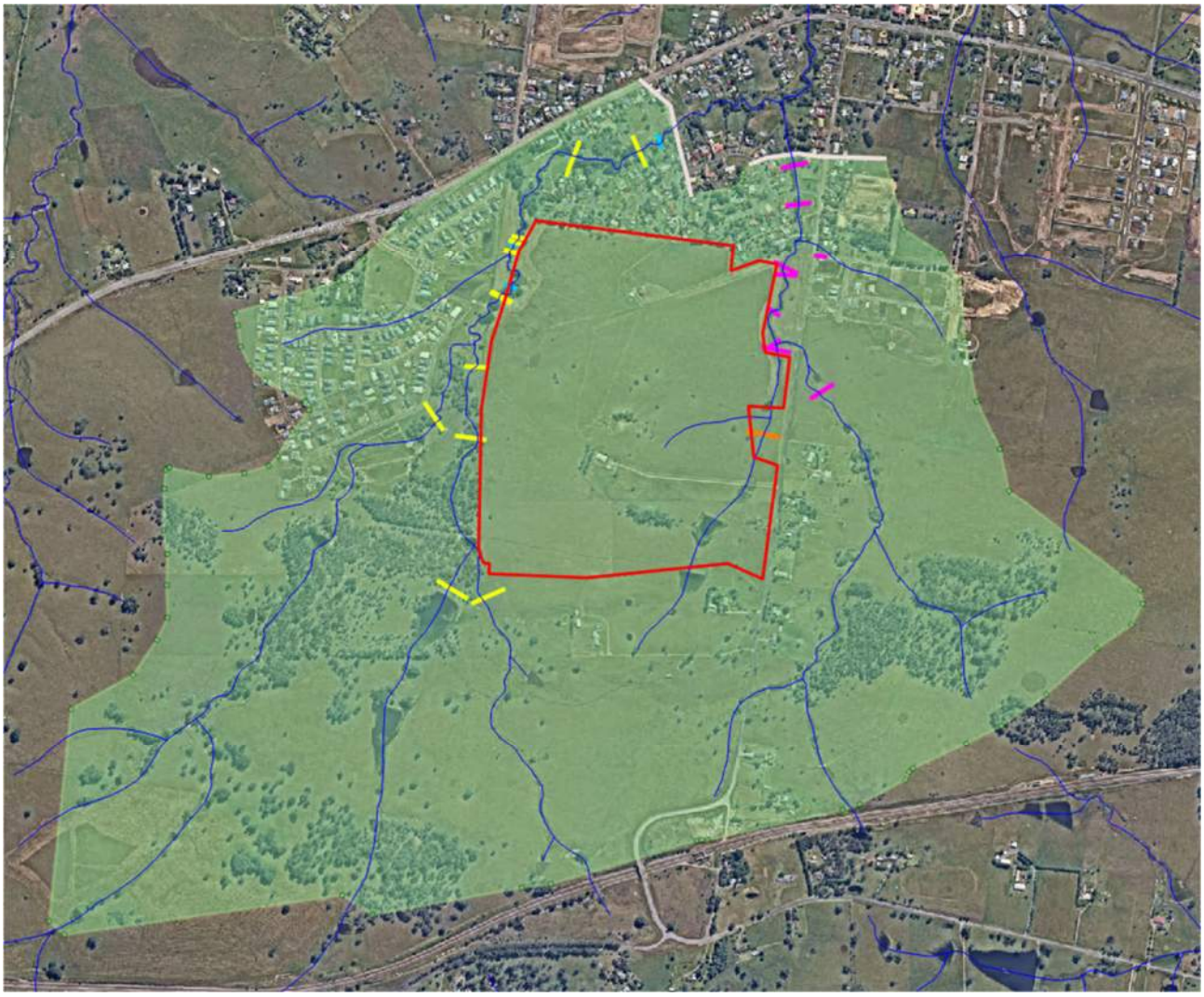


Figure 6-1 Model boundaries

6.2.3 Topography

A 1 m grid Digital Elevation Model (DEM) was generated for the catchment using Airborne Laser Survey (ALS) survey data. This DEM was used to represent the base ground elevations throughout the catchment.

The existing conditions hydraulic models had the survey DEM overlaid to the ALS DEM as shown in **Error! Reference source not found.**.

For proposed conditions hydraulic modelling, **Error! Reference source not found.** below shows the contours of digital elevation models that were layered. The DEMs are as follows:

- LiDAR catchment contours (white),
- Survey extent contours (yellow),
- Design Subdivision surface (orange).

Features that potentially influence flow behaviour, including culvert inlets and outlets, road crests, and as-built detention basins, modifications to the terrain were incorporated into the topography using elevation shapes to ensure that these were accurately represented in the model.

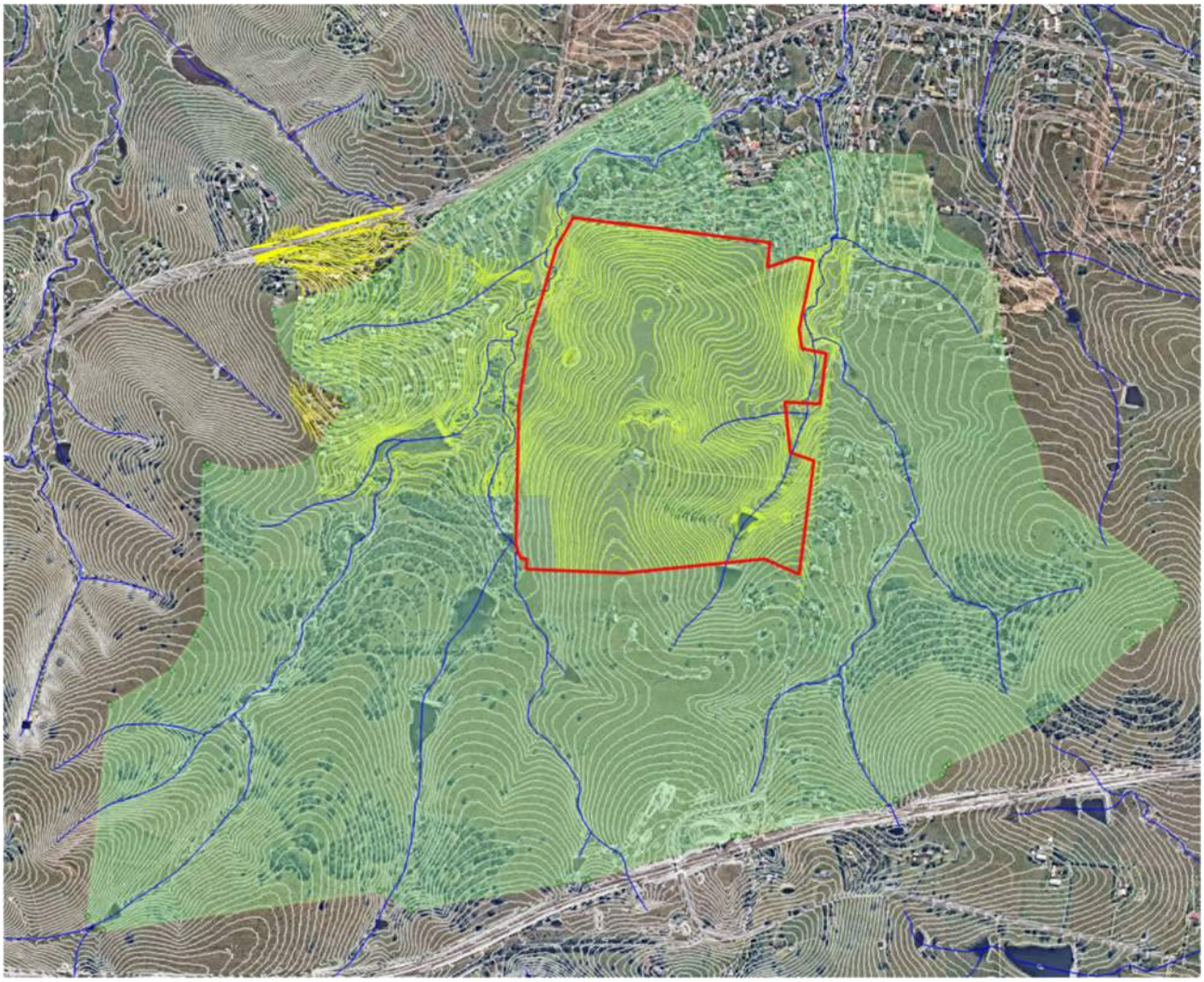


Figure 6-2 Existing conditions contours of digital elevation models (ALS – white; survey – yellow)

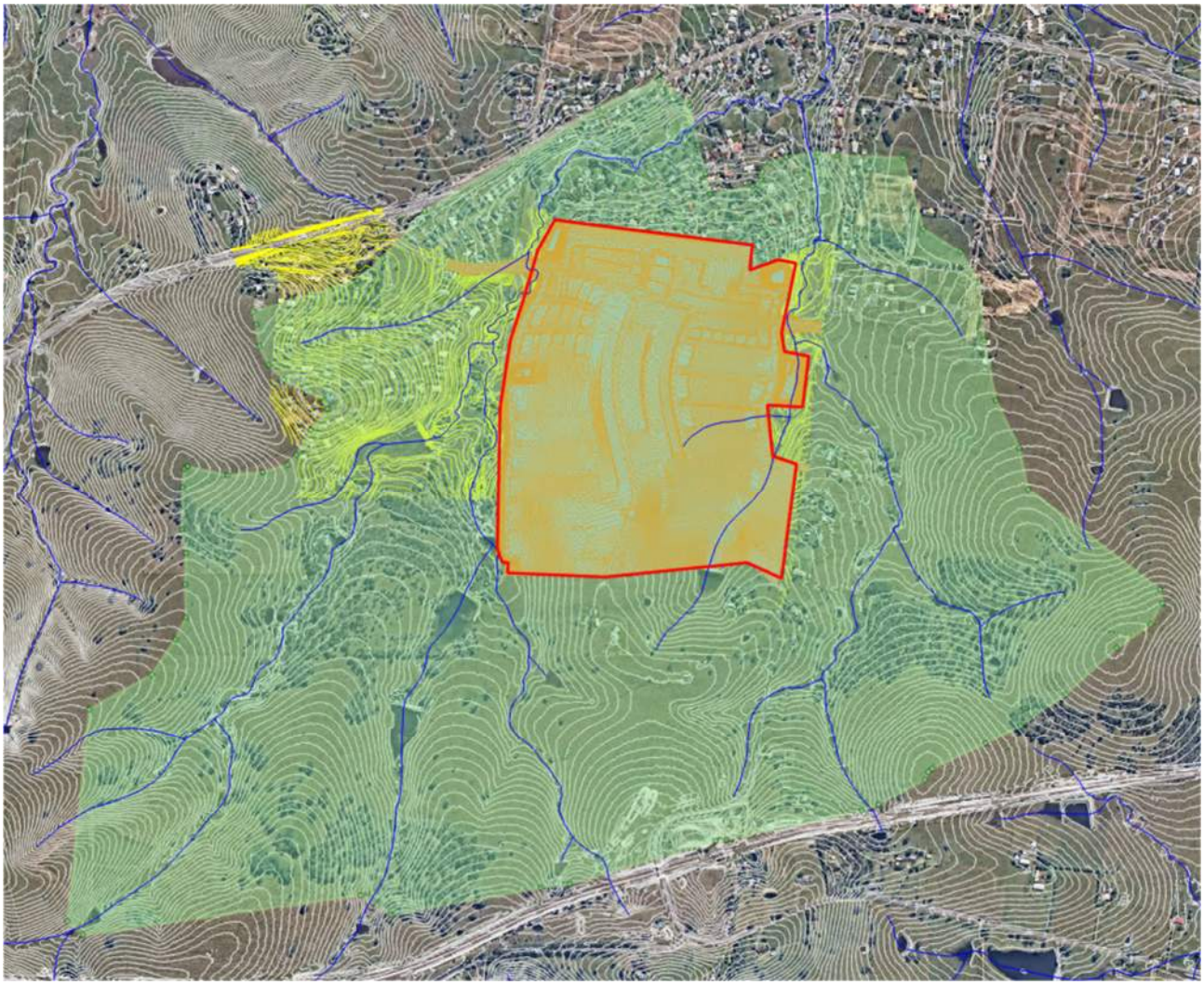


Figure 6-3 Proposed conditions contours of digital elevation models (ALS – white; survey – yellow; subdivision surface - orange)

6.2.4 2D cell size

The 2-dimensional grid applied has 2 m cell sides, which is sufficiently fine to appropriately represent the variations in the topography. It should be noted that TUFLOW samples elevation points at the cell centres, mid-sides and corners, as a consequence a 2 m square cell size results in surface elevations being sampled every 1m.

6.2.5 Structures

Proposed cross drainage culverts of Lochinvar Creek and Greedy Creek were built into the model. No blockage of pipe cross-sectional area was applied (refer to section 8). The figures below show the TUFLOW model alignment of the proposed culvert structures at the Terriere Drive crossing of Lochinvar Creek and Greedy Creek.

Table 6-1 Proposed culvert structures

Proposed culvert	Type	Configuration	Length
Terriere Drive crossing of Lochinvar Creek	RCBC	8/1500 (W) x 1500 (H)	45 m
Terriere Drive crossing of Greedy Creek	RCBC	6/1500 (W) x 1500 (H)	51 m

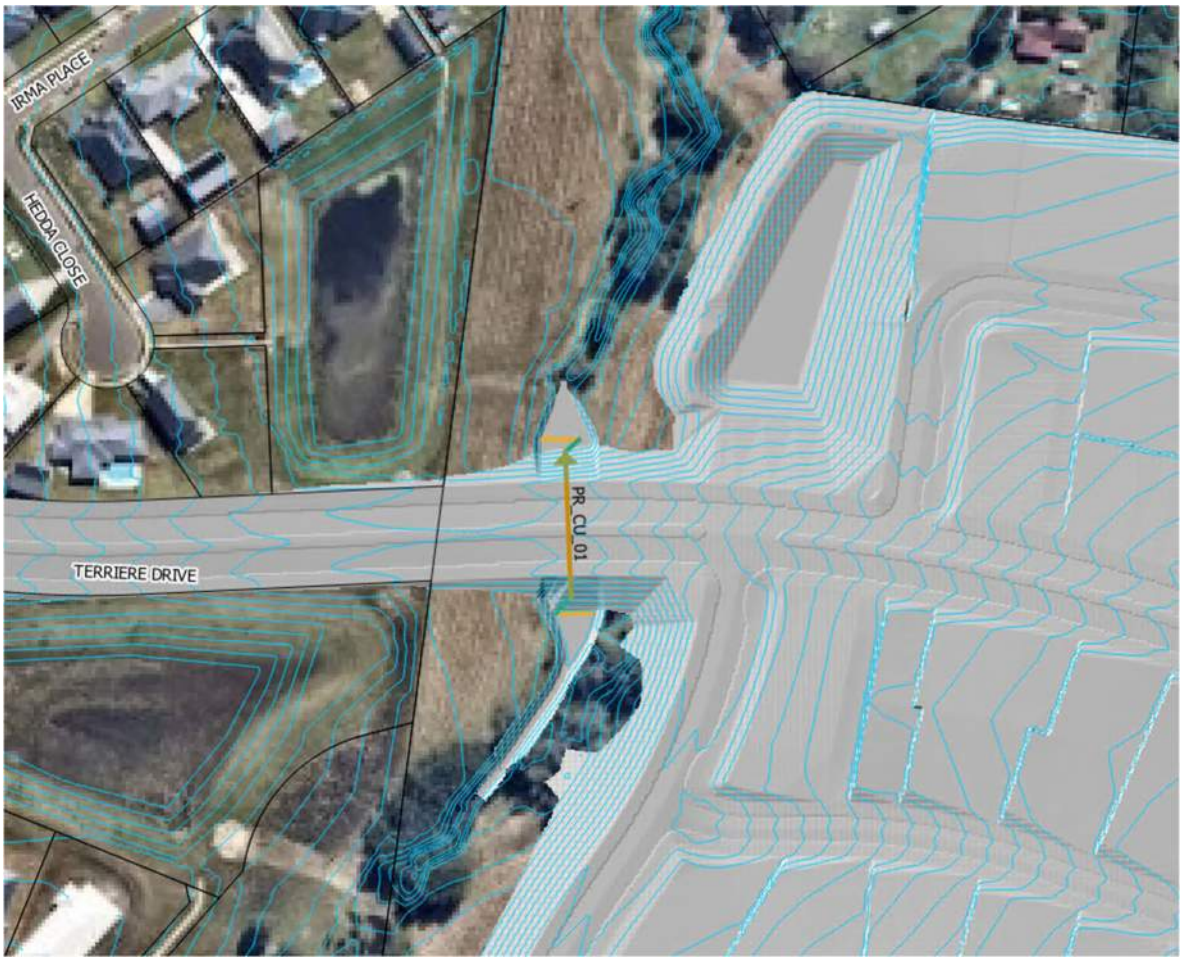


Figure 6-4 1-dimensional culvert structure at the Terriere Drive crossing of Lochinvar Creek

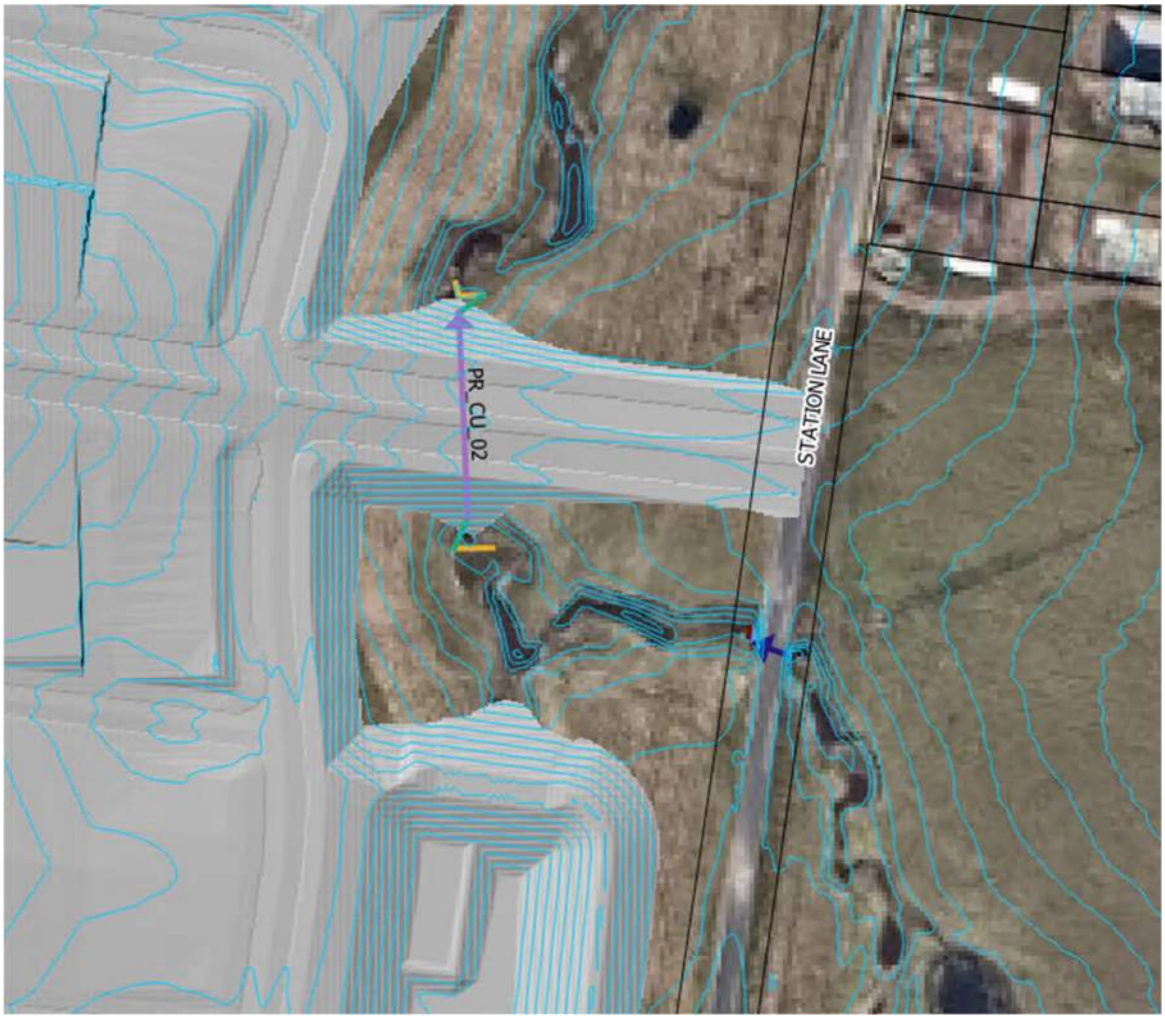


Figure 6-5 1-dimensional culvert structure at the Terriere Drive crossing of Greedy Creek

6.2.6 Hydraulic roughness

Manning n roughness polygons were adopted from the Lochinvar Creek Flood Study for existing conditions. Proposed conditions roughness polygons were drawn using the proposed development digital elevation model. Building footprints were digitised and the model domain was deactivated for their footprint. The table below presents the Manning n values and TUFLOW model code values.

Table 6-2 Manning n roughness values adopted in the TUFLOW models

Description	Manning n	TUFLOW model code
Light vegetation	0.032	2 (Default)
Roads (asphalt)	0.016	7
Dense vegetation	0.064	3
Medium vegetation	0.044	10
Riparian heavy vegetation	0.064	11
Creeks (light vegetation)	0.056	5
Creeks (heavy vegetation)	0.08	4

7 Hydraulic model results

This section summarises the results of the hydrologic and hydraulic modelling of flows within the catchment. The 20%, 10%, 5%, 2%, 1%, and 0.5% (1 in 200) Annual Exceedance Probability (AEP) events are presented. The flood impacts in the area of interest as a result of the proposed development, Terriere Drive extension and culvert crossings are discussed.

7.1 Existing conditions

Mapping of existing conditions depth, velocity and flood hazard for the 1% AEP event (defined flood event) is presented in Appendix A .

Table 7-1 Existing conditions figure numbers

Figure number	Title	Revision
Figure EX_001	Existing conditions 1% AEP depth map	01
Figure EX_002	Existing conditions 1% AEP maximum velocity map	01
Figure EX_003	Existing conditions 1% AEP flood hazard map	01

7.2 Proposed conditions

Mapping of proposed conditions depth, velocity and flood hazard for the 1% AEP event (defined flood event) is presented in Appendix A .

Table 7-2 Proposed conditions figure numbers

Figure number	Title	Revision
Figure PR_001	Proposed conditions 1% AEP depth map	01
Figure PR_002	Proposed conditions 1% AEP maximum velocity map	01
Figure PR_003	Proposed conditions 1% AEP flood hazard map	01

The development of the site will route runoff from the subdivision's lots and roads to proposed detention basins, such that overland flows will not flow across the site's northern boundary to existing lots at Freeman Drive and Harper Close. Refer to the report by ACOR Consultants *Civil Engineering Report Development Application. Kaludah Subdivision, Station Lane, Lochinvar* (Document no. NSW212012_ R01_Civil Engineering DA Report.docx Revision A) for details of performance of proposed detention basins, stormwater drainage network and site grading.

7.3 Impacts of development

7.3.1 Afflux and change in flood extent

Refer to the Flood Impact Maps listed in the table below for illustration of the impacts of the proposed conditions.

The flood impact maps show there are no impacts within Greedy Creek downstream of the site area. There are minor increases in water level upstream of the proposed Terriere Drive culvert crossing at Greedy Creek in the 1% AEP and 1 in 200 AEP, however these increases are within the site area. There is existing overtopping on Station Lane and under the proposed conditions the changed design surface for Terriere Drive at the intersection with Station Lane provides a new flow path for water at the fringe of overtopping on Station Lane to enter Terriere Drive. The water on Terriere Drive will be drained by road drainage pits. This is a minor, localised, newly wet area and is considered a minor impact.

The flood impact maps show that any impacts within Lochinvar Creek are confined and do not have the potential to worsen the use or enjoyment of the land. An area within the site boundary where there is a change in flood extent is in Lochinvar Creek at the downstream end of the site. This newly wet area is flow on the left overbank of Lochinvar Creek, which is caused by backing up of water at the proposed culvert outlet due to transition of culvert

outlet terrain to the existing creek section. The newly wet area is shallow, low velocity and of low flood hazard (H1 classification) and considered a minor impact fully contained within the site boundary. There is afflux upstream of the proposed culvert crossing of Terriere Drive at Lochinvar Creek, which is localised and within the site area. There is 350 mm freeboard available to the upstream Terriere Drive top of embankment batter level at Lochinvar Creek in the 1% AEP event.

The differences in flood levels are demonstrated by the colour ranges on the maps.

Afflux mapping (water level difference between existing conditions and proposed conditions) and change in flood extent for the simulated AEP events are presented in Appendix A

Table 7-3 Flood Impact Map figure numbers

Figure number	Title	Revision
Figure 001	1 in 200 AEP Flood Impact Map	01
Figure 002	1% AEP Flood Impact Map	01
Figure 003	2% AEP Flood Impact Map	01
Figure 004	5% AEP Flood Impact Map	01
Figure 005	10% AEP Flood Impact Map	01
Figure 006	20% AEP Flood Impact Map	01

7.3.2 Flood hazard classification

Existing and proposed conditions flood hazard classification (Australian Emergency Management Institute, 2014) was compared. Flood hazard classification is defined below.

Table 7-4 Hazard classification levels (Australian Emergency Management Institute, 2014)

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

An area within the site boundary where there is change in flood hazard classification is in Lochinvar Creek at the downstream end of the site. This is a newly wet area of shallow depth and low velocity flow with flood hazard H1 classification. This flow on the left overbank of Lochinvar Creek is caused by backing up of water at the proposed culvert outlet due to transition of culvert outlet terrain to the existing creek section.

As described in section 7.3.1, there is a newly wet area on Terriere Drive near the proposed intersection with Station Lane. The flood hazard on Terriere Drive is H1 classification and the location is trafficable. The water on Terriere Drive will be drained by road drainage pits. This is a minor, localised, newly wet area and is considered a minor impact.

8 Sensitivity Testing

8.1 Regional catchment flooding

Sensitivity testing was not undertaken for high tailwater conditions (riverine flooding of the Hunter River), as this was not part of the scope of this flood impact assessment.

8.2 Culvert blockage

Sensitivity testing for partial blockage of the proposed culvert structures at the Terriere Drive crossings of Lochinvar Creek and Greedy Creek was undertaken for the 1% AEP event. A blockage assessment was undertaken of the catchment draining to the proposed culverts using Australian Rainfall and Runoff (2019) procedures. The L_{10} debris length was conservatively estimated at 2 m, and the assessment determined there is a medium debris potential. The design blockage is conservatively estimated for the 1% AEP as 50%. Blockage in TUFLOW is simulated as 50% decrease in width of the culvert. It is considered blockage of 50% of the culvert width is unlikely. Map results are presented in the Appendices.

At the proposed culvert structure at the Terriere Drive crossing of Greedy Creek, the impact of 50% blockage is exhibited immediately upstream of the culvert in the form of higher water levels that are contained within the creek, with headwater levels not overtopping Terriere Drive.

At the proposed culvert structure at the Terriere Drive crossing of Lochinvar Creek, the impact of 50% blockage is exhibited by floodwater overtopping Terriere Drive, which is confined to the sag in Terriere Drive above and to the west of the culvert.

Table 8-1 Culvert blockage flood maps

Figure number	Title	Revision
Figure BL_001	1% AEP Culvert Blockage (50%) Flood Depth Map	01

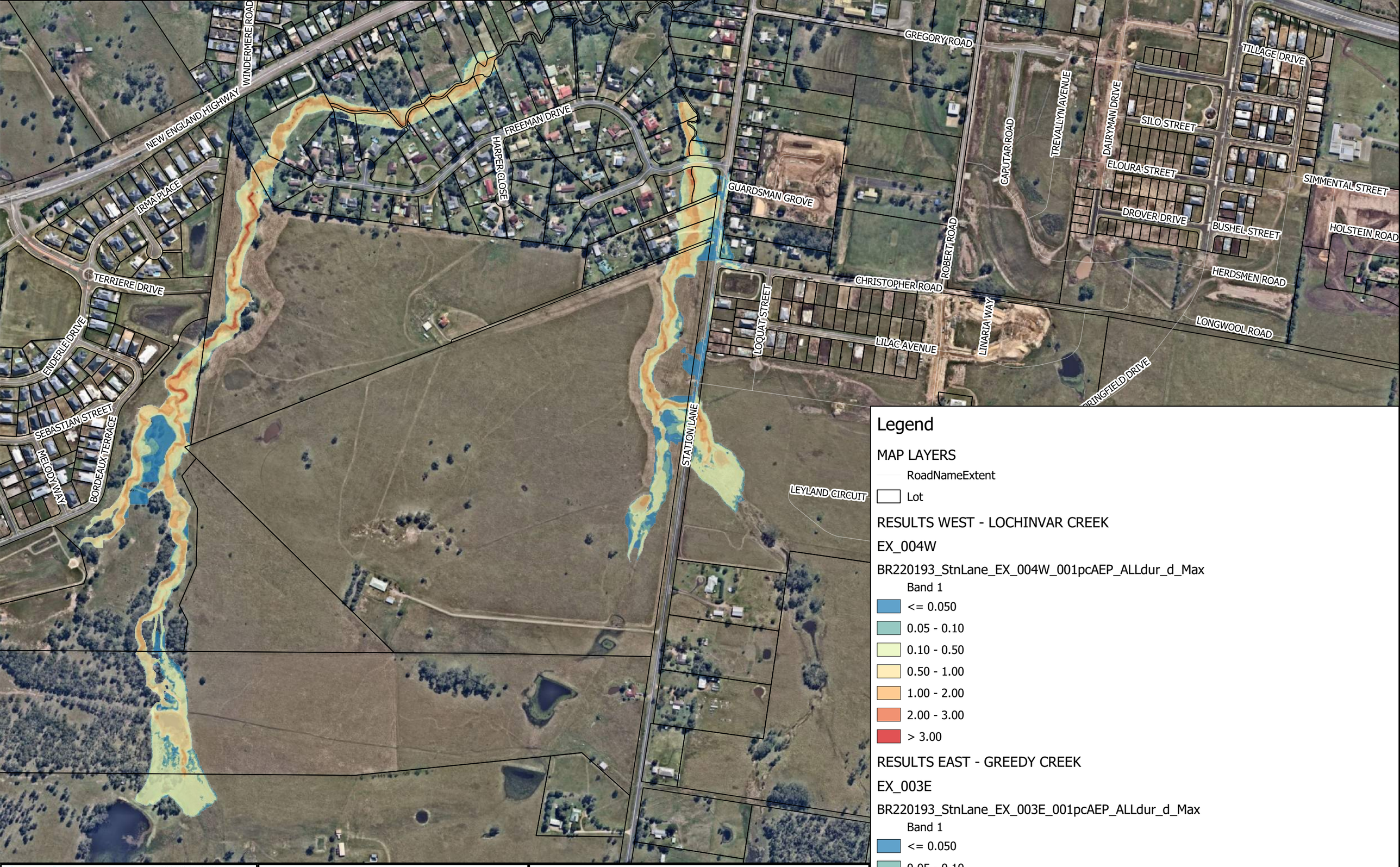
8.3 Flood event greater than the design event

A sensitivity simulation was undertaken for the 0.5% (1 in 200) AEP. Headwater levels do not overtop Terriere Drive at the culvert crossings, with:

- 300 mm freeboard available to the upstream Terriere Drive top of embankment batter level at Lochinvar Creek,
- 1.3 m freeboard available to the upstream Terriere Drive top of embankment batter level at Greedy Creek. It is noted that Terriere Drive at the proposed intersection with Station Lane shows ponded water due to flows overtopping Station Lane from the eastern tributary entering Terriere Drive.
- adequate freeboard available to the proposed subdivision formation level adjacent to Lochinvar Creek and Greedy Creek.

Appendix A Flood maps

A.1 Existing conditions



Legend

MAP LAYERS

RoadNameExtent

Lot

RESULTS WEST - LOCHINVAR CREEK

EX_004W

BR220193_StnLane_EX_004W_001pcAEP_ALLdur_d_Max

Band 1

- <= 0.050
- 0.05 - 0.10
- 0.10 - 0.50
- 0.50 - 1.00
- 1.00 - 2.00
- 2.00 - 3.00
- > 3.00

RESULTS EAST - GREEDY CREEK

EX_003E

BR220193_StnLane_EX_003E_001pcAEP_ALLdur_d_Max

Band 1

- <= 0.050
- 0.05 - 0.10
- 0.10 - 0.50
- 0.50 - 1.00
- 1.00 - 2.00
- 2.00 - 3.00
- > 3.00

ENGINEERS
MANAGERS
INFRASTRUCTURE PLANNERS
DEVELOPMENT CONSULTANTS

CONSULTANTS

Scale in metres (1:6000 @ A3)
Horizontal Datum: GDA 1994 MGA Zone 56
Vertical Datum: Australian Height Datum
EPSG: 28356

0 200 400 m

Kaludah Subdivision, Station Lane, Lochinvar
Flood Impact Assessment
Figure EX_001 - Existing conditions 1% AEP Depth Map
Project Number: BR220193 (NSW212012)
Revision: 01
Drawn: KU
Date: 10/06/2022

Legend

MAP LAYERS

RoadNameExtent

Lot

RESULTS WEST - LOCHINVAR CREEK

EX_004W

BR220193_StnLane_EX_004W_001pcAEP_ALLdur_V_Max

Band 1

- 0.5 and below
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.0
- 2.0 - 3.0
- 3.0 and above

RESULTS EAST - GREEDY CREEK

EX_003E

BR220193_StnLane_EX_003E_001pcAEP_ALLdur_V_Max

Band 1

- 0.5 and below
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.0
- 2.0 - 3.0
- 3.0 and above

ENGINEERS
MANAGERS
INFRASTRUCTURE PLANNERS
DEVELOPMENT CONSULTANTS

CONSULTANTS

Scale in metres (1:6000 @ A3)
Horizontal Datum: GDA 1994 MGA Zone 56
Vertical Datum: Australian Height Datum
EPSG: 28356

0 200 400 m

Kaludah Subdivision, Station Lane, Lochinvar
Flood Impact Assessment
Figure EX_002 - Existing conditions 1% AEP Maximum Velocity Map
Project Number: BR220193 (NSW212012)
Revision: 01
Drawn: KU

Legend

MAP LAYERS

RoadNameExtent

Lot

RESULTS WEST - LOCHINVAR CREEK

EX_004W

BR220193_StnLane_EX_004W_001pcAEP_ALLdur_ZAEM1_Max

Band 1

- H1
- H2
- H3
- H4
- H5
- H6

RESULTS EAST - GREEDY CREEK

EX_003E

BR220193_StnLane_EX_003E_001pcAEP_ALLdur_ZAEM1_Max

Band 1

- H1
- H2
- H3
- H4
- H5
- H6

ACOR CONSULTANTS

ENGINEERS
MANAGERS
INFRASTRUCTURE PLANNERS
DEVELOPMENT CONSULTANTS

Scale in metres (1:6000 @ A3)
Horizontal Datum: GDA 1994 MGA Zone 56
Vertical Datum: Australian Height Datum
EPSG: 28356

0 200 400 m

Kaludah Subdivision, Station Lane, Lochinvar
Flood Impact Assessment
Figure EX_003 - Existing conditions 1% AEP Flood Hazard Map
Project Number: BR220193 (NSW212012)
Revision: 01
Drawn: KU

A.2 Proposed conditions

Legend

MAP LAYERS

RoadNameExtent

Lot

RESULTS WEST - LOCHINVAR CREEK

PR_003W

BR220193_StnLane_PR_003W_001pcAEP_ALLdur_d_Max

Band 1

- <= 0.050
- 0.05 - 0.10
- 0.10 - 0.50
- 0.50 - 1.00
- 1.00 - 2.00
- 2.00 - 3.00
- > 3.00

RESULTS EAST - GREEDY CREEK

PR_002E

BR220193_StnLane_PR_002E_001pcAEP_ALLdur_d_Max

Band 1

- <= 0.050
- 0.05 - 0.10
- 0.10 - 0.50
- 0.50 - 1.00
- 1.00 - 2.00
- 2.00 - 3.00
- > 3.00

ACOR CONSULTANTS

ENGINEERS
MANAGERS
INFRASTRUCTURE PLANNERS
DEVELOPMENT CONSULTANTS

Scale in metres (1:6000 @ A3)
Horizontal Datum: GDA 1994 MGA Zone 56
Vertical Datum: Australian Height Datum
EPSG: 28356

0 200 400 m

Kaludah Subdivision, Station Lane, Lochinvar
Flood Impact Assessment
Figure PR_001 - Proposed conditions 1% AEP Depth Map
Project Number: BR220193 (NSW212012)
Revision: 01
Drawn: KU

Legend

MAP LAYERS

RoadNameExtent

Lot

RESULTS WEST - LOCHINVAR CREEK

PR_003W

BR220193_StnLane_PR_003W_001pcAEP_ALLdur_V_Max

Band 1

- 0.5 and below
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.0
- 2.0 - 3.0
- 3.0 and above

RESULTS EAST - GREEDY CREEK

PR_002E

BR220193_StnLane_PR_002E_001pcAEP_ALLdur_V_Max

Band 1

- 0.5 and below
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.0
- 2.0 - 3.0
- 3.0 and above

ENGINEERS
MANAGERS
INFRASTRUCTURE PLANNERS
DEVELOPMENT CONSULTANTS

CONSULTANTS

Scale in metres (1:6000 @ A3)
Horizontal Datum: GDA 1994 MGA Zone 56
Vertical Datum: Australian Height Datum
EPSG: 28356

0 200 400 m

Kaludah Subdivision, Station Lane, Lochinvar
Flood Impact Assessment
Figure PR_002 - Proposed conditions 1% AEP
Maximum Velocity Map
Project Number: BR220193 (NSW212012)
Revision: 01
Drawn: KU

Legend

MAP LAYERS

RoadNameExtent

Lot

RESULTS WEST - LOCHINVAR CREEK

PR_003W

BR220193_StnLane_PR_003W_001pcAEP_ALLdur_ZAEM1_Max

Band 1

H1

H2

H3

H4

H5

H6

RESULTS EAST - GREEDY CREEK

PR_002E

BR220193_StnLane_PR_002E_001pcAEP_ALLdur_ZAEM1_Max

Band 1

H1

H2

H3

H4

H5

H6

ACOR CONSULTANTS

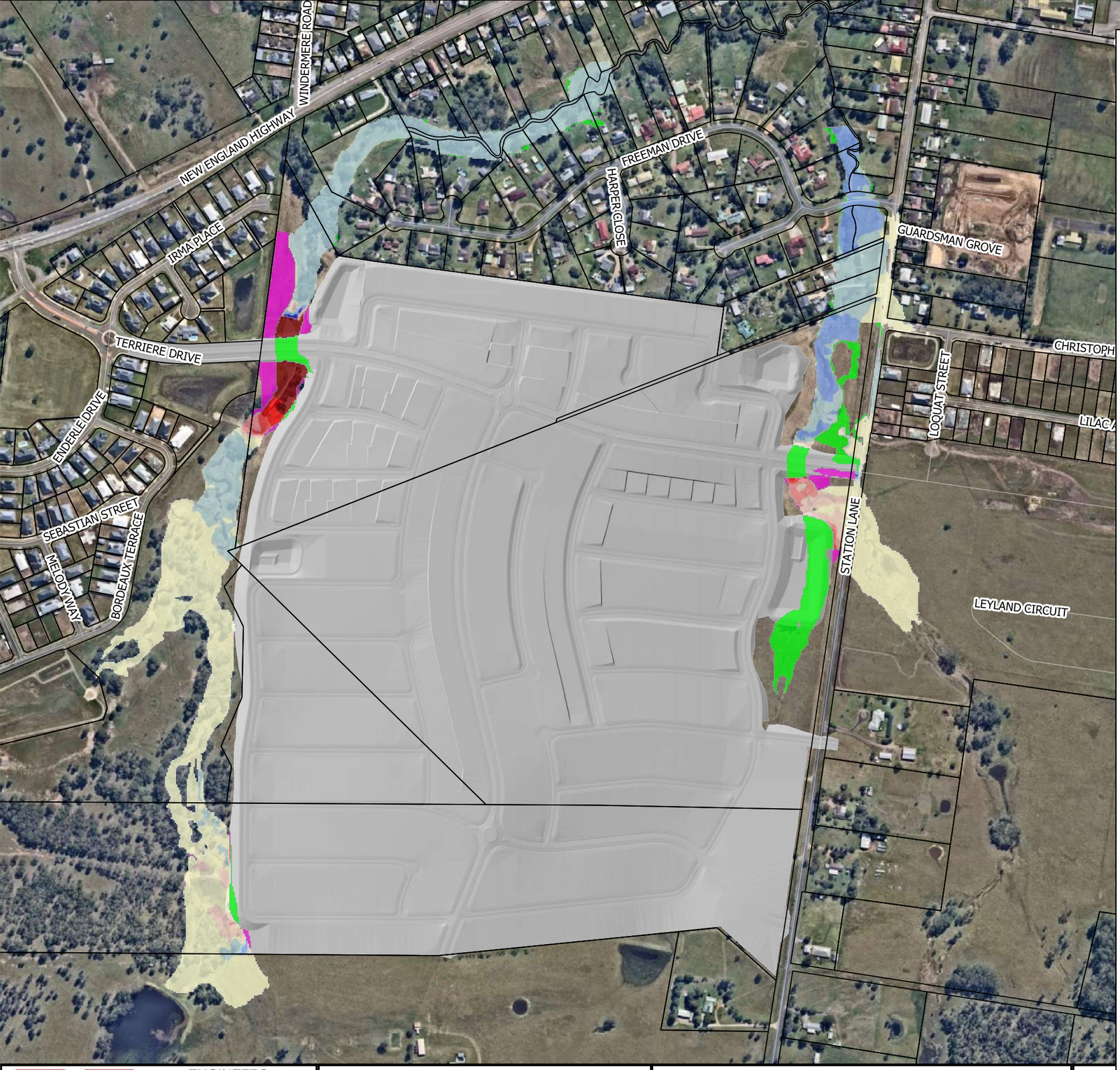
ENGINEERS
MANAGERS
INFRASTRUCTURE PLANNERS
DEVELOPMENT CONSULTANTS

Scale in metres (1:6000 @ A3)
Horizontal Datum: GDA 1994 MGA Zone 56
Vertical Datum: Australian Height Datum
EPSG: 28356

0 200 400 m

Kaludah Subdivision, Station Lane, Lochinvar
Flood Impact Assessment
Figure EX_003 - Existing conditions 1% AEP Flood Hazard Map
Project Number: BR220193 (NSW212012)
Revision: 01
Drawn: KU

A.3 Flood impact maps



Legend

MAP LAYERS

RoadNameExtent

Lot

RESULTS WEST - LOCHINVAR CREEK

AFFLUX PR_003W - EX_004W

BR220193_StnLane_PR_003W-EX_004W_1in200AEP_ALLdur_h_Max_wd

Band 1

- Was wet now dry
- Was dry now wet

BR220193_StnLane_PR_003W-EX_004W_1in200AEP_ALLdur_h_Max

Band 1

- <= -0.3
- -0.3 to -0.225
- -0.225 to -0.15
- -0.15 to -0.075
- -0.075 to -0.01
- -0.01 to 0.01
- 0.01 - 0.075
- 0.075 to 0.15
- 0.15 to 0.225
- 0.225 to 0.3
- > 0.3

RESULTS EAST - GREEDY CREEK

AFFLUX PR_002E - EX_003E

BR220193_StnLane_PR_002E-EX_003E_1in200AEP_ALLdur_h_Max_wd

Band 1

- Was wet now dry
- Was dry now wet

BR220193_StnLane_PR_002E-EX_003E_1in200AEP_ALLdur_h_Max

Band 1

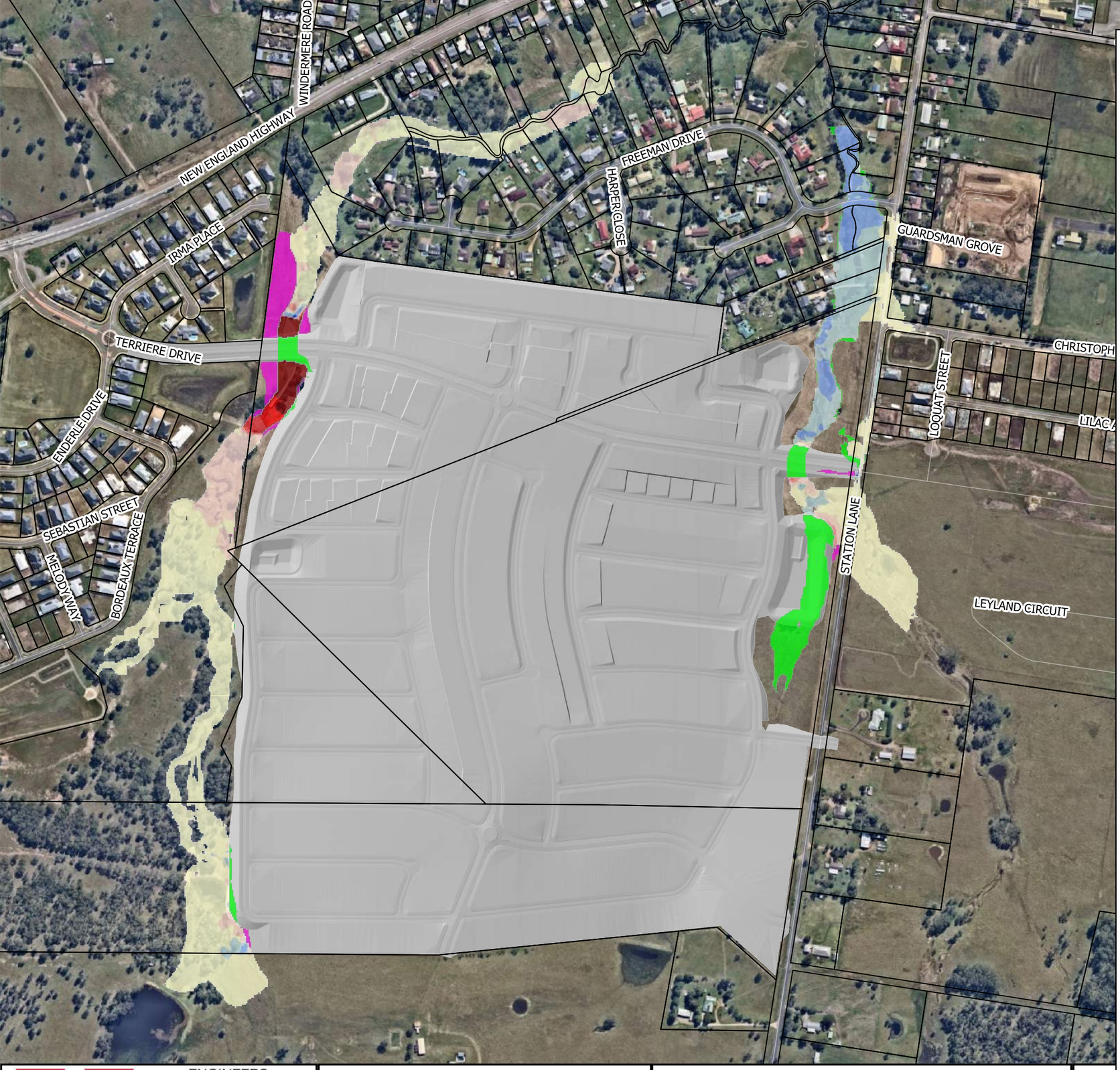
- <= -0.3
- -0.3 to -0.225
- -0.225 to -0.15
- -0.15 to -0.075
- -0.075 to -0.01
- -0.01 to 0.01
- 0.01 - 0.075
- 0.075 to 0.15
- 0.15 to 0.225
- 0.225 to 0.3
- > 0.3

ACOR CONSULTANTS
ENGINEERS
MANAGERS
INFRASTRUCTURE PLANNERS
DEVELOPMENT CONSULTANTS

Scale in metres (1:6000 @ A3)
Horizontal Datum: GDA 1994 MGA Zone 56
Vertical Datum: Australian Height Datum
EPSG: 28356

0 200 400 m

Kaludah Subdivision, Station Lane, Lochinvar
Flood Impact Assessment
Figure 001 - 1 in 200 AEP Flood Impact Map
Project Number: BR220193 (NSW212012)
Revision: 01
Drawn: KU
Date: 10/06/2022



Legend

MAP LAYERS

RoadNameExtent

Lot

RESULTS WEST - LOCHINVAR CREEK

AFFLUX PR_003W - EX_004W

BR220193_StnLane_PR_003W-EX_004W_001pcAEP_ALLdur_h_Max_wd

Band 1

Was wet now dry

Was dry now wet

BR220193_StnLane_PR_003W-EX_004W_001pcAEP_ALLdur_h_Max

Band 1

<= -0.3

-0.3 to -0.225

-0.225 to -0.15

-0.15 to -0.075

-0.075 to -0.01

-0.01 to 0.01

0.01 - 0.075

0.075 to 0.15

0.15 to 0.225

0.225 to 0.3

> 0.3

RESULTS EAST - GREEDY CREEK

AFFLUX PR_002E - EX_003E

BR220193_StnLane_PR_002E-EX_003E_001pcAEP_ALLdur_h_Max_wd

Band 1

Was wet now dry

Was dry now wet

BR220193_StnLane_PR_002E-EX_003E_001pcAEP_ALLdur_h_Max

Band 1

<= -0.3

-0.3 to -0.225

-0.225 to -0.15

-0.15 to -0.075

-0.075 to -0.01

-0.01 to 0.01

0.01 - 0.075

0.075 to 0.15

0.15 to 0.225

0.225 to 0.3

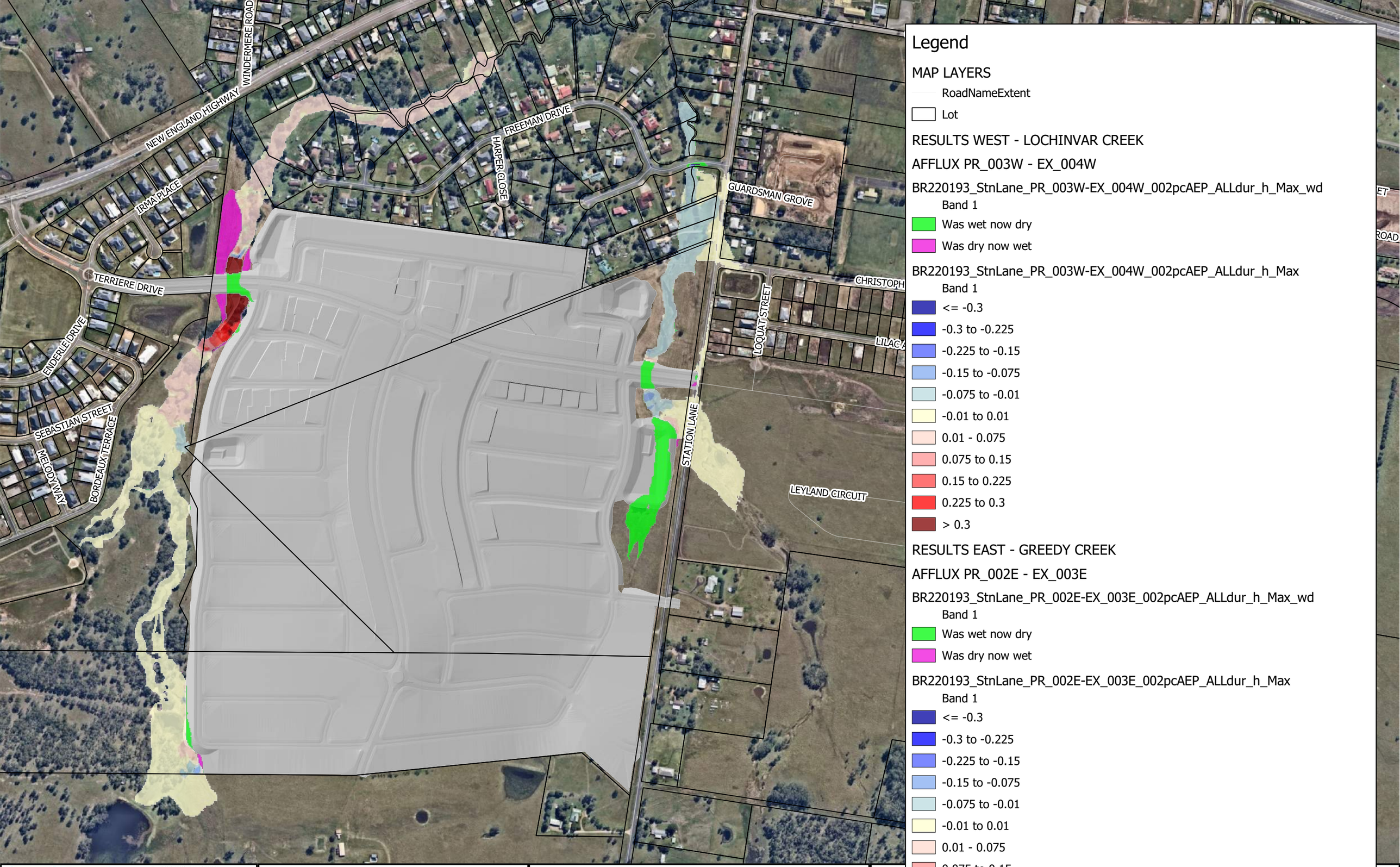
> 0.3

ENGINEERS
MANAGERS
INFRASTRUCTURE PLANNERS
DEVELOPMENT CONSULTANTS

Scale in metres (1:6000 @ A3)
Horizontal Datum: GDA 1994 MGA Zone 56
Vertical Datum: Australian Height Datum
EPSG: 28356

0 200 400 m

Kaludah Subdivision, Station Lane, Lochinvar
Flood Impact Assessment
Figure 002 - 1% AEP Flood Impact Map
Project Number: BR220193 (NSW212012)
Revision: 01
Drawn: KU
Date: 10/06/2022



Legend

MAP LAYERS

RoadNameExtent

Lot

RESULTS WEST - LOCHINVAR CREEK

AFFLUX PR_003W - EX_004W

BR220193_StnLane_PR_003W-EX_004W_002pcAEP_ALLdur_h_Max_wd

Band 1

- Was wet now dry
- Was dry now wet

BR220193_StnLane_PR_003W-EX_004W_002pcAEP_ALLdur_h_Max

Band 1

- <= -0.3
- -0.3 to -0.225
- -0.225 to -0.15
- -0.15 to -0.075
- -0.075 to -0.01
- -0.01 to 0.01
- 0.01 - 0.075
- 0.075 to 0.15
- 0.15 to 0.225
- 0.225 to 0.3
- > 0.3

RESULTS EAST - GREEDY CREEK

AFFLUX PR_002E - EX_003E

BR220193_StnLane_PR_002E-EX_003E_002pcAEP_ALLdur_h_Max_wd

Band 1

- Was wet now dry
- Was dry now wet

BR220193_StnLane_PR_002E-EX_003E_002pcAEP_ALLdur_h_Max

Band 1

- <= -0.3
- -0.3 to -0.225
- -0.225 to -0.15
- -0.15 to -0.075
- -0.075 to -0.01
- -0.01 to 0.01
- 0.01 - 0.075
- 0.075 to 0.15
- 0.15 to 0.225
- 0.225 to 0.3
- > 0.3

ACOR CONSULTANTS
ENGINEERS
MANAGERS
INFRASTRUCTURE PLANNERS
DEVELOPMENT CONSULTANTS

Scale in metres (1:6000 @ A3)
Horizontal Datum: GDA 1994 MGA Zone 56
Vertical Datum: Australian Height Datum
EPSG: 28356

0 200 400 m

Kaludah Subdivision, Station Lane, Lochinvar
Flood Impact Assessment
Figure 003 - 2% AEP Flood Impact Map
Project Number: BR220193 (NSW212012)
Revision: 01
Drawn: KU
Date: 10/06/2022

Legend

MAP LAYERS

RoadNameExtent

Lot

RESULTS WEST - LOCHINVAR CREEK

AFFLUX PR_003W - EX_004W

BR220193_StnLane_PR_003W-EX_004W_005pcAEP_ALLdur_h_Max_wd

Band 1

- Was wet now dry
- Was dry now wet

BR220193_StnLane_PR_003W-EX_004W_005pcAEP_ALLdur_h_Max

Band 1

- <= -0.3
- -0.3 to -0.225
- -0.225 to -0.15
- -0.15 to -0.075
- -0.075 to -0.01
- -0.01 to 0.01
- 0.01 - 0.075
- 0.075 to 0.15
- 0.15 to 0.225
- 0.225 to 0.3
- > 0.3

RESULTS EAST - GREEDY CREEK

AFFLUX PR_002E - EX_003E

BR220193_StnLane_PR_002E-EX_003E_005pcAEP_ALLdur_h_Max_wd

Band 1

- Was wet now dry
- Was dry now wet

BR220193_StnLane_PR_002E-EX_003E_005pcAEP_ALLdur_h_Max

Band 1

- <= -0.3
- -0.3 to -0.225
- -0.225 to -0.15
- -0.15 to -0.075
- -0.075 to -0.01
- -0.01 to 0.01
- 0.01 - 0.075
- 0.075 to 0.15
- 0.15 to 0.225
- 0.225 to 0.3
- > 0.3

ACOR CONSULTANTS
ENGINEERS
MANAGERS
INFRASTRUCTURE PLANNERS
DEVELOPMENT CONSULTANTS

Scale in metres (1:6000 @ A3)
Horizontal Datum: GDA 1994 MGA Zone 56
Vertical Datum: Australian Height Datum
EPSG: 28356

0 200 400 m

Kaludah Subdivision, Station Lane, Lochinvar
Flood Impact Assessment
Figure 004 - 5% AEP Flood Impact Map
Project Number: BR220193 (NSW212012)
Revision: 01
Drawn: KU
Date: 10/06/2022

Legend

MAP LAYERS

RoadNameExtent

Lot

RESULTS WEST - LOCHINVAR CREEK

AFFLUX PR_003W - EX_004W

BR220193_StnLane_PR_003W-EX_004W_010pcAEP_ALLdur_h_Max_wd

Band 1

- Was wet now dry
- Was dry now wet

BR220193_StnLane_PR_003W-EX_004W_010pcAEP_ALLdur_h_Max

Band 1

- <= -0.3
- -0.3 to -0.225
- -0.225 to -0.15
- -0.15 to -0.075
- -0.075 to -0.01
- -0.01 to 0.01
- 0.01 - 0.075
- 0.075 to 0.15
- 0.15 to 0.225
- 0.225 to 0.3
- > 0.3

RESULTS EAST - GREEDY CREEK

AFFLUX PR_002E - EX_003E

BR220193_StnLane_PR_002E-EX_003E_010pcAEP_ALLdur_h_Max_wd

Band 1

- Was wet now dry
- Was dry now wet

BR220193_StnLane_PR_002E-EX_003E_010pcAEP_ALLdur_h_Max

Band 1

- <= -0.3
- -0.3 to -0.225
- -0.225 to -0.15
- -0.15 to -0.075
- -0.075 to -0.01
- -0.01 to 0.01
- 0.01 - 0.075
- 0.075 to 0.15
- 0.15 to 0.225
- 0.225 to 0.3
- > 0.3

ACOR CONSULTANTS
ENGINEERS
MANAGERS
INFRASTRUCTURE PLANNERS
DEVELOPMENT CONSULTANTS

Scale in metres (1:6000 @ A3)
Horizontal Datum: GDA 1994 MGA Zone 56
Vertical Datum: Australian Height Datum
EPSG: 28356

0 200 400 m

Kaludah Subdivision, Station Lane, Lochinvar
Flood Impact Assessment
Figure 005 - 10% AEP Flood Impact Map
Project Number: BR220193 (NSW212012)
Revision: 01
Drawn: KU
Date: 10/06/2022

Legend

MAP LAYERS

RoadNameExtent

Lot

RESULTS WEST - LOCHINVAR CREEK

AFFLUX PR_003W - EX_004W

BR220193_StnLane_PR_003W-EX_004W_020pcAEP_ALLdur_h_Max_wd

Band 1

Was wet now dry

Was dry now wet

BR220193_StnLane_PR_003W-EX_004W_020pcAEP_ALLdur_h_Max

Band 1

<= -0.3

-0.3 to -0.225

-0.225 to -0.15

-0.15 to -0.075

-0.075 to -0.01

-0.01 to 0.01

0.01 - 0.075

0.075 to 0.15

0.15 to 0.225

0.225 to 0.3

> 0.3

RESULTS EAST - GREEDY CREEK

AFFLUX PR_002E - EX_003E

BR220193_StnLane_PR_002E-EX_003E_020pcAEP_ALLdur_h_Max_wd

Band 1

Was wet now dry

Was dry now wet

BR220193_StnLane_PR_002E-EX_003E_020pcAEP_ALLdur_h_Max

Band 1

<= -0.3

-0.3 to -0.225

-0.225 to -0.15

-0.15 to -0.075

-0.075 to -0.01

-0.01 to 0.01

0.01 - 0.075

0.075 to 0.15

0.15 to 0.225

0.225 to 0.3

> 0.3

ENGINEERS
MANAGERS
INFRASTRUCTURE PLANNERS
DEVELOPMENT CONSULTANTS

CONSULTANTS

Scale in metres (1:6000 @ A3)
Horizontal Datum: GDA 1994 MGA Zone 56
Vertical Datum: Australian Height Datum
EPSG: 28356

0 200 400 m

Kaludah Subdivision, Station Lane, Lochinvar
Flood Impact Assessment
Figure 006 - 20% AEP Flood Impact Map
Project Number: BR220193 (NSW212012)
Revision: 01
Drawn: KU
Date: 10/06/2022

A.4 Proposed culvert blockage flood map

Legend

MAP LAYERS

RoadNameExtent

Lot

RESULTS WEST - LOCHINVAR CREEK

PR_003WBL

BR220193_StnLane_PR_003WBL_001pcAEP_ALLdur_d_Max

Band 1

- <= 0.050
- 0.05 - 0.10
- 0.10 - 0.50
- 0.50 - 1.00
- 1.00 - 2.00
- 2.00 - 3.00
- > 3.00

RESULTS EAST - GREEDY CREEK

PR_002EBL

BR220193_StnLane_PR_002EBL_001pcAEP_ALLdur_d_Max

Band 1

- <= 0.050
- 0.05 - 0.10
- 0.10 - 0.50
- 0.50 - 1.00
- 1.00 - 2.00
- 2.00 - 3.00
- > 3.00

ACOR CONSULTANTS
ENGINEERS
MANAGERS
INFRASTRUCTURE PLANNERS
DEVELOPMENT CONSULTANTS

Scale in metres (1:6000 @ A3)
Horizontal Datum: GDA 1994 MGA Zone 56
Vertical Datum: Australian Height Datum
EPSG: 28356

0 200 400 m

Kaludah Subdivision, Station Lane, Lochinvar
Flood Impact Assessment
Figure BL_001 - 1% AEP Culvert Blockage Flood Depth Map
Project Number: BR220193 (NSW212012)
Revision: 01
Drawn: KU