Ballina Shire Council

Ballina Island and West Ballina Overland Flow Flood Study Final Overland Flood Study Report and Mapping (Appendices E, F, G & H)

November 2020

Appendices

Appendices

Appendix E – Flood maps – Sensitivity tests on tide level conditions

Figure ID	Description	Flood event
E1	Peak Flood Depth | Existing Conditions	0.2% AEP Design Flood Event | MLWS Tide Level
E2	Peak Flood Depth | Existing Conditions	1% AEP Design Flood Event | MLWS Tide Level
E3	Peak Flood Depth | Existing Conditions	5% AEP Design Flood Event | MLWS Tide Level
E4	Peak Flood Depth | Existing Conditions	10% AEP Design Flood Event | MLWS Tide Level
E5	Peak Flood Depth | Existing Conditions	20% AEP Design Flood Event | MLWS Tide Level
E6	Changes in Flood Level | MLWS vs MHWS Tide Level Scenario	0.2% AEP Design Flood Event
E7	Changes in Flood Level | MLWS vs MHWS Tide Level Scenario	1% AEP Design Flood Event
E8	Changes in Flood Level | MLWS vs MHWS Tide Level Scenario	5% AEP Design Flood Event
E9	Changes in Flood Level | MLWS vs MHWS Tide Level Scenario	10% AEP Design Flood Event
E10	Changes in Flood Level | MLWS vs MHWS Tide Level Scenario	20% AEP Design Flood Event
E11	Peak Flood Depth | Existing Conditions	0.2% AEP Design Flood Event | HAT Level
E12	Peak Flood Depth | Existing Conditions	1% AEP Design Flood Event | HAT Level
E13	Peak Flood Depth | Existing Conditions	5% AEP Design Flood Event | HAT Level
E14	Peak Flood Depth | Existing Conditions	10% AEP Design Flood Event | HAT Level
E15	Peak Flood Depth | Existing Conditions	20% AEP Design Flood Event | HAT Level
E16	Changes in Flood Level | HAT vs MHWS Tide Level Scenario	0.2% AEP Design Flood Event
E17	Changes in Flood Level | HAT vs MHWS Tide Level Scenario	1% AEP Design Flood Event
E18	Changes in Flood Level | HAT vs MHWS Tide Level Scenario	5% AEP Design Flood Event
E19	Changes in Flood Level | HAT vs MHWS Tide Level Scenario	10% AEP Design Flood Event
E20	Changes in Flood Level | HAT vs MHWS Tide Level Scenario	20% AEP Design Flood Event
E21	Peak Flood Depth | Existing Conditions	No Local Rainfall Event | HAT Level (1.11 mAHD)
E22	Peak Flood Depth | Existing Conditions	No Local Rainfall Event | January 2018 King Tide (1.29 mAHD)
E23	Peak Flood Depth | Existing Conditions	No Local Rainfall Event | 1% AEP Storm Tide (2.0 mAHD)

Legend

2D Hydraulic Model Boundary

Flood Depth (m)

- < 0.1
- 0.1 - 0.2
- 0.2 - 0.3
- 0.3 - 0.5
- > 0.5

Paper Size ISO A3

0 0.1 0.2 0.3 0.4

Kilometers

Map Projection: Mercator Auxiliary Sphere
Horizontal Datum: WGS 1984
Grid: WGS 1984 Web Mercator Auxiliary Sphere

N

BALLINA SHIRE COUNCIL
BALLINA ISLAND AND WEST BALLINA FLOOD STUDY

Peak Flood Depth | Existing Conditions
0.2% AEP Design Flood Event | MLWS Tide Level

Project No. 4132837
Revision No. 00
Date 22/09/2020

Figure E1

D:\99_Local_folder\Rachael\Projects\4132837_Ballina\Outputs\Fig_E1_E012_0-2_AEP_Depth_E012_Ballina.mxd
Print date: 22 Sep 2020 - 13:54

Legend

2D Hydraulic Model Boundary

Flood Depth (m)

- < 0.1
- 0.1 - 0.2
- 0.2 - 0.3
- 0.3 - 0.5
- > 0.5

Paper Size ISO A3

0 0.1 0.2 0.3 0.4

Kilometers

Map Projection: Mercator Auxiliary Sphere
Horizontal Datum: WGS 1984
Grid: WGS 1984 Web Mercator Auxiliary Sphere

N

GHD

BALLINA SHIRE COUNCIL
BALLINA ISLAND AND WEST BALLINA FLOOD STUDY

Peak Flood Depth | Existing Conditions
1% AEP Design Flood Event | MLWS Tide Level

Project No. 4132837
Revision No. 00
Date 22/09/2020

Figure E2

Data source: Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community. Created by: rbiggins

Legend

2D Hydraulic Model Boundary

Flood Depth (m)

- < 0.1
- 0.1 - 0.2
- 0.2 - 0.3
- 0.3 - 0.5
- > 0.5

Paper Size ISO A3

0 0.1 0.2 0.3 0.4

Kilometers

Map Projection: Mercator Auxiliary Sphere
Horizontal Datum: WGS 1984
Grid: WGS 1984 Web Mercator Auxiliary Sphere

N

BALLINA SHIRE COUNCIL
BALLINA ISLAND AND WEST BALLINA FLOOD STUDY

Peak Flood Depth | Existing Conditions
5% AEP Design Flood Event | MLWS Tide Level

Project No. 4132837
Revision No. 00
Date 22/09/2020

Figure E3

Data source: Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community. Created by: rbiggins

Legend

2D Hydraulic Model Boundary

Flood Depth (m)

- < 0.1
- 0.1 - 0.2
- 0.2 - 0.3
- 0.3 - 0.5
- > 0.5

Paper Size ISO A3

0 0.1 0.2 0.3 0.4

Kilometers

Map Projection: Mercator Auxiliary Sphere
Horizontal Datum: WGS 1984
Grid: WGS 1984 Web Mercator Auxiliary Sphere

N

BALLINA SHIRE COUNCIL
BALLINA ISLAND AND WEST BALLINA FLOOD STUDY

Peak Flood Depth | Existing Conditions
10% AEP Design Flood Event | MLWS Tide Level

Project No. 4132837
Revision No. 00
Date 22/09/2020

Figure E4

Data source: Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community. Created by: rbiggins

Legend

2D Hydraulic Model Boundary

Flood Depth (m)

- < 0.1
- 0.1 - 0.2
- 0.2 - 0.3
- 0.3 - 0.5
- > 0.5

Paper Size ISO A3

0 0.1 0.2 0.3 0.4

Kilometers

Map Projection: Mercator Auxiliary Sphere
Horizontal Datum: WGS 1984
Grid: WGS 1984 Web Mercator Auxiliary Sphere

N

BALLINA SHIRE COUNCIL
BALLINA ISLAND AND WEST BALLINA FLOOD STUDY

Peak Flood Depth | Existing Conditions
20% AEP Design Flood Event | MLWS Tide Level

Project No. 4132837
Revision No. 00
Date 22/09/2020

Figure E5

Data source: Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community. Created by: rbiggins

Paper Size ISO A3

0 0.1 0.2 0.3 0.4

Kilometers

Map Projection: Mercator Auxiliary Sphere
Horizontal Datum: WGS 1984
Grid: WGS 1984 Web Mercator Auxiliary Sphere

N

BALLINA SHIRE COUNCIL
BALLINA ISLAND AND WEST BALLINA FLOOD STUDY

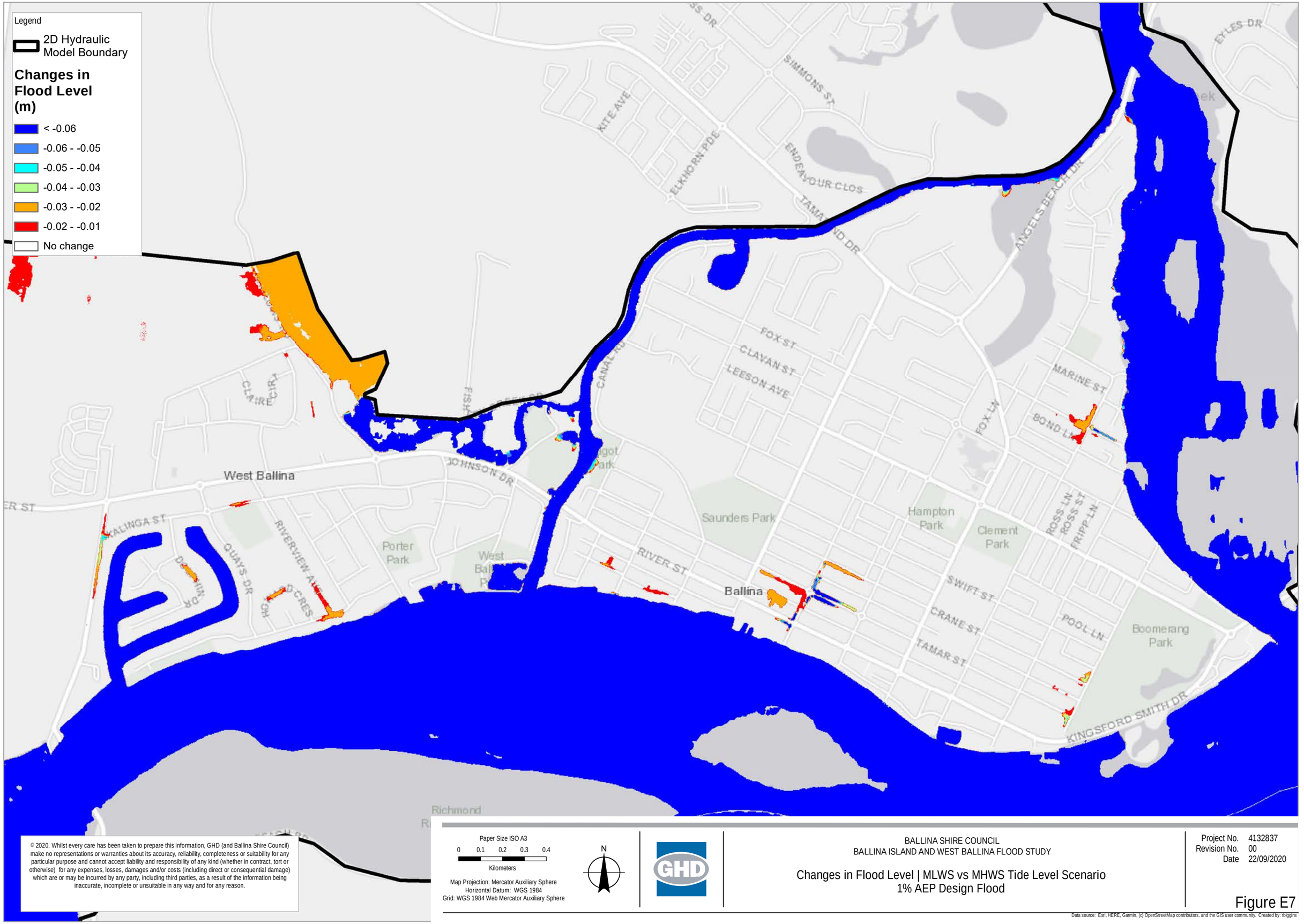
Changes in Flood Level | MLWS vs MHWS Tide Level Scenario
0.2% AEP Design Flood

Project No. 4132837
Revision No. 00
Date 22/09/2020

Figure E6

D:\99_Local_folder\Rachael\Projects\4132837_Ballina\Outputs\Fig_E6_E012vsE011_0-2_AEP_Afflux_E012_Ballina.mxd
Print date: 22 Sep 2020 - 13:56

Data source: Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community. Created by: rbiggins



Paper Size ISO A3

0 0.1 0.2 0.3 0.4

Kilometers

Map Projection: Mercator Auxiliary Sphere
Horizontal Datum: WGS 1984
Grid: WGS 1984 Web Mercator Auxiliary Sphere

N

GHD

BALLINA SHIRE COUNCIL
BALLINA ISLAND AND WEST BALLINA FLOOD STUDY

Changes in Flood Level | MLWS vs MHWS Tide Level Scenario
1% AEP Design Flood

Project No. 4132837
Revision No. 00
Date 22/09/2020

Figure E7

Data source: Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community. Created by: rbiggins

Legend

2D Hydraulic Model Boundary

Changes in Flood Level (m)

- < -0.06
- -0.06 - -0.05
- -0.05 - -0.04
- -0.04 - -0.03
- -0.03 - -0.02
- -0.02 - -0.01
- No change

West Ballina
Ballina
Porter Park
Saunders Park
Hampton Park
Clement Park
Boomerang Park
Richmond
KALINGA ST
RIVERVIEW AV
HOWARD CRES
QUAYS DR
DOLPHIN DR
JOHNSON DR
RIVER ST
FISH
CANAL RD
FOX ST
CLAVAN ST
LEESON AVE
SIMMONS ST
KITE AVE
ELKHORN PDE
ENDEAVOUR CLOS
JAMA
ND DR
ANGELS BEACH DR
EYLES DR
MARINE ST
FOX LN
BOND LN
ROSS LN
ROSS ST
CRIPPS LN
SWIFT ST
CRANE ST
TAMAR ST
POOL LN
KINGSFORD SMITH DR

Paper Size ISO A3

0 0.1 0.2 0.3 0.4

Kilometers

Map Projection: Mercator Auxiliary Sphere
Horizontal Datum: WGS 1984
Grid: WGS 1984 Web Mercator Auxiliary Sphere

N

GHD

BALLINA SHIRE COUNCIL
BALLINA ISLAND AND WEST BALLINA FLOOD STUDY

Changes in Flood Level | MLWS vs MHWS Tide Level Scenario
5% AEP Design Flood

Project No. 4132837
Revision No. 00
Date 22/09/2020

Figure E8

Legend

2D Hydraulic Model Boundary

Changes in Flood Level (m)

- < -0.06
- -0.06 - -0.05
- -0.05 - -0.04
- -0.04 - -0.03
- -0.03 - -0.02
- -0.02 - -0.01
- No change

Paper Size ISO A3

0 0.1 0.2 0.3 0.4

Kilometers

Map Projection: Mercator Auxiliary Sphere
Horizontal Datum: WGS 1984
Grid: WGS 1984 Web Mercator Auxiliary Sphere

N

BALLINA SHIRE COUNCIL
BALLINA ISLAND AND WEST BALLINA FLOOD STUDY

Changes in Flood Level | MLWS vs MHWS Tide Level Scenario
10% AEP Design Flood

Project No. 4132837
Revision No. 00
Date 22/09/2020

Figure E9

Legend

2D Hydraulic Model Boundary

Changes in Flood Level (m)

- < -0.06
- -0.06 - -0.05
- -0.05 - -0.04
- -0.04 - -0.03
- -0.03 - -0.02
- -0.02 - -0.01
- No change

Paper Size ISO A3

0 0.1 0.2 0.3 0.4

Kilometers

Map Projection: Mercator Auxiliary Sphere
Horizontal Datum: WGS 1984
Grid: WGS 1984 Web Mercator Auxiliary Sphere

N

BALLINA SHIRE COUNCIL
BALLINA ISLAND AND WEST BALLINA FLOOD STUDY

Changes in Flood Level | MLWS vs MHWS Tide Level Scenario
20% AEP Design Flood

Project No. 4132837
Revision No. 00
Date 22/09/2020

Figure E10

Legend

2D Hydraulic Model Boundary

Flood Depth (m)

- < 0.1
- 0.1 - 0.2
- 0.2 - 0.3
- 0.3 - 0.6
- > 0.6

Paper Size ISO A3

0 0.1 0.2 0.3 0.4

Kilometers

Map Projection: Mercator Auxiliary Sphere
Horizontal Datum: WGS 1984
Grid: WGS 1984 Web Mercator Auxiliary Sphere

N

BALLINA SHIRE COUNCIL
BALLINA ISLAND AND WEST BALLINA FLOOD STUDY

Peak Flood Depth | Existing Conditions
0.2% AEP Design Flood Event | HAT Tide Level

Project No. 4132837
Revision No. 00
Date 22/09/2020

Figure E11

D:\99_Local_folder\Rachael\Projects\4132837_Ballina\Outputs\Fig_E11_E013_0-2_AEP_Depth_E013_Ballina.mxd
Print date: 22 Sep 2020 - 13:59

Data source: Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community. Created by: rbiggins

Legend

2D Hydraulic Model Boundary

Flood Depth (m)

- < 0.1
- 0.1 - 0.2
- 0.2 - 0.3
- 0.3 - 0.6
- > 0.6

Paper Size ISO A3

0 0.1 0.2 0.3 0.4

Kilometers

Map Projection: Mercator Auxiliary Sphere
Horizontal Datum: WGS 1984
Grid: WGS 1984 Web Mercator Auxiliary Sphere

N

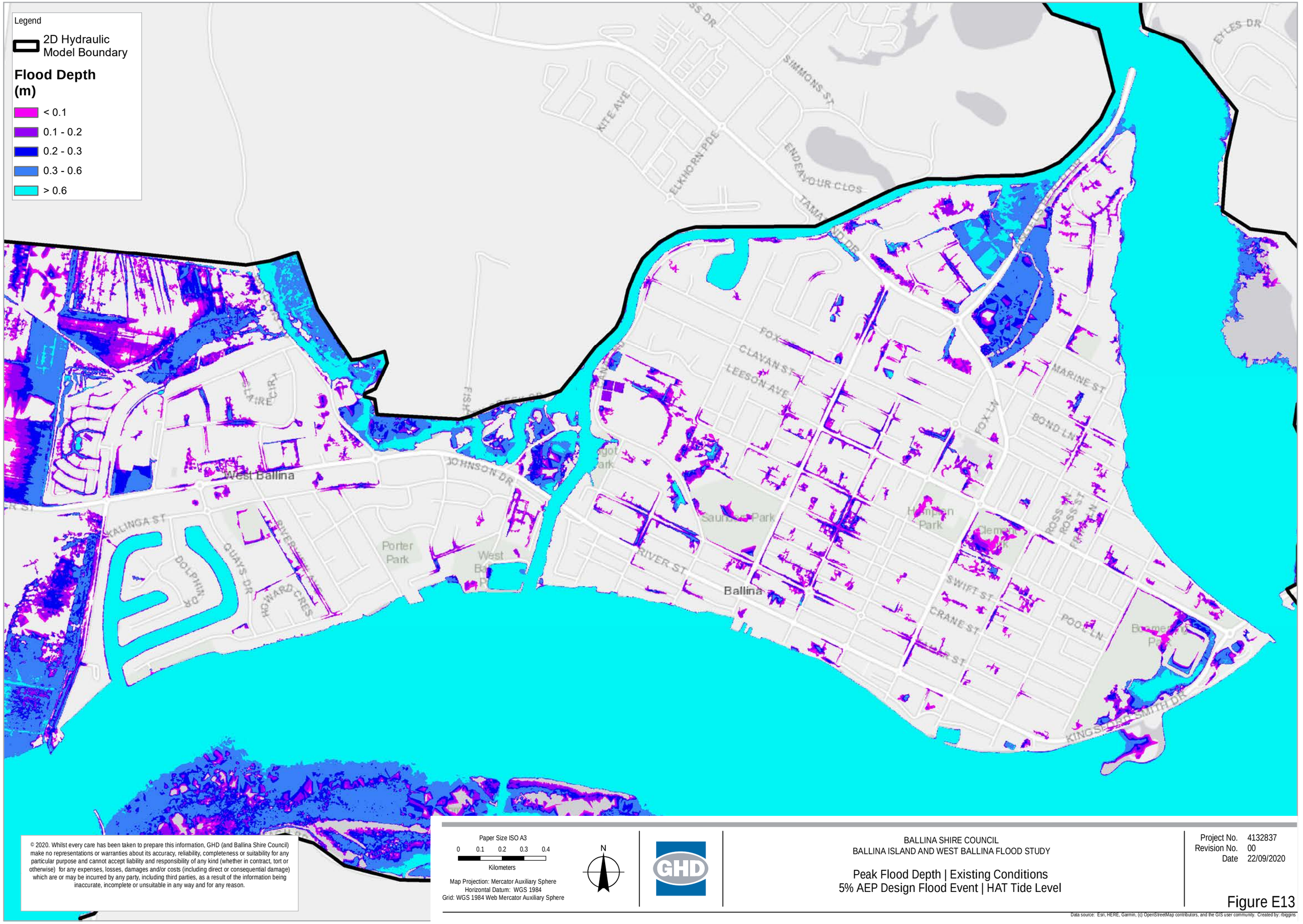
BALLINA SHIRE COUNCIL
BALLINA ISLAND AND WEST BALLINA FLOOD STUDY

Peak Flood Depth | Existing Conditions
1% AEP Design Flood Event | HAT Tide Level

Project No. 4132837
Revision No. 00
Date 22/09/2020

Figure E12

Data source: Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community. Created by: rbiggins



Paper Size ISO A3

0 0.1 0.2 0.3 0.4

Kilometers

Map Projection: Mercator Auxiliary Sphere
Horizontal Datum: WGS 1984
Grid: WGS 1984 Web Mercator Auxiliary Sphere

N

BALLINA SHIRE COUNCIL
BALLINA ISLAND AND WEST BALLINA FLOOD STUDY

Peak Flood Depth | Existing Conditions
5% AEP Design Flood Event | HAT Tide Level

Project No. 4132837
Revision No. 00
Date 22/09/2020

Figure E13

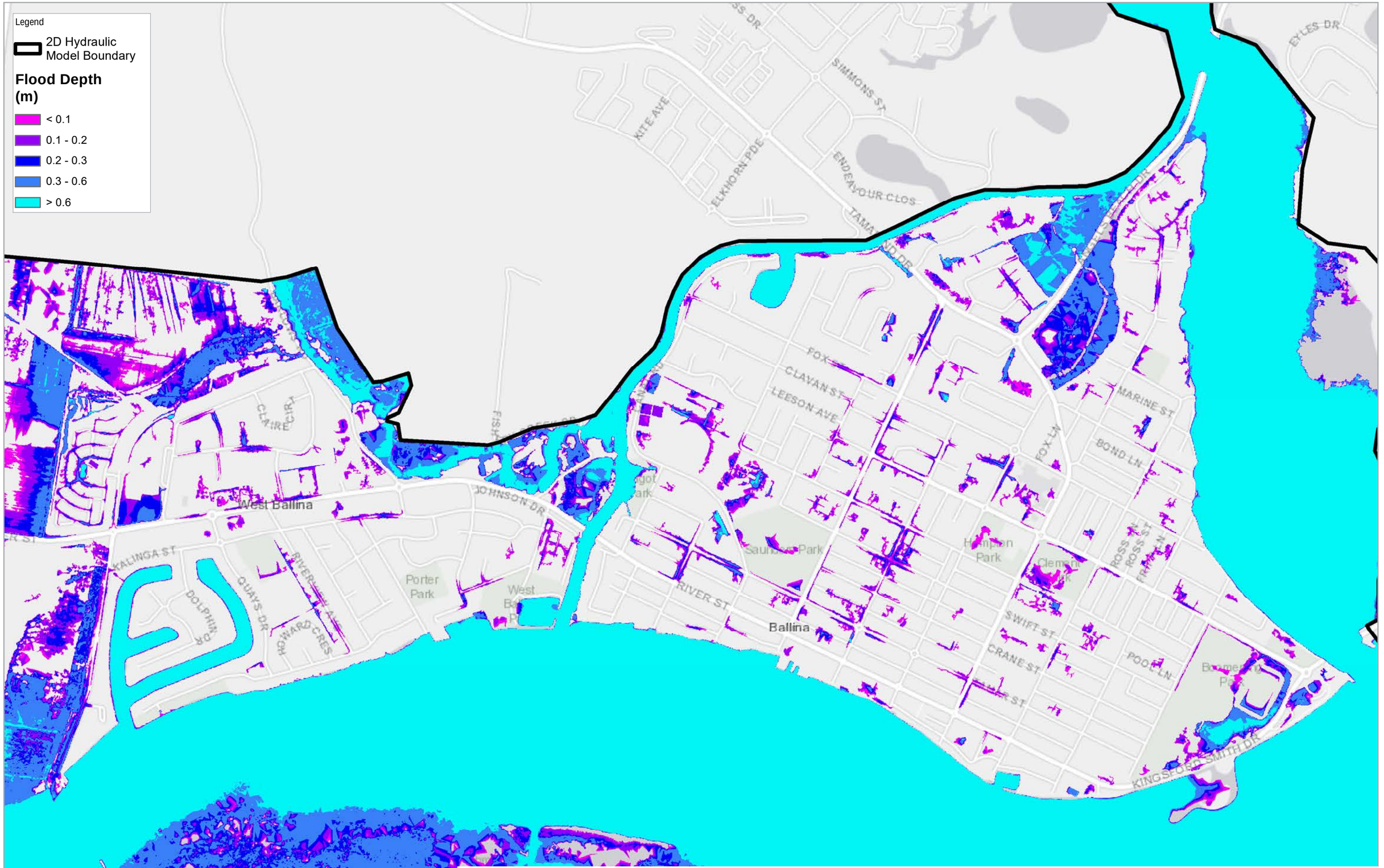
Data source: Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community. Created by: rbiggins

Legend

2D Hydraulic Model Boundary

Flood Depth (m)

- < 0.1
- 0.1 - 0.2
- 0.2 - 0.3
- 0.3 - 0.6
- > 0.6



Paper Size ISO A3

0 0.1 0.2 0.3 0.4

Kilometers

Map Projection: Mercator Auxiliary Sphere
Horizontal Datum: WGS 1984
Grid: WGS 1984 Web Mercator Auxiliary Sphere

N

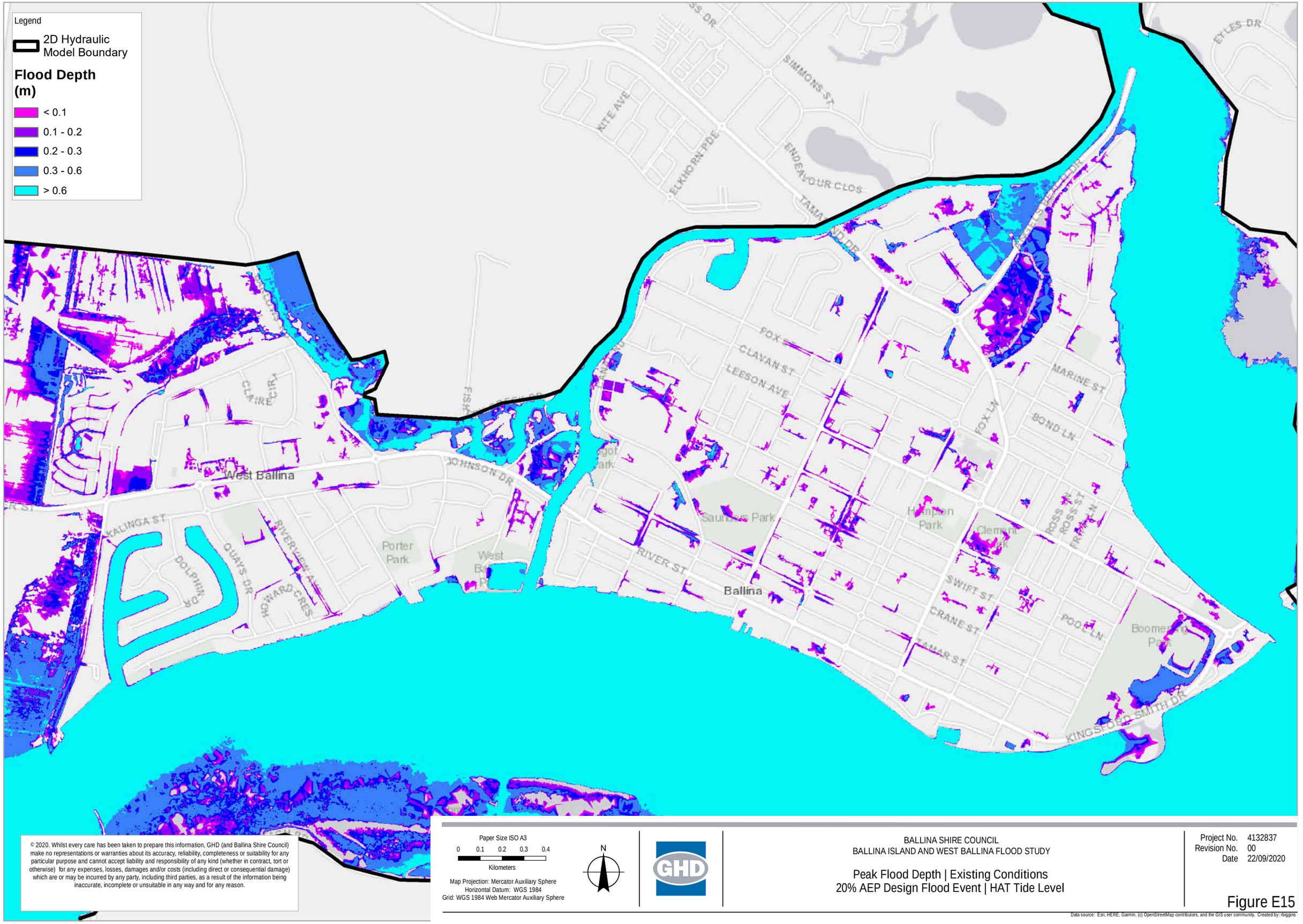
GHD

BALLINA SHIRE COUNCIL
BALLINA ISLAND AND WEST BALLINA FLOOD STUDY

Peak Flood Depth | Existing Conditions
10% AEP Design Flood Event | HAT Tide Level

Project No. 4132837
Revision No. 00
Date 22/09/2020

Figure E14



Paper Size ISO A3

0 0.1 0.2 0.3 0.4

Kilometers

Map Projection: Mercator Auxiliary Sphere
Horizontal Datum: WGS 1984
Grid: WGS 1984 Web Mercator Auxiliary Sphere

N

BALLINA SHIRE COUNCIL
BALLINA ISLAND AND WEST BALLINA FLOOD STUDY

Peak Flood Depth | Existing Conditions
20% AEP Design Flood Event | HAT Tide Level

Project No. 4132837
Revision No. 00
Date 22/09/2020

Figure E15

Data source: Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community. Created by: rbiggins

Paper Size ISO A3

0 0.1 0.2 0.3 0.4

Kilometers

Map Projection: Mercator Auxiliary Sphere
Horizontal Datum: WGS 1984
Grid: WGS 1984 Web Mercator Auxiliary Sphere

N

GHD

BALLINA SHIRE COUNCIL
BALLINA ISLAND AND WEST BALLINA FLOOD STUDY

Changes in Flood Level | HAT vs MHWS Tide Level Scenario
0.2% AEP Design Flood

Project No. 4132837
Revision No. 00
Date 22/09/2020

Figure E16

D:\99_Local_folder\Rachael\Projects\4132837_Ballina\Outputs\Fig_E16_E013vsE011_0-2_AEP_Afflux_E013_Ballina.mxd
Print date: 22 Sep 2020 - 14:01

Data source: Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community. Created by: rbiggins

Paper Size ISO A3

0 0.1 0.2 0.3 0.4

Kilometers

Map Projection: Mercator Auxiliary Sphere
Horizontal Datum: WGS 1984
Grid: WGS 1984 Web Mercator Auxiliary Sphere

N

BALLINA SHIRE COUNCIL
BALLINA ISLAND AND WEST BALLINA FLOOD STUDY

Changes in Flood Level | HAT vs MHWS Tide Level Scenario
1% AEP Design Flood

Project No. 4132837
Revision No. 00
Date 22/09/2020

Figure E17

Data source: Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community. Created by: rbiggins

Legend

2D Hydraulic Model Boundary

Changes in Flood Level (m)

- No change
- 0.010 - 0.025
- 0.025 - 0.050
- 0.050 - 0.075
- 0.075 - 0.100
- 0.100 - 0.150
- > 0.150

West Ballina
Porter Park
Saunders Park
Hampton Park
Clement Park
Ballina
Boomerang Park
Richmond R

BARLOWS RD
CLAIRE CT
KALINGA ST
DOLPHIN DR
QUAYS DR
RIVERVIEW
HOWARD CRES
JOHNSON DR
RIVER ST
SIMMONS ST
KITE AVE
ELKHORN PDE
ENDEAVOUR CLOS
JAMA
ND DR
EYLES DR
ANGELS BEACH DR
FOX ST
CLAVAN ST
LEESON AVE
MARINE ST
BOND LN
FOX LN
ROSS LN
ROSS ST
FRIPP LN
SWIFT ST
CRANE ST
TAMAR ST
POOL LN
KINGSFORD SMITH DR

Paper Size ISO A3

0 0.1 0.2 0.3 0.4

Kilometers

Map Projection: Mercator Auxiliary Sphere
Horizontal Datum: WGS 1984
Grid: WGS 1984 Web Mercator Auxiliary Sphere

N

GHD

BALLINA SHIRE COUNCIL
BALLINA ISLAND AND WEST BALLINA FLOOD STUDY

Changes in Flood Level | HAT vs MHWS Tide Level Scenario
5% AEP Design Flood

Project No. 4132837
Revision No. 00
Date 22/09/2020

Figure E18

Data source: Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community. Created by: rbiggins

Legend

2D Hydraulic Model Boundary

Changes in Flood Level (m)

- No change
- 0.010 - 0.025
- 0.025 - 0.050
- 0.050 - 0.075
- 0.075 - 0.100
- 0.100 - 0.150
- > 0.150

Paper Size ISO A3

0 0.1 0.2 0.3 0.4

Kilometers

Map Projection: Mercator Auxiliary Sphere
Horizontal Datum: WGS 1984
Grid: WGS 1984 Web Mercator Auxiliary Sphere

N

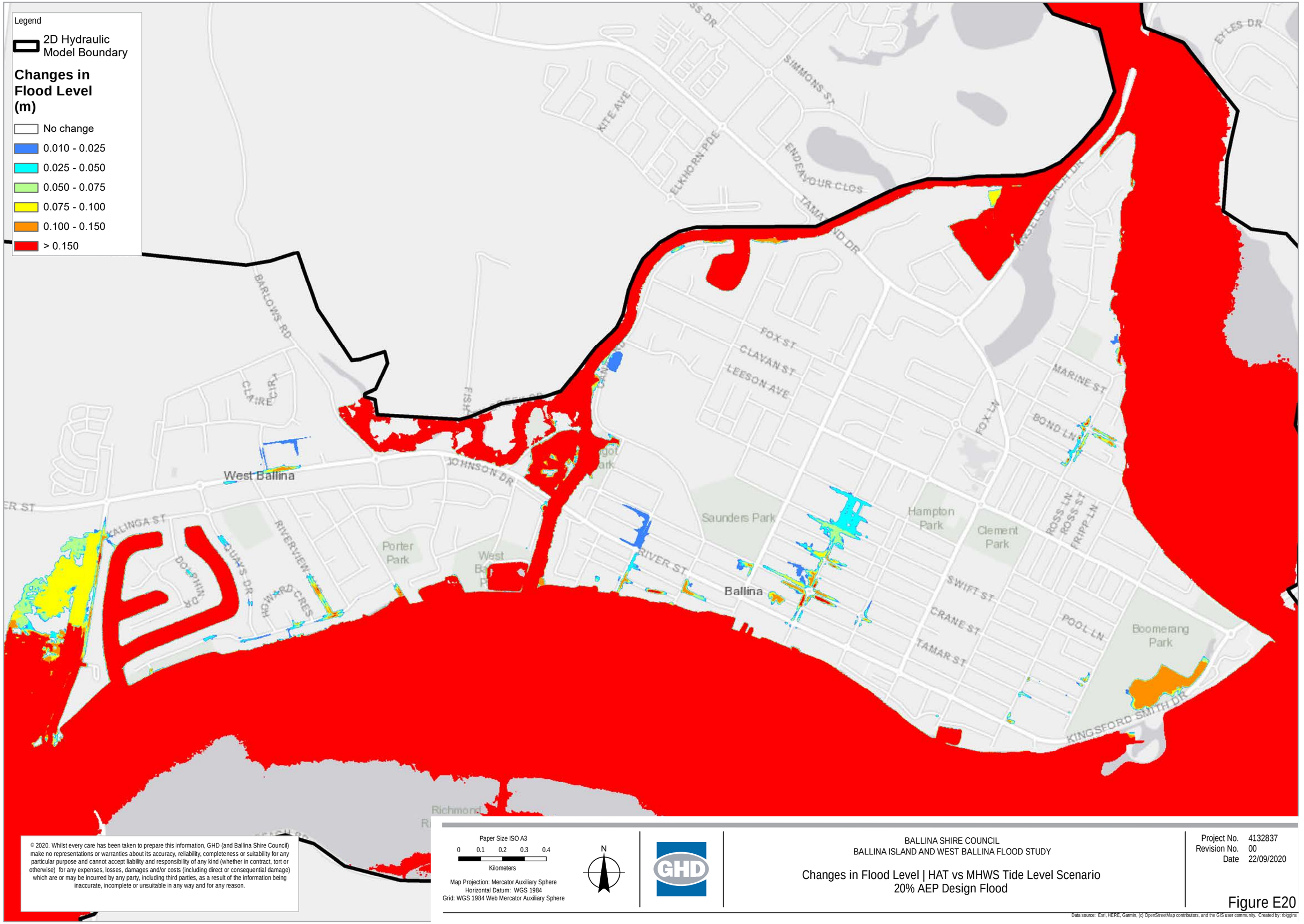
BALLINA SHIRE COUNCIL
BALLINA ISLAND AND WEST BALLINA FLOOD STUDY

Changes in Flood Level | HAT vs MHWS Tide Level Scenario
10% AEP Design Flood

Project No. 4132837
Revision No. 00
Date 22/09/2020

Figure E19

Data source: Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community. Created by: rbiggins



Paper Size ISO A3

0 0.1 0.2 0.3 0.4

Kilometers

Map Projection: Mercator Auxiliary Sphere
Horizontal Datum: WGS 1984
Grid: WGS 1984 Web Mercator Auxiliary Sphere

N

BALLINA SHIRE COUNCIL
BALLINA ISLAND AND WEST BALLINA FLOOD STUDY

Changes in Flood Level | HAT vs MHWS Tide Level Scenario
20% AEP Design Flood

Project No. 4132837
Revision No. 00
Date 22/09/2020

Figure E20

Data source: Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community. Created by: rbiggins

Legend

2D Hydraulic Model Boundary

Percentage of Full Pipe

- 0% - 40%
- 40% - 60%
- 60% - 80%
- 80% - 90%
- 90% - 100%

Flood Depth (m)

- < 0.1
- 0.1 - 0.2
- 0.2 - 0.3
- 0.3 - 0.5
- > 0.5

Paper Size ISO A3

0 0.1 0.2 0.3 0.4

Kilometers

Map Projection: Mercator Auxiliary Sphere
Horizontal Datum: WGS 1984
Grid: WGS 1984 Web Mercator Auxiliary Sphere

N

GHD

BALLINA SHIRE COUNCIL
BALLINA ISLAND AND WEST BALLINA FLOOD STUDY

Peak Flood Depth | Existing Conditions
No Local Rainfall Event | HAT Level (1.1 mAHD)

Project No. 4132837
Revision No. 00
Date 18/11/2020

Figure E21

D:\Rachael\Projects\4132837_Ballina\Outputs\Fig_E21_E020_NORainfall_Depth_Percentage of Full Pipe_1_Ballina.mxd
Print date: 18 Nov 2020 - 17:15

Data source: Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community. Created by: rbiggins

Legend

2D Hydraulic Model Boundary

Percentage of Full Pipe

- 0% - 40%
- 40% - 60%
- 60% - 80%
- 80% - 90%
- 90% - 100%

Flood Depth (m)

- < 0.1
- 0.1 - 0.2
- 0.2 - 0.3
- 0.3 - 0.5
- > 0.5

Paper Size ISO A3

0 0.1 0.2 0.3 0.4

Kilometers

Map Projection: Mercator Auxiliary Sphere
Horizontal Datum: WGS 1984
Grid: WGS 1984 Web Mercator Auxiliary Sphere

N

BALLINA SHIRE COUNCIL
BALLINA ISLAND AND WEST BALLINA FLOOD STUDY

Peak Flood Depth | Existing Conditions
No Local Rainfall Event | January 2018 King Tide (1.29 mAHD)

Project No. 4132837
Revision No. 00
Date 18/11/2020

Figure E22

D:\Rachael\Projects\4132837_Ballina\Outputs\Fig_E22_E024_NORainfall_Depth_Percentage of Full Pipe_2_Ballina.mxd
Print date: 18 Nov 2020 - 17:16

Data source: Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community. Created by: rbiggins

Legend

2D Hydraulic Model Boundary

Percentage of Full Pipe

- 0% - 40%
- 40% - 60%
- 60% - 80%
- 80% - 90%
- 90% - 100%

Flood Depth (m)

- < 0.1
- 0.1 - 0.2
- 0.2 - 0.3
- 0.3 - 0.5
- > 0.5

Paper Size ISO A3

0 0.1 0.2 0.3 0.4

Kilometers

Map Projection: Mercator Auxiliary Sphere
Horizontal Datum: WGS 1984
Grid: WGS 1984 Web Mercator Auxiliary Sphere

N

BALLINA SHIRE COUNCIL
BALLINA ISLAND AND WEST BALLINA FLOOD STUDY

Peak Flood Depth | Existing Conditions
No Local Rainfall Event | 1% AEP Storm Tide (2.0 mAHD)

Project No. 4132837
Revision No. 00
Date 18/11/2020

Figure E23

D:\Rachael\Projects\4132837_Ballina\Outputs\Fig_E23_E021_NORainfall_Depth_Percentage of Full Pipe_3_Ballina.mxd
Print date: 18 Nov 2020 - 17:16

Data source: Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community. Created by: rbiggins

Appendix F – Flood maps – Sensitivity tests on model parameters

Figure ID	Description	Flood event
F1	Changes in Flood Level | 100% Blockage of Stormwater Network	0.2% AEP Design Flood Event | MHWS Tide Level
F2	Changes in Flood Level | 100% Blockage of Stormwater Network	1% AEP Design Flood Event | MHWS Tide Level
F3	Changes in Flood Level | 100% Blockage of Stormwater Network	5% AEP Design Flood Event | MHWS Tide Level
F4	Changes in Flood Level | 100% Blockage of Stormwater Network	20% AEP Design Flood Event | MHWS Tide Level
F5	Changes in Flood Level | No Losses Scenario vs Baseline Losses Scenario	1% AEP Design Flood Event | MHWS Tide Level
F6	Changes in Flood Level | No Losses Scenario vs Baseline Losses Scenario	5% AEP Design Flood Event | MHWS Tide Level
F7	Changes in Flood Level | No Losses Scenario vs Baseline Losses Scenario	20% AEP Design Flood Event | MHWS Tide Level

Legend

2D Hydraulic Model Boundary

Changes in Flood Level (m)

- No change
- 0.01 - 0.1
- 0.1 - 0.2
- 0.2 - 0.3
- 0.3 - 0.4
- > 0.4

Paper Size ISO A3

0 0.1 0.2 0.3 0.4

Kilometers

Map Projection: Mercator Auxiliary Sphere
Horizontal Datum: WGS 1984
Grid: WGS 1984 Web Mercator Auxiliary Sphere

N

BALLINA SHIRE COUNCIL
BALLINA ISLAND AND WEST BALLINA FLOOD STUDY

Changes in Flood Level | 100% Blockage of Stormwater Network
0.2% AEP Design Flood Event | MHWS Tide Level

Project No. 4132837
Revision No. 00
Date 22/09/2020

Figure F1

D:\99_Local_folder\Rachael\Projects\4132837_Ballina\Outputs\Fig_F1_E014vsE011_0-2_AEP_Afflux_E014_Ballina.mxd
Print date: 22 Sep 2020 - 14:25

Data source: Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community. Created by: rbiggins

Legend

2D Hydraulic Model Boundary

Changes in Flood Level (m)

- No change
- 0.01 - 0.1
- 0.1 - 0.2
- 0.2 - 0.3
- 0.3 - 0.4
- > 0.4

Paper Size ISO A3

0 0.1 0.2 0.3 0.4

Kilometers

Map Projection: Mercator Auxiliary Sphere
Horizontal Datum: WGS 1984
Grid: WGS 1984 Web Mercator Auxiliary Sphere

N

BALLINA SHIRE COUNCIL
BALLINA ISLAND AND WEST BALLINA FLOOD STUDY

Changes in Flood Level | 100% Blockage of Stormwater Network
1% AEP Design Flood Event | MHWS Tide Level

Project No. 4132837
Revision No. 00
Date 22/09/2020

Figure F2

Legend

2D Hydraulic Model Boundary

Changes in Flood Level (m)

- No change
- 0.01 - 0.1
- 0.1 - 0.2
- 0.2 - 0.3
- 0.3 - 0.4
- > 0.4

Paper Size ISO A3

0 0.1 0.2 0.3 0.4

Kilometers

Map Projection: Mercator Auxiliary Sphere
Horizontal Datum: WGS 1984
Grid: WGS 1984 Web Mercator Auxiliary Sphere

N

BALLINA SHIRE COUNCIL
BALLINA ISLAND AND WEST BALLINA FLOOD STUDY

Changes in Flood Level | 100% Blockage of Stormwater Network
5% AEP Design Flood Event | MHWS Tide Level

Project No. 4132837
Revision No. 00
Date 22/09/2020

Figure F3

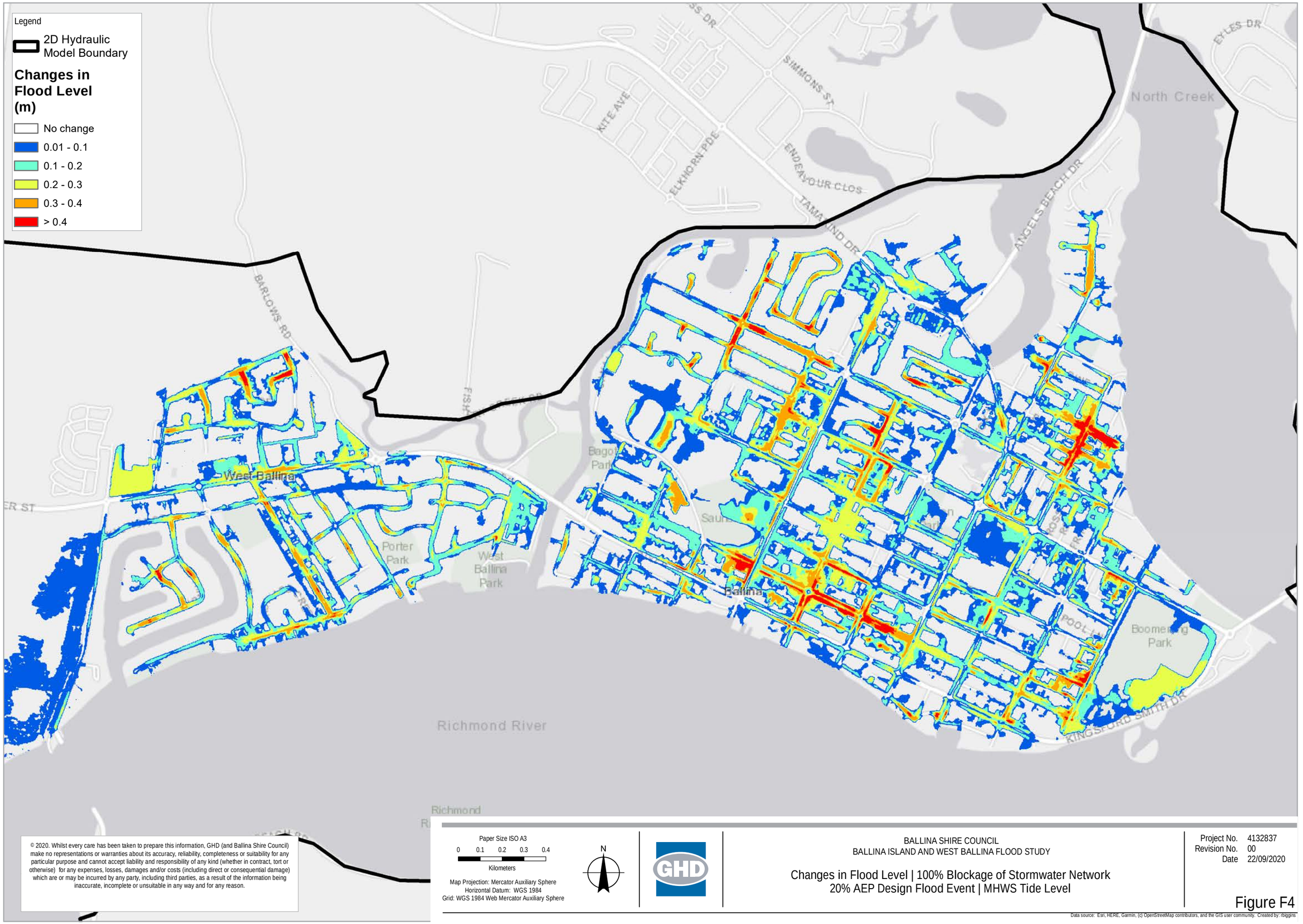
Data source: Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community. Created by: rbiggins

Legend

2D Hydraulic Model Boundary

Changes in Flood Level (m)

- No change
- 0.01 - 0.1
- 0.1 - 0.2
- 0.2 - 0.3
- 0.3 - 0.4
- > 0.4



Paper Size ISO A3

0 0.1 0.2 0.3 0.4

Kilometers

Map Projection: Mercator Auxiliary Sphere
Horizontal Datum: WGS 1984
Grid: WGS 1984 Web Mercator Auxiliary Sphere

N

BALLINA SHIRE COUNCIL
BALLINA ISLAND AND WEST BALLINA FLOOD STUDY

Changes in Flood Level | 100% Blockage of Stormwater Network
20% AEP Design Flood Event | MHWS Tide Level

Project No. 4132837
Revision No. 00
Date 22/09/2020

Figure F4

Data source: Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community. Created by: rbiggins

Legend

2D Hydraulic Model Boundary

Changes in Flood Level (m)

- No change
- 0.01 - 0.02
- 0.02 - 0.03
- 0.03 - 0.04
- 0.04 - 0.05
- 0.05 - 0.06
- > 0.06

Paper Size ISO A3

0 0.1 0.2 0.3 0.4

Kilometers

Map Projection: Mercator Auxiliary Sphere
Horizontal Datum: WGS 1984
Grid: WGS 1984 Web Mercator Auxiliary Sphere

N

BALLINA SHIRE COUNCIL
BALLINA ISLAND AND WEST BALLINA FLOOD STUDY

Changes in Flood Level | No Losses Scenario vs Baseline Losses Scenario
1% AEP Design Flood | MHWS Tide Level

Project No. 4132837
Revision No. 00
Date 22/09/2020

Figure F5

Data source: Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community. Created by: rbiggins

Legend

2D Hydraulic Model Boundary

Changes in Flood Level (m)

- No change
- 0.01 - 0.02
- 0.02 - 0.03
- 0.03 - 0.04
- 0.04 - 0.05
- 0.05 - 0.06
- > 0.06

West Ballina
Bagot Park
Saunders Park
Hampton Park
Clement Park
Porter Park
West Ballina Park
Ballina
Richmond River
North Creek
Richmond
KITE AVE
ELKHORN PDE
SIMMONS ST
ENDEAVOUR CLOS
TAMARIND DR
EYLES DR
SHELLY BEACH DR
FOX ST
CLAVAN ST
LEESON AVE
CANAL RD
MARINE ST
FOX LN
BOND LN
ROSS LN
ROSS ST
TRIPP LN
JOHNSON DR
KALINGA ST
DOLPHIN DR
QUAYS DR
RIVERVIEW AVE
HOWARD CRES
RIVER ST
SWIFT ST
CRANE ST
TAMAR ST
POOL LN
KINGSFORD SMITH DR

Paper Size ISO A3

0 0.1 0.2 0.3 0.4

Kilometers

Map Projection: Mercator Auxiliary Sphere
Horizontal Datum: WGS 1984
Grid: WGS 1984 Web Mercator Auxiliary Sphere

N

GHD

BALLINA SHIRE COUNCIL
BALLINA ISLAND AND WEST BALLINA FLOOD STUDY

Changes in Flood Level | No Losses Scenario vs Baseline Losses Scenario
5% AEP Design Flood | MHWS Tide Level

Project No. 4132837
Revision No. 00
Date 22/09/2020

Figure F6

Legend

2D Hydraulic Model Boundary

Changes in Flood Level (m)

- No change
- 0.01 - 0.02
- 0.02 - 0.03
- 0.03 - 0.04
- 0.04 - 0.05
- 0.05 - 0.06
- > 0.06

West Ballina
Bagot Park
Saunders Park
Hampton Park
Clement Park
Porter Park
West Ballina Park
Ballina
Boomerang Park
North Creek
Richmond River
Richmond

Paper Size ISO A3

0 0.1 0.2 0.3 0.4

Kilometers

Map Projection: Mercator Auxiliary Sphere
Horizontal Datum: WGS 1984
Grid: WGS 1984 Web Mercator Auxiliary Sphere

N

GHD

BALLINA SHIRE COUNCIL
BALLINA ISLAND AND WEST BALLINA FLOOD STUDY

Changes in Flood Level | No Losses Scenario vs Baseline Losses Scenario
20% AEP Design Flood | MHWS Tide Level

Project No. 4132837
Revision No. 00
Date 22/09/2020

Figure F7

Data source: Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community. Created by: rbiggins

Appendix G – Flood maps – Coincidental occurrence of 1% local rainfall event and 1% AEP storm tide

Figure ID	Description	Flood event
G1	Peak Flood Depth	Coincidental Occurrence of 1% AEP Local Rainfall Event and 1% AEP Storm Tide
G2	Peak Flood Level	Coincidental Occurrence of 1% AEP Local Rainfall Event and 1% AEP Storm Tide
G3	Peak Flow Velocity	Coincidental Occurrence of 1% AEP Local Rainfall Event and 1% AEP Storm Tide
G4	Changes in Flood Level	Occurrence of 1% AEP Storm Tide vs MHWS Tide Level Scenario

Legend

2D Hydraulic Model Boundary

Flood Depth (m)

- < 0.1
- 0.1 - 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- > 0.6

Paper Size ISO A3

0 0.1 0.2 0.3 0.4

Kilometers

Map Projection: Mercator Auxiliary Sphere
Horizontal Datum: WGS 1984
Grid: WGS 1984 Web Mercator Auxiliary Sphere

N

BALLINA SHIRE COUNCIL
BALLINA ISLAND AND WEST BALLINA FLOOD STUDY

Peak Flood Depth
Coincidental Occurrence of 1% AEP Local Rainfall Event and 1% AEP Storm Tide

Project No. 4132837
Revision No. 00
Date 22/09/2020

Figure G1

Data source: Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community. Created by: rbiggins

Legend

2D Hydraulic Model Boundary

Flood Level (mAHD)

- 1.70 - 1.75
- 1.75 - 1.85
- 1.85 - 1.95
- 1.95 - 2.00
- > 2.00

Paper Size ISO A3

0 0.1 0.2 0.3 0.4

Kilometers

Map Projection: Mercator Auxiliary Sphere
Horizontal Datum: WGS 1984
Grid: WGS 1984 Web Mercator Auxiliary Sphere

N

BALLINA SHIRE COUNCIL
BALLINA ISLAND AND WEST BALLINA FLOOD STUDY

Peak Flood Level
Coincidental Occurrence of 1% AEP Local Rainfall Event and 1% AEP Storm Tide

Project No. 4132837
Revision No. 00
Date 22/09/2020

Figure G2

Data source: Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community. Created by: rbiggins

Legend

2D Hydraulic Model Boundary

Flow Velocity (m/s)

- < 0.050
- 0.050 - 0.075
- 0.075 - 0.100
- 0.100 - 0.200
- 0.200 - 0.400
- > 0.400

Paper Size ISO A3

0 0.1 0.2 0.3 0.4

Kilometers

Map Projection: Mercator Auxiliary Sphere
Horizontal Datum: WGS 1984
Grid: WGS 1984 Web Mercator Auxiliary Sphere

N

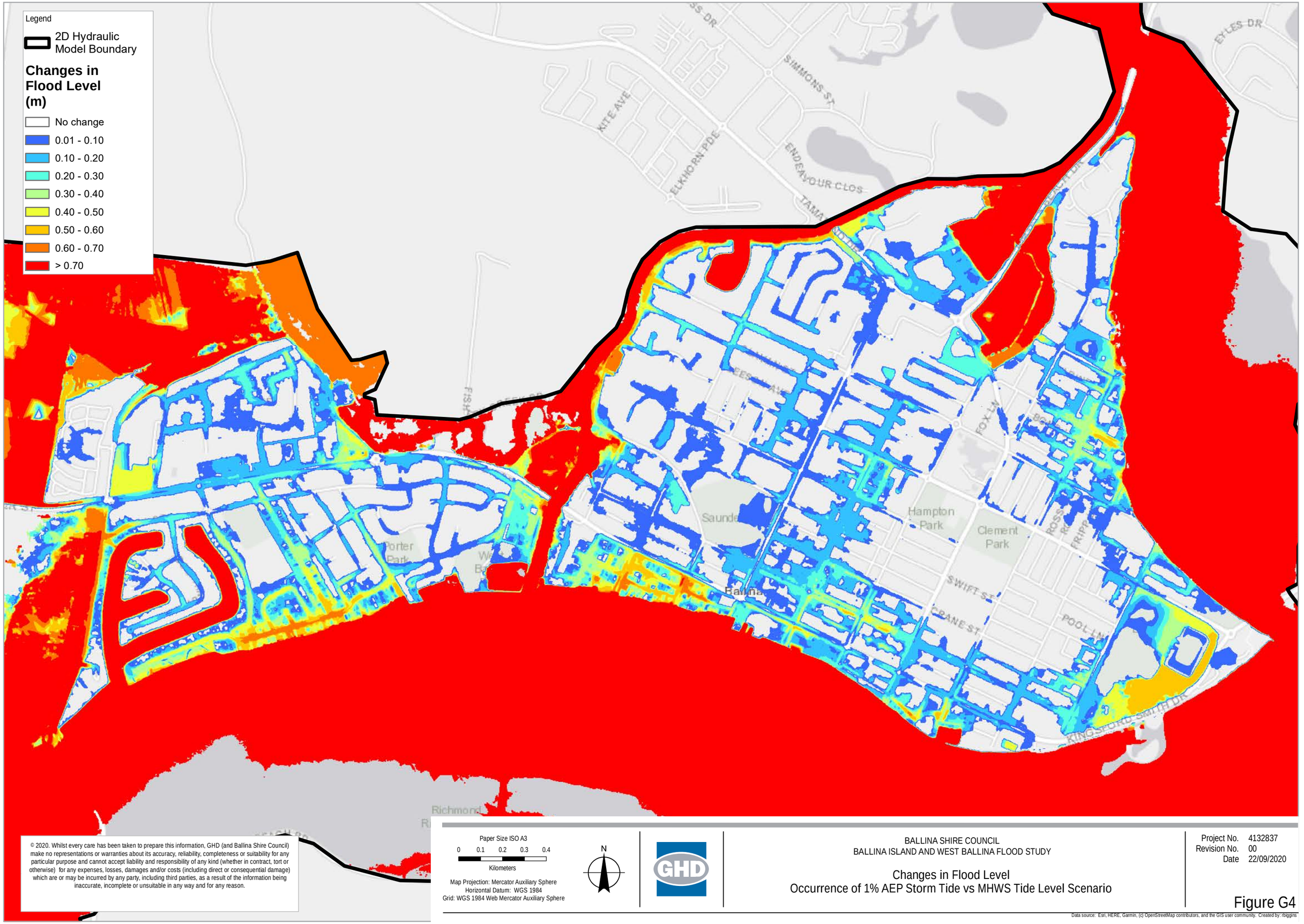
BALLINA SHIRE COUNCIL
BALLINA ISLAND AND WEST BALLINA FLOOD STUDY

Peak Flow Velocity
Coincidental Occurrence of 1% AEP Local Rainfall Event and 1% AEP Storm Tide

Project No. 4132837
Revision No. 00
Date 22/09/2020

Figure G3

Data source: Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community. Created by: rbiggins



Paper Size ISO A3

0 0.1 0.2 0.3 0.4

Kilometers

Map Projection: Mercator Auxiliary Sphere
Horizontal Datum: WGS 1984
Grid: WGS 1984 Web Mercator Auxiliary Sphere

N

GHD

BALLINA SHIRE COUNCIL
BALLINA ISLAND AND WEST BALLINA FLOOD STUDY

Changes in Flood Level
Occurrence of 1% AEP Storm Tide vs MHWS Tide Level Scenario

Project No. 4132837
Revision No. 00
Date 22/09/2020

Figure G4

Data source: Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community. Created by: rbiggins

Appendix H - Flooding hotspots

Flooding hotspot #1: Grant St

d > 0.2 m in 20% AEP
d > 0.2 m in 5% AEP
d > 0.2 m in 1% AEP

d = flood depth

Flooding hotspot #2: Moon St and Acacia Pl

d > 0.2 m in 20% AEP
d > 0.2 m in 5% AEP
d > 0.2 m in 1% AEP

d = flood depth

Flooding hotspot #3: Russell St

d > 0.2 m in 20% AEP
d > 0.2 m in 5% AEP
d > 0.2 m in 1% AEP

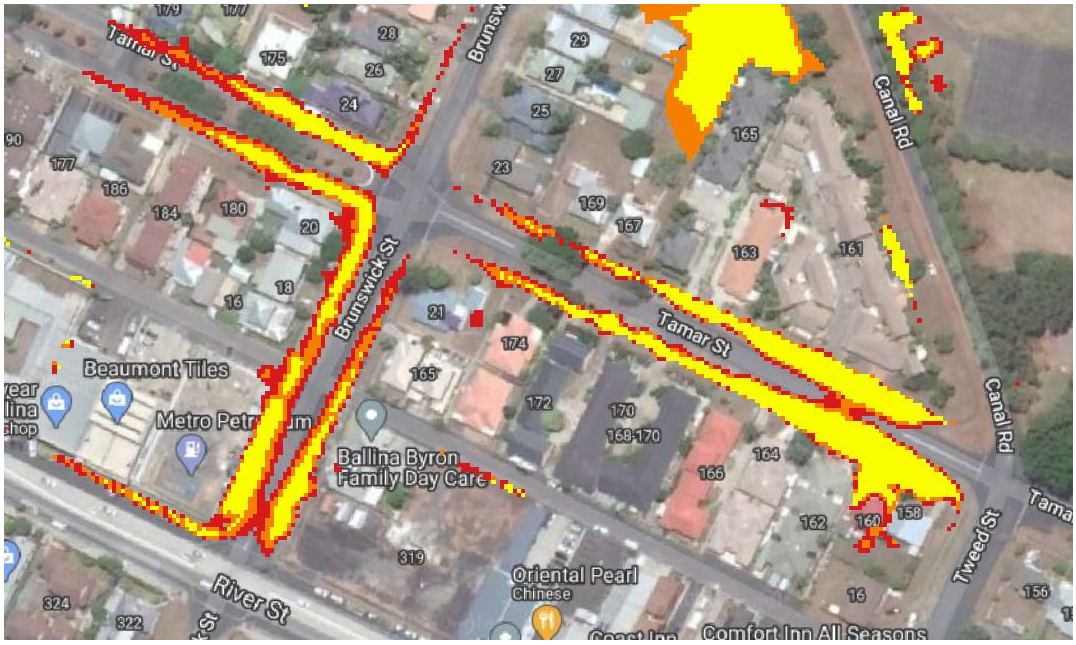
d = flood depth

Flooding hotspot #4: TAFE NSW

d > 0.2 m in 20% AEP
d > 0.2 m in 5% AEP
d > 0.2 m in 1% AEP

d = flood depth

Flooding hotspot #5: Tamar St & Brunswick St



d > 0.2 m in 20% AEP
d > 0.2 m in 5% AEP
d > 0.2 m in 1% AEP

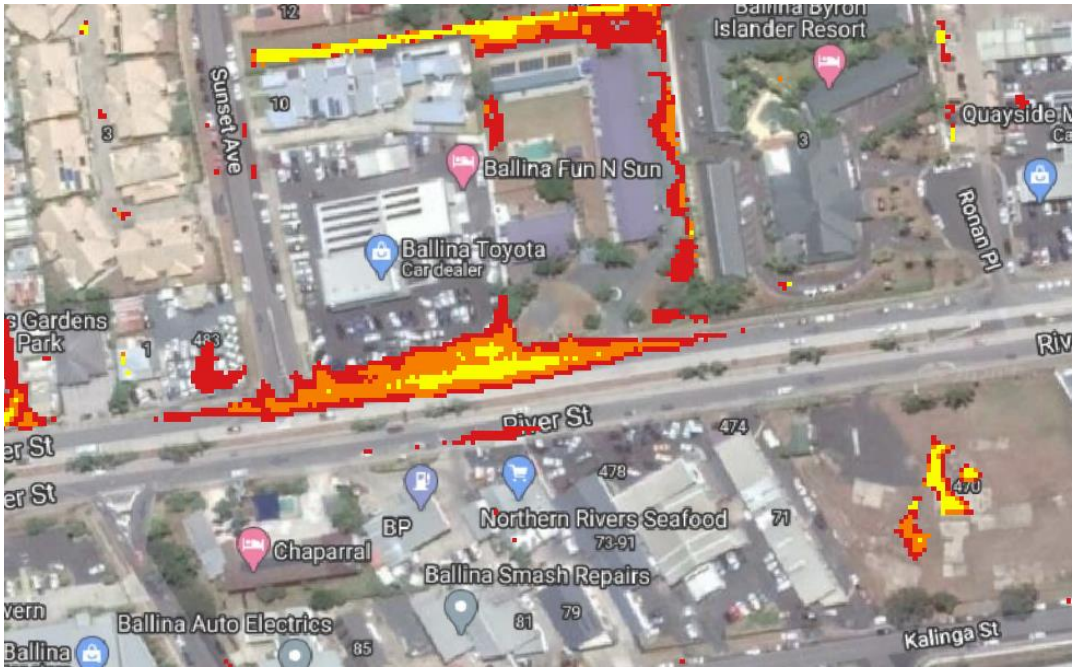
d = flood depth

Flooding hotspot #6: Newland St and Westland Pl

d > 0.2 m in 20% AEP
d > 0.2 m in 5% AEP
d > 0.2 m in 1% AEP

d = flood depth

Flooding hotspot #7: River St



d > 0.2 m in 20% AEP
d > 0.2 m in 5% AEP
d > 0.2 m in 1% AEP

d = flood depth

Flooding hotspot #8: Kalinga St

d > 0.2 m in 20% AEP
d > 0.2 m in 5% AEP
d > 0.2 m in 1% AEP

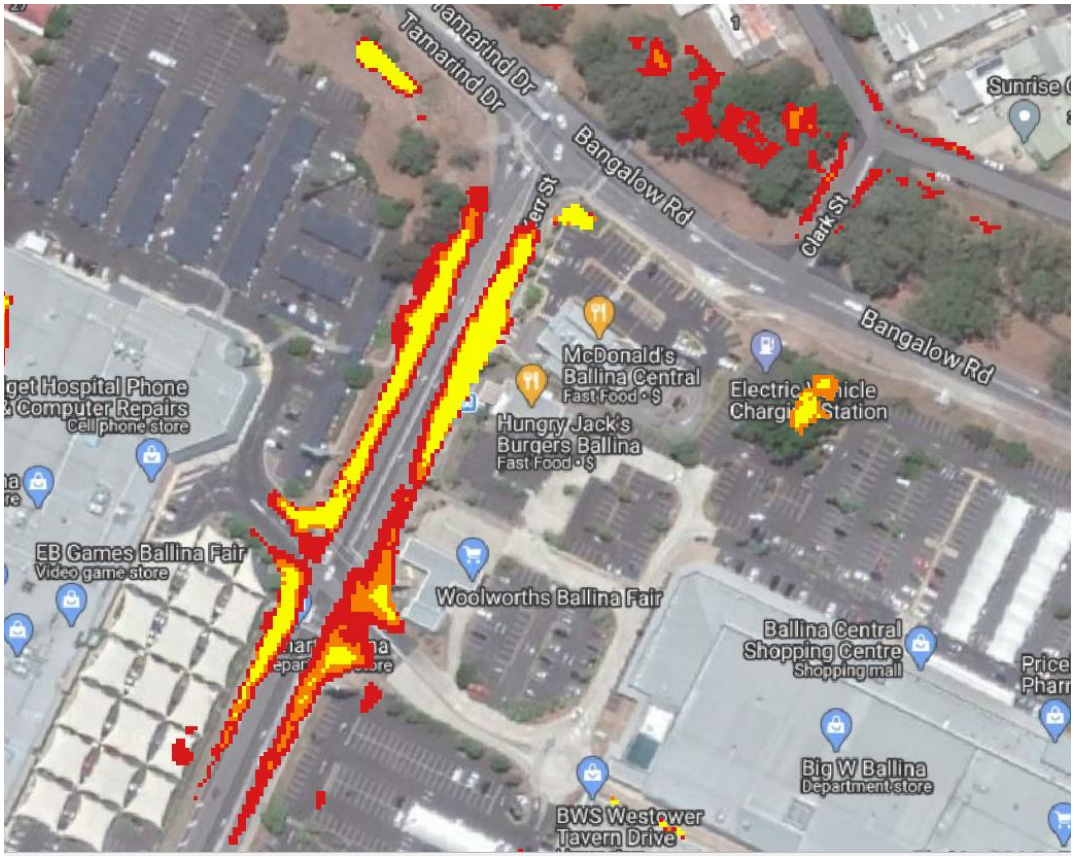
d = flood depth

Flooding hotspot #9: Waterview Ct

d > 0.2 m in 20% AEP
d > 0.2 m in 5% AEP
d > 0.2 m in 1% AEP

d = flood depth

Flooding hotspot #10: Kerr St



d > 0.2 m in 20% AEP
d > 0.2 m in 5% AEP
d > 0.2 m in 1% AEP

d = flood depth

Flooding hotspot #11: Grant St and Tamar St

Area flooded by January 2018 King Tide with no local rainfall event

Flooding hotspot #12: Skinner St and Martin St

Area flooded by January 2018 King Tide with no local rainfall event

Flooding hotspot #13: Riverside Dr

Area flooded by January 2018 King Tide with no local rainfall event

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