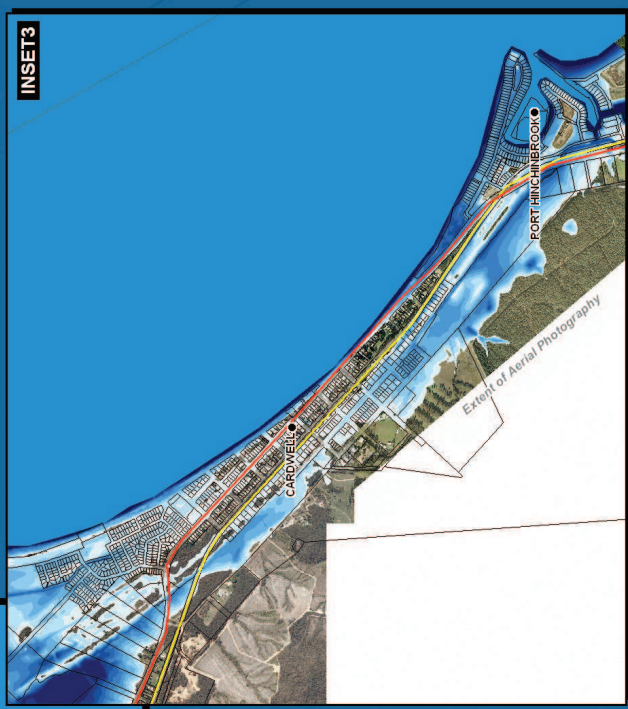
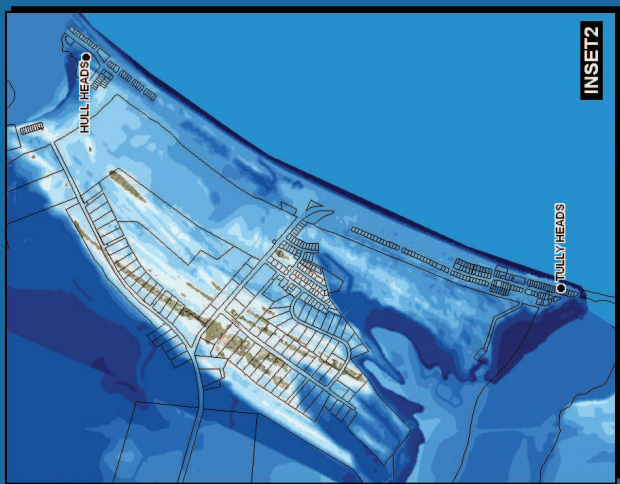
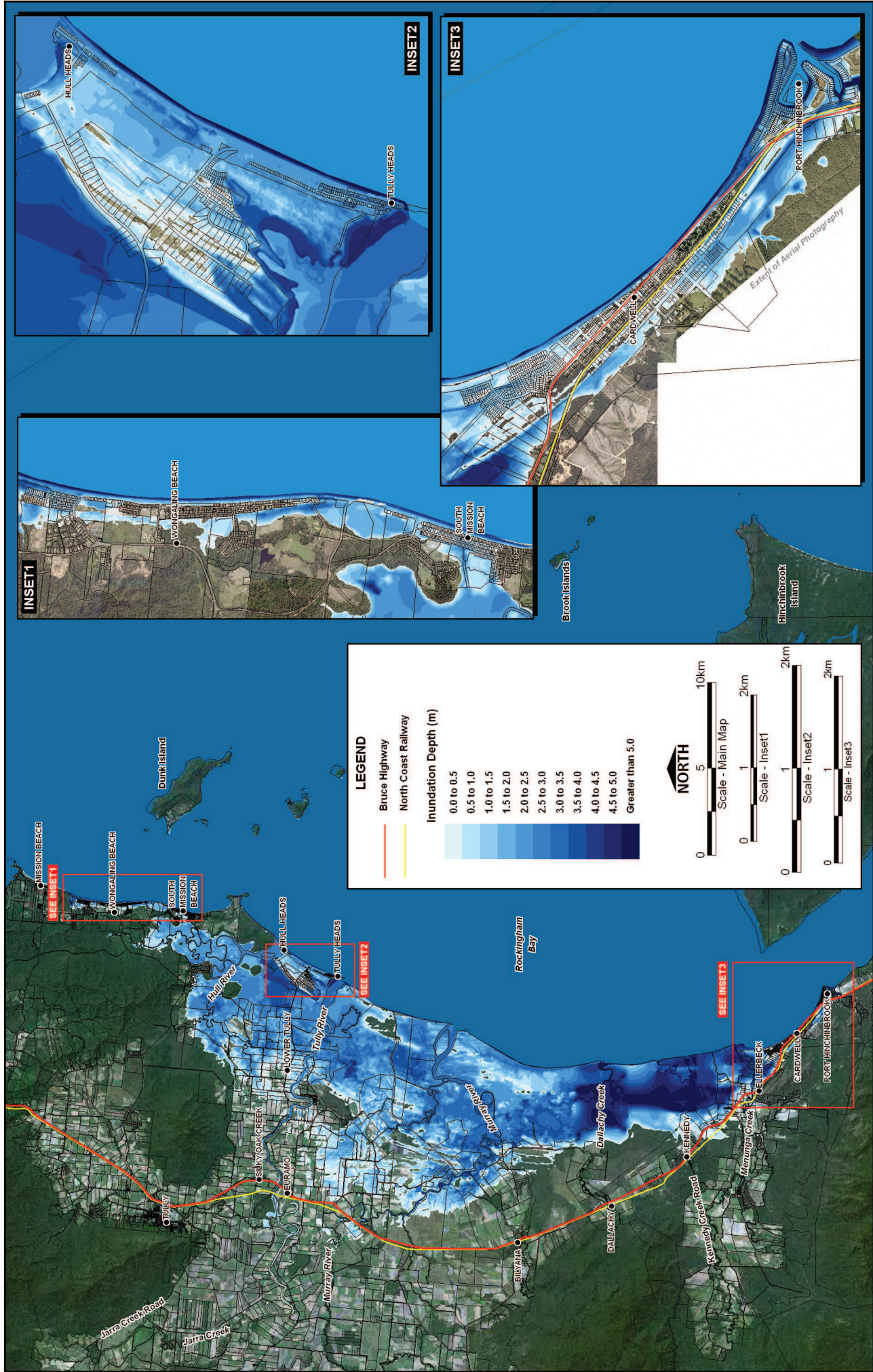


Storm Tide Inundation Including Wave Runup Effects: 0.1% AEP Event

I:\1948_L_BRI_CardwellInundation\BRI\COAST\FINAL\Storm_Tide_Mapping\1000_S1_Top_Inc_Setup_Inc_Runup_Inc_GWarm_GRC_d_002_10m.dwg



LEGEND

- Bruce Highway
- North Coast Railway

Inundation Depth (m)

- 0.0 to 0.5
- 0.5 to 1.0
- 1.0 to 1.5
- 1.5 to 2.0
- 2.0 to 2.5
- 2.5 to 3.0
- 3.0 to 3.5
- 3.5 to 4.0
- 4.0 to 4.5
- 4.5 to 5.0
- Greater than 5.0

NORTH

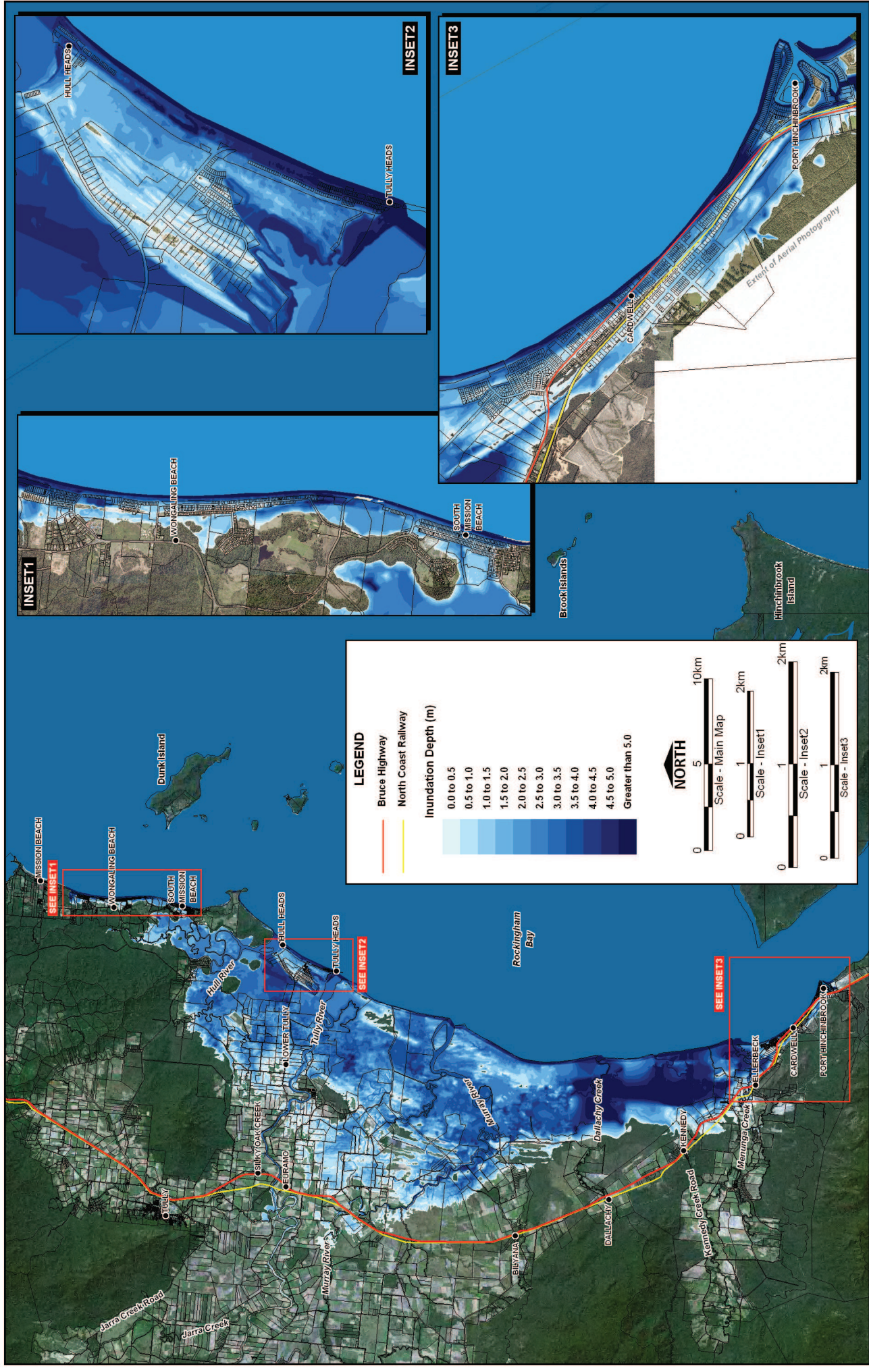
Scale - Main Map: 0 5 10km

Scale - Inset1: 0 1 2km

Scale - Inset2: 0 1 2km

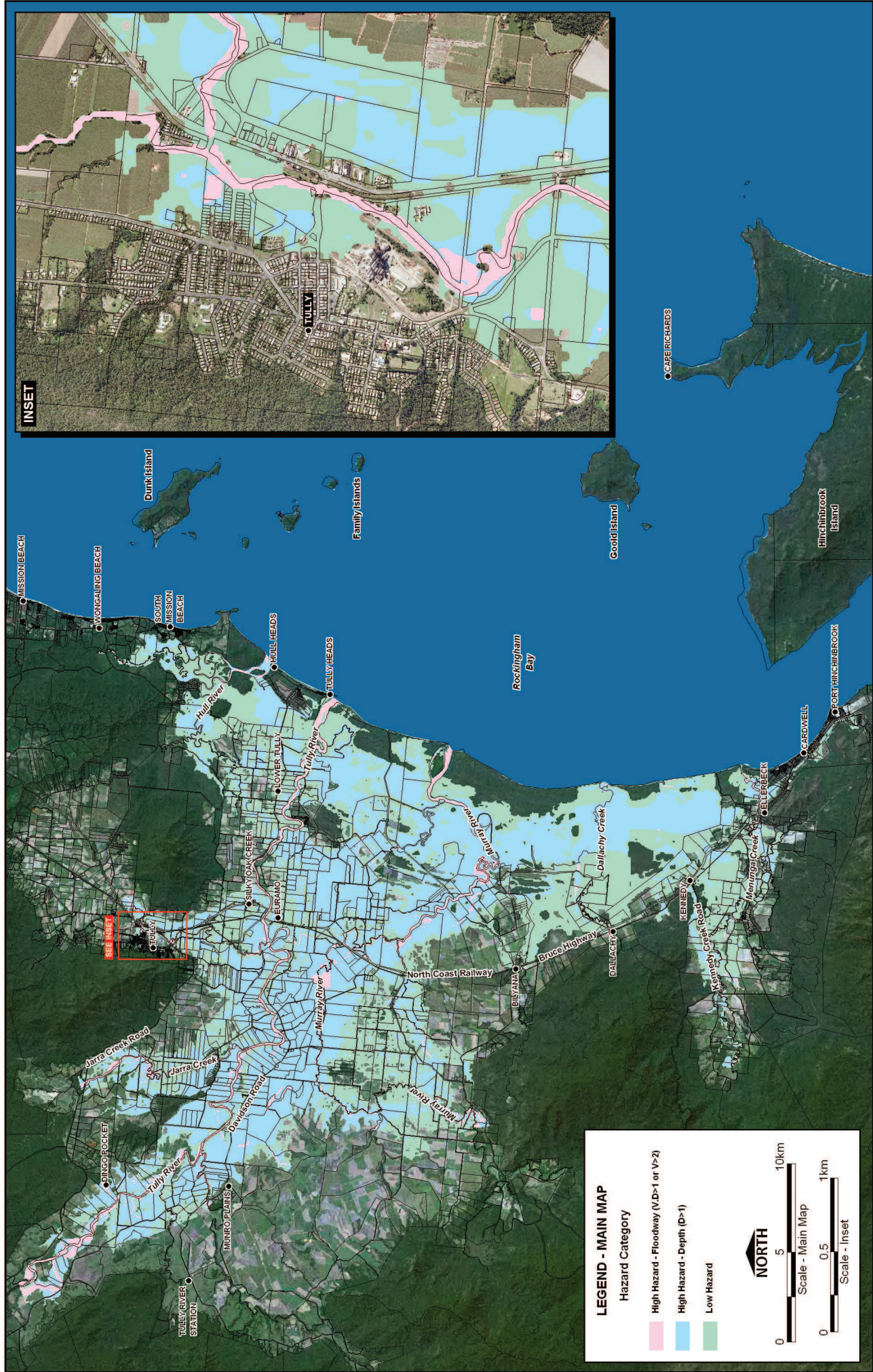
Scale - Inset3: 0 1 2km

Storm Tide Inundation Excluding Wave Runup Effects: 0.01% AEP Event



Storm Tide Inundation Including Wave Runup Effects: 0.01% AEP Event

I:\15946_L_BRI_Cardwello\unabridged\GIS\ASIS\Storm_Tide_Mapping\10000_Side_Inc_Setup_Inc_Runup_Inc_GWD_C_003.dwg



LEGEND - MAIN MAP

Hazard Category

- High Hazard - Floodway (V.D > 1 or V > 2)
- High Hazard - Depth (D > 1)
- Low Hazard

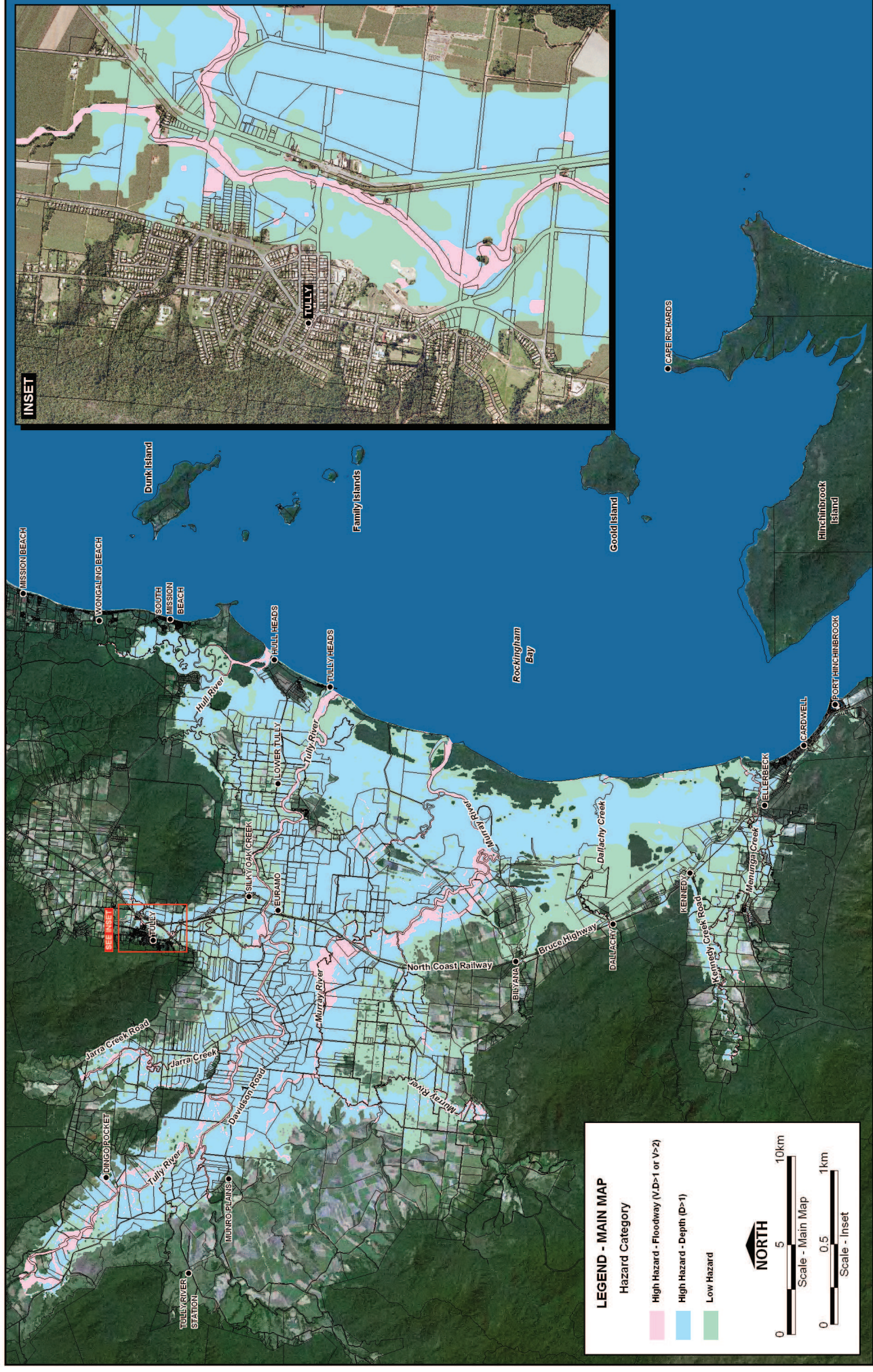
NORTH

Scale - Main Map: 0, 5, 10 km

Scale - Inset: 0, 0.5, 1 km

K:\B15948.k\g\carabw\hydra\rastr\UFLow\murray\murray\ken_0010_20r_C8B00_113.tif
 K:\B15948.k\g\carabw\hydra\rastr\UFLow\murray\murray\ken_0010_20r_C8B00_113.tif
 K:\B15948.k\g\carabw\hydra\rastr\UFLow\murray\murray\ken_0010_20r_C8B00_113.tif

K:\B15948_L1\BRI_Cardwell\murray\murray\ken_0010_20r_C8B00_113.tif\FloodHazard.wor



LEGEND - MAIN MAP

Hazard Category

- High Hazard - Floodway (V.D>1 or V>2)
- High Hazard - Depth (D>1)
- Low Hazard

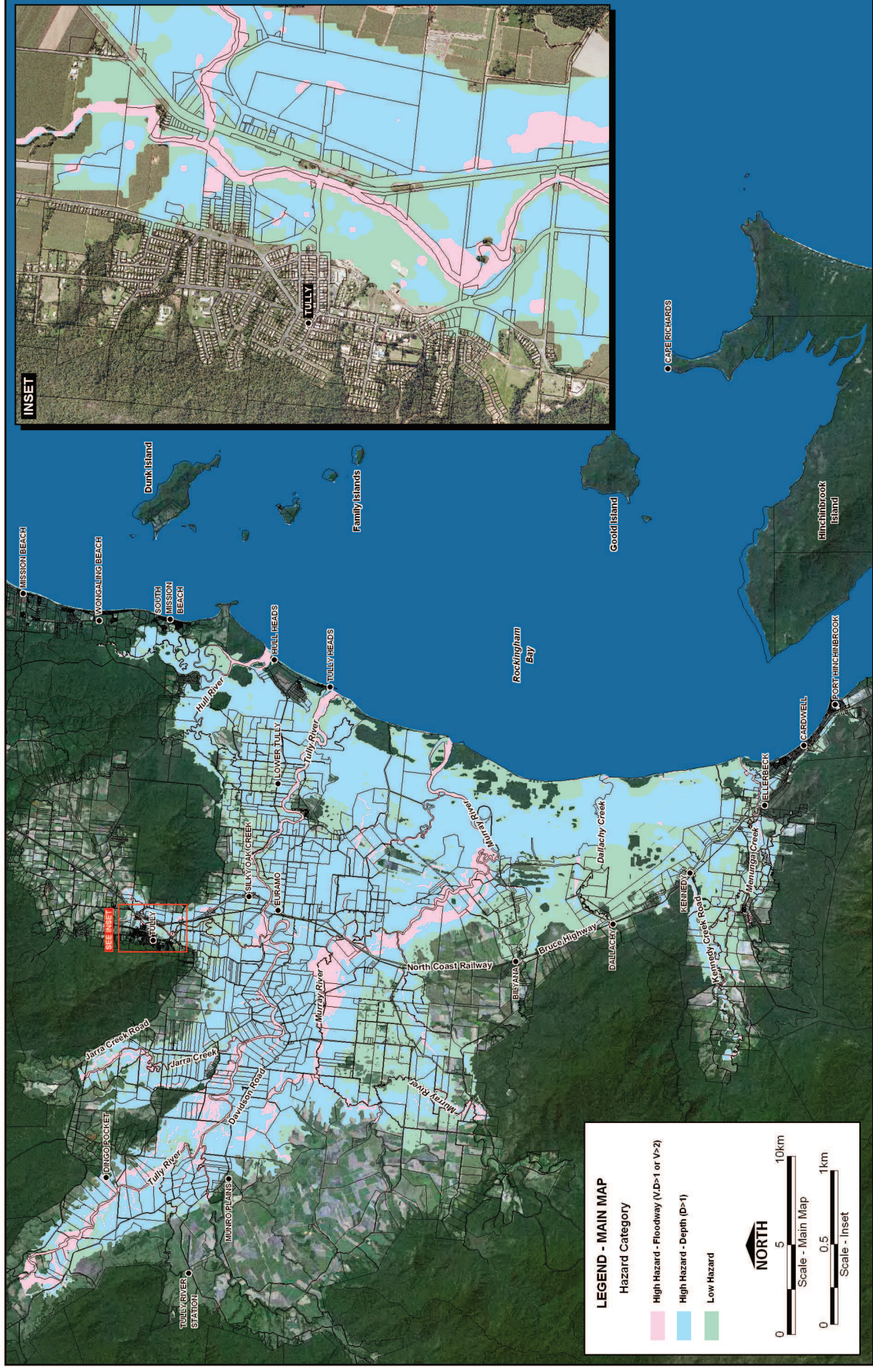
NORTH

Scale - Main Map: 0, 5, 10km

Scale - Inset: 0, 0.5, 1km

Mapset Path:
 K:\B15948.k\gfcad\w\hydra\raust\uf\LOW\w\murray\ken\0260_12\m_C8B6C0_113.txf
 K:\B15948.k\gfcad\w\hydra\raust\uf\LOW\w\murray\ken\0260_72\m_C8B6C0_113.txf
 K:\B15948.k\gfcad\w\hydra\raust\uf\LOW\w\murray\ken\0260_10\m_C8B6C0_113.txf

K:\B15948_L1\BRI_Cardwell\murray\0260\murray\0260_07\0260_3pct\FloodHazard.mxd



LEGEND - MAIN MAP

Hazard Category

- High Hazard - Floodway (V.D>1 or V>2)
- High Hazard - Depth (D>1)
- Low Hazard

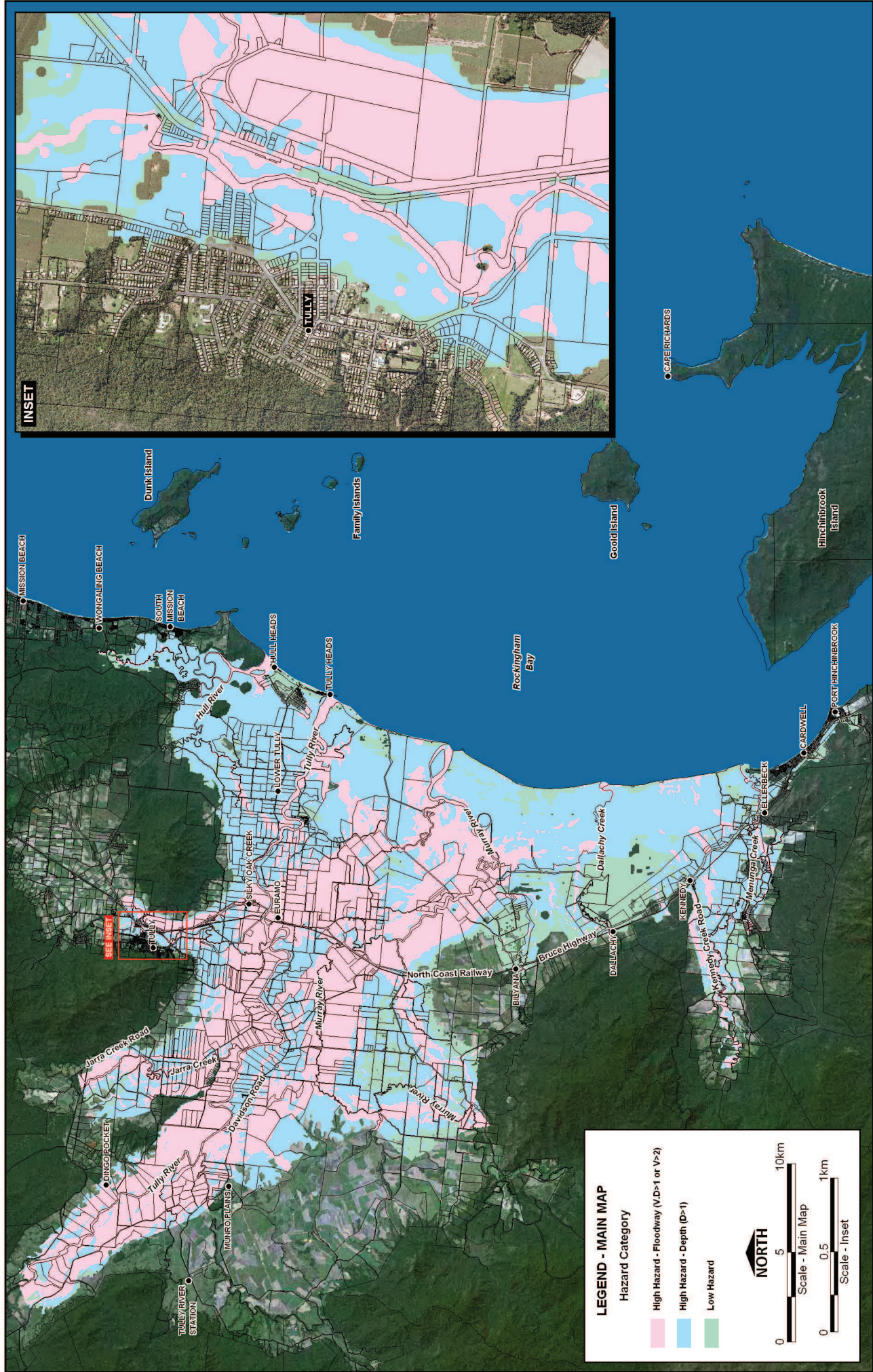
NORTH

Scale - Main Map: 0, 5, 10km

Scale - Inset: 0, 0.5, 1km

K:\B15948.k\g\carabellhydraustudy\LOW\Watershed\Design\Ken_O100_1204_C8B6C0_113.txf
 K:\B15948.k\g\carabellhydraustudy\LOW\Watershed\MurrayDesign\Tul_Ken_O100_7204_C8B6C0_113.txf
 K:\B15948.k\g\carabellhydraustudy\LOW\Watershed\MurrayDesign\Tul_O100_10r_C8B6C0_113.txf

K:\B15948_L1\BRI_CarabellHydraustudy\Gis\Gis\Report\FID_040_071005_1pct\FloodHazards.wfx



INSET

LEGEND - MAIN MAP

Hazard Category

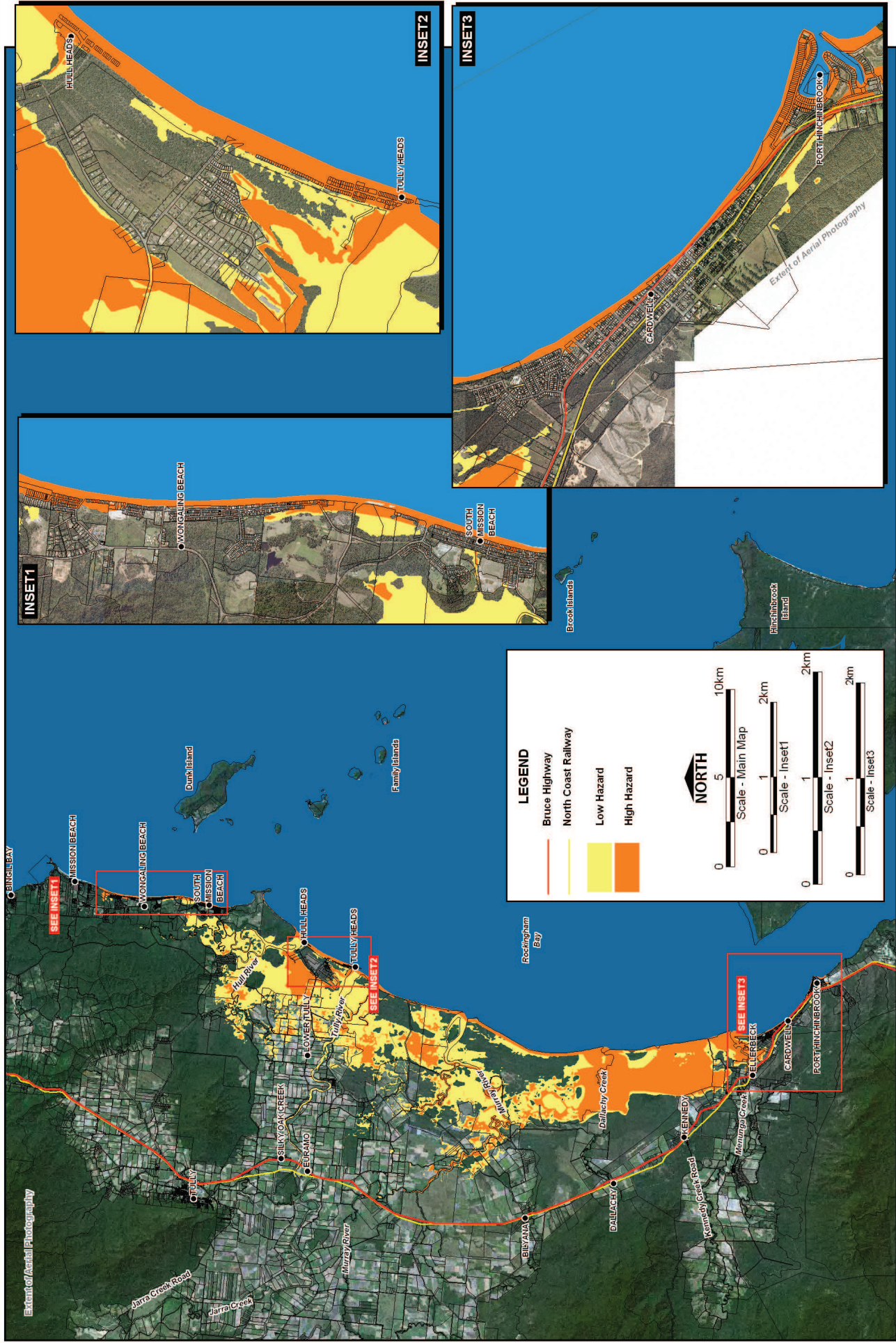
- High Hazard - Floodway (V.D>1 or V>2)
- High Hazard - Depth (D>1)
- Low Hazard

NORTH

Scale - Main Map

Scale - Inset

Map by
 K:\15948.k\gr_carwell\hydraulics\LOW\Watershed\Design\ken_010000_12\r_DSE60_113.tcf
 K:\15948.k\gr_carwell\hydraulics\LOW\Watershed\ken_010000_12\p_DSE60_113.tcf
 K:\15948.k\gr_carwell\hydraulics\LOW\Watershed\ken_010000_12\p_DSE60_113.tcf



FLOODPLAIN / COASTAL AREA PLANNING MATRIX

TABLE 2: DEVELOPMENT IN RURAL AREAS

Controls	Development / Building Type	No Hazard	Inundation Hazard Category ¹		
			Low Hazard	High Hazard (Flood Depth only)	All Other High Hazard ⁴
Land Use Suitability & Fill Level	Habitable Building	N/A	SF1	SF1	
	Ancillary Building (eg. shed)	N/A	SF1	SF1	SF1
	Other Developments (eg. levees, roads, dams, etc)	N/A	SF1	SF1	SF1
	Emergency Services Site (Hospitals, etc.)	N/A	SF3a		
	Other Community Service Building (School, etc.)	N/A	SF3b	SF3b	
Floor Level	New Habitable Building	N/A	FL2c	FL2c	
	New Emergency Service Building (Hospitals, etc.)	FL3a	FL3a		
	New Other Community Service Building (School, etc.)	FL3b	FL3b		
	New Ancillary Building (eg shed, carport)	N/A	FL1	FL1	FL1
	Building Extension	N/A	FL4a	FL4b	
	New Rural Industry	N/A	FL2b	FL2b	
Building Components		N/A	BC1	BC1	BC1
Structural	Small-scale ² Development (eg. shed, small dam)	N/A	SS1	SS1	SS2
Soundness	Large-scale Development (eg. levee, raised road)	N/A	SS1	SS2	SS2
Flood Effect	Small-scale ² Development (eg. shed, small dam)	N/A	FE1	FE2	FE2
	Large-scale Development (eg. levee, raised road)	N/A	FE2	FE3	FE3
Evacuation & Access	Habitable Building	N/A	EA1	EA1	
	Emergency Service Site (Hospitals, etc.)	N/A	EA4a		
	Other Community Service Site (Schools, etc.)	N/A	EA4b		
Flood Awareness, etc		N/A	FA2	FA2	FA2

Note 1: An explanation of the criteria used to define the hazard categories is contained in the Laidley Creek Floodplain Study (WBM Oceanics Australia, 2003)
 Note 2: Small-scale development implies development on rural land that is small relative to the width of the floodplain and is not part of a planned large-scale development.
 Note 3: Weatherproof Area Definition - Enclosed areas excluding garages / carports / open verandahs
 Note 4: All other High Hazard areas include all coastal high hazard areas and floodplain high hazard floodway (VxD>1) and Floodplain Extreme Hazard (V>2m/s)

Control Measures

N/A Controls Not Applicable
 Unsuitable Land Use - Not considered suitable for development

SF1	LAND USE SUITABILITY & MINIMUM FILL LEVEL Consider for development subject to the controls below. No minimum fill level required.
SF2	Consider for development subject to the controls below. For residential and commercial areas, the minimum fill level to be greater than or equal to the 100 year flood level. For industrial areas, the minimum fill level to be greater than or equal to the 10 year flood level.
SF3a	Consider for development subject to the controls below. Minimum fill level greater than or equal to the PMF flood level.
SF3b	Consider for development subject to the controls below. Council to give consideration on the benefits of using the development during and after a flood emergency. If the site is to be used for a flood emergency, the minimum fill level should preferably be greater than or equal to the PMF flood level.
	MINIMUM FLOOR LEVEL
FL1	No minimum floor level required (Council to advise developer of flood risk and potential damage to building & contents. Flood levels available on request)
FL2a	All floor levels to be greater than or equal to the 100 year flood level
FL2b	For permissible uses other than residential, it is preferable to have all floor levels greater than or equal to the 100 year flood level subject to industry standards and individual site assessment.
FL2c	All habitable floor levels to be greater than or equal to the 100 year flood level plus 0.3m
FL3a	All floor levels to be greater than or equal to the PMF flood level.
FL3b	If practical, some or all floor levels to be greater than or equal to the PMF flood level, so that these buildings will be available for accommodation / storage during and after a flood emergency.
FL4a	Habitable, commercial or industrial floor levels to be as close to the <i>minimum floor level</i> above as practical and not less than the floor level of the existing building being extended if the existing floor level is less than or equal to the minimum floor level. If the extended weatherproof area ³ exceeds 50% of the existing weatherproof area, the extension is treated as a new building. The extended weatherproof area is measured as the cumulative area of any previous extensions plus the proposed extension. If building is identified as being suitable for voluntary house raising scheme, Council to discuss potential house raising with owner.
FL4b	As for FL4a with the maximum percentage increase in extended weatherproof area ³ to be: (a) 50% if the extension's floor level is less than one (1) metre below the 100 year flood level; (b) 25% if the extension's floor level is greater than two (2) metres below the 100 year flood level; or (c) pro-rata between 50% and 25% for floor levels from one (1) metre to two (2) metres below the 100 year flood level.
	BUILDING COMPONENTS
BC1	Buildings to have flood compatible material below the higher of (a) the minimum floor level or (b) the 1 in 100 year flood level plus 0.3m.
	STRUCTURAL SOUNDNESS
SS1	No structural soundness requirements for the force of floodwater, debris & buoyancy. Must still comply with BCA requirements.
SS2	Engineers report to prove that structures subject to a flood up to the 100 year event can withstand the force of floodwater, debris & buoyancy.
SS3	Engineers report to prove that structures subject to a flood up to the 500 year event can withstand the force of floodwater, debris & buoyancy.
	FLOOD EFFECT
FE1	No action required
FE2	The flood impact of the development to be considered by Council, with Council having the right to request an engineer's report (see FE3 below)
FE3	Engineers report required to prove that the development will not result in adverse flood impact elsewhere
	EVACUATION/ACCESS
EA1	Council to provide information on flood evacuation strategy
EA2	Not used
EA3	Site specific Flood Evacuation Strategy be developed consistent with Council / SES overall Flood Evacuation Strategy.
EA4a	Emergency service site - should have good access up to the PMF and preferably not cut-off from the main residential area(s). Council to evaluate suitability of site in this respect.
EA4b	If site to be used during and after a flood emergency (see FL3b above), should have good access up to the PMF and preferably not cut-off from the main residential area(s).
	FLOOD AWARENESS
FA1	Not used
FA2	Not used

FLOODPLAIN / COASTAL AREA PLANNING MATRIX

TABLE 1: RESIDENTIAL, COMMERCIAL AND INDUSTRIAL DEVELOPMENT WITHIN AN URBAN AREA

Controls	Development / Building Type	No Hazard	Inundation Hazard Category ¹		
			Low Hazard	High Hazard (Flood Depth only)	All Other High Hazard ⁴
Land Use Suitability & Fill Level	Existing Lot - including infill subdivision	N/A	SF1	SF1	
	Subdivision - en globo	N/A	SF2	SF2	
	Emergency Services Site (Hospitals, etc.)	N/A	SF3a		
	Other Community Service Building (School, etc.)	N/A	SF3b		
Floor Level	New Habitable Building	N/A	FL2c	FL2c	
	New Commercial or Industrial Building	N/A	FL2a	FL2a	
	New Emergency Service Building (Hospitals, etc.)	FL3a	FL3a		
	New Other Community Service Building (School, etc.)	FL3b	FL3b		
	New Ancillary Building (eg shed, carport)	N/A	FL1	FL1	
	Building Extension	N/A	FL4a	FL4b	
Building Components		N/A	BC1		
Structural Soundness	Ancillary Building (eg. shed, carport)	N/A	SS1	SS1	
	Other Building	N/A	SS1	SS2	
Flood Effect / Impact	Existing Lot - including infill subdivision	N/A	FE2	FE2	
	Subdivision - en globo	N/A	FE2	FE2	
	New Ancillary Building (eg shed, carport)	N/A	FE2	FE2	
	Building Extension	N/A	FE1	FE2	
	Other Developments (road raising, etc)	N/A	FE2	FE2	FE3
Evacuation & Access	Existing Lot - including infill subdivision	N/A	EA1	EA1	
	Subdivision - en globo	N/A	EA3	EA3	
	Emergency Service Site (Hospitals, etc.)	N/A	EA4a		
	Other Community Service Site (Schools, etc.)	N/A	EA4b		
Flood / Coastal Inundation Awareness, etc		N/A	FA2	FA2	FA2

Note 1: An explanation of the criteria used to define the hazard categories is contained in the Cardwell Inundation Study (BMT WBM, 2008)

Note 2: Small-scale development implies development on rural land that is small relative to the width of the floodplain and is not part of a planned large-scale development.

Note 3: Weatherproof Area Definition - Enclosed areas excluding garages / carports / open verandahs

Note 4: All other High Hazard areas include all coastal high hazard areas and floodplain high hazard floodway (VxD>1) and Floodplain Extreme Hazard (V>2m/s)

N/A Controls Not Applicable

Unsuitable Land Use - Not considered suitable for development

LAND USE SUITABILITY & MINIMUM FILL LEVEL

SF1	Consider for development subject to the controls below. No minimum fill level required.
SF2	Consider for development subject to the controls below. For residential and commercial areas, the minimum fill level to be greater than or equal to the 100 year flood / coastal inundation level. For industrial areas, the minimum fill level to be greater than or equal to the 50 year flood / coastal inundation level.
SF3a	Consider for development subject to the controls below. Minimum fill level greater than or equal to the 1 in 10,000 year flood / coastal inundation level.
SF3b	Consider for development subject to the controls below. Council to give consideration on the benefits of using the development during and after a flood / coastal inundation emergency. If the site is to be used for a flood / coastal inundation emergency, the minimum fill level should preferably be greater than or equal to the 1 in 10,000 year flood / coastal inundation level.
MINIMUM FLOOR LEVEL	
FL1	No minimum floor level required (Council to advise developer of flood / coastal inundation risk and potential damage to building & contents. flood / coastal inundation levels available on request)
FL2a	All floor levels to be greater than or equal to the 100 year flood / coastal inundation level
FL2b	For permissible uses other than residential, it is preferable to have all floor levels greater than or equal to the 100 year flood / coastal inundation level subject to industry standards and individual site assessment.
FL2c	All habitable floor levels to be greater than or equal to the 100 year flood / coastal inundation level plus 0.3m
FL3a	All floor levels to be greater than or equal to the 1 in 10,000 year flood / coastal inundation level.
FL3b	If practical, some or all floor levels to be greater than or equal to the 1 in 10,000 year flood / coastal inundation level, so that these buildings will be available for accommodation / storage during and after a flood / coastal inundation emergency.
FL4a	Habitable, commercial or industrial floor levels to be as close to the <i>minimum floor level</i> above as practical and not less than the floor level of the existing building being extended if the existing floor level is less than or equal to the minimum floor level. If the extended weatherproof area ³ exceeds 50% of the existing weatherproof area, the extension is treated as a new building. The extended weatherproof area is measured as the cumulative area of any previous extensions plus the proposed extension. If building is identified as being suitable for voluntary house raising scheme, Council to discuss potential house raising with owner.
FL4b	As for FL4a with the maximum percentage increase in extended weatherproof area ³ to be: (a) 50% if the extension's floor level is less than one (1) metre below the 100 year flood / coastal inundation level; (b) 25% if the extension's floor level is greater than two (2) metres below the 100 year flood / coastal inundation level; or (c) pro-rata between 50% and 25% for floor levels from one (1) metre to two (2) metres below the 100 year flood / coastal inundation level.
BUILDING COMPONENTS	
BC1	Buildings to have flood / coastal inundation compatible material below the higher of (a) the minimum floor level or (b) the 1 in 100 year flood / coastal inundation level plus 0.3m.
STRUCTURAL SOUNDNESS	
SS1	No structural soundness requirements for the force of flood / coastal inundation, debris & buoyancy. Must still comply with BCA requirements.
SS2	Engineers report to prove that structures subject to a flood / coastal inundation up to the 100 year event can withstand the force of flood / coastal inundation, debris & buoyancy.
SS3	Engineers report to prove that structures subject to a flood / coastal inundation up to the 500 year event can withstand the force of flood / coastal inundation, debris & buoyancy.
FLOOD EFFECT	
FE1	No action required
FE2	The flood impact of the development to be considered by Council, with Council having the right to request an engineer's report (see FE3 below)
FE3	Engineers report required to prove that the development will not result in adverse flood impact elsewhere
EVACUATION/ACCESS	
EA1	Council to provide information on evacuation strategy
EA2	Not used
EA3	Site specific Evacuation Strategy be developed consistent with Council / SES overall Evacuation Strategy.
EA4a	Emergency service site - should have good access up to the 1 in 10,000 year level and preferably not cut-off from the main residential area. Council to evaluate suitability of site in this respect.
EA4b	If site to be used during and after a flood / coastal inundation emergency (see FL3b above), should have good access up to the 1 in 10,000 year level and preferably not cut-off from the main residential area(s).
FLOOD AWARENESS	
FA1	Not used
FA2	Not used

FLOODPLAIN / COASTAL AREA PLANNING MATRIX

TABLE 3: OTHER

Controls	Development / Building Type	No Hazard	Inundation Hazard Category ¹		
			Low Hazard	High Hazard (Flood Depth only)	All Other High Hazard ⁴
Land Use Suitability & Fill Level	Non-Habitable Building (shed, toilets, shelter, etc)	N/A	SF1	SF1	SF1
	Other Developments (eg. levees, roads, dams, etc)	N/A	SF1	SF1	SF1
Floor Level		N/A	N/A	N/A	N/A
Building Components		N/A	BC1	BC1	BC1
Structural	Small-scale ² Development (eg. shed, small dam)	N/A	SS1	SS1	SS2
Soundness	Large-scale Development (eg. levee, raised road)	N/A	SS1	SS2	SS2
Flood Effect	Small-scale Development (eg. shed, small dam)	N/A	FE1	FE2	FE2
	Large-scale Development (eg. levee, raised road)	N/A	FE2	FE3	FE3
Evacuation & Access	Not Applicable				
Flood Awareness, etc	Not Applicable				


Note 1: An explanation of the criteria used to define the hazard categories is contained in the Laidley Creek Floodplain Study (WBM Oceanics Australia, 2003)

Note 2: Small-scale development implies development on rural land that is small relative to the width of the floodplain and is not part of a planned large-scale development.

Note 3: Weatherproof Area Definition - Enclosed areas excluding garages / carports / open verandahs

Note 4: All other High Hazard areas include all coastal high hazard areas and floodplain high hazard floodway (VxD>1) and Floodplain Extreme Hazard (V>2m/s)

Control Measures

N/A	Controls Not Applicable
	Unsuitable Land Use - Not considered suitable for development
LAND USE SUITABILITY & MINIMUM FILL LEVEL	
SF1	Consider for development subject to the controls below. No minimum fill level required.
SF2	Consider for development subject to the controls below. For residential and commercial areas, the minimum fill level to be greater than or equal to the 100 year flood level. For industrial areas, the minimum fill level to be greater than or equal to the 10 year flood level.
SF3a	Consider for development subject to the controls below. Minimum fill level greater than or equal to the PMF flood level.
SF3b	Consider for development subject to the controls below. Council to give consideration on the benefits of using the development during and after a flood emergency. If the site is to be used for a flood emergency, the minimum fill level should preferably be greater than or equal to the PMF flood level.
MINIMUM FLOOR LEVEL	
FL1	No minimum floor level required (Council to advise developer of flood risk and potential damage to building & contents. Flood levels available on request)
FL2a	All floor levels to be greater than or equal to the 100 year flood level
FL2b	For permissible uses other than residential, it is preferable to have all floor levels greater than or equal to the 100 year flood level subject to industry standards and individual site assessment.
FL2c	All habitable floor levels to be greater than or equal to the 100 year flood level plus 0.3m
FL3a	All floor levels to be greater than or equal to the PMF flood level.
FL3b	If practical, some or all floor levels to be greater than or equal to the PMF flood level, so that these buildings will be available for accommodation / storage during and after a flood emergency.
FL4a	Habitable, commercial or industrial floor levels to be as close to the <i>minimum floor level</i> above as practical and not less than the floor level of the existing building being extended if the existing floor level is less than or equal to the minimum floor level. If the extended weatherproof area ³ exceeds 50% of the existing weatherproof area, the extension is treated as a new building. The extended weatherproof area is measured as the cumulative area of any previous extensions plus the proposed extension. If building is identified as being suitable for voluntary house raising scheme, Council to discuss potential house raising with owner.
FL4b	As for FL4a with the maximum percentage increase in extended weatherproof area ³ to be: (a) 50% if the extension's floor level is less than one (1) metre below the 100 year flood level; (b) 25% if the extension's floor level is greater than two (2) metres below the 100 year flood level; or (c) pro-rata between 50% and 25% for floor levels from one (1) metre to two (2) metres below the 100 year flood level.
BUILDING COMPONENTS	
BC1	Buildings to have flood compatible material below the higher of (a) the minimum floor level or (b) the 1 in 100 year flood level plus 0.3m.
STRUCTURAL SOUNDNESS	
SS1	No structural soundness requirements for the force of floodwater, debris & buoyancy. Must still comply with BCA requirements.
SS2	Engineers report to prove that structures subject to a flood up to the 100 year event can withstand the force of floodwater, debris & buoyancy.
SS3	Engineers report to prove that structures subject to a flood up to the 500 year event can withstand the force of floodwater, debris & buoyancy.
FLOOD EFFECT	
FE1	No action required
FE2	The flood impact of the development to be considered by Council, with Council having the right to request an engineer's report (see FE3 below)
FE3	Engineers report required to prove that the development will not result in adverse flood impact elsewhere
EVACUATION/ACCESS	
EA1	Council to provide information on flood evacuation strategy
EA2	Not used
EA3	Site specific Flood Evacuation Strategy be developed consistent with Council / SES overall Flood Evacuation Strategy.
EA4a	Emergency service site - should have good access up to the PMF and preferably not cut-off from the main residential area(s). Council to evaluate suitability of site in this respect.
EA4b	If site to be used during and after a flood emergency (see FL3b above), should have good access up to the PMF and preferably not cut-off from the main residential area(s).
FLOOD AWARENESS	
FA1	Not used
FA2	Not used

Drawing 47 Planning Matrix - Other Land Uses



BMT WBM Brisbane

Level 11, 490 Upper Edward Street Brisbane 4000
PO Box 203 Spring Hill QLD 4004
Tel +61 7 3831 6744 Fax +61 7 3832 3627
Email wbm@wbmpl.com.au
Web www.wbmpl.com.au

BMT WBM Denver

14 Inverness Drive East, #B132
Englewood Denver Colorado 80112 USA
Tel +1 303 792 9814 Fax +1 303 792 9742
Email wbm@denver.wbmpl.com.au
Web www.wbmpl.com.au

BMT WBM Melbourne

Level 5, 99 King Street Melbourne, 3000
PO Box 604 Collins Street West VIC 8007
Tel +61 3 9614 6400 Fax +61 3 9614 6866
Email wbm@melbourne.wbmpl.com.au
Web www.wbmpl.com.au

BMT WBM Morwell

Cnr Hazelwood Drive & Miners Way Morwell 3640
PO Box 888 Morwell VIC 3640
Tel +61 3 5135 3400 Fax +61 3 5135 3444
Email wbm@morwell.wbmpl.com.au
Web www.wbmpl.com.au

BMT WBM Newcastle

126 Belford Street Broadmeadow 2292
PO Box 100 Broadmeadow 2292
Tel +61 2 6940 8880 Fax +61 2 6940 8887
Email wbm@newcastle.wbmpl.com.au
Web www.wbmpl.com.au

BMT WBM Perth

1 Brodie Hall Drive Technology Park, Bentley 6102
Tel +61 8 9328 2029 Fax +61 8 9486 7568
Email wbm@perth.wbmpl.com.au
Web www.wbmpl.com.au

BMT WBM Sydney

Suite 206, 116 Great North Road Five Dock 2046
PO Box 129 Five Dock NSW 2046
Tel +61 2 9713 4836 Fax +61 2 9713 4890
Email wbm@sydney.wbmpl.com.au
Web www.wbmpl.com.au

BMT WBM Vancouver

1190 Melville Street #700 Vancouver
British Columbia V6E 3W1 Canada
Tel +1 604 683 5777 Fax +1 604 608 3232
Email wbm@vancouver.wbmpl.com.au
Web www.wbmpl.com.au