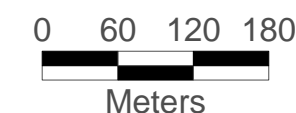
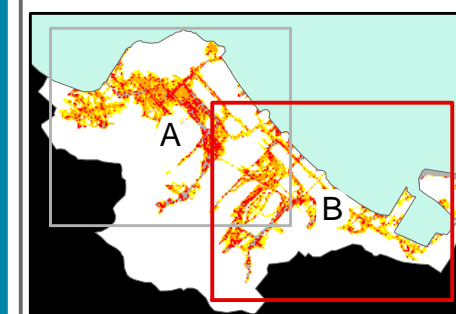
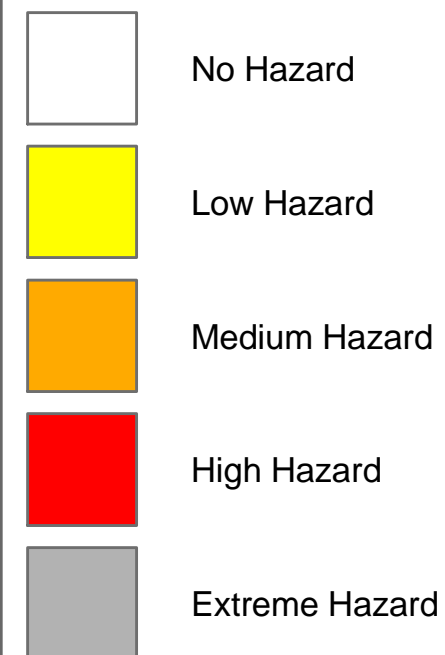


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Flood Hazard



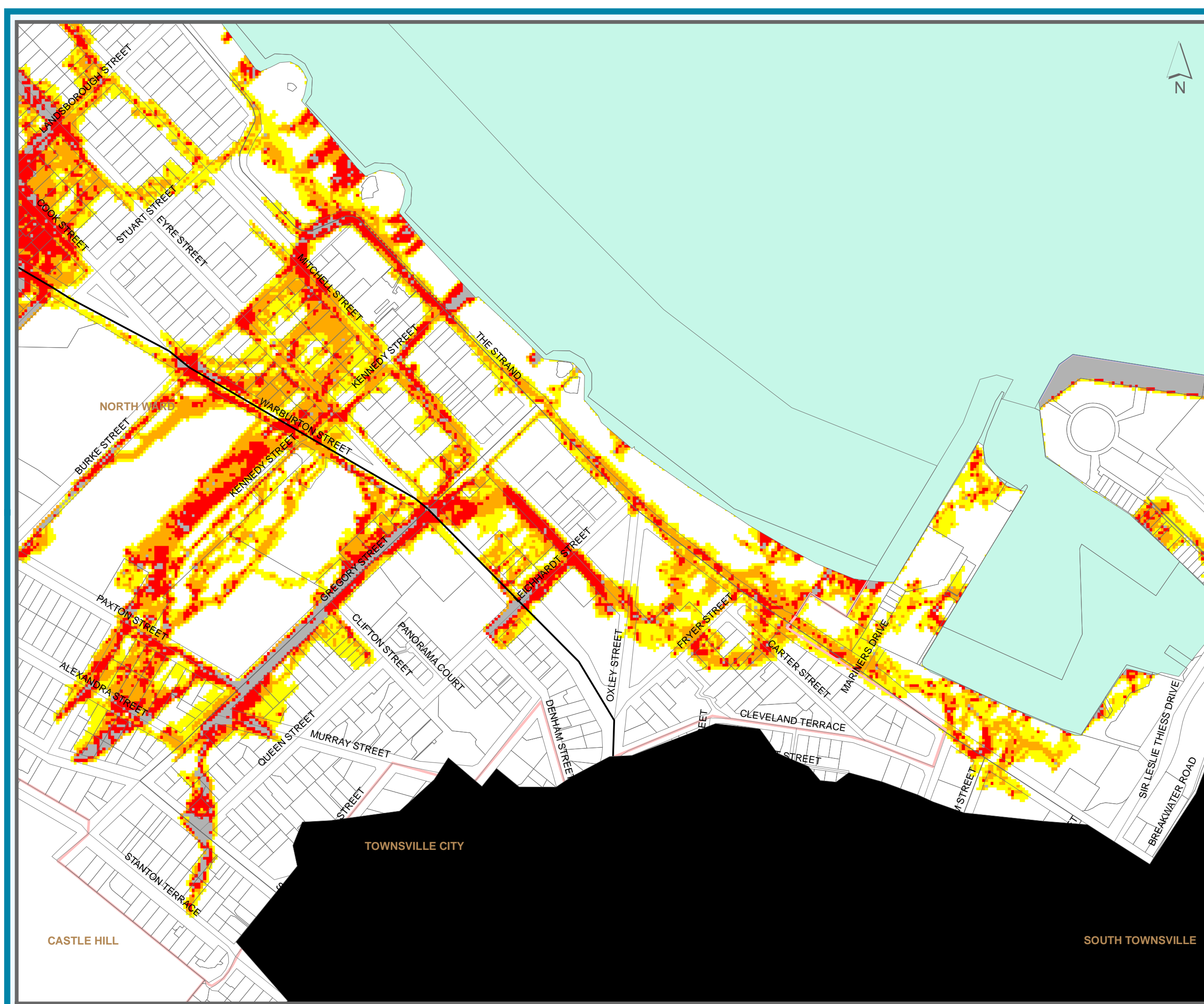
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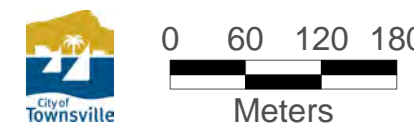
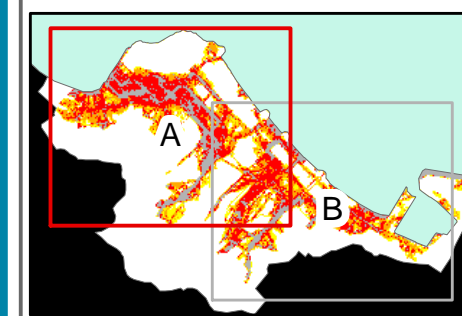
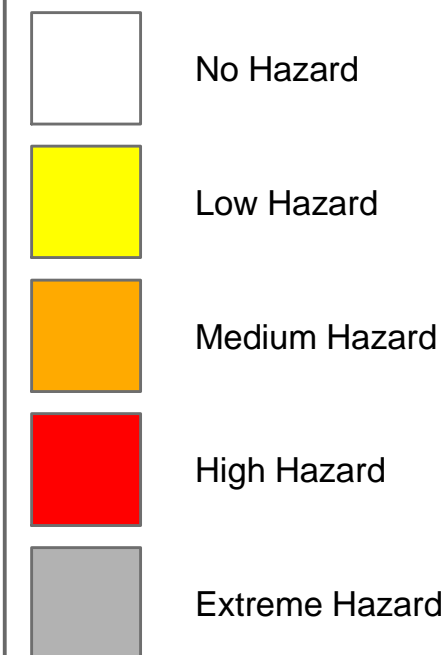
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Figure 5.6.2:
Flood Hazard Map - 500y



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Flood Hazard



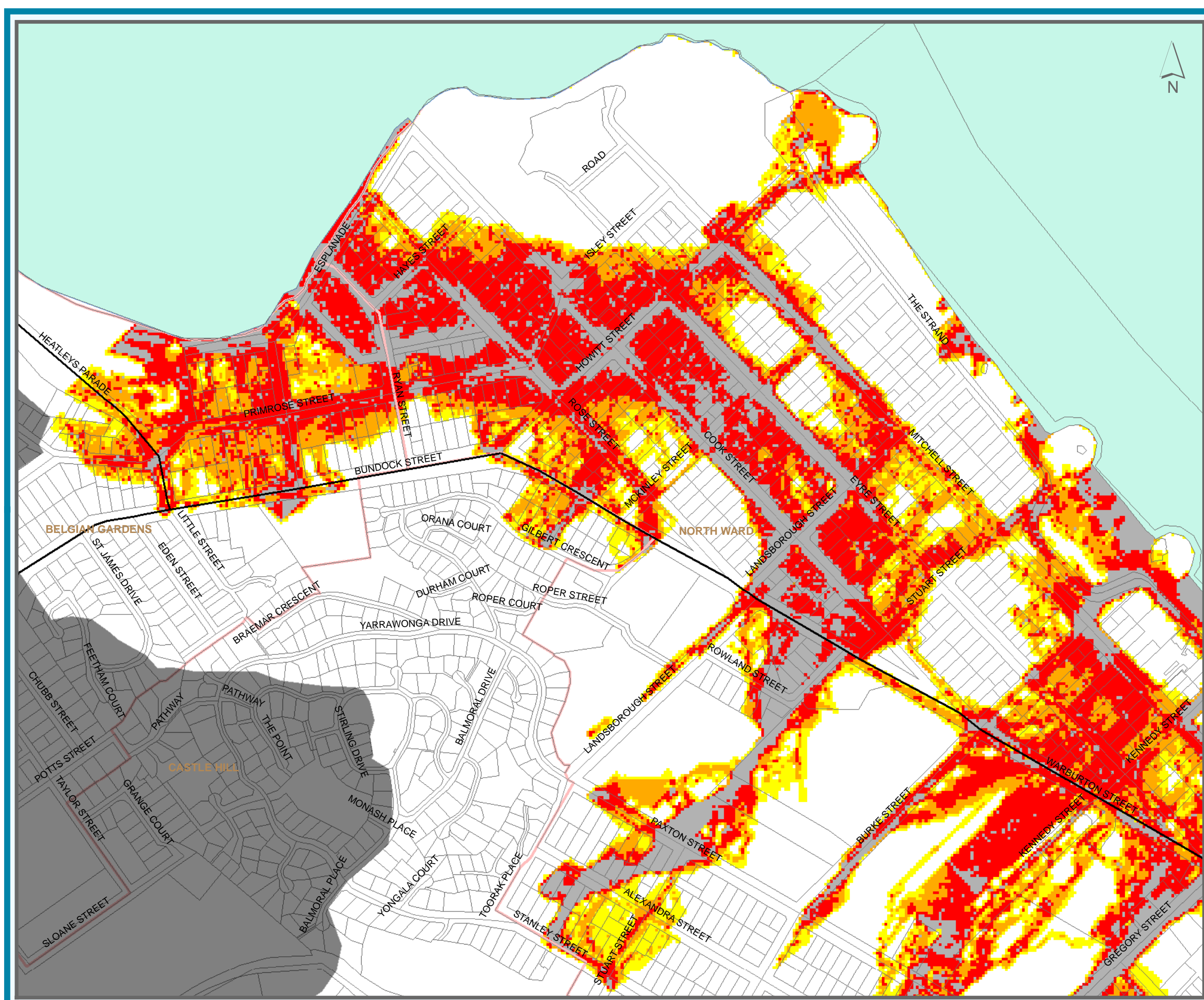
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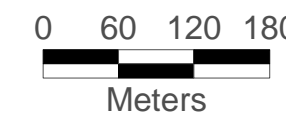
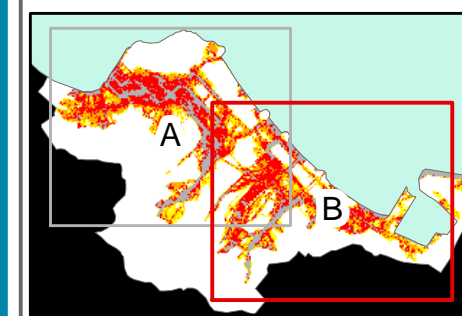
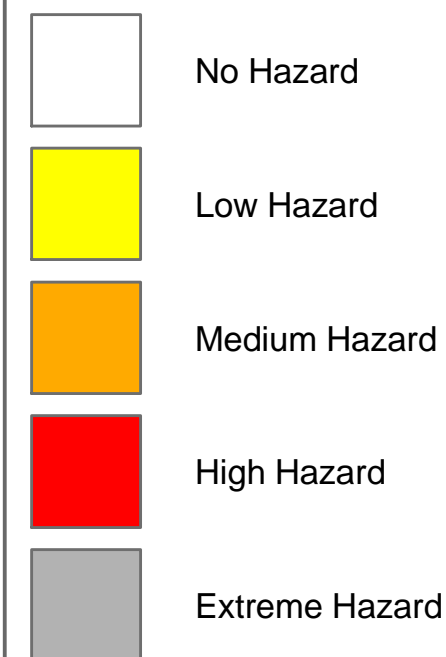
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Figure 5.6.3:
Flood Hazard Map - PMF



LEGEND

Flood Hazard



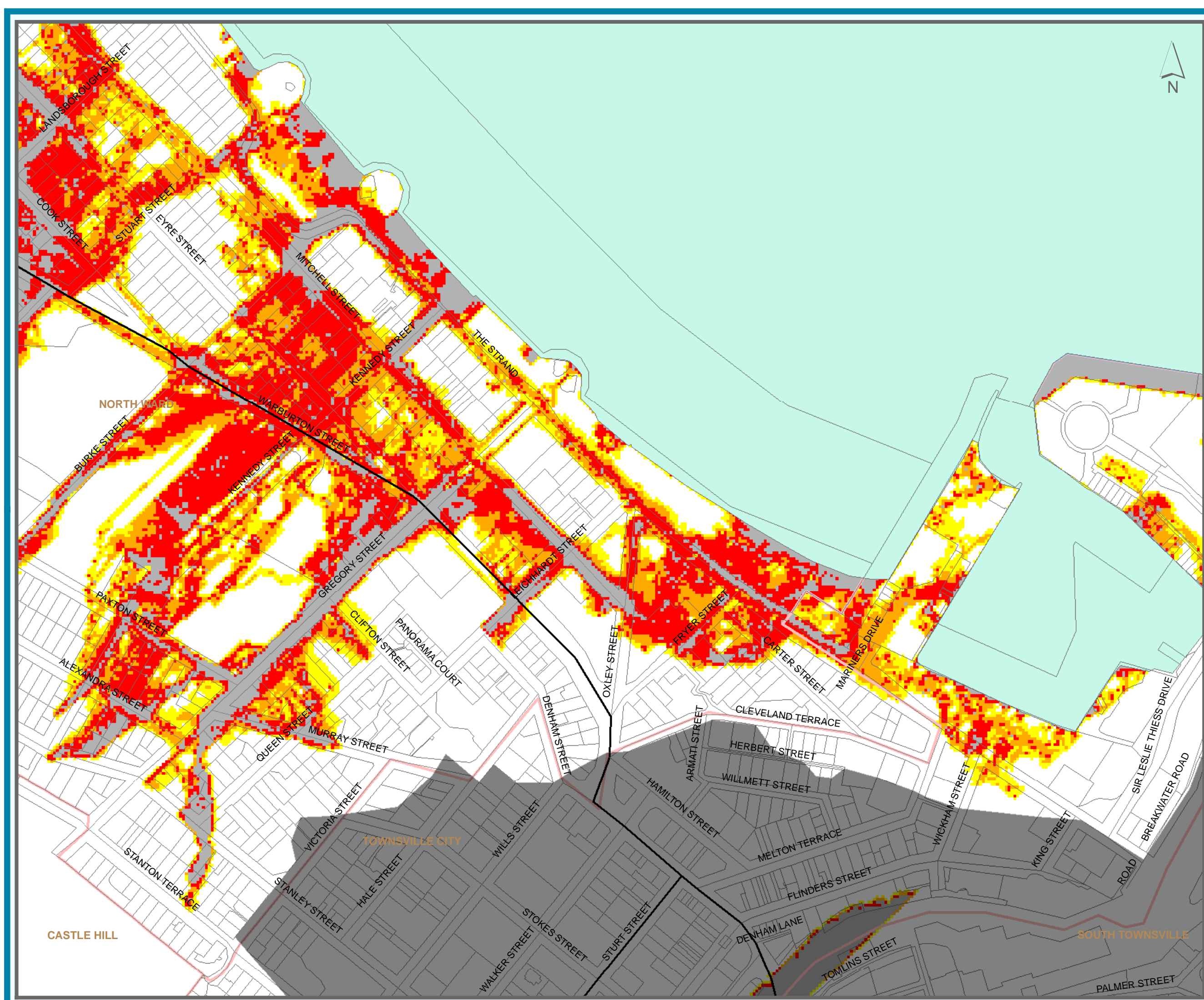
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Figure 5.6.3:
Flood Hazard Map - PMF



5.7 Mitchell Street Mitigation Works

The commonly referred to Mitchell Street area mainly includes the block surrounded by Mitchell, Eyre, Burke, and Kennedy Streets. Up until recent works at the intersection of Mitchell Street and Burke Street, the area was a trap low point. Prior to the works, model results show that in the 50 Year ARI, water depths got to over a metre and did not drain easily. The underground pipe network was the only way to drain the area. The recently constructed mitigation works were modelled in the base case. The model results show an improvement in localised flooding with water depths reaching a maximum of 0.8m, and draining much quicker than prior to the works.

Table 5.7.1 shows the number of properties inundated with water greater than 200mm depth above ground level in the area on Mitchell Street. The table details each ARI for the base case 2009 model runs. The base case 2008 model runs did not include the recent mitigation works and showed the 50 year event to cause 15 houses to be inundated. **Chapter 5.3** also details flooding in the Mitchell Street area.

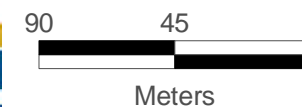
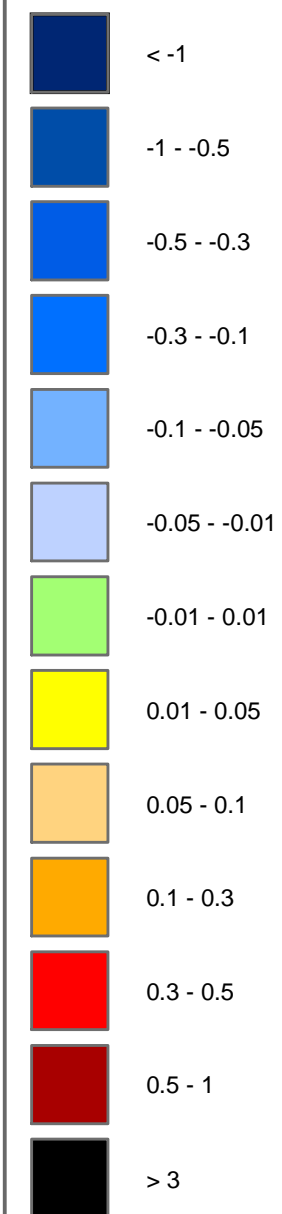
Table 5.7.1: Inundated properties at Mitchell Street post mitigation works	
ARI	No. Properties Inundated
2 year	5
5 year	6
10 year	7
20 year	8
50 year	10
100 year	11
500 year	14
PMF	48

Figure 5.7.1 shows the difference in flood levels as a result of the works for the 50 Year, ARI storm. This map shows that the construction has decreased flood levels upstream of the works by up to 200mm. Downstream of the works, within the Strand Park and roadway, flood levels increased by up to 100mm, but these level increases did not affect any houses.

Figure 5.7.2 shows a water level time series plot of base case 2008 and base case 2009 at a point in the Mitchell Street area. **Figure 5.7.3** shows the location of the time series extraction. This plot demonstrates that the time of inundation has been reduced from approximately up to 5 hours, to approximately 20 minutes. As the North Ward flood model didn't include local inlet pits attached to small pipes in the Mitchell Street area, the real time of inundation is likely to decrease in both cases.

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Difference to 2008



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Figure 5.7.1: Mitchell St
Impact of works

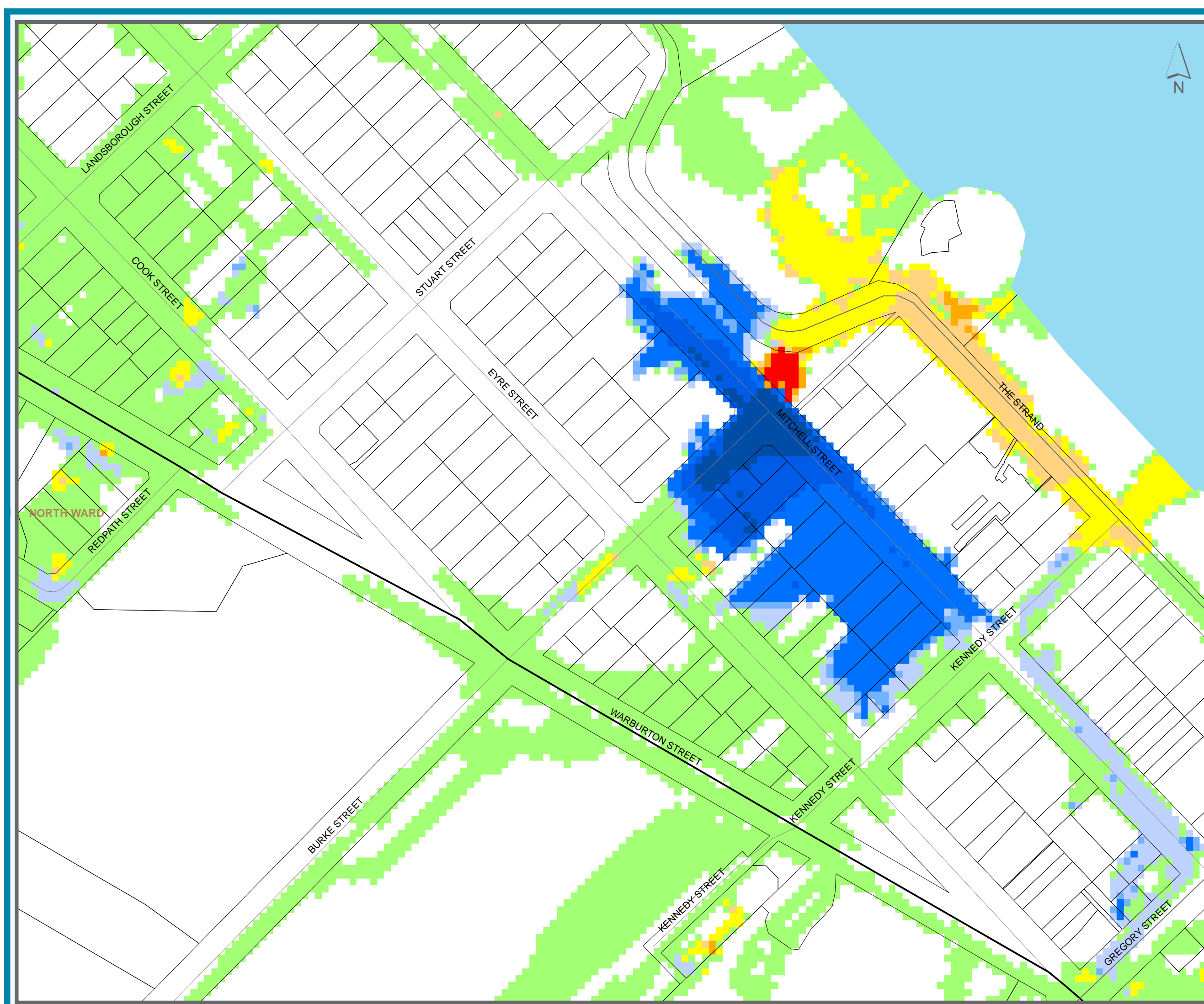
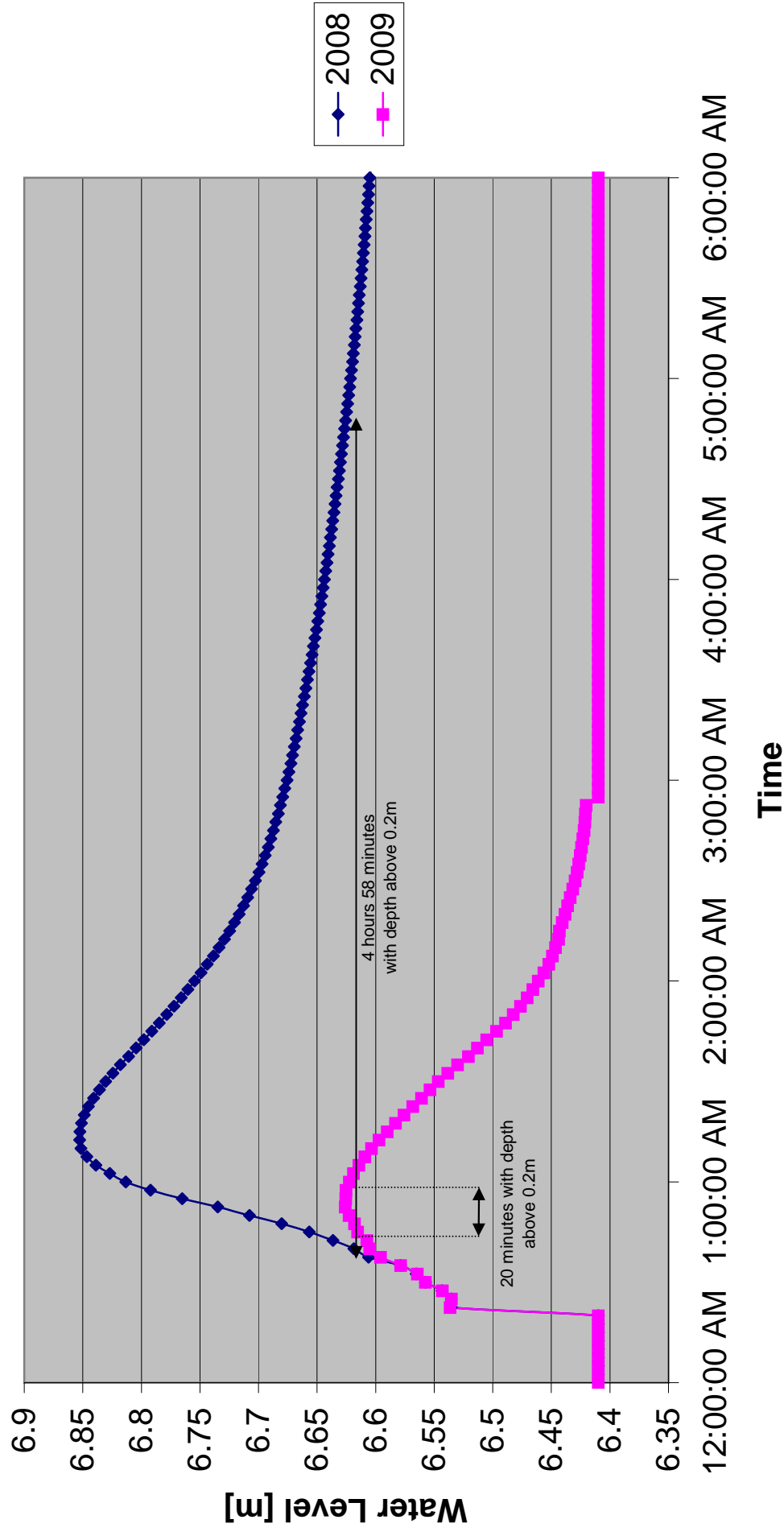


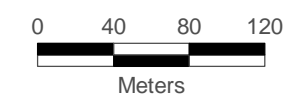
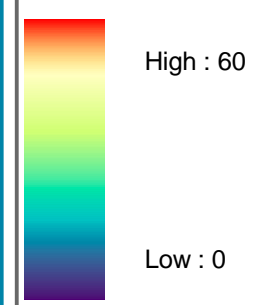
Figure 5.7.2: Mitchell Street Time Series



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- Pipe Network
- Time Series Extraction Point

Bathymetry



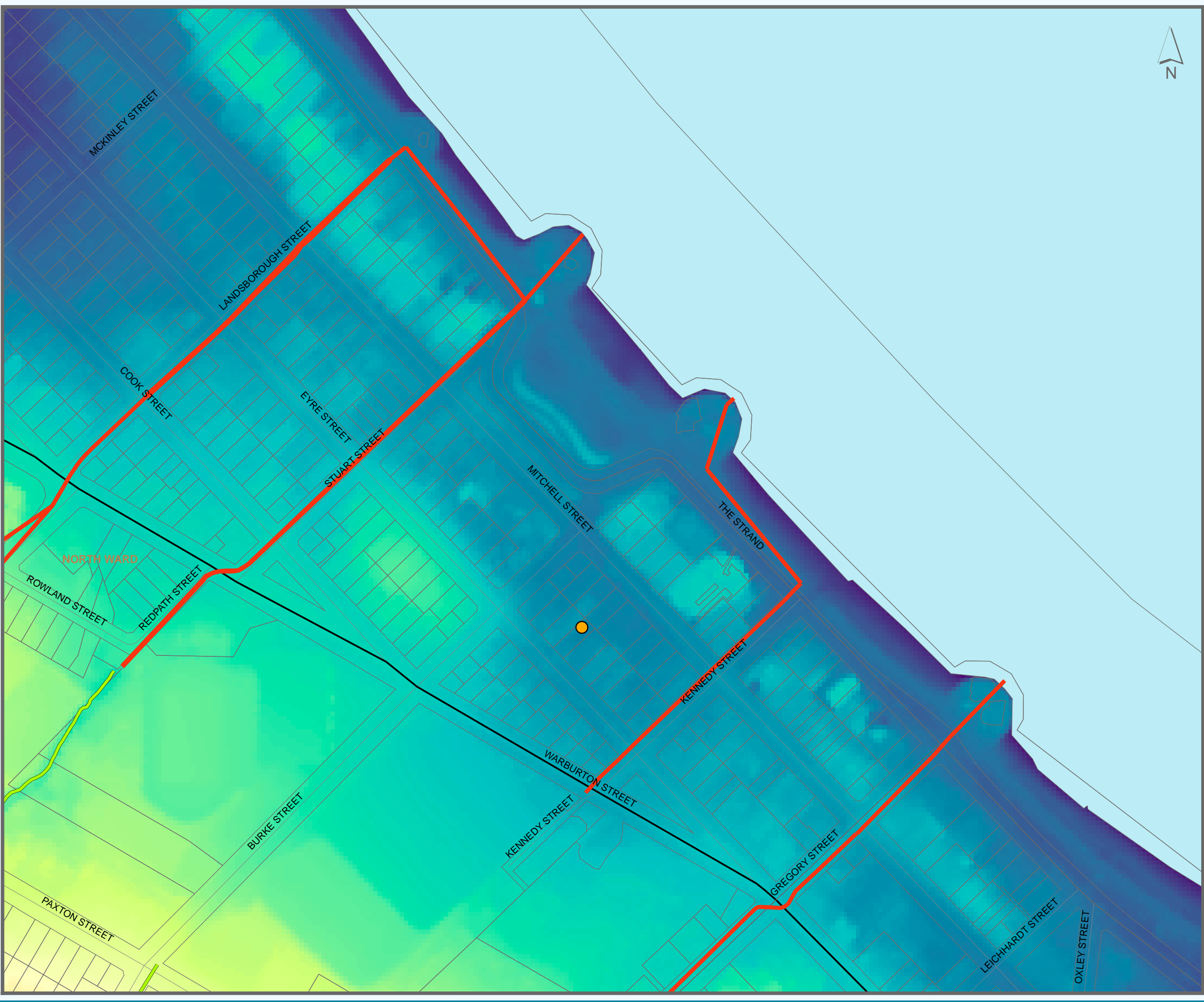
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Figure 5.7.3:
Time Series Point



6.0 Climate Change

An evaluation of the potential impact of climate change on flooding has been undertaken. The sea-level rise specified within the *Queensland Coastal Plan* of 0.88m to allow for conditions in 2100 was adopted. This value is consistent with advice from the *IPCC Fourth Assessment Report: Climate Change* (2007) and within the range of projections within *Climate Change Projections for the Townsville Region* (Hennessy et al, 2008).

Predictions on changes to ARI storm intensities have been made only based on the analysis of 24 and 72 hour storm durations. There is no indication that these values are relevant for shorter duration storms like those critical in North Ward. Is it on this basis that only a sea level rise has been modelled in the evaluation for climate change for the study area.

To assess the potential impact of sea-level rise on North Ward flooding, the tailwater level of the flood model was updated to include the sea level rise value. The impacts of climate change on ARIs from 2 to 100 years have been evaluated. **Appendix C** contains maps showing the difference between the base case 2009 scenario and the climate change scenario for each ARI.

The analysis shows that a sea level rise due to climate change has a greatest effect at more frequent durations. For the 2 year ARI storm, the areas surrounding Howitt and Rose Streets show flood water depth increases up to around 0.15m, with all other areas being unaffected. The 100 year ARI storm shows that the only areas to be affected are those around Ryan Street and the Ryan Street drain, which have flood water depth increases of up to 0.05m.

7.0 Conclusion

The *North Ward Flood Study – Baseline Flooding Assessment* is part of the City Wide Flood Constraints project being completed by Townsville City Council. This report details the model setup and the conclusions it helped to derive.

The hydrologic XP-RAFTS model and the hydraulic MIKE FLOOD model were set up using various data sources available to council. The models were jointly calibrated to the January 1998 and the December 2007 events. Once verified and calibrated, the models were run to simulate ARIs of 2 year, 5 year, 10 year, 20 year, 50 year, 100 year, 500 year, and PMF. For each ARI, the storm durations modelled were 30 minutes, 45 minutes, 1 hour, 2 hours, 3 hours, 4.5 hours, 6 hours, 9 hours, 12 hours, 18 hours, and 24 hours.

The results of the model were used to generate flood maps from which the major flow paths were identified. The main problem areas were also identified to be at the trap low point at Rose and Howitt Streets, and the Mitchell Street area. Along with the overland flow results, underground pipe network results were reported.

An analysis of road closures was undertaken identifying two significant road closures of Howitt Street and Heatleys Parade, with Heatleys Parade being of some concern for the evacuation of Rowes Bay and Pallarenda.

A flood plain hazard analysis of the catchment was undertaken for the 100 Year, 500 Year, and PMF ARIs. This analysis classified each area of the catchment with a hazard ranging from none to extreme.

The recent construction works at Mitchell Street have been analysed using the hydraulic model. It was shown that the works have decreased flood water depths in the area by up to 200mm and have reduced the time of inundation of the area by several hours.

The analysis of the effects of a sea level rise due to climate change was completed on the study area. A sea level rise was shown to have a greatest effect on more frequent events around the Rose and Howitt Street area. No other areas are affected by a sea level rise due to climate change.

8.0 References

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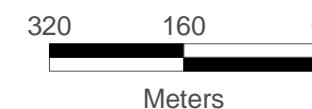
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Appendix A

Flood Envelope Maps

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- Model Result Points



SCALE: 1:9,000 @ A3

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**Figure A0:
Result Points**

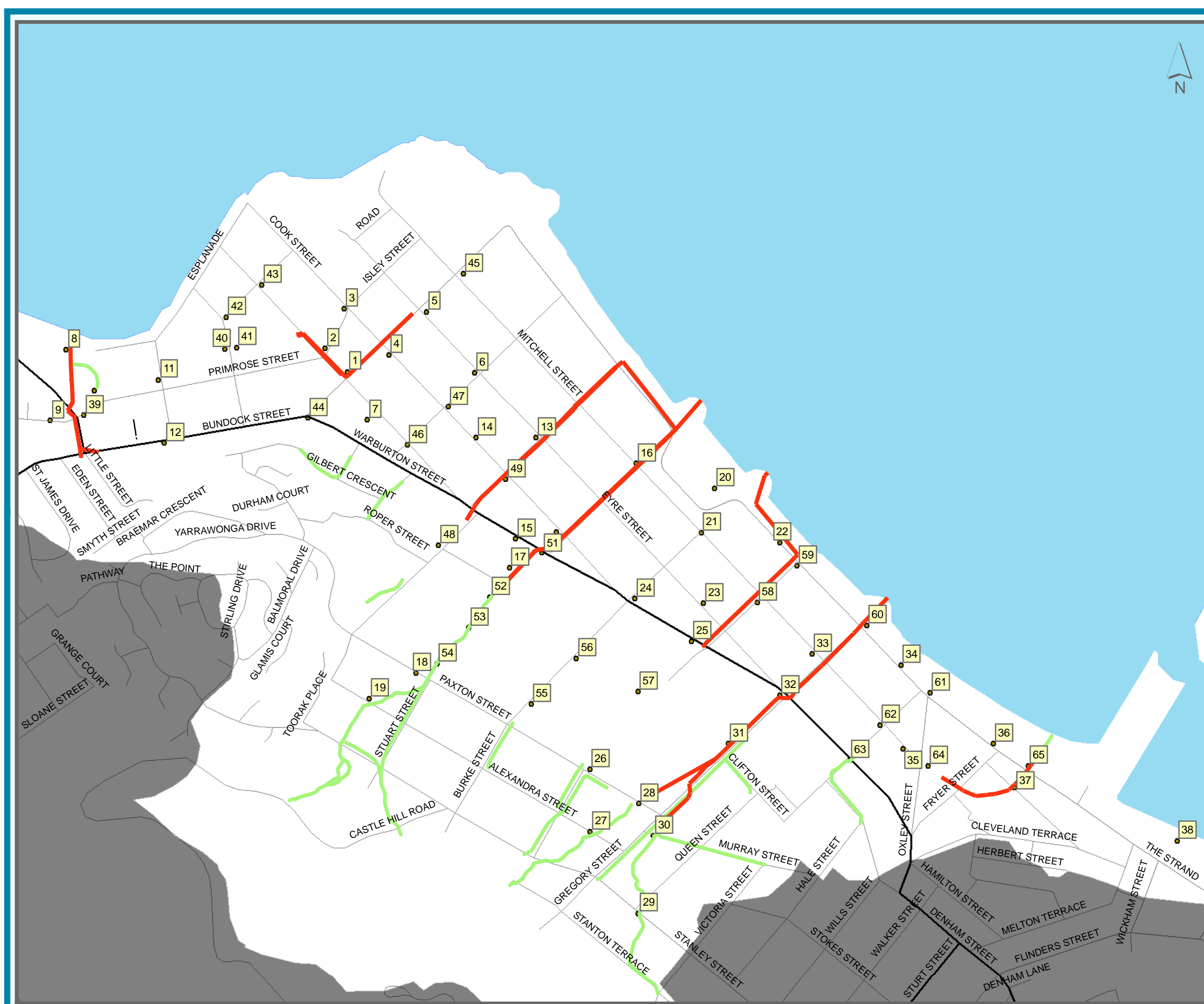


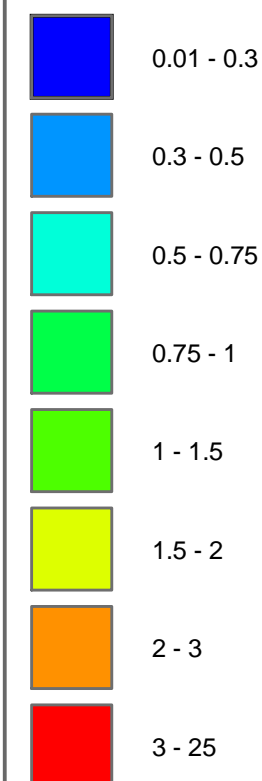
Table A1: Comparison of Results Points for base case 2009, 50 year ARI

Duration			Water Depth [m]														
Points	X	Y	0.5	0.75	1	1.5	2	3	4.5	6	9	12	18	24	Max	Max Source	
1	10	41	-	0.37	1.10	1.18	1.19	1.14	0.91	-	0.40	0.23	-	1.13	1.19	2	
2	31	10	0.46	0.49	0.51	0.50	0.49	0.48	0.45	0.46	0.47	0.45	0.40	0.49	0.51	1	
3	36	37	0.67	0.78	0.83	0.84	0.84	0.81	0.77	0.74	0.77	0.76	0.65	0.83	0.84	2	
4	55	65	0.46	0.49	0.50	0.50	0.50	0.50	0.49	0.49	0.50	0.49	0.47	0.50	0.50	1.5	
5	81	44	0.44	0.43	0.44	0.44	0.43	0.42	0.42	0.40	0.40	0.40	0.38	0.40	0.44	1	
6	103	139	0.51	0.54	0.60	0.62	0.61	0.58	0.54	0.50	0.51	0.49	0.46	0.53	0.62	1.5	
7	95	160	0.44	0.46	0.53	0.54	0.53	0.50	0.46	0.43	0.44	0.41	0.39	0.46	0.54	1.5	
8	120	139	0.37	0.39	0.45	0.46	0.45	0.42	0.39	0.36	0.36	0.34	0.32	0.38	0.46	1.5	
9	145	129	0.07	0.07	0.08	0.08	0.07	0.06	0.06	0.05	0.05	0.05	0.04	0.04	0.08	1	
10	128	160	0.69	0.72	0.78	0.79	0.77	0.74	0.71	0.68	0.68	0.66	0.64	0.70	0.79	1.5	
11	126	190	0.56	0.58	0.64	0.65	0.63	0.60	0.58	0.55	0.55	0.54	0.52	0.56	0.65	1.5	
12	166	186	0.36	0.41	0.46	0.47	0.45	0.42	0.40	0.38	0.37	0.38	0.24	0.33	0.47	1.5	
13	191	164	0.19	0.26	0.31	0.30	0.28	0.26	0.24	0.20	0.18	0.17	-	0.10	0.31	1	
14	212	186	0.34	0.38	0.42	0.42	0.40	0.38	0.36	0.34	0.34	0.34	0.19	0.29	0.42	1.5	
15	258	214	0.10	0.12	0.12	0.11	0.12	0.12	0.12	0.11	0.11	0.11	0.10	0.11	0.12	2	
16	243	142	0.47	0.49	0.54	0.53	0.51	0.49	0.48	0.46	0.45	0.45	0.38	0.40	0.54	1	
17	251	129	0.30	0.37	0.47	0.46	0.42	0.37	0.33	0.26	0.25	0.25	0.11	0.13	0.47	1	
18	258	56	0.08	0.09	0.12	0.12	0.10	0.09	0.08	0.02	0.02	0.02	-	0.01	0.12	1	
19	250	29	0.33	0.34	0.37	0.37	0.35	0.33	0.33	0.31	0.30	0.31	0.28	0.28	0.37	1	
20	309	165	0.26	0.25	0.27	0.28	0.27	0.24	0.24	0.22	0.22	0.23	0.19	0.20	0.28	1.5	
21	296	235	0.52	0.55	0.56	0.56	0.56	0.56	0.55	0.55	0.55	0.54	0.53	0.55	0.56	1.5	
22	309	214	0.31	0.38	0.42	0.43	0.43	0.42	0.39	0.38	0.39	0.36	0.33	0.40	0.43	1.5	
23	335	189	0.30	0.31	0.32	0.31	0.31	0.31	0.30	0.30	0.30	0.30	0.29	0.30	0.32	1	
24	345	171	0.39	0.40	0.41	0.41	0.40	0.40	0.40	0.39	0.39	0.39	0.38	0.38	0.41	1	
25	340	239	0.54	0.61	0.64	0.64	0.64	0.63	0.61	0.60	0.61	0.58	0.56	0.61	0.64	1.5	
26	393	212	0.37	0.39	0.41	0.39	0.40	0.39	0.37	0.38	0.37	0.37	0.35	0.36	0.41	1	
27	397	184	0.30	0.32	0.35	0.35	0.33	0.32	0.31	0.32	0.31	0.31	0.26	0.27	0.35	1.5	
28	397	148	0.54	0.57	0.63	0.64	0.60	0.58	0.55	0.57	0.55	0.55	0.39	0.42	0.64	1.5	
29	356	86	0.22	0.23	0.23	0.22	0.22	0.23	0.23	0.22	0.22	0.22	0.21	0.21	0.23	4.5	
30	387	92	0.04	0.04	0.05	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.03	0.03	0.05	1	
31	380	64	0.07	0.07	0.08	0.08	0.07	0.07	0.07	0.06	0.06	0.07	0.06	0.06	0.08	1	

Points	X	Y	0.5	0.75	1	1.5	2	3	4.5	6	9	12	18	24	Max	Max Source
32	404	86	0.05	0.05	0.06	0.07	0.06	0.05	0.05	0.05	0.05	0.05	0.02	0.02	0.07	1.5
33	428	53	0.04	0.05	0.05	0.05	0.05	0.05	0.04	0.04	0.04	0.04	0.04	0.00	0.05	1.5
34	429	241	0.60	0.63	0.65	0.65	0.64	0.64	0.62	0.63	0.63	0.62	0.60	0.61	0.65	1.5
35	461	211	0.76	0.76	0.79	0.80	0.79	0.77	0.76	0.76	0.76	0.75	0.72	0.74	0.80	1.5
36	492	247	0.25	0.26	0.28	0.28	0.27	0.27	0.26	0.26	0.26	0.26	0.25	0.26	0.28	1.5
37	516	239	0.40	0.58	0.75	0.73	0.64	0.49	0.31	-	-	-	-	-	0.75	1
38	595	281	0.38	0.38	0.40	0.39	0.39	0.39	0.38	0.39	0.39	0.39	0.39	0.39	0.40	1
39	41	24	0.20	0.22	0.24	0.24	0.23	0.22	0.20	0.20	0.21	0.20	0.16	0.23	0.24	1.5
40	67	101	1.27	1.46	1.56	1.58	1.57	1.52	1.48	1.39	1.41	1.35	1.31	1.46	1.58	1.5
41	71	106	1.57	1.77	1.93	1.97	1.95	1.88	1.80	1.71	1.73	1.66	1.61	1.79	1.97	1.5
42	56	113	-	-	0.31	0.31	0.31	0.26	-	-	-	-	-	-	0.31	1.5
43	56	138	0.13	0.14	0.21	0.23	0.22	0.19	0.15	0.13	0.13	0.12	0.10	0.14	0.23	1.5
44	123	107	0.16	0.16	0.15	0.14	0.13	0.13	0.14	0.13	0.13	0.13	0.11	0.11	0.16	0.5
45	125	218	0.35	0.34	0.36	0.36	0.35	0.34	0.34	0.33	0.33	0.33	0.31	0.32	0.36	1.5
46	169	135	0.10	0.10	0.09	0.08	0.10	0.10	0.09	0.10	0.09	0.10	0.10	0.10	0.10	0.5
47	169	164	0.04	0.08	0.10	0.10	0.09	0.07	0.07	0.05	0.05	0.05	0.03	0.04	0.10	1
48	218	110	0.02	0.00	0.06	0.04	-	-	-	-	-	-	-	-	0.06	1
49	217	159	0.16	0.19	0.21	0.21	0.20	0.18	0.17	0.16	0.16	0.16	0.14	0.15	0.21	1
50	255	159	-	-	-	0.04	0.04	-	-	-	-	-	-	-	0.04	1.5
51	258	147	-	-	0.14	0.13	0.11	-	-	-	-	-	-	-	0.14	1
52	256	111	1.42	1.47	1.56	1.55	1.51	1.46	1.44	1.38	1.37	1.37	1.23	1.26	1.56	1
53	260	92	1.12	1.16	1.26	1.25	1.20	1.15	1.12	1.07	1.07	1.07	0.96	0.98	1.26	1
54	262	67	0.25	0.28	0.31	0.32	0.30	0.27	0.26	0.22	0.22	0.23	0.20	0.20	0.32	1.5
55	311	88	0.11	0.12	0.12	0.12	0.11	0.11	0.10	0.09	0.09	0.09	0.08	0.09	0.12	1.5
56	310	120	0.04	0.04	0.04	0.04	0.04	0.03	0.03	-	-	-	-	-	0.04	1.5
57	344	132	0.09	0.10	0.10	0.10	0.10	0.10	0.09	0.09	0.09	0.09	0.08	0.08	0.10	1
58	354	209	0.15	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.15	0.15	0.15	0.16	1
59	355	238	-	0.11	0.15	0.16	0.16	0.15	0.13	0.13	0.13	0.10	0.13	0.13	0.16	2
60	402	242	0.26	0.27	0.27	0.27	0.28	0.27	0.26	0.25	0.25	0.25	0.22	0.23	0.28	2
61	450	242	0.34	0.36	0.37	0.37	0.36	0.36	0.35	0.35	0.36	0.36	0.34	0.35	0.37	1.5
62	444	211	0.17	0.17	0.22	0.22	0.21	0.20	0.18	0.18	0.18	0.16	0.12	0.14	0.22	1.5
63	446	187	0.05	0.04	0.05	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.05	1
64	477	215	0.81	0.84	0.99	1.00	0.94	0.84	0.83	0.81	0.81	0.81	0.81	0.81	1.00	1.5
65	513	252	0.43	0.51	0.54	0.55	0.54	0.53	0.51	0.51	0.52	0.49	0.43	0.52	0.55	1.5

LEGEND

2y Flood Envelope



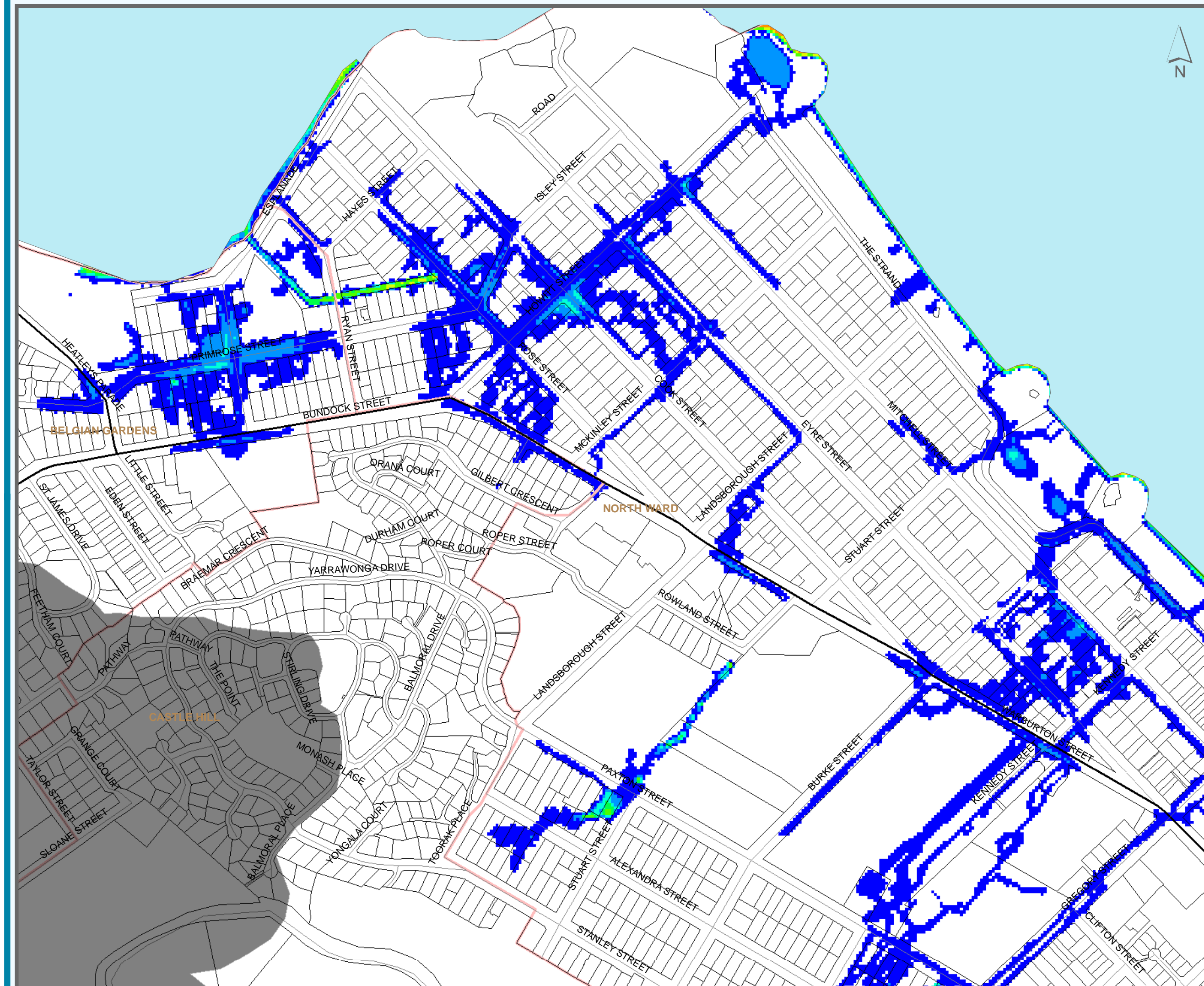
SCALE: 1:6,000 @ A3

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PLANNING AND DEVELOPMENT

DATE: 15/03/2011
DRAWN BY: JAJ
DIGITAL FILE: mxd

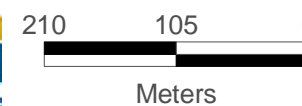
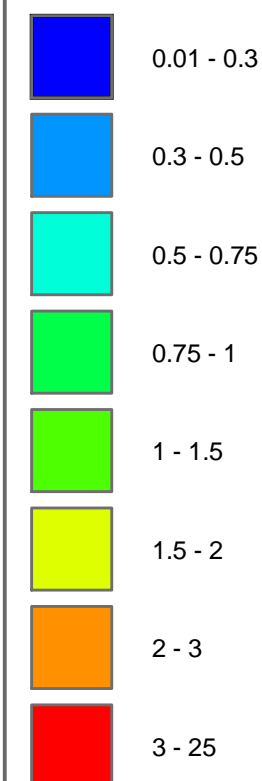
© Townsville City Council 2010

Figure A1: 2y Flood
Envelope 1 of 2



LEGEND

2y Flood Envelope



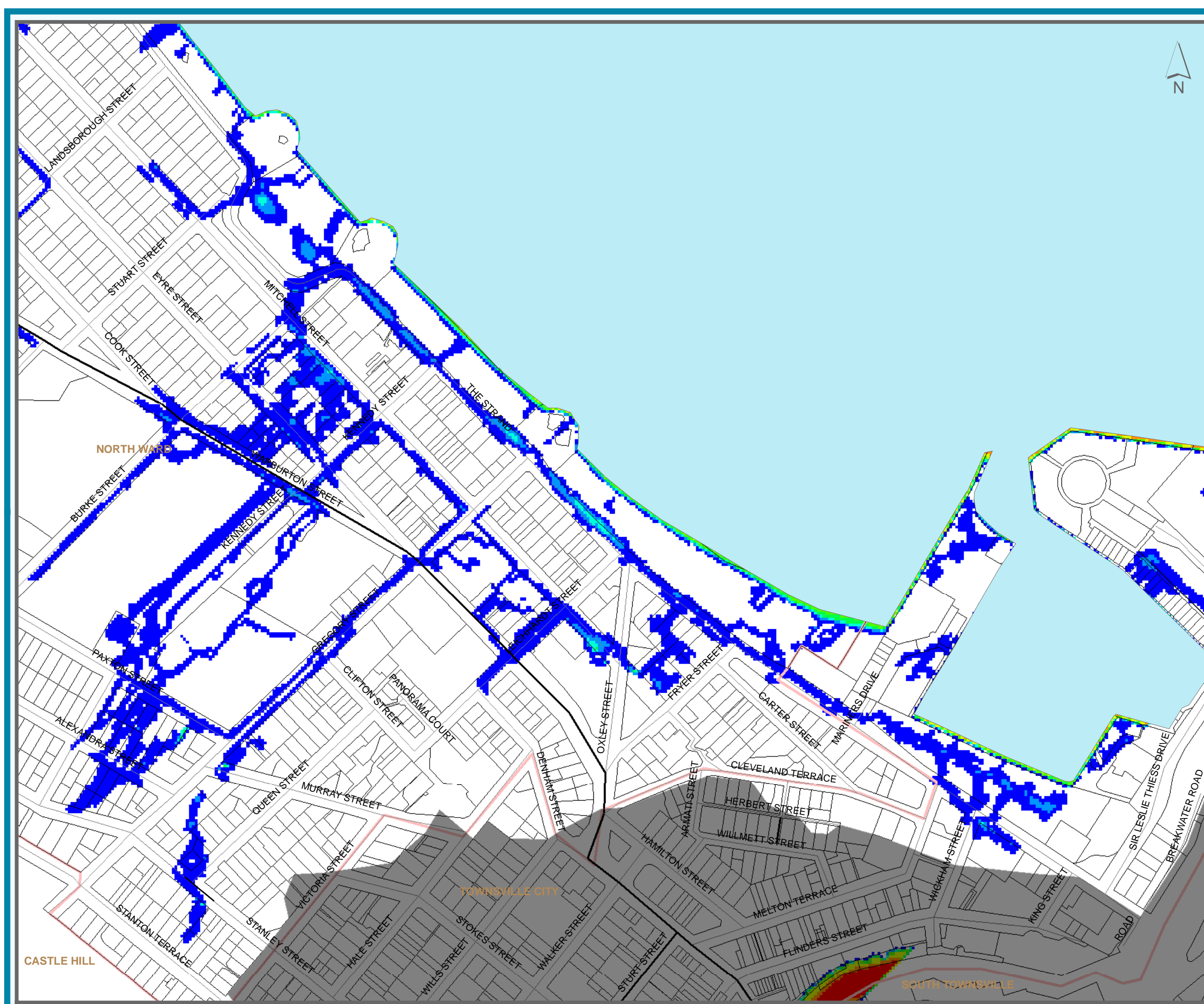
SCALE: 1:6,000 @ A3

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DATE: 09/02/2011
DRAWN BY: JAJ
DIGITAL FILE: mxd

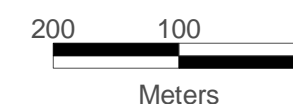
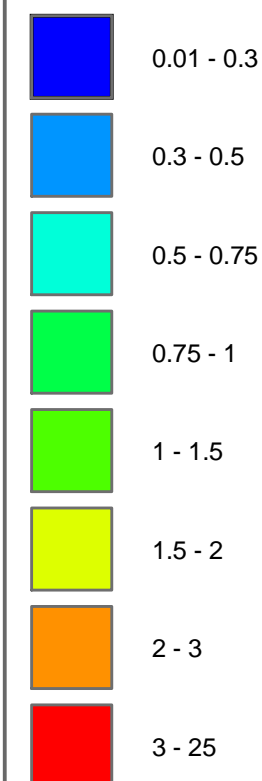
© Townsville City Council 2010

Figure A2: 2y Flood
Envelope 2 of 2



LEGEND

5y Flood Envelope



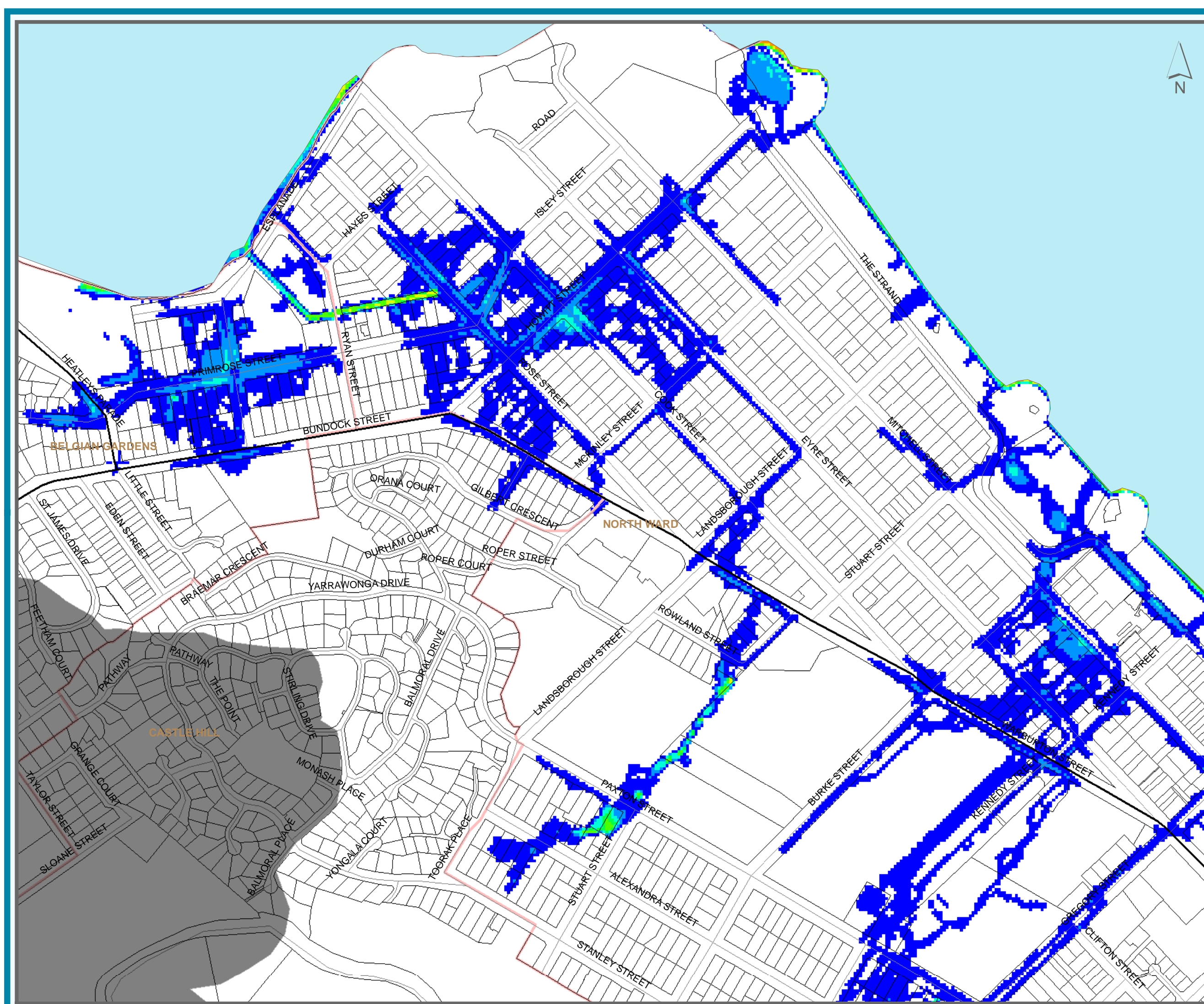
SCALE: 1:6,000 @ A3

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DATE: 15/03/2011
DRAWN BY: JAJ
DIGITAL FILE: mxd

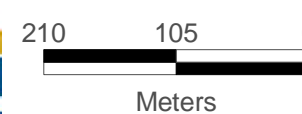
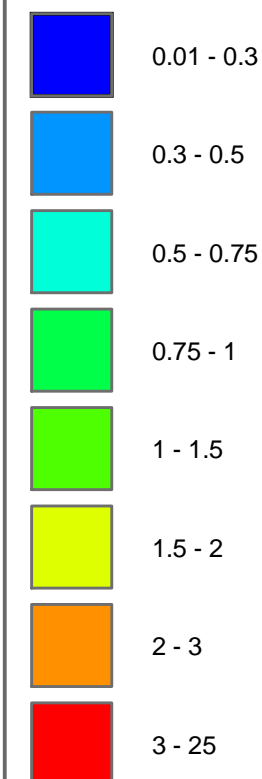
© Townsville City Council 2010

Figure A3: 5y Flood
Envelope 1 of 2



LEGEND

5y Flood Envelope



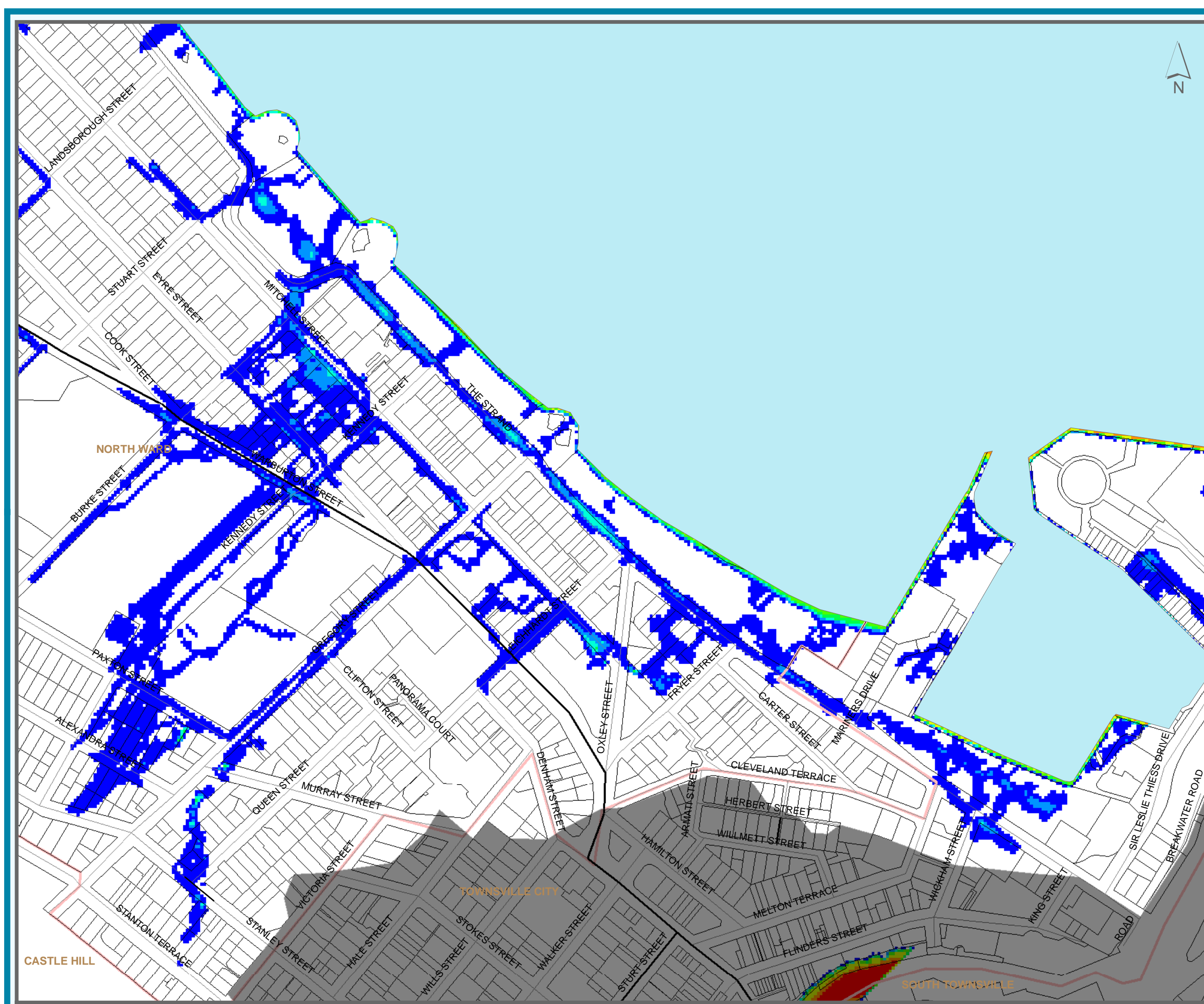
SCALE: 1:6,000 @ A3

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DATE: 15/03/2011
DRAWN BY: JAJ
DIGITAL FILE: mxd

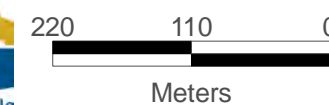
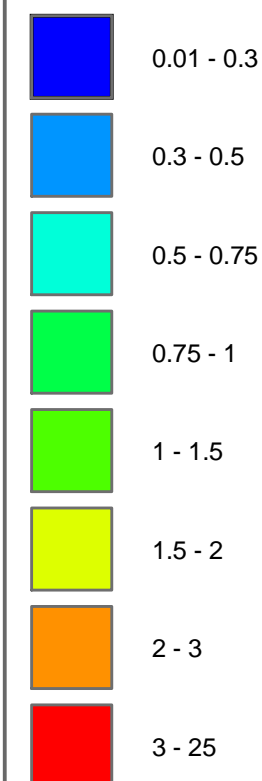
© Townsville City Council 2010

Figure A4: 5y Flood
Envelope 2 of 2



LEGEND

10y Flood Envelope



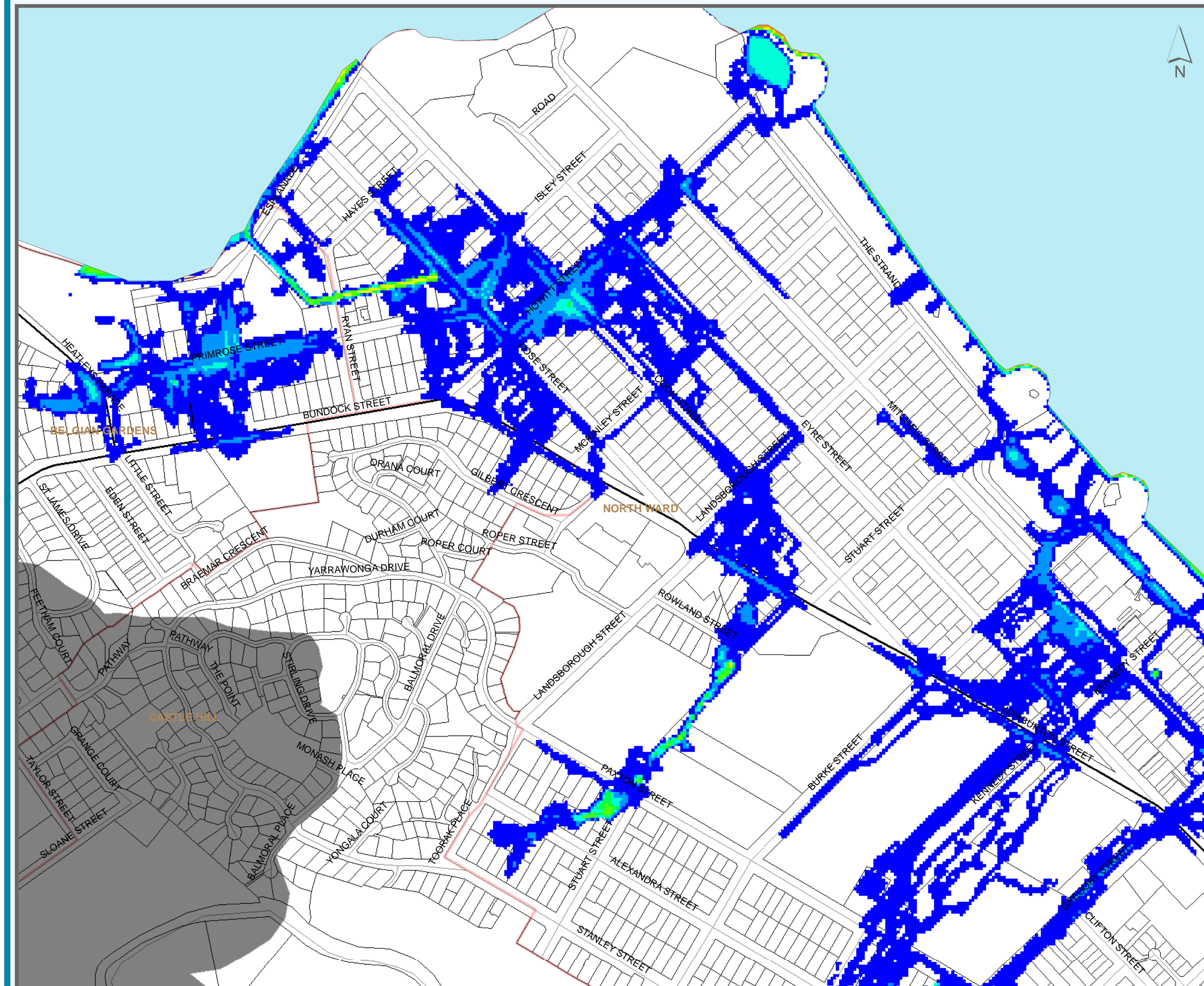
SCALE: 1:6,000 @ A3

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DATE: 15/03/2011
DRAWN BY: JAJ
DIGITAL FILE: mxd

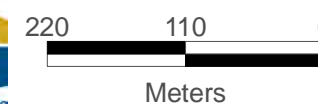
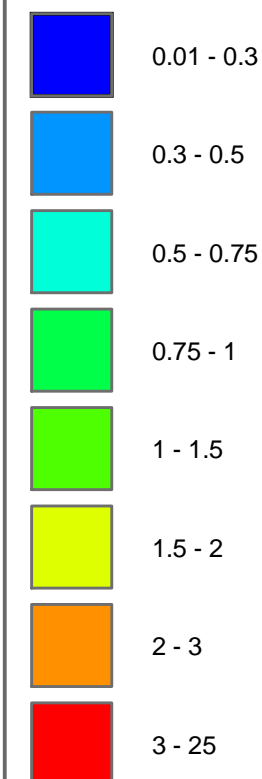
© Townsville City Council 2010

Figure A5: 10y Flood
Envelope 1 of 2



LEGEND

10y Flood Envelope



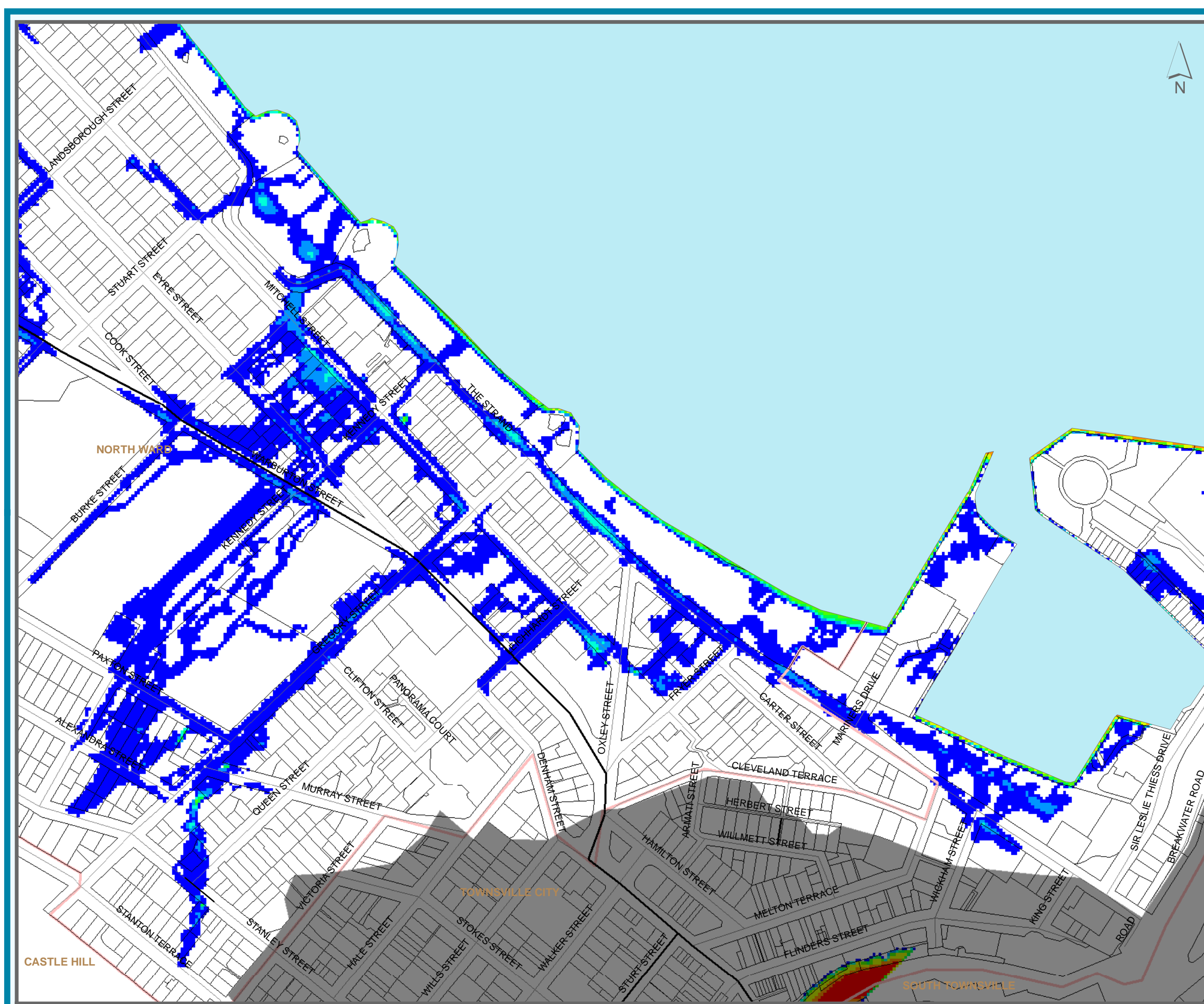
SCALE: 1:6,000 @ A3

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DATE: 15/03/2011
DRAWN BY: JAJ
DIGITAL FILE: mxd

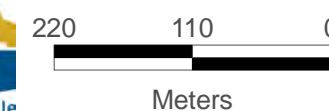
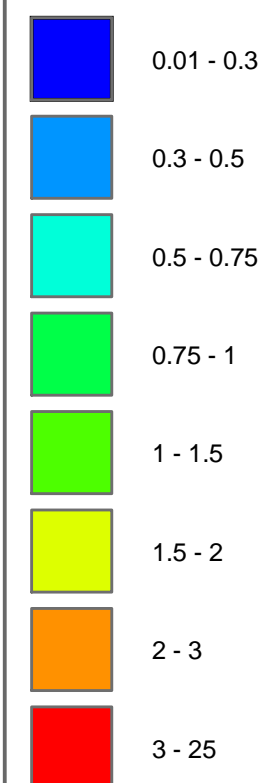
© Townsville City Council 2010

Figure A6: 10y Flood
Envelope 2 of 2



LEGEND

20y Flood Envelope



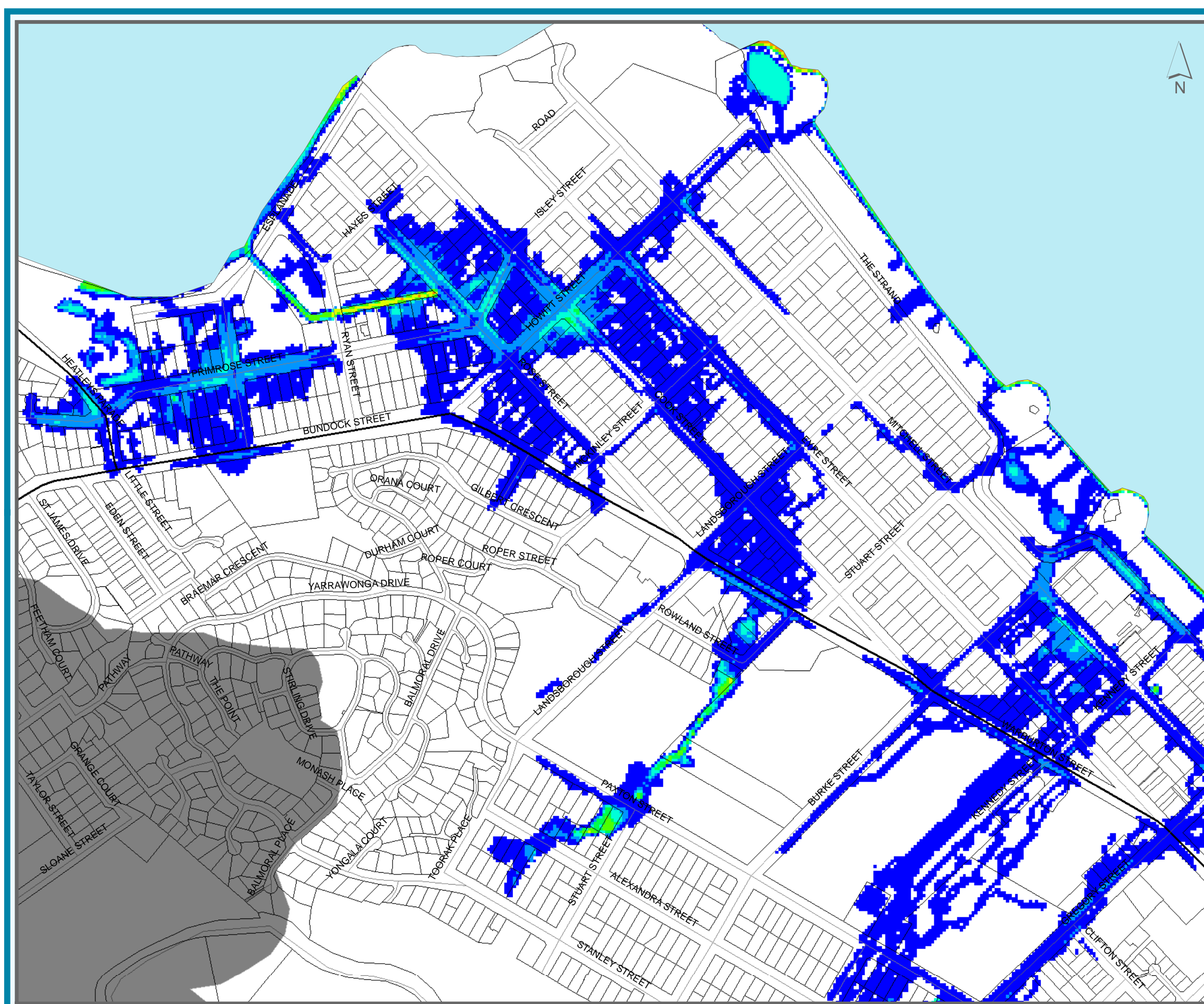
SCALE: 1:6,000 @ A3

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DATE: 15/03/2011
DRAWN BY: JAJ
DIGITAL FILE: mxd

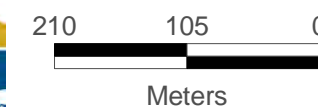
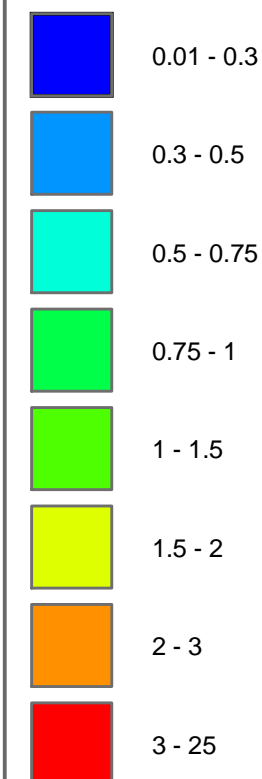
© Townsville City Council 2010

Figure A7: 20y Flood Envelope
1 of 2



LEGEND

20y Flood Envelope



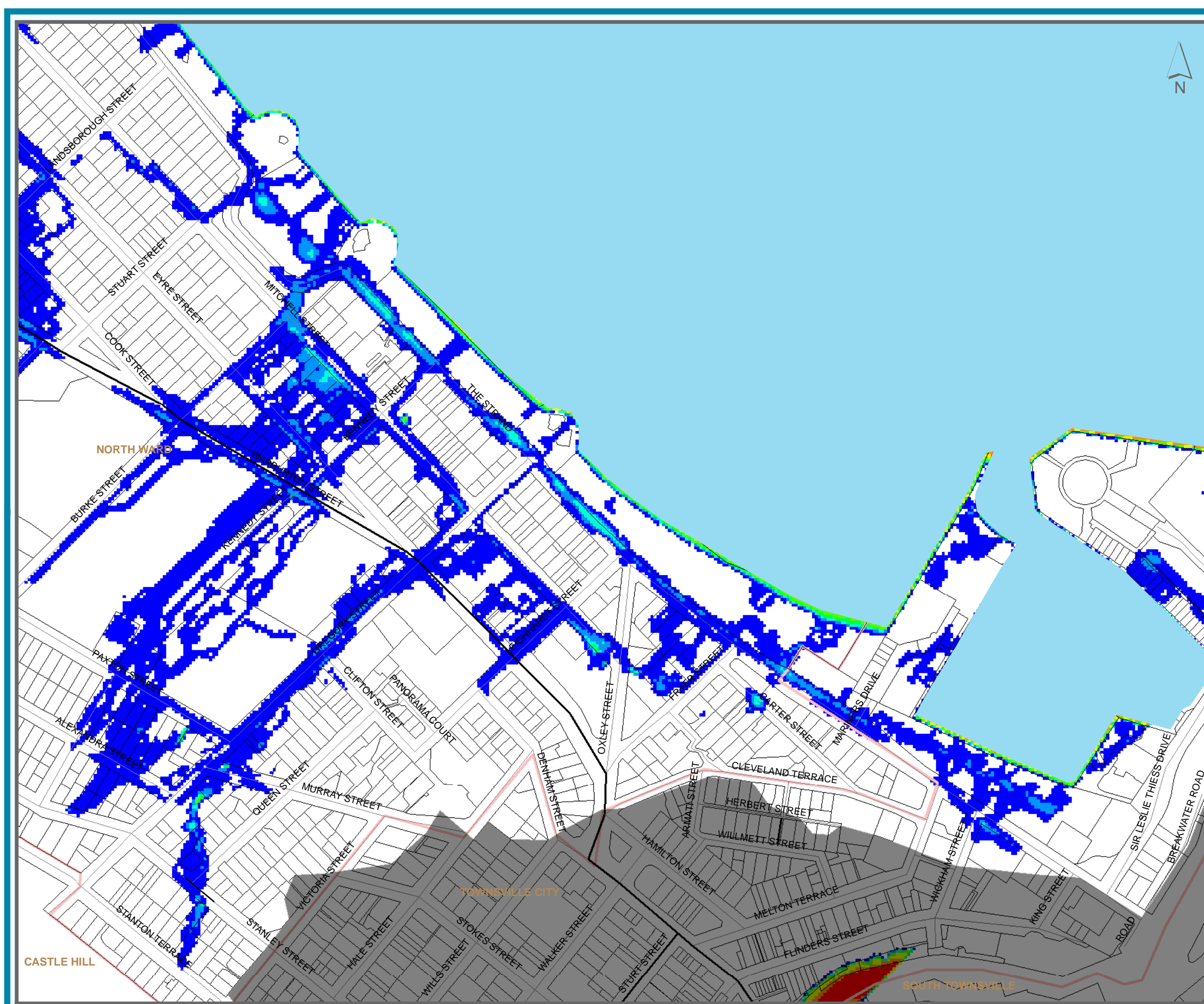
SCALE: 1:6,000 @ A3

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DATE: 08/02/2011
DRAWN BY: JDJ
DIGITAL FILE: mxd

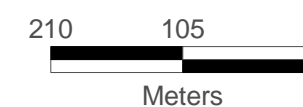
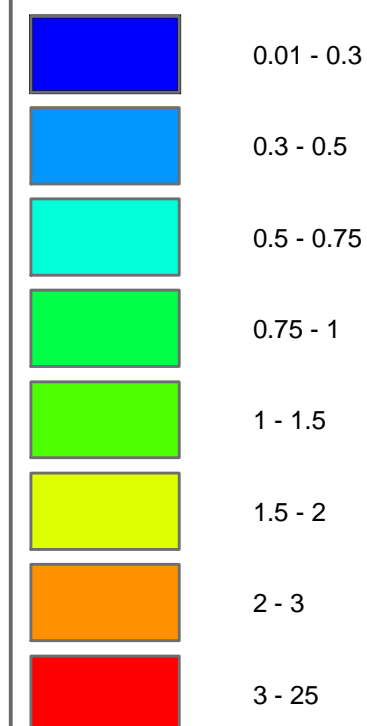
© Townsville City Council 2010

Figure A8: 20y Flood
Envelope 2 of 2



LEGEND

50y Flood Envelope



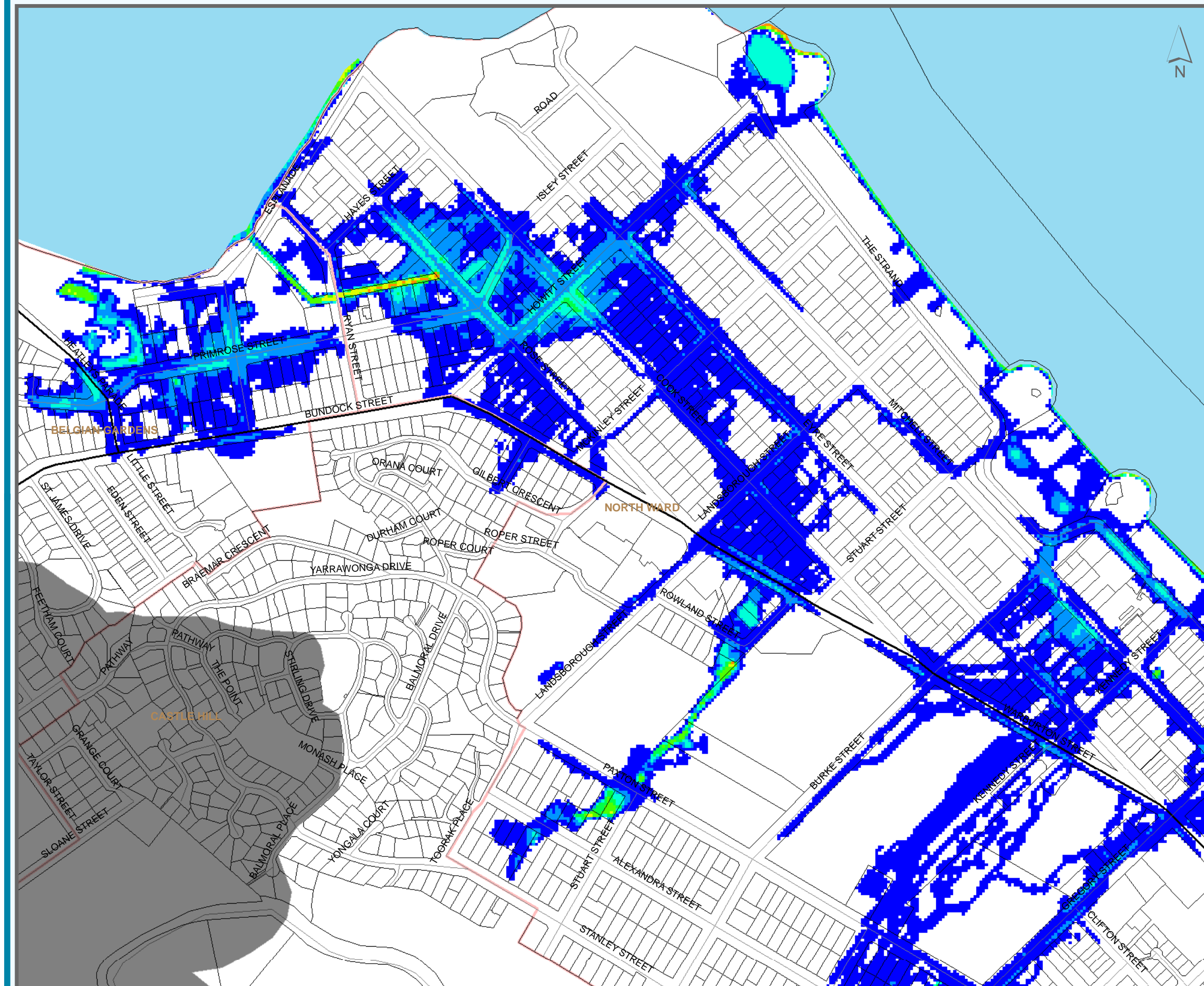
SCALE: 1:6,000 @ A3

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DATE: 15/03/2011
DRAWN BY: JAJ
DIGITAL FILE: mxd

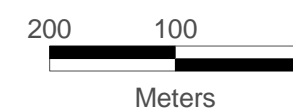
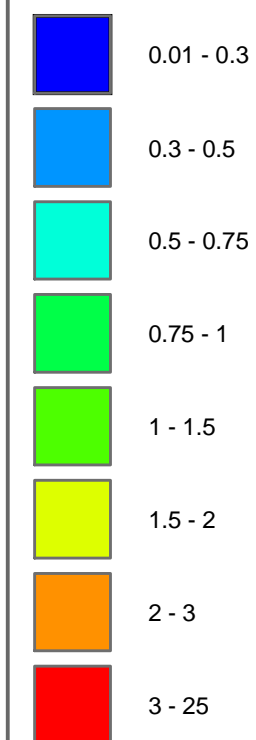
© Townsville City Council 2010

Figure A9: 50y Flood
Envelope 1 of 2



LEGEND

50y Flood Envelope



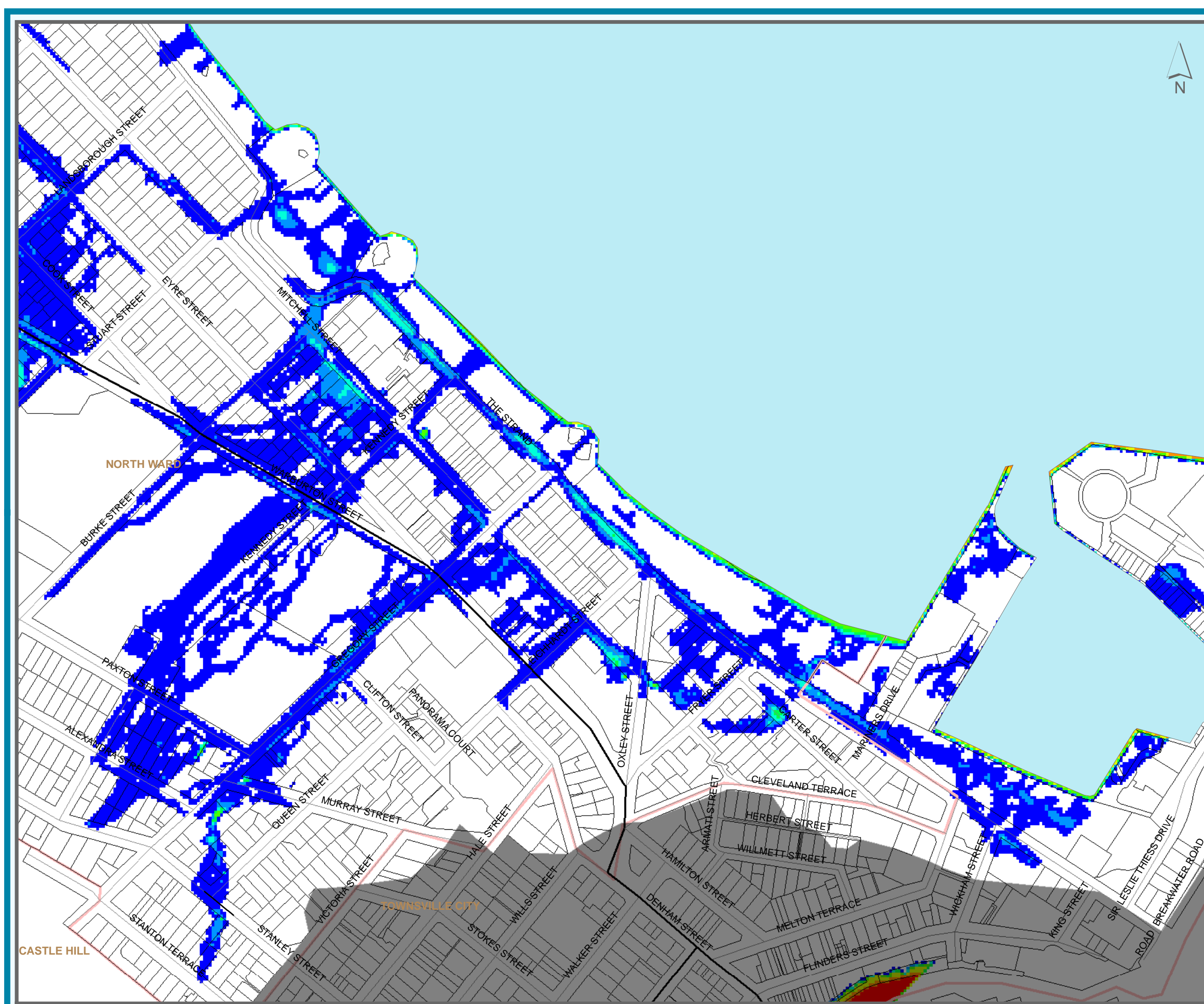
SCALE: 1:6,000 @ A3

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DATE: 15/03/2011
DRAWN BY: JAJ
DIGITAL FILE: mxd

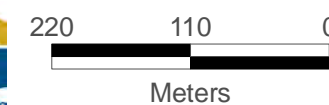
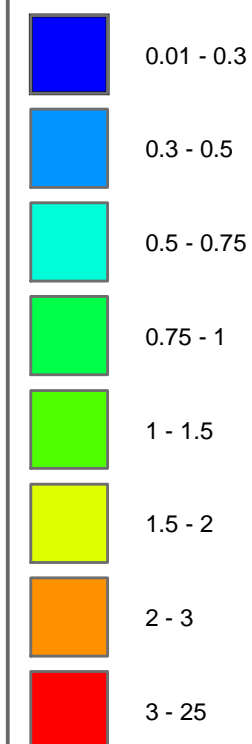
© Townsville City Council 2010

Figure A10: 50y Flood
Envelope 2 of 2



LEGEND

100y Flood Envelope



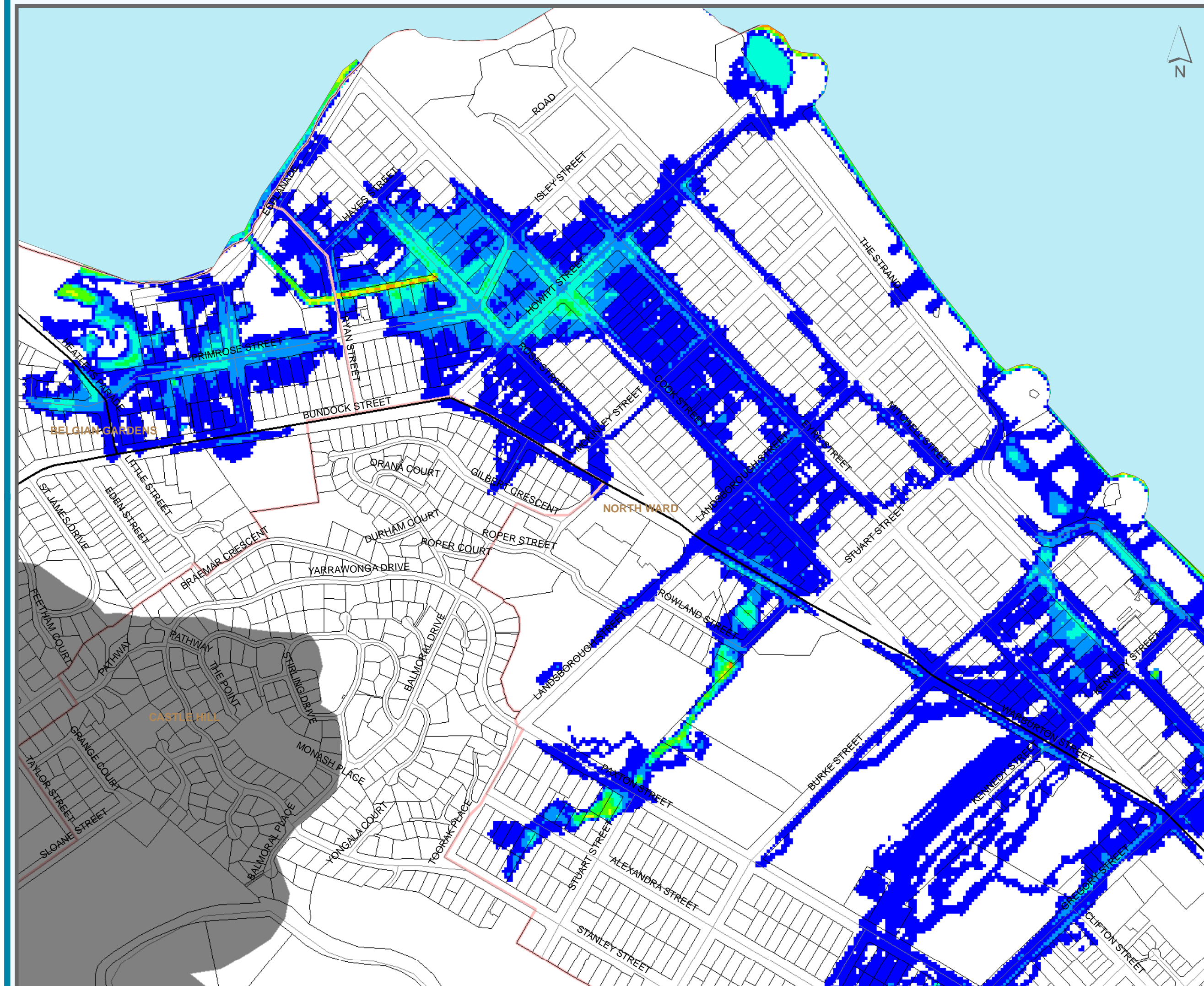
SCALE: 1:6,000 @ A3

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DATE: 15/03/2011
DRAWN BY: JAJ
DIGITAL FILE: mxd

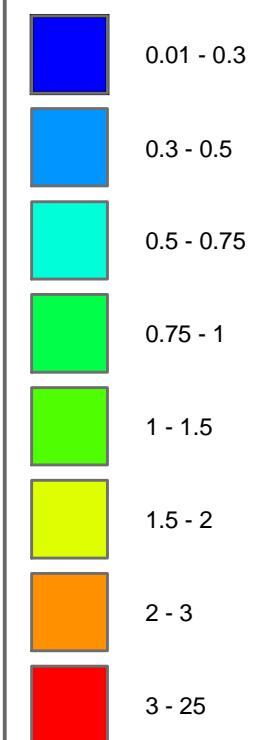
© Townsville City Council 2010

Figure A11: 100y Flood
Envelope 1 of 2



LEGEND

100y Flood Envelope



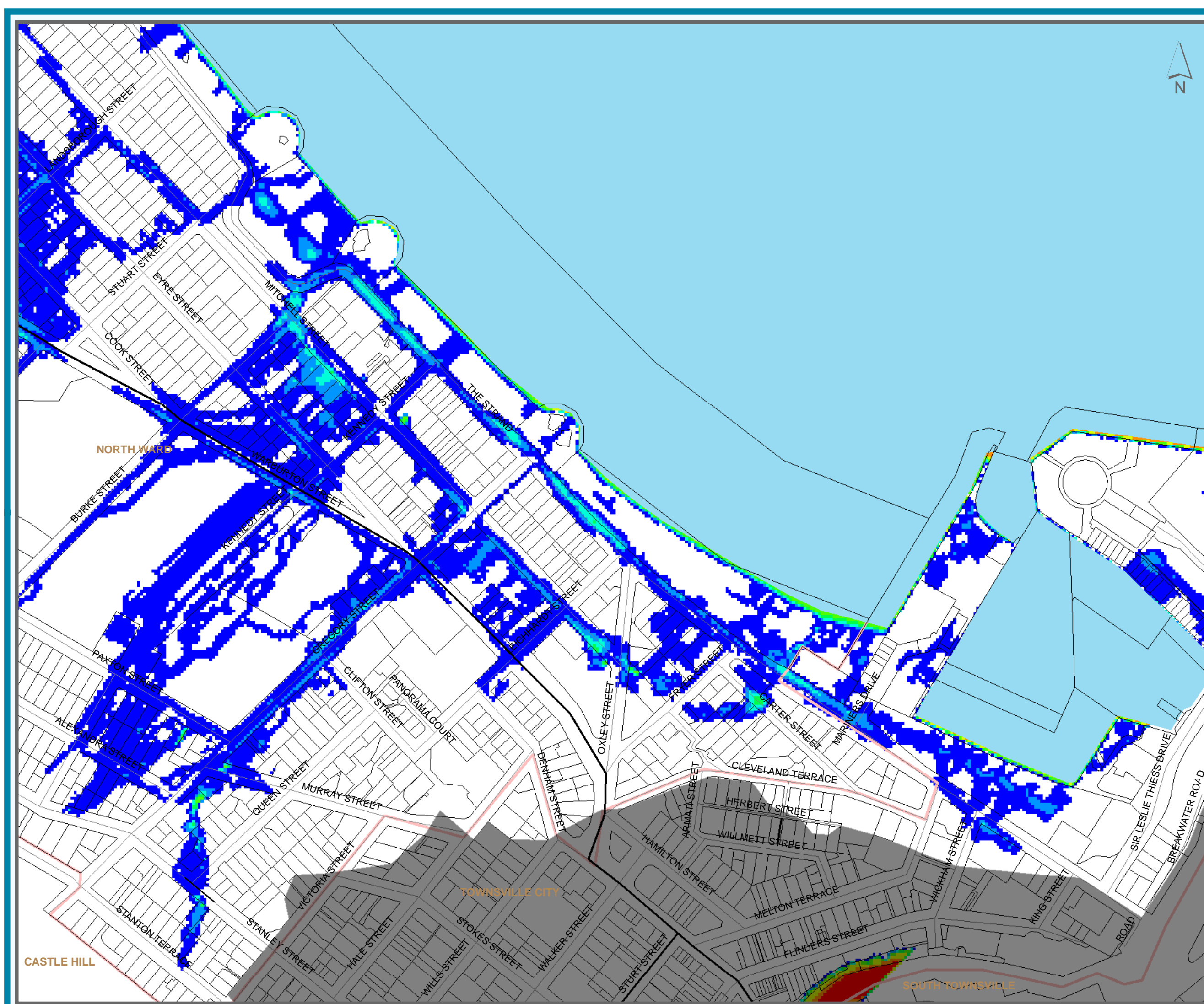
SCALE: 1:6,000 @ A3

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DATE: 15/02/2011
DRAWN BY: JAJ
DIGITAL FILE: mxd

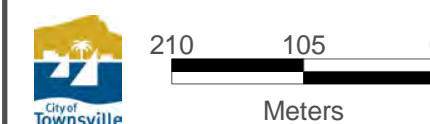
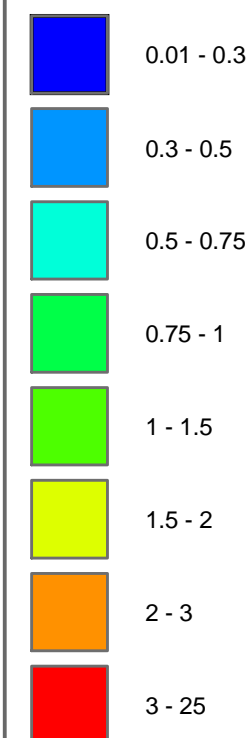
© Townsville City Council 2010

Figure A12: 100y Flood
Envelope 2 of 2



LEGEND

500y Flood Envelope



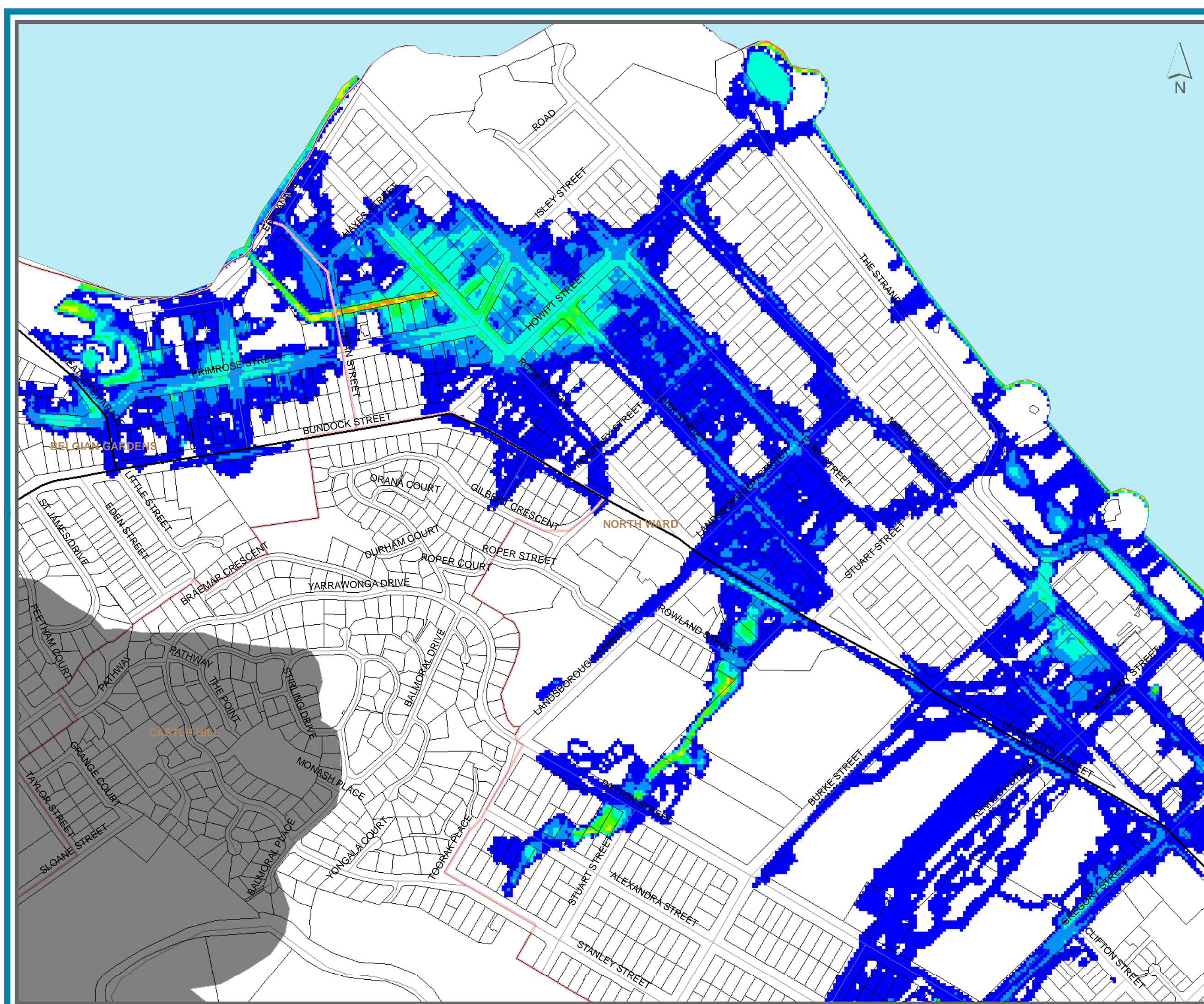
SCALE: 1:6,000 @ A3

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DATE: 15/03/2011
DRAWN BY: JAJ
DIGITAL FILE: mxd

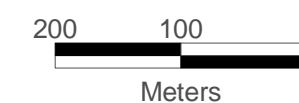
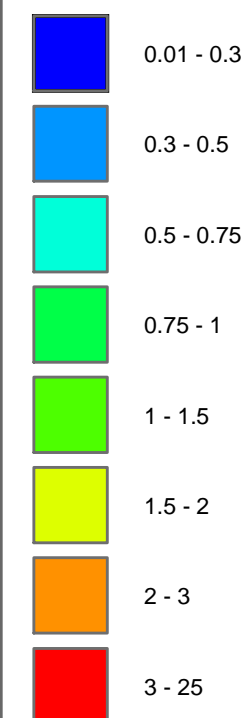
© Townsville City Council 2010

Figure A13: 500y Flood
Envelope 1 of 2



LEGEND

500y Flood Envelope



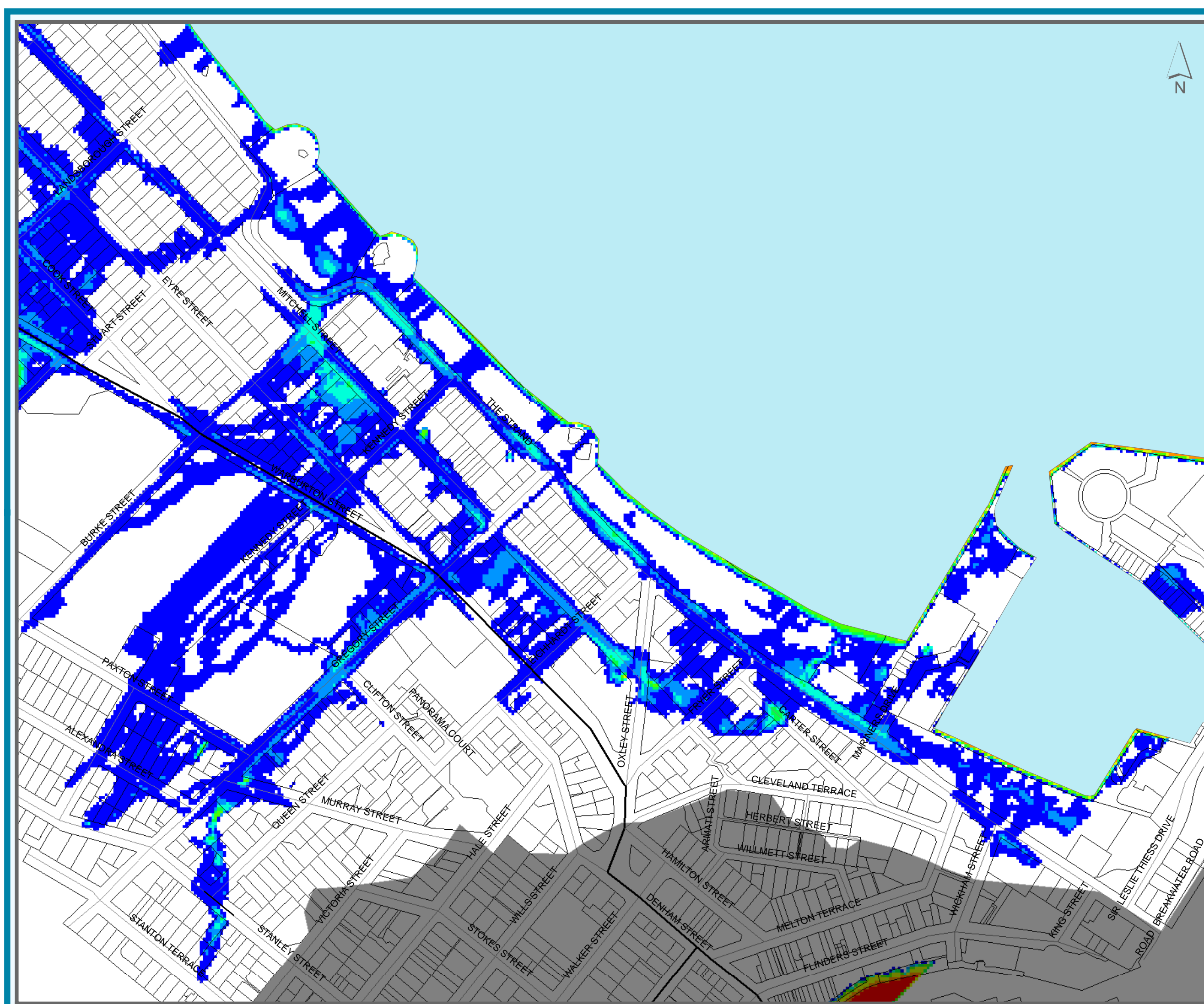
SCALE: 1:6,000 @ A3

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DATE: 15/03/2011
DRAWN BY: JAJ
DIGITAL FILE: mxd

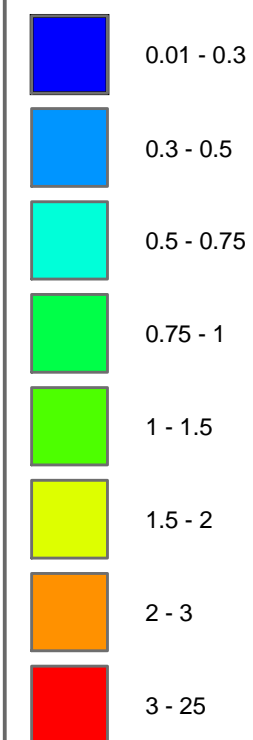
© Townsville City Council 2010

Figure A14: 500y Flood
Envelope 2 of 2



LEGEND

PMF Flood Envelope



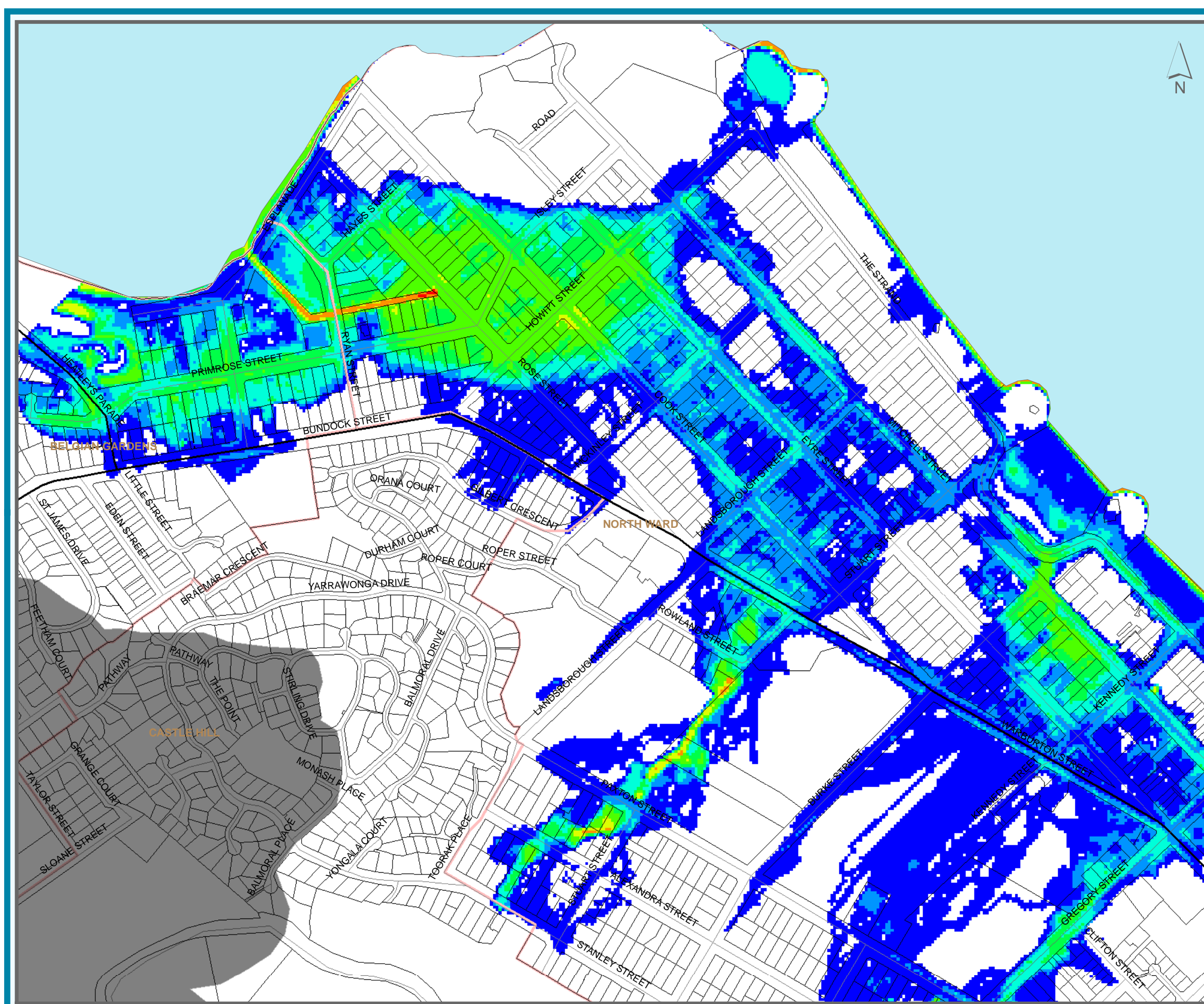
SCALE: 1:6,000 @ A3

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DRAWN BY: JAJ
DIGITAL FILE: mxd

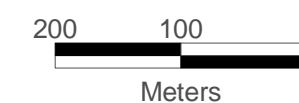
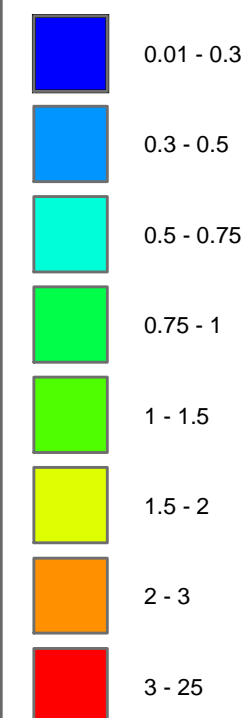
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Figure A15: PMF Flood Envelope
Envelope 1 of 2



LEGEND

PMF Flood Envelope



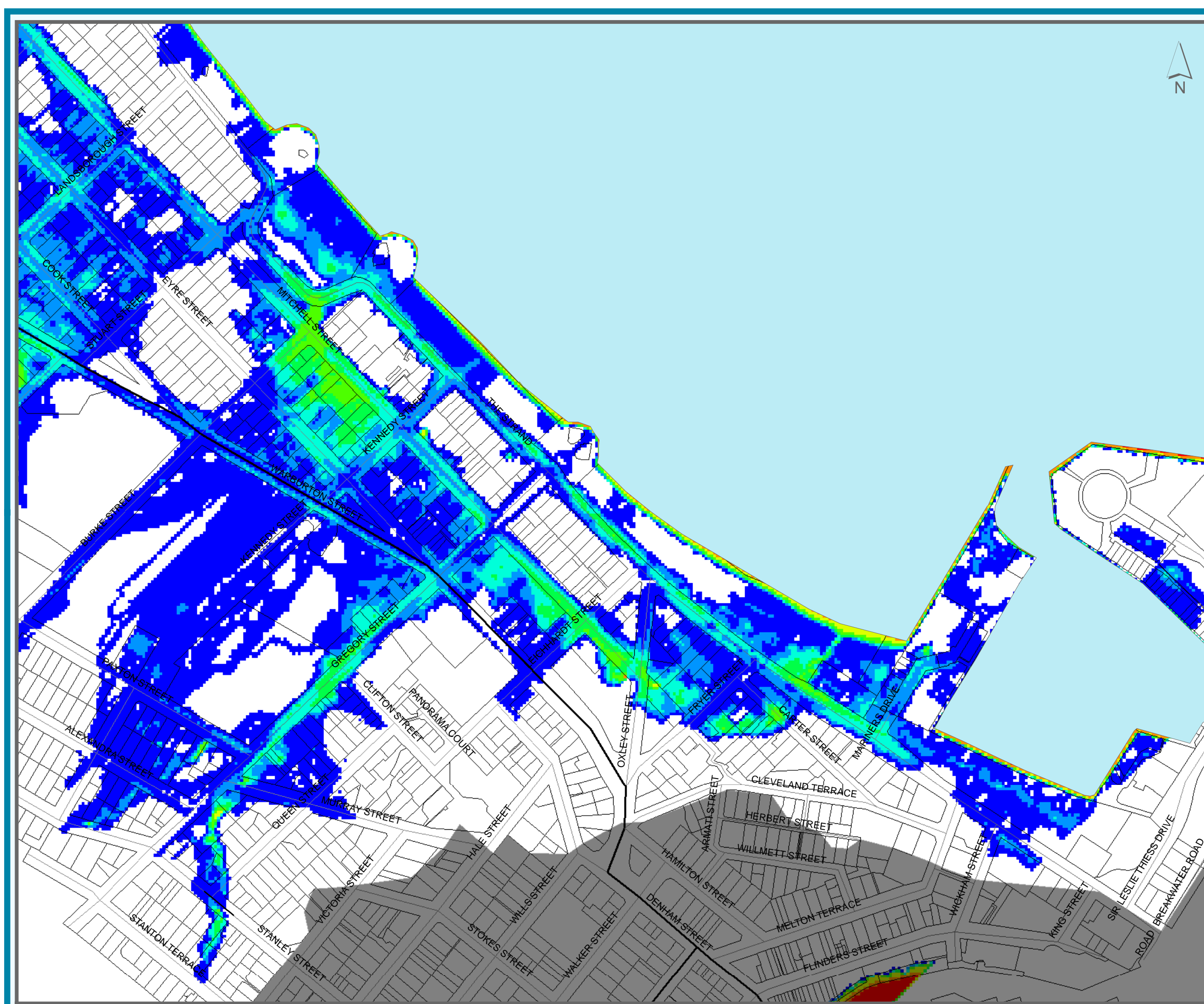
SCALE: 1:6,000 @ A3

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DRAWN BY: JAJ
DIGITAL FILE: mxd

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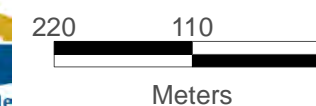
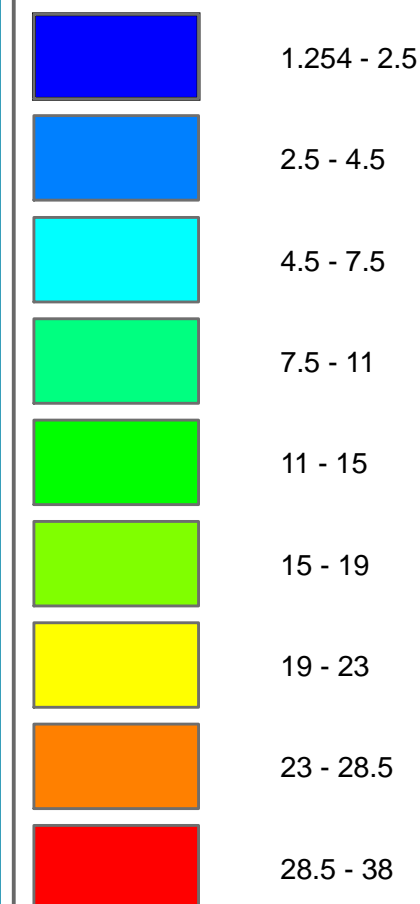
Figure A16: PMF Flood Envelope
Envelope 2 of 2



LEGEND

2y Flood Envelope

Water Level [m]



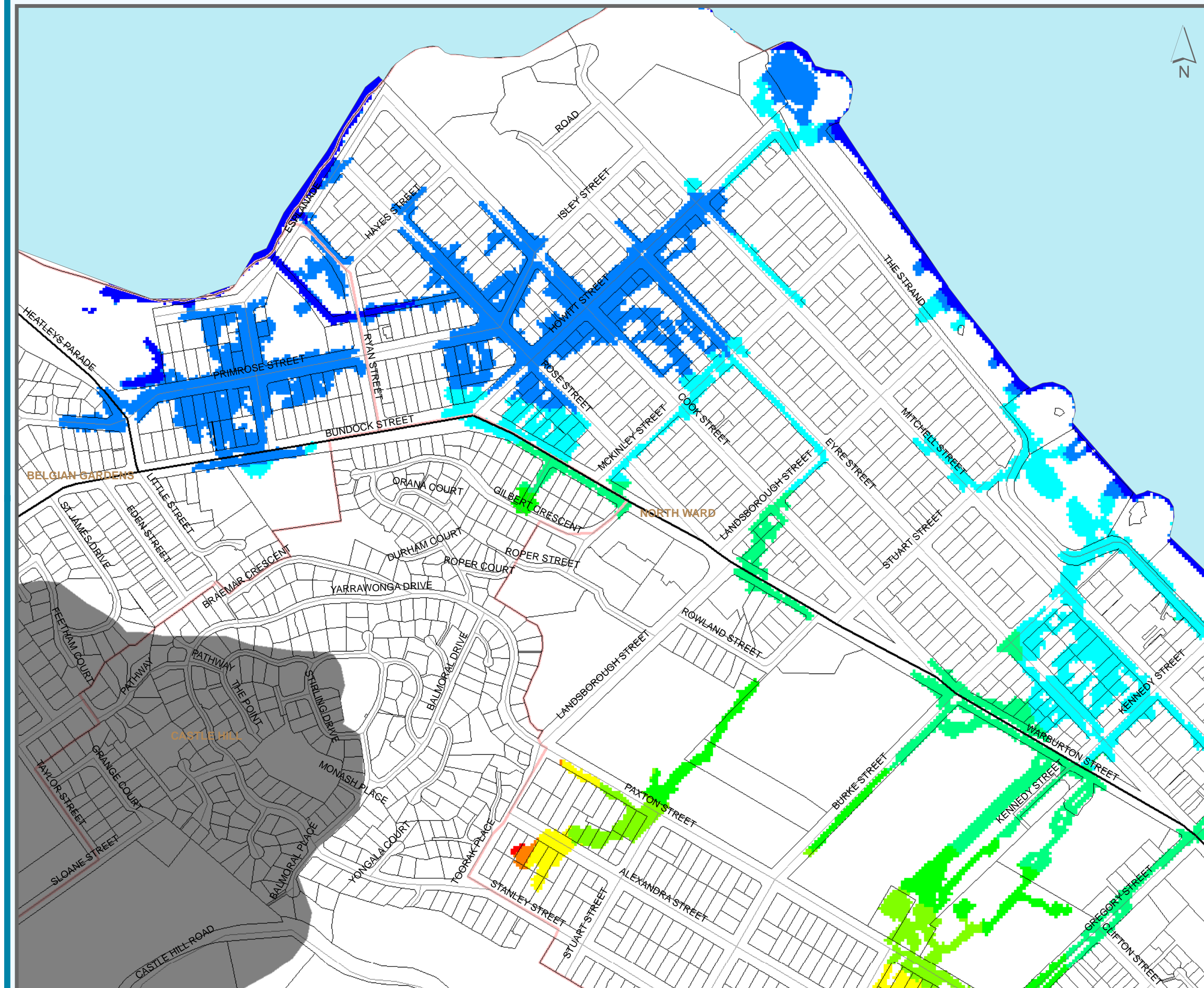
SCALE: 1:6,000 @ A3

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Figure A17: 2y Flood
Envelope 1 of 2



LEGEND

2y Flood Envelope

Water Level [m]

	1.254 - 2.5
	2.5 - 4.5
	4.5 - 7.5
	7.5 - 11
	11 - 15
	15 - 19
	19 - 23
	23 - 28.5
	28.5 - 38



200 100 0
Meters

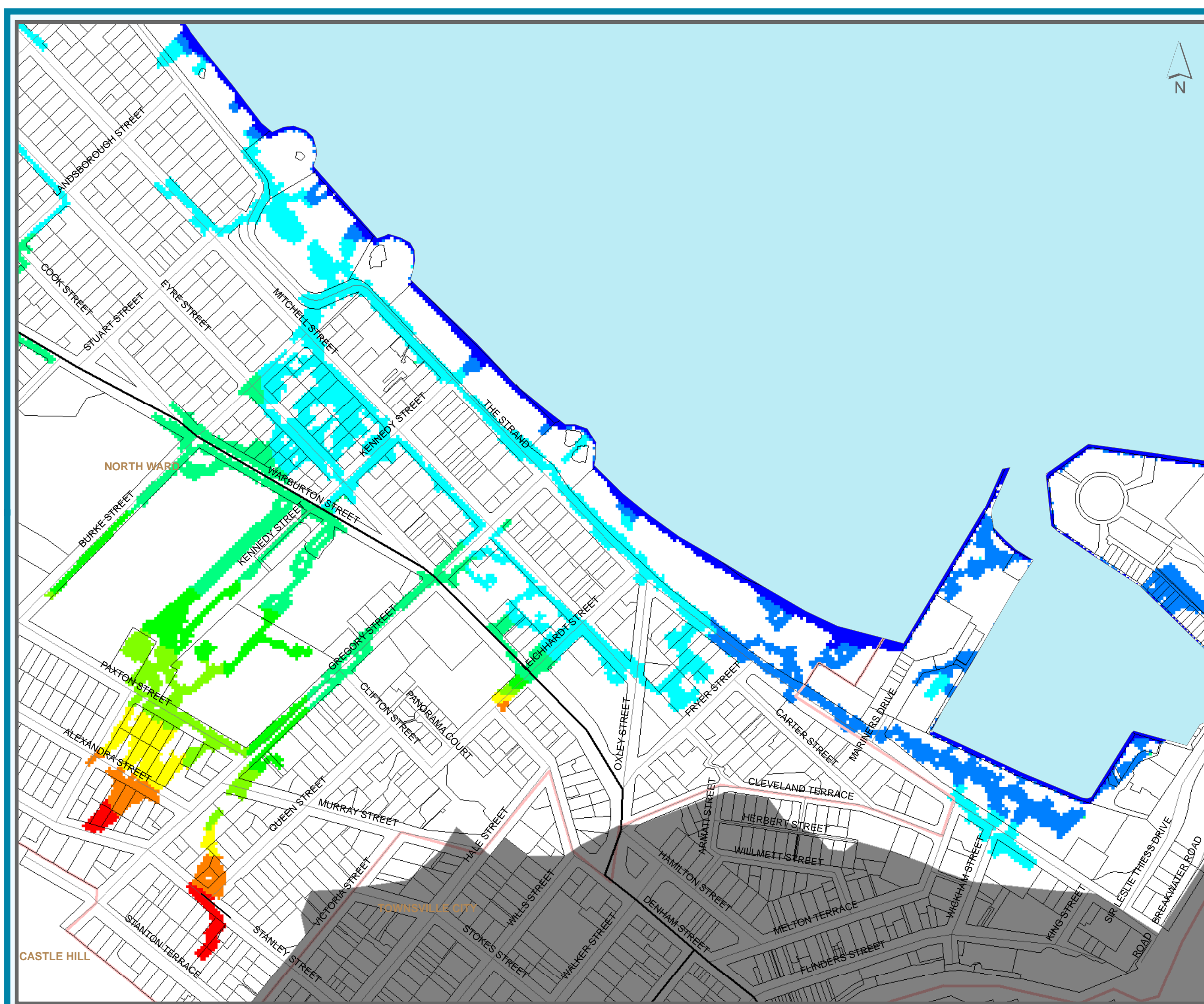
SCALE: 1:6,000 @ A3

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DIGITAL FILE: mxd

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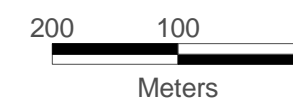
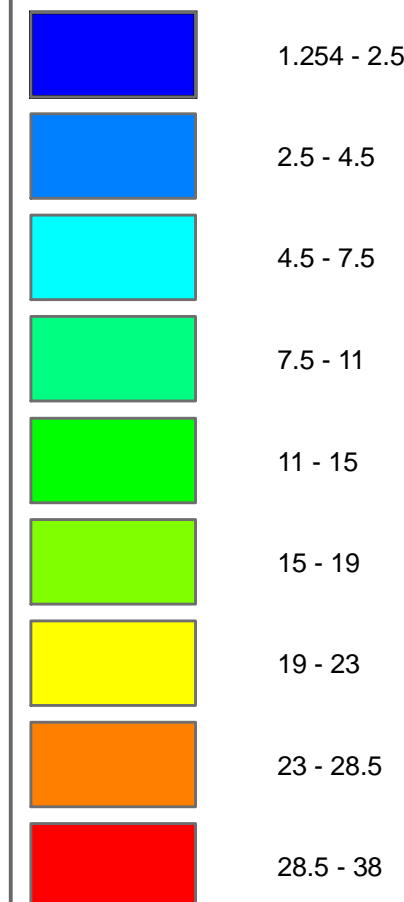
Figure A18: 2y Flood
Envelope 2 of 2



LEGEND

5y Flood Envelope

Water Level [m]



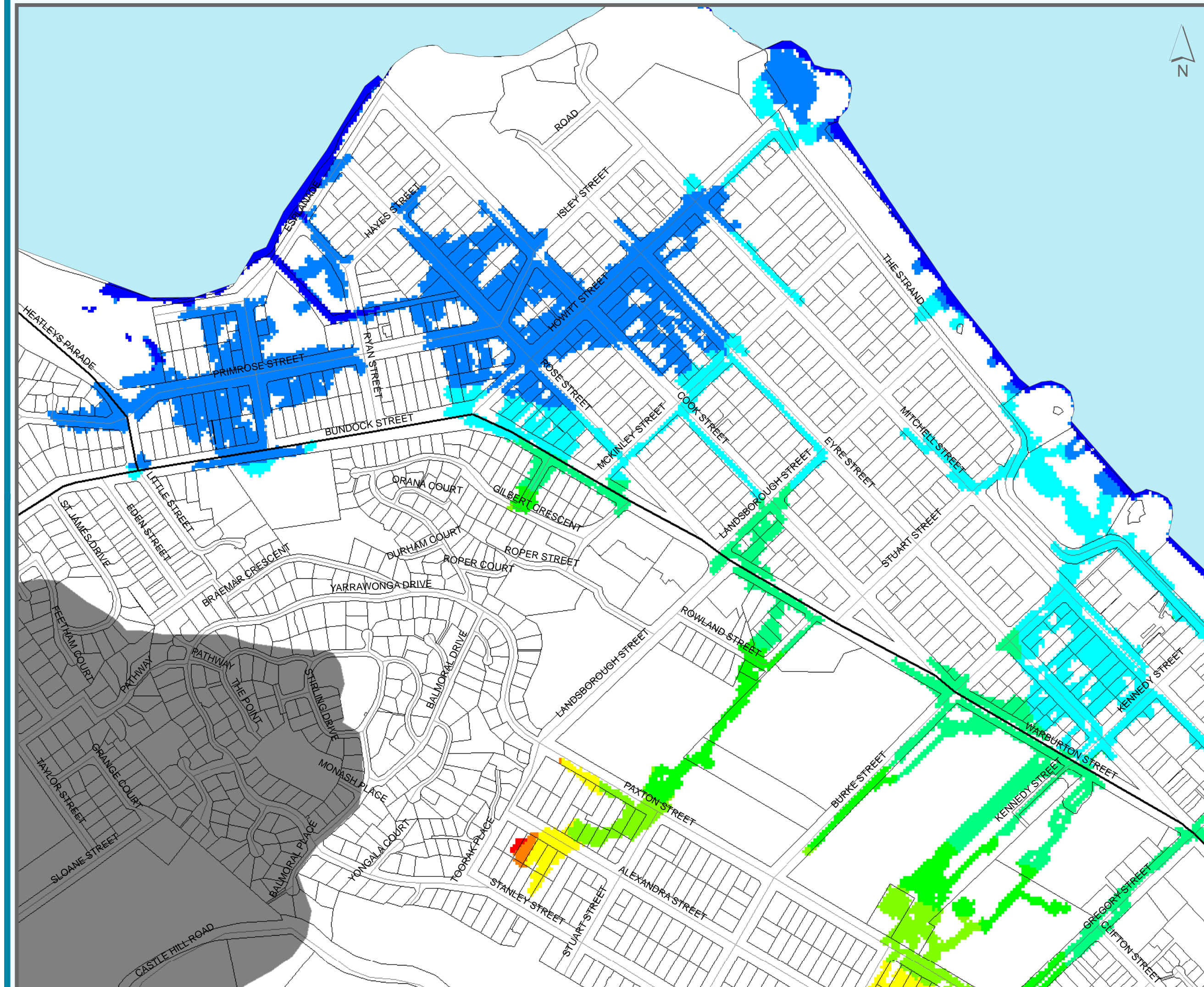
SCALE: 1:6,000 @ A3

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DRAWN BY: JAJ
DIGITAL FILE: mxd

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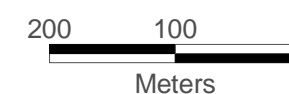
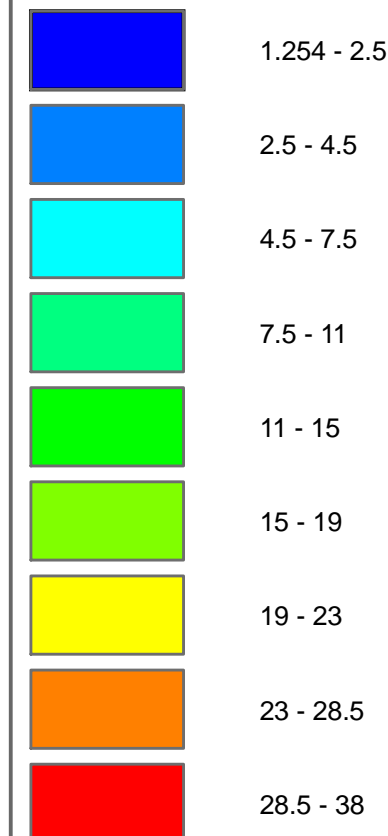
Figure A19: 5y Flood
Envelope 1 of 2



LEGEND

5y Flood Envelope

Water Level [m]



SCALE: 1:6,000 @ A3

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Figure A20: 5y Flood
Envelope 2 of 2

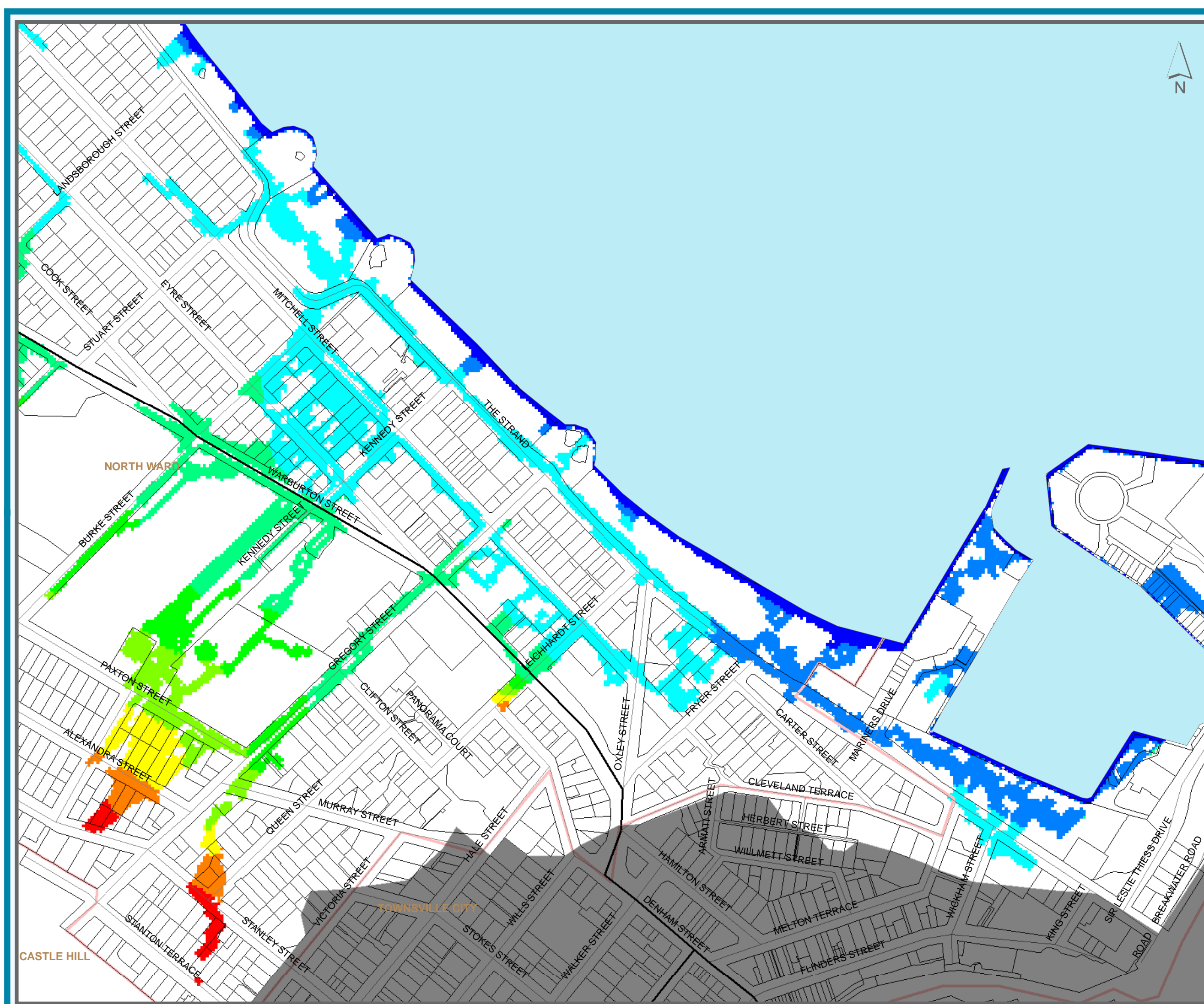
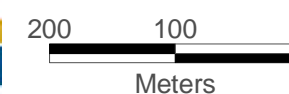
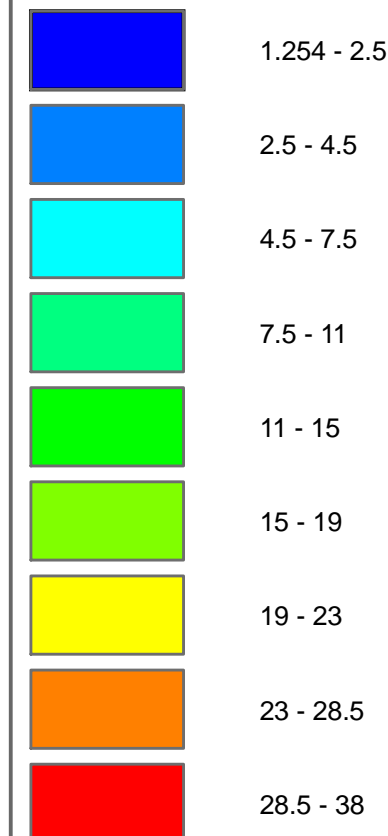


Figure A21: 10y Flood Envelope 1 of 2

LEGEND

10y Flood Envelope

Water Level [m]



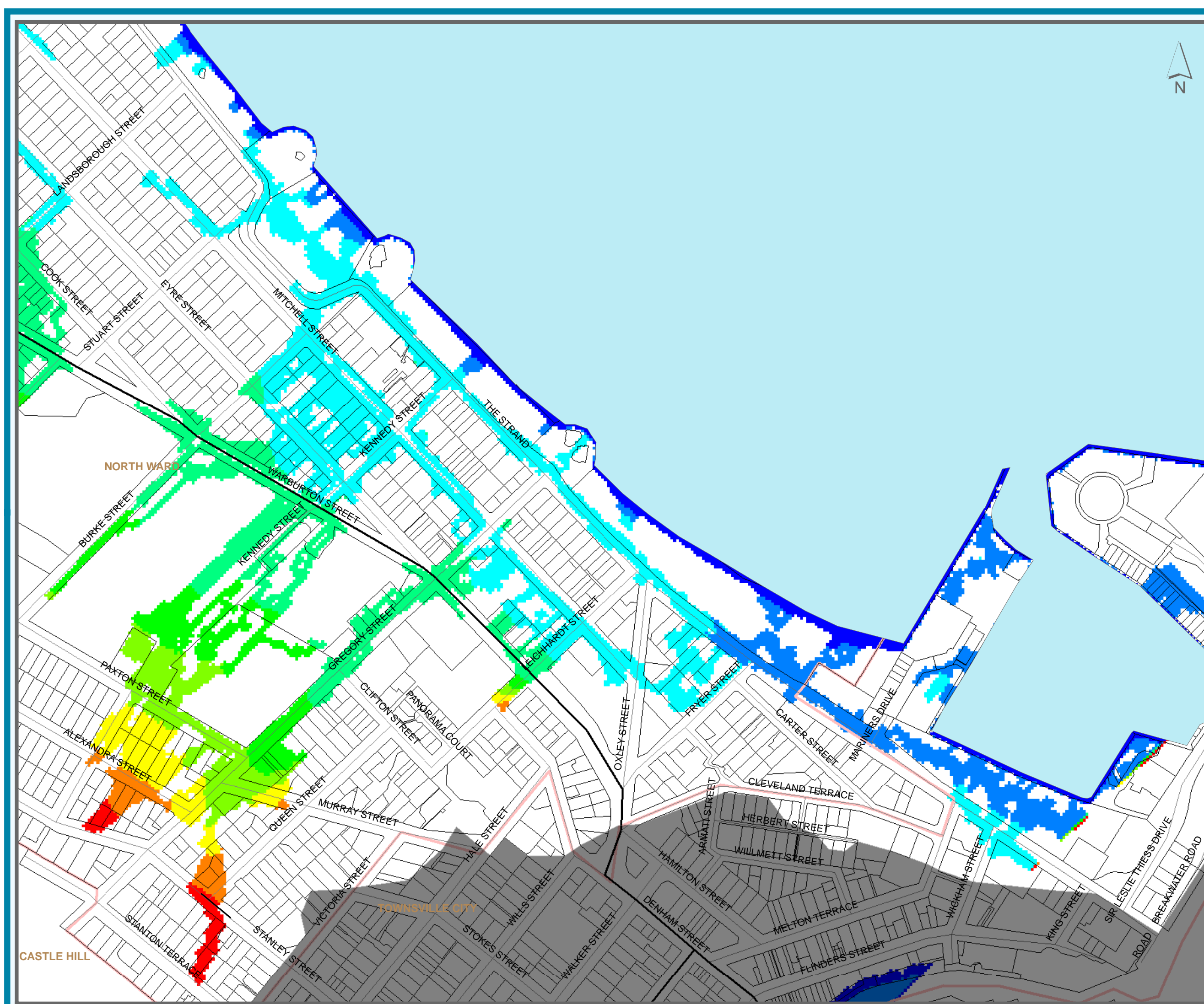
SCALE: 1:6,000 @ A3

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DIGITAL FILE: mxd

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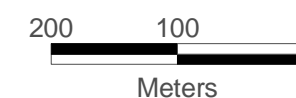
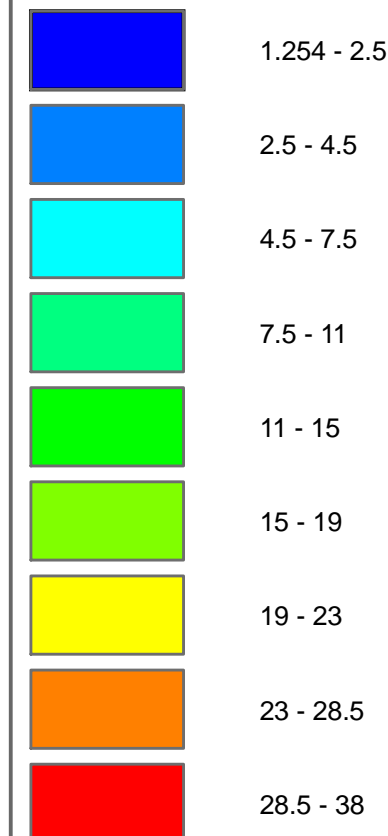
Figure A22: 10y Flood
Envelope 2 of 2



LEGEND

20y Flood Envelope

Water Level [m]



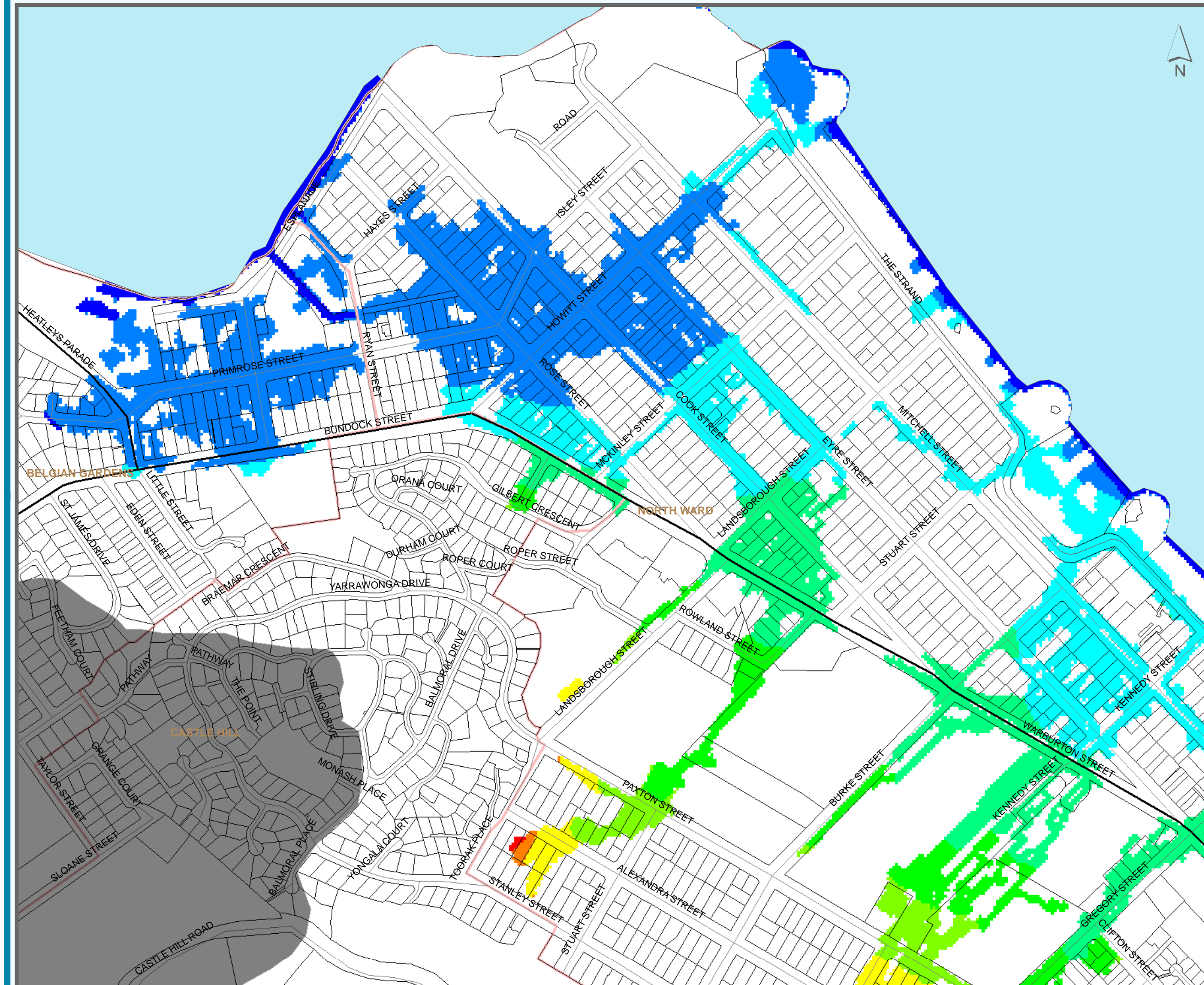
SCALE: 1:6,000 @ A3

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DIGITAL FILE: mxd

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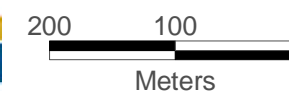
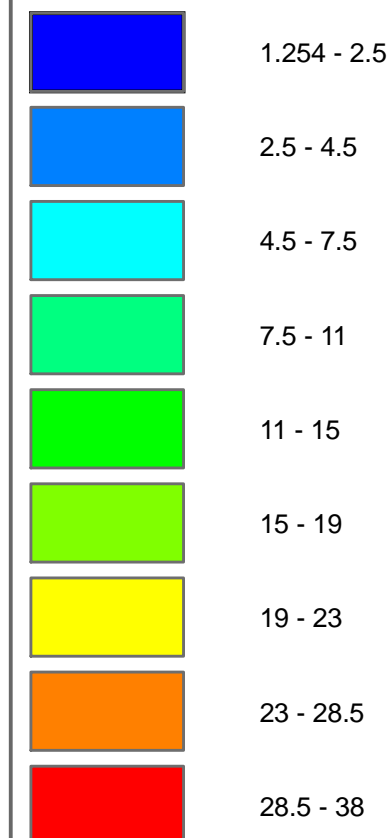
Figure A23: 20y Flood
Envelope 1 of 2



LEGEND

20y Flood Envelope

Water Level [m]



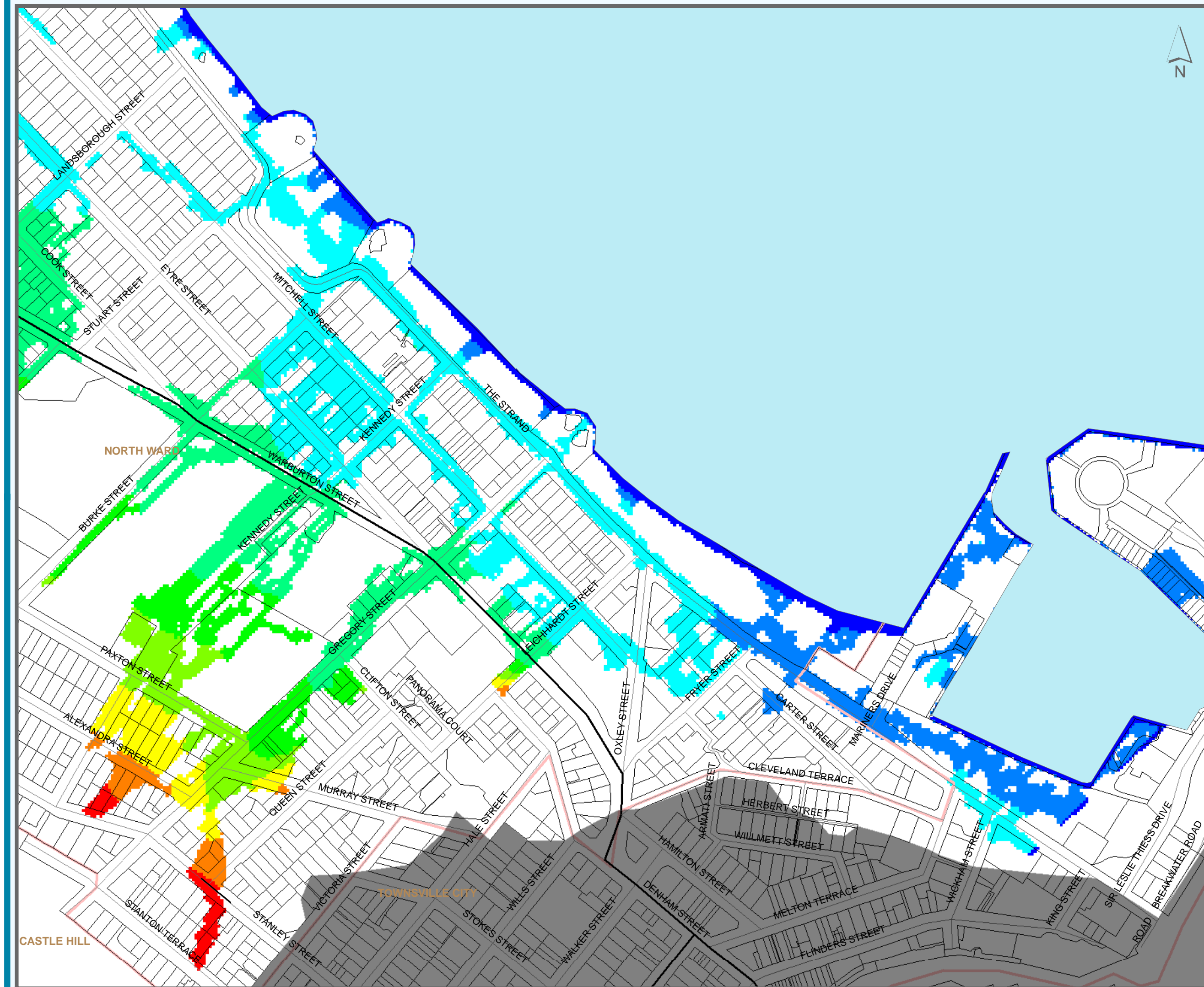
SCALE: 1:6,000 @ A3

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DRAWN BY: JAJ
DIGITAL FILE: mxd

© Townsville City Council 2010

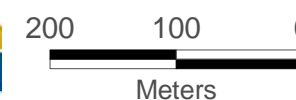
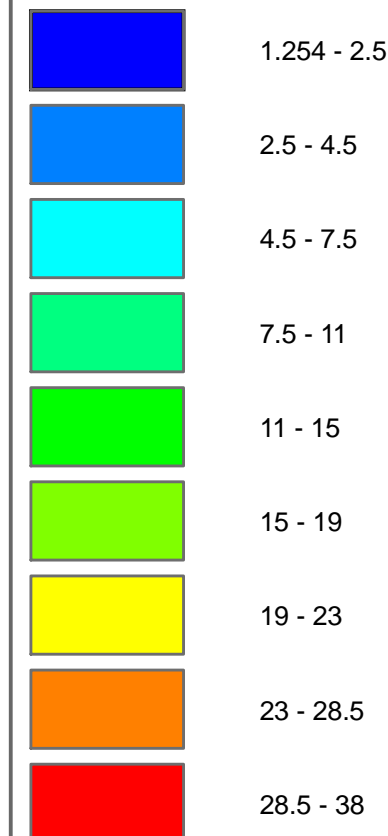
Figure A24: 20y Flood
Envelope 2 of 2



LEGEND

50y Flood Envelope

Water Level [m]



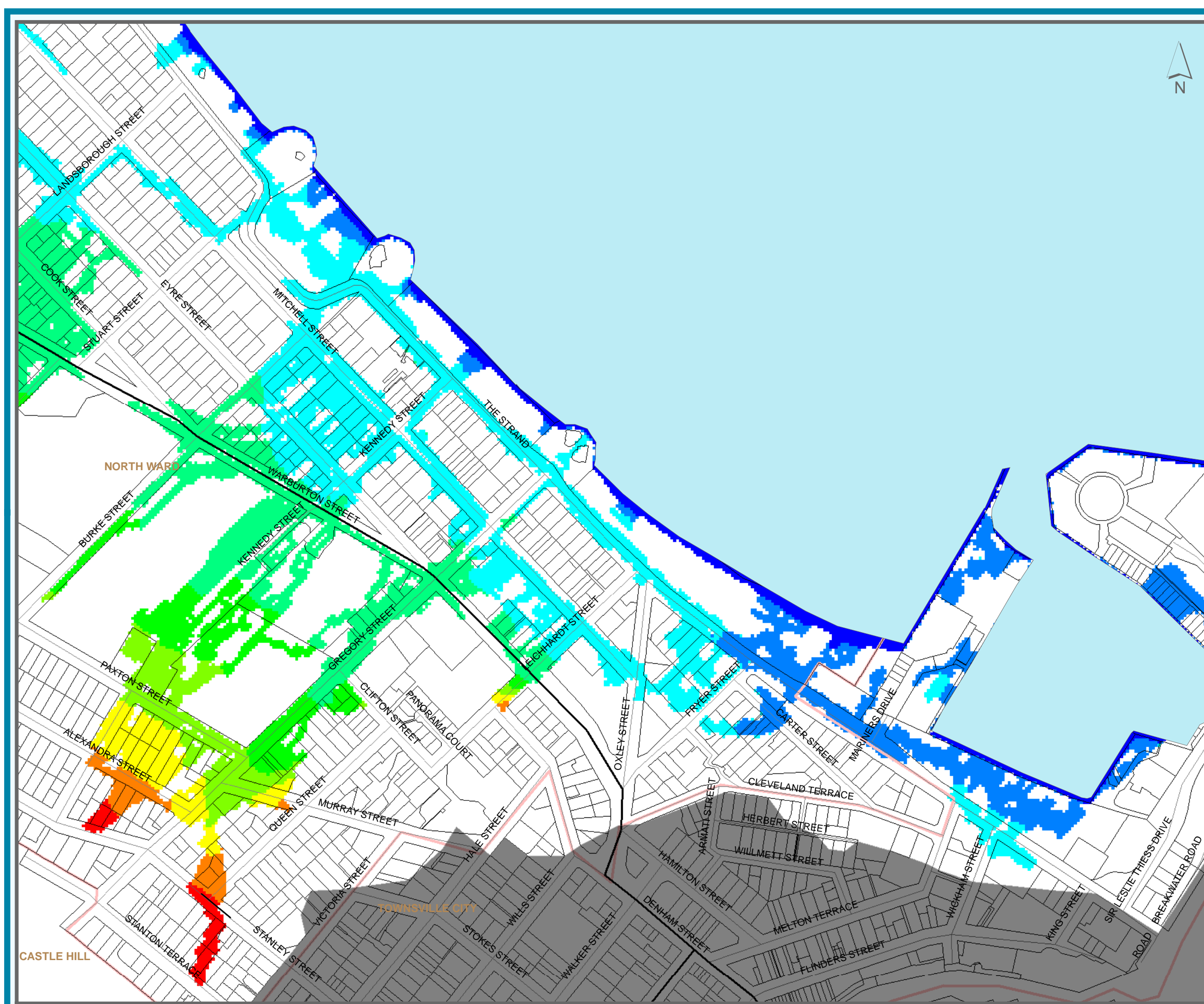
SCALE: 1:6,000 @ A3

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DATE: 15/03/2011
DRAWN BY: JAJ
DIGITAL FILE: mxd

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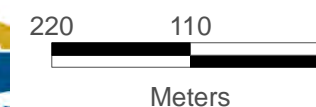
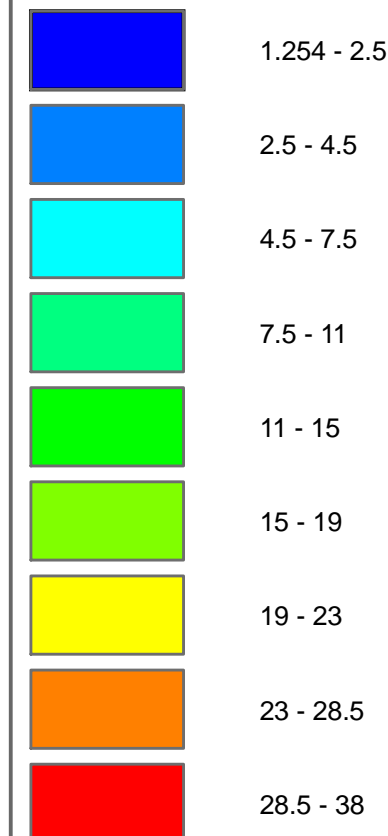
Figure A25: 50y Flood
Envelope 2 of 2



LEGEND

50y Flood Envelope

Water Level [m]



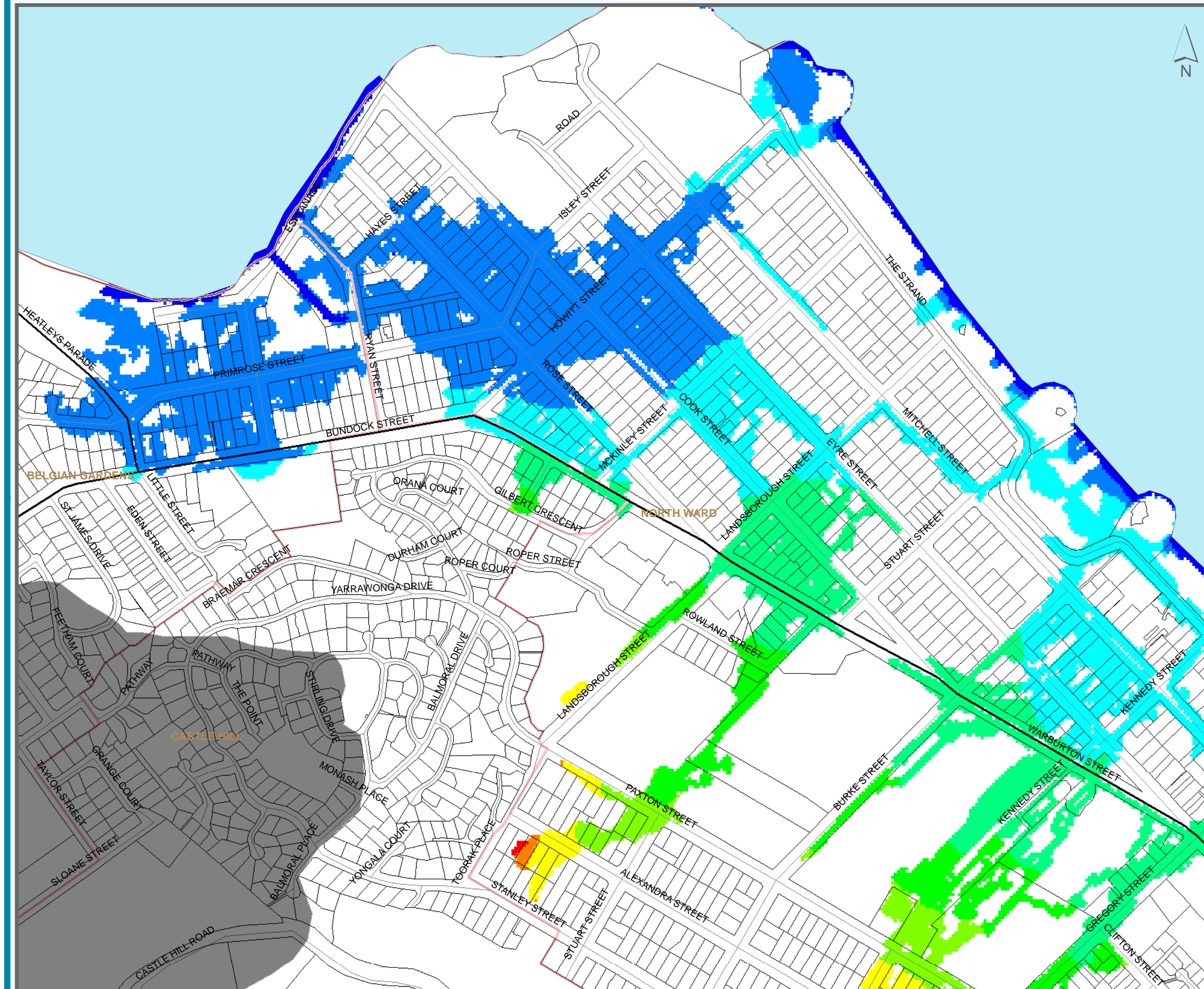
SCALE: 1:6,000 @ A3

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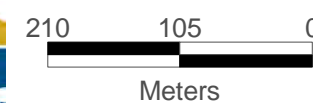
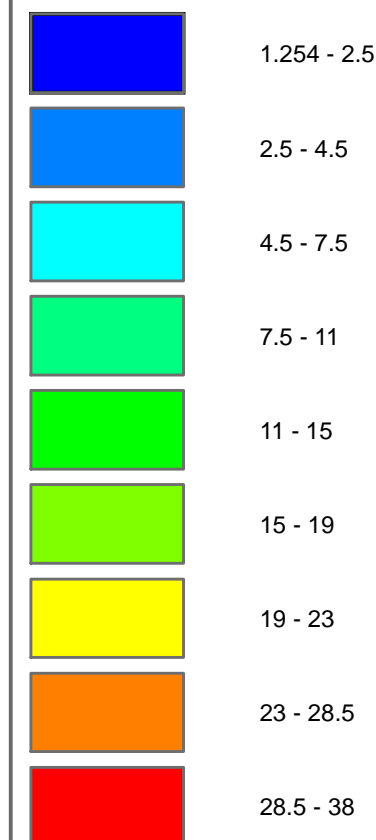
Figure A26: 50y Flood
Envelope 1 of 2



LEGEND

100y Flood Envelope

Water Level [m]



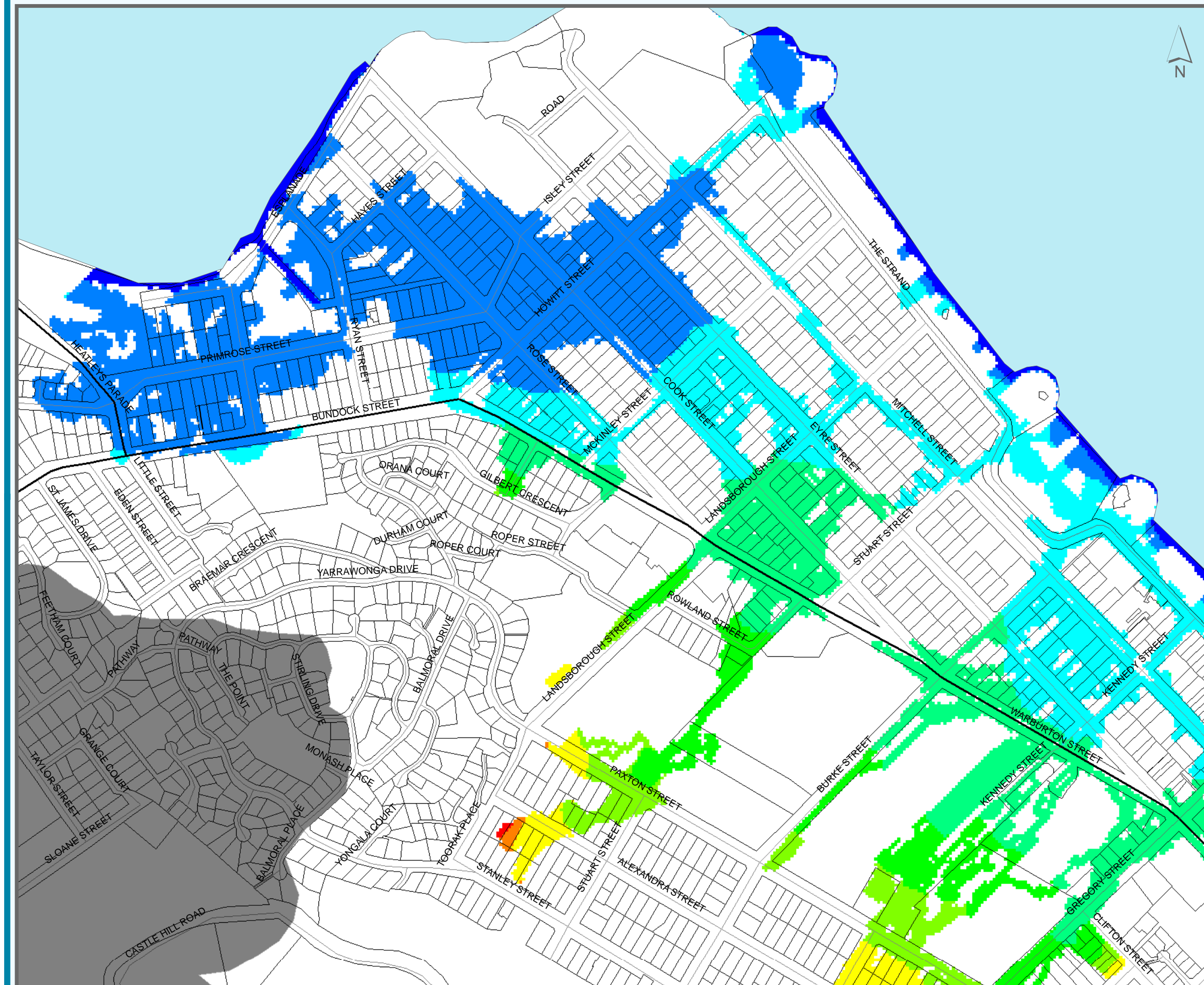
SCALE: 1:6,000 @ A3

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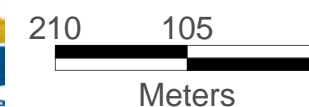
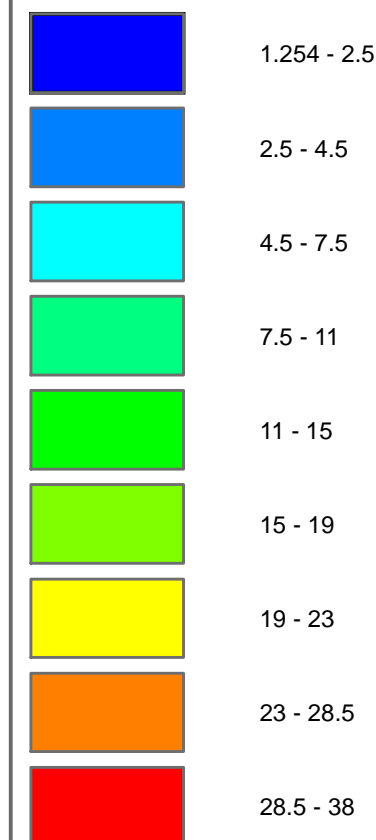
Figure A27: 100y Flood
Envelope 1 of 2



LEGEND

100y Flood Envelope

Water Level [m]



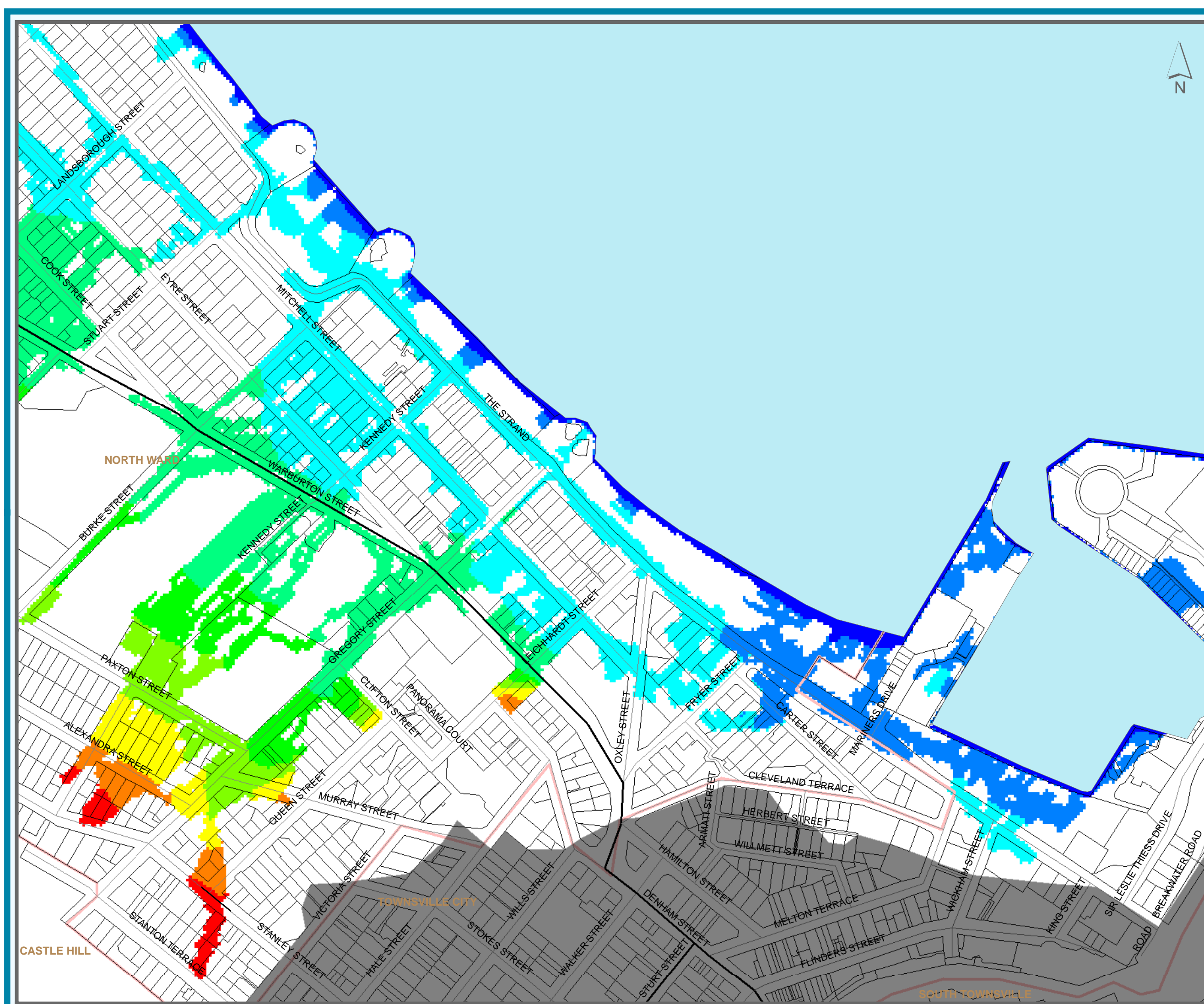
SCALE: 1:6,000 @ A3

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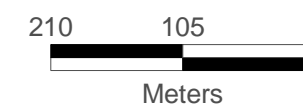
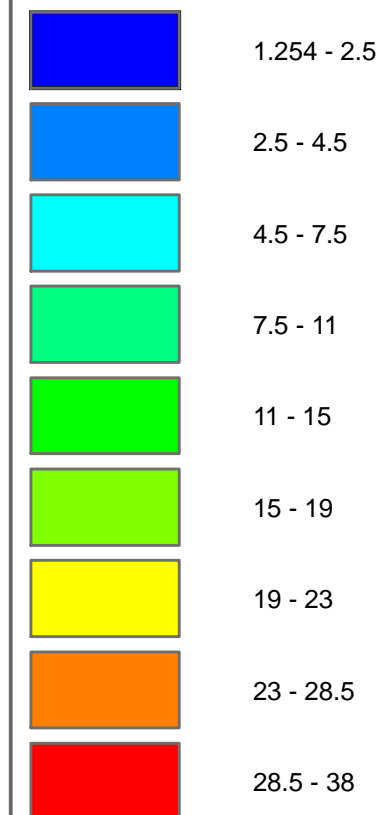
Figure A28: 100y Flood Envelope 2 of 2



LEGEND

500y Flood Envelope

Water Level [m]



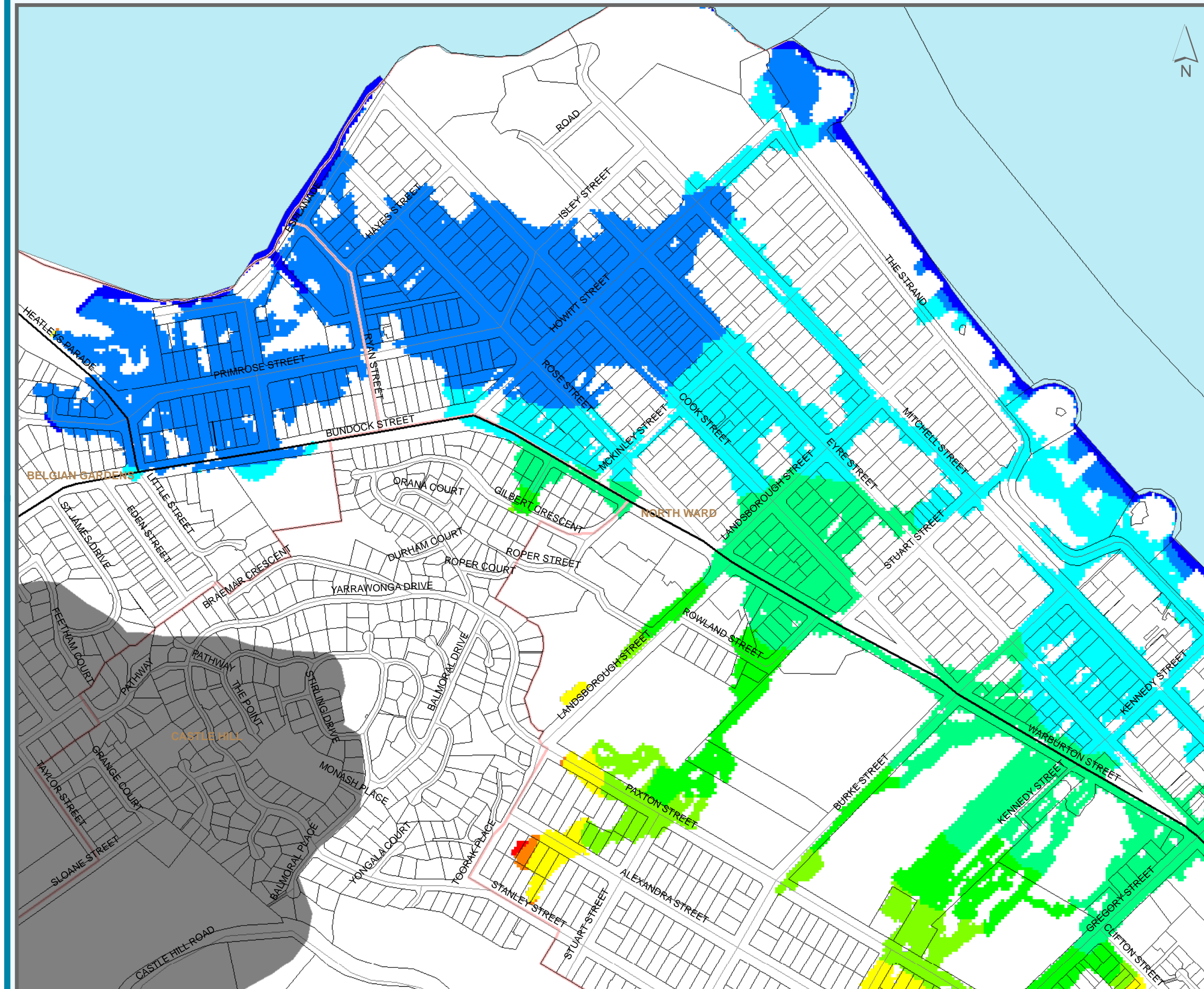
SCALE: 1:6,000 @ A3

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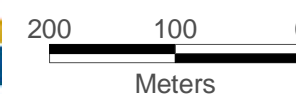
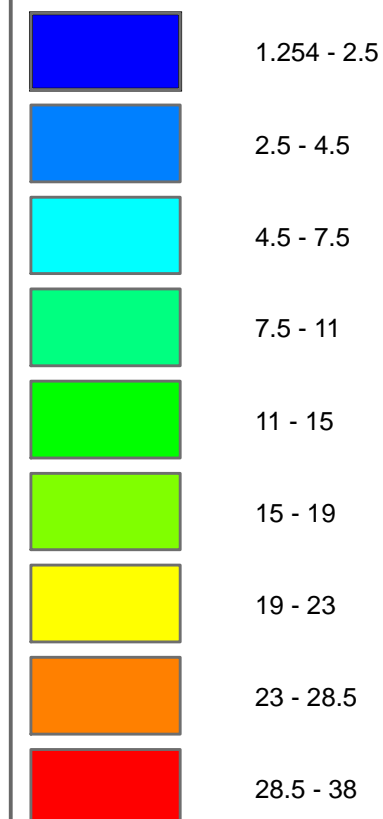
Figure A29: 500y Flood
Envelope 1 of 2



LEGEND

500y Flood Envelope

Water Level [m]



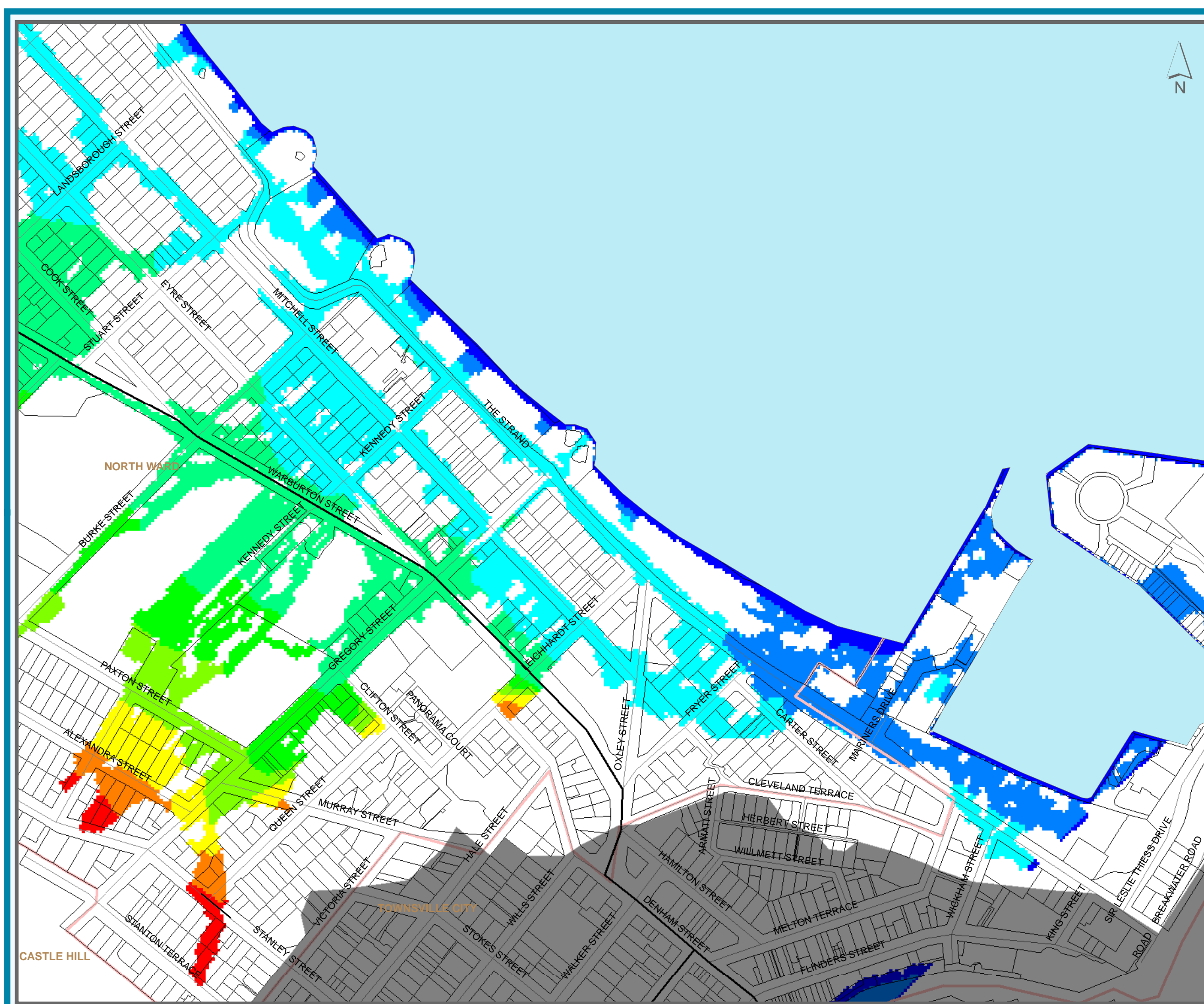
SCALE: 1:6,000 @ A3

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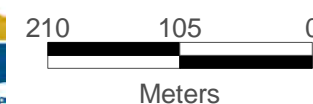
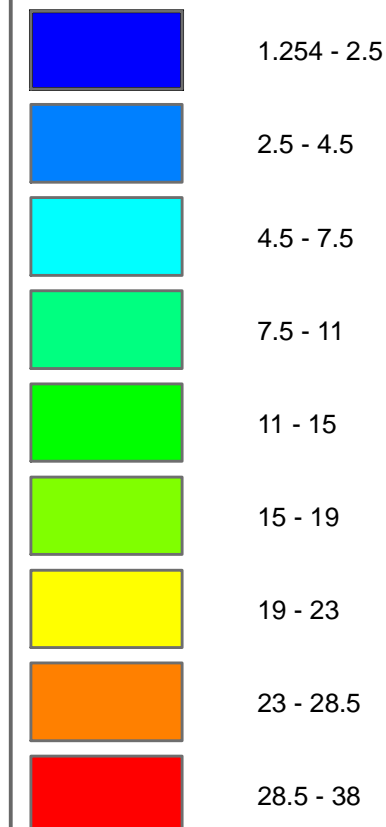
Figure A30: 500y Flood Envelope
Envelope 2 of 2



LEGEND

PMF Flood Envelope

Water Level [m]



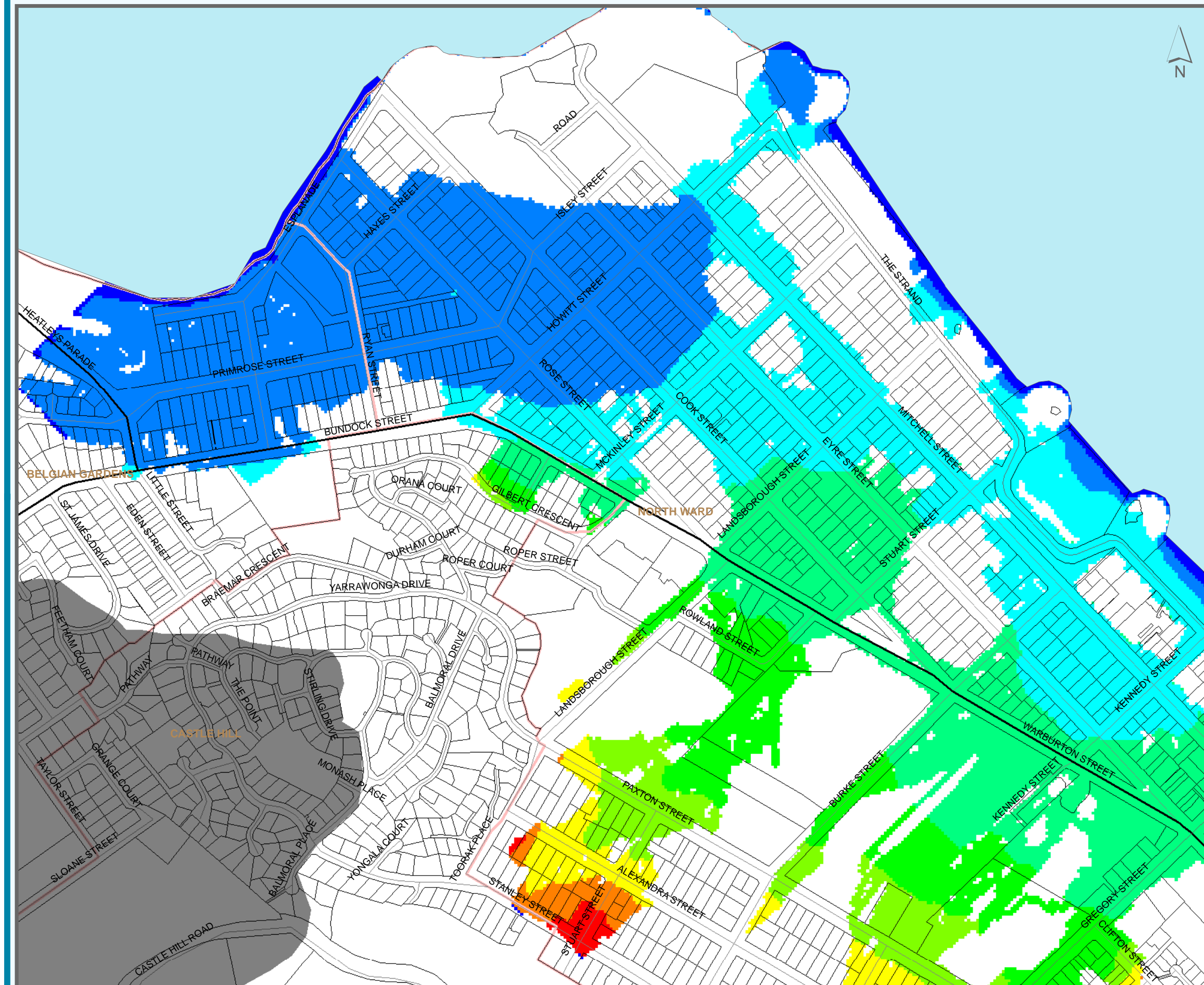
SCALE: 1:6,000 @ A3

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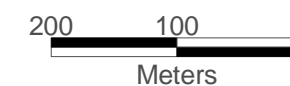
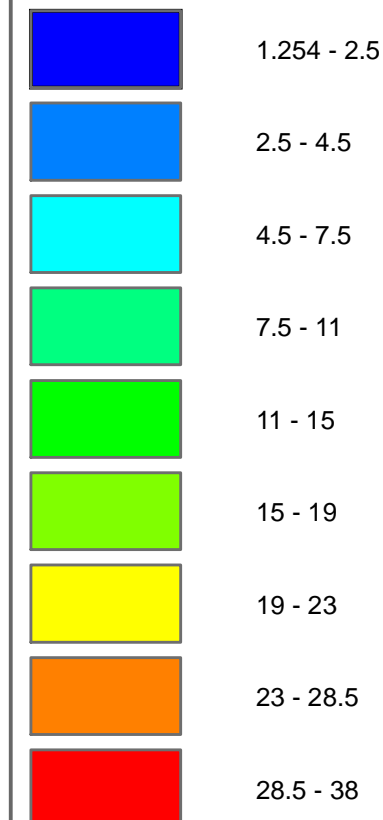
Figure A31: PMF Flood
Envelope 1 of 2



LEGEND

PMF Flood Envelope

Water Level [m]



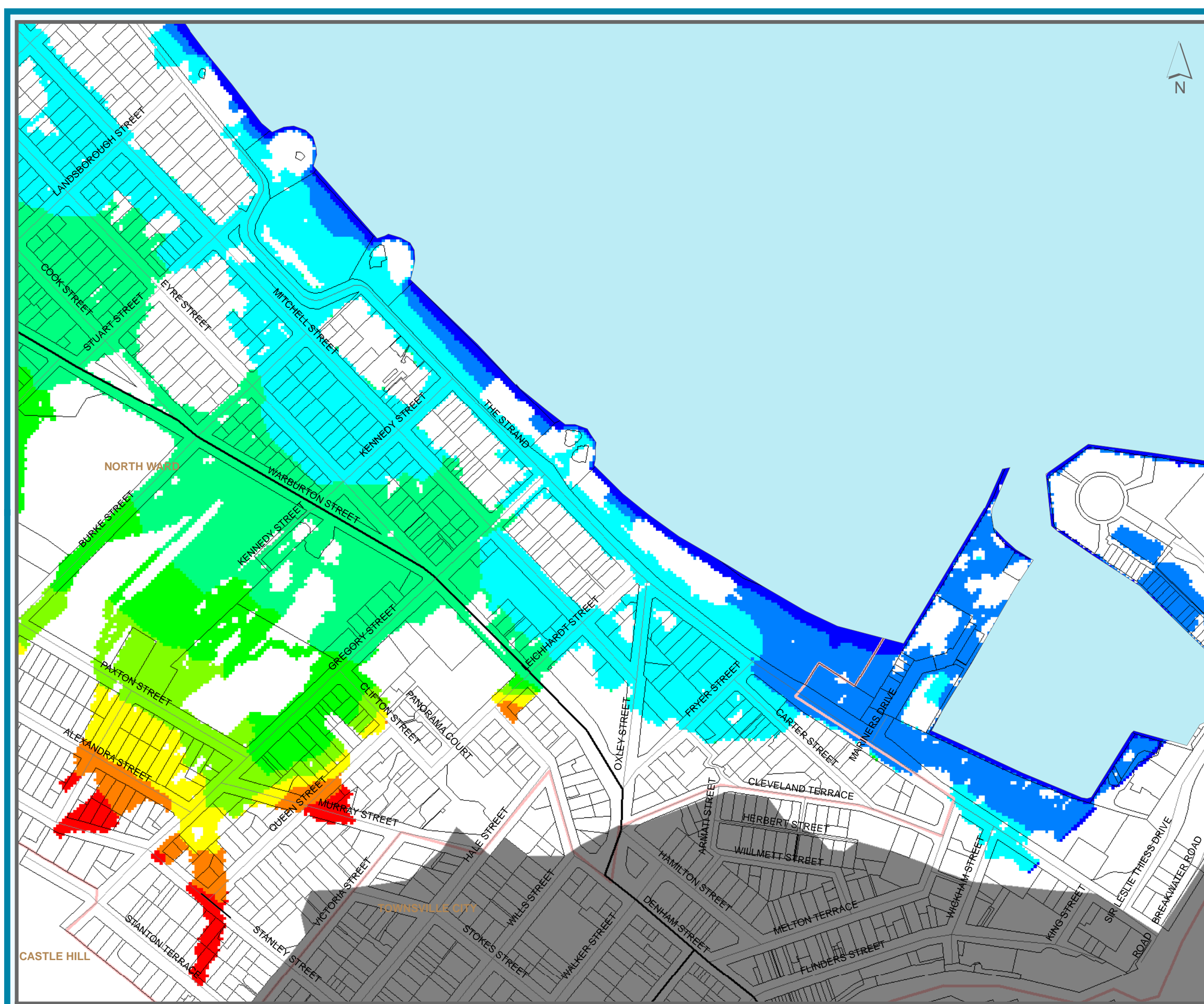
SCALE: 1:6,000 @ A3

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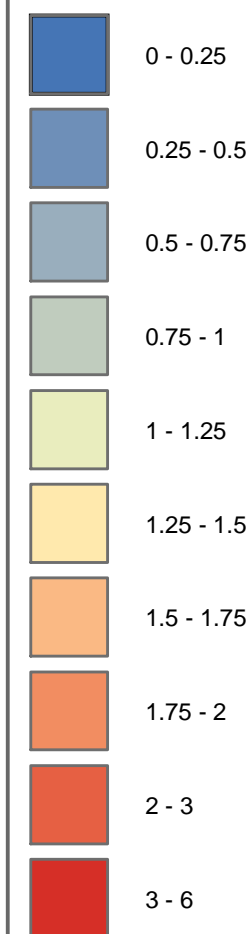
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Figure A32: PMF Flood Envelope
Envelope 2 of 2



LEGEND

Flow Velocity [m/s]



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Figure A33: 2y Flood
Envelope 1 of 2

