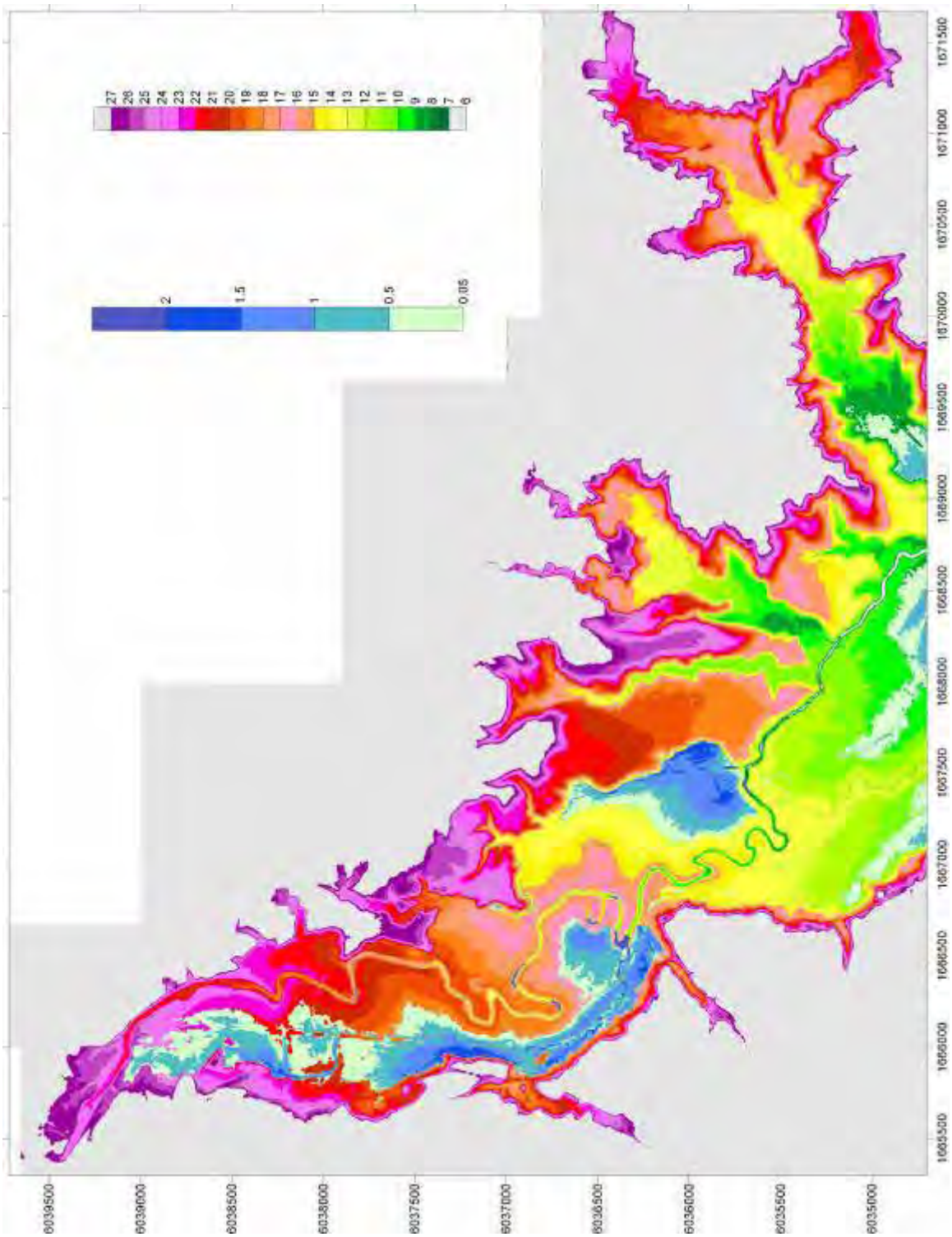

Figure 23: Maximum flood extent from Ahikiwi to Mamaranui in 10 year ARI flood (10ym4.jpg)

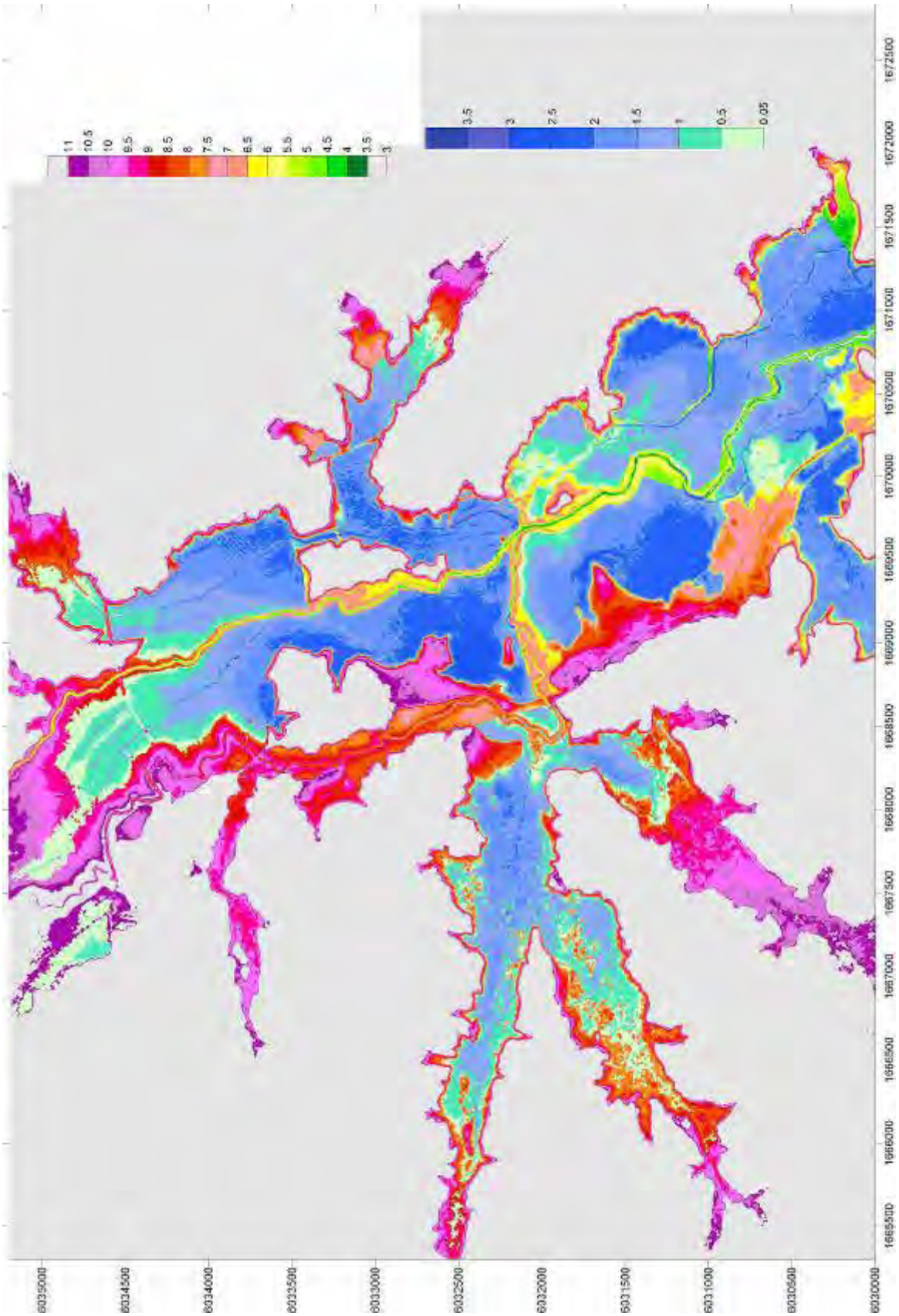

Figure 24: Maximum flood extent from Mamaranui to Waitukuhuruhuru Stream (State Highway 12 dip) in 10 year ARI event (10ym3.jpg)

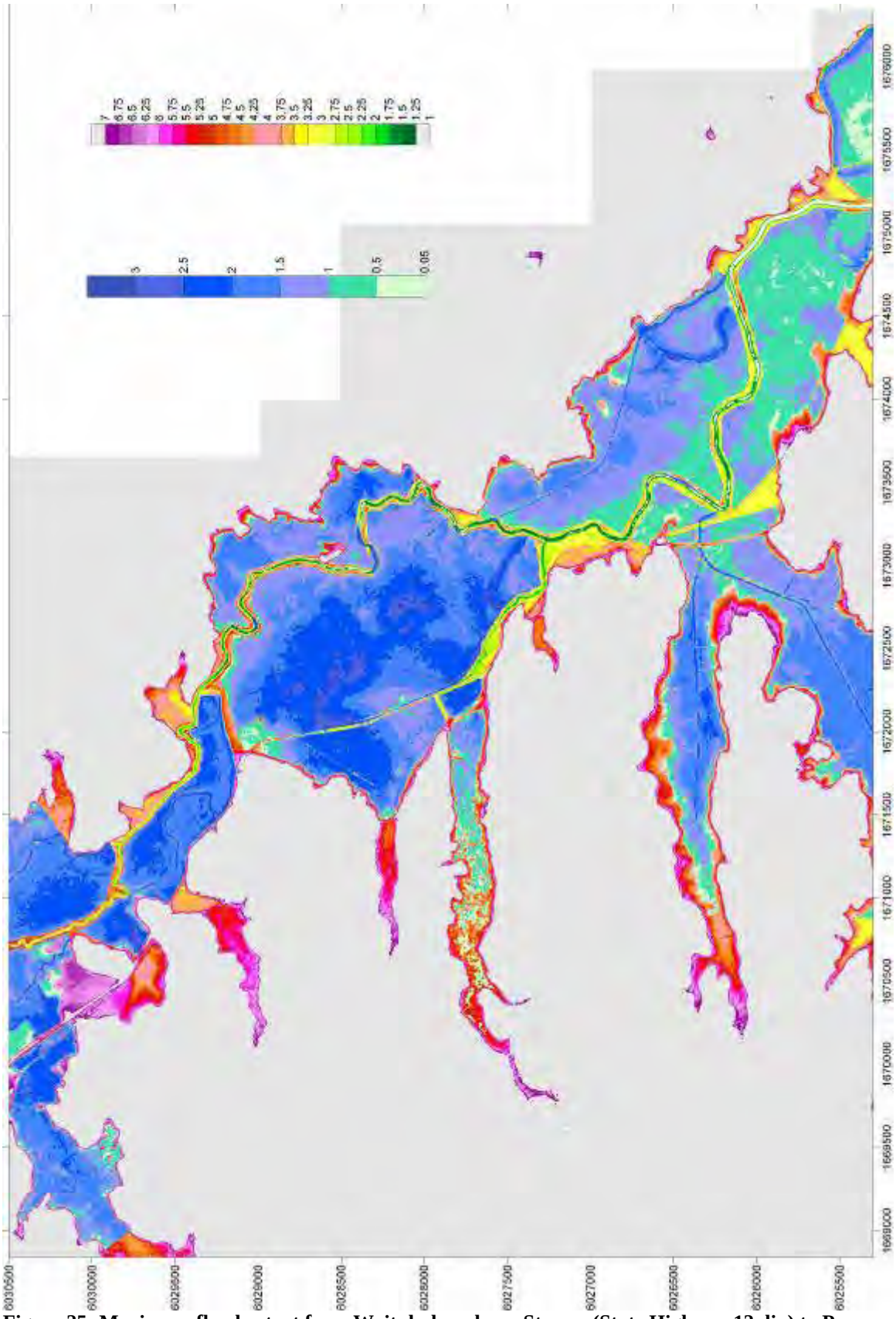

Figure 25: Maximum flood extent from Waitukuhuruhuru Stream (State Highway 12 dip) to Parore Road in 10 year ARI event (10ym2.jpg)

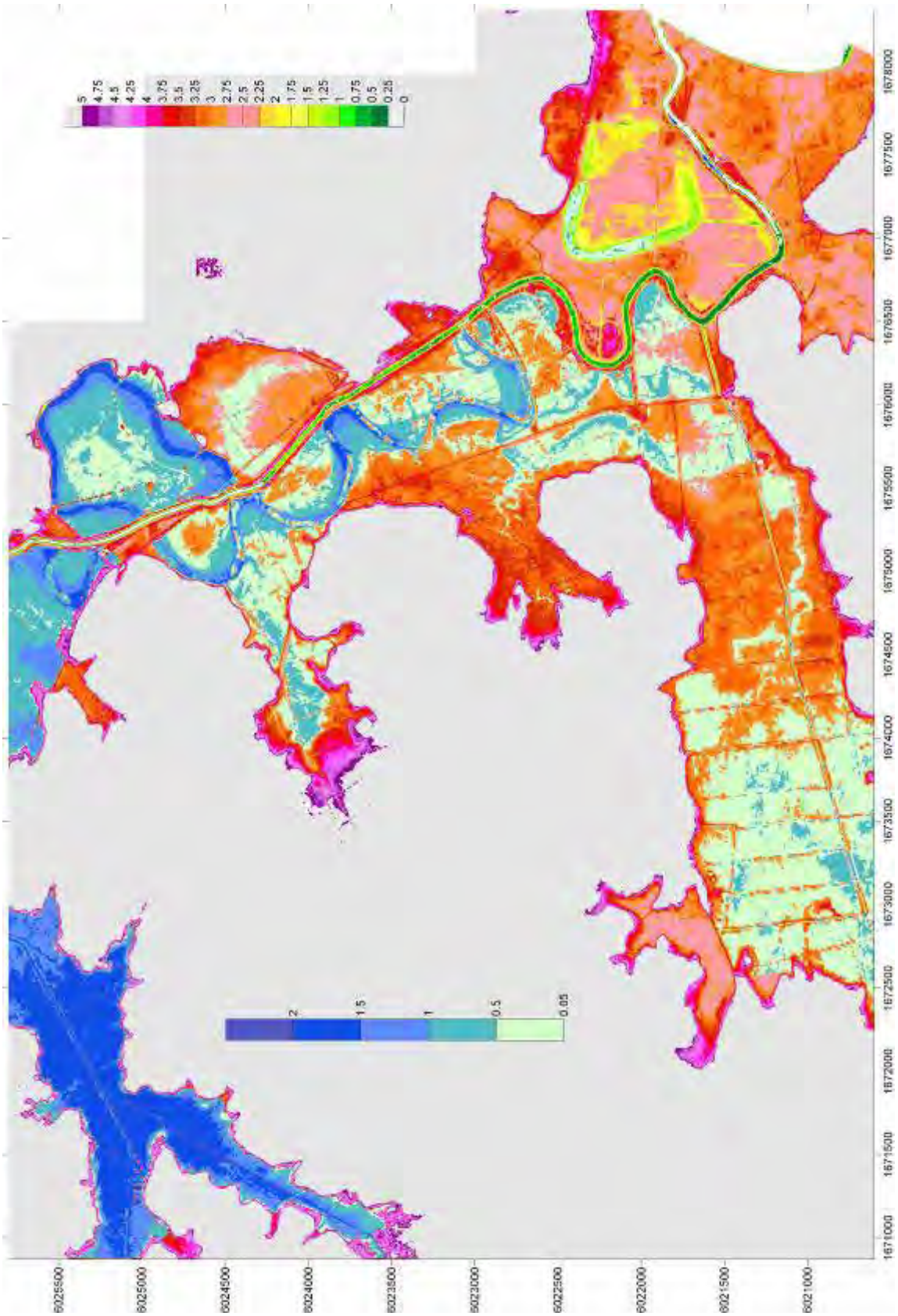

Figure 26: Maximum flood extent from Parore Road to Dargaville in 10 year ARI flood (10ym1.jpg)

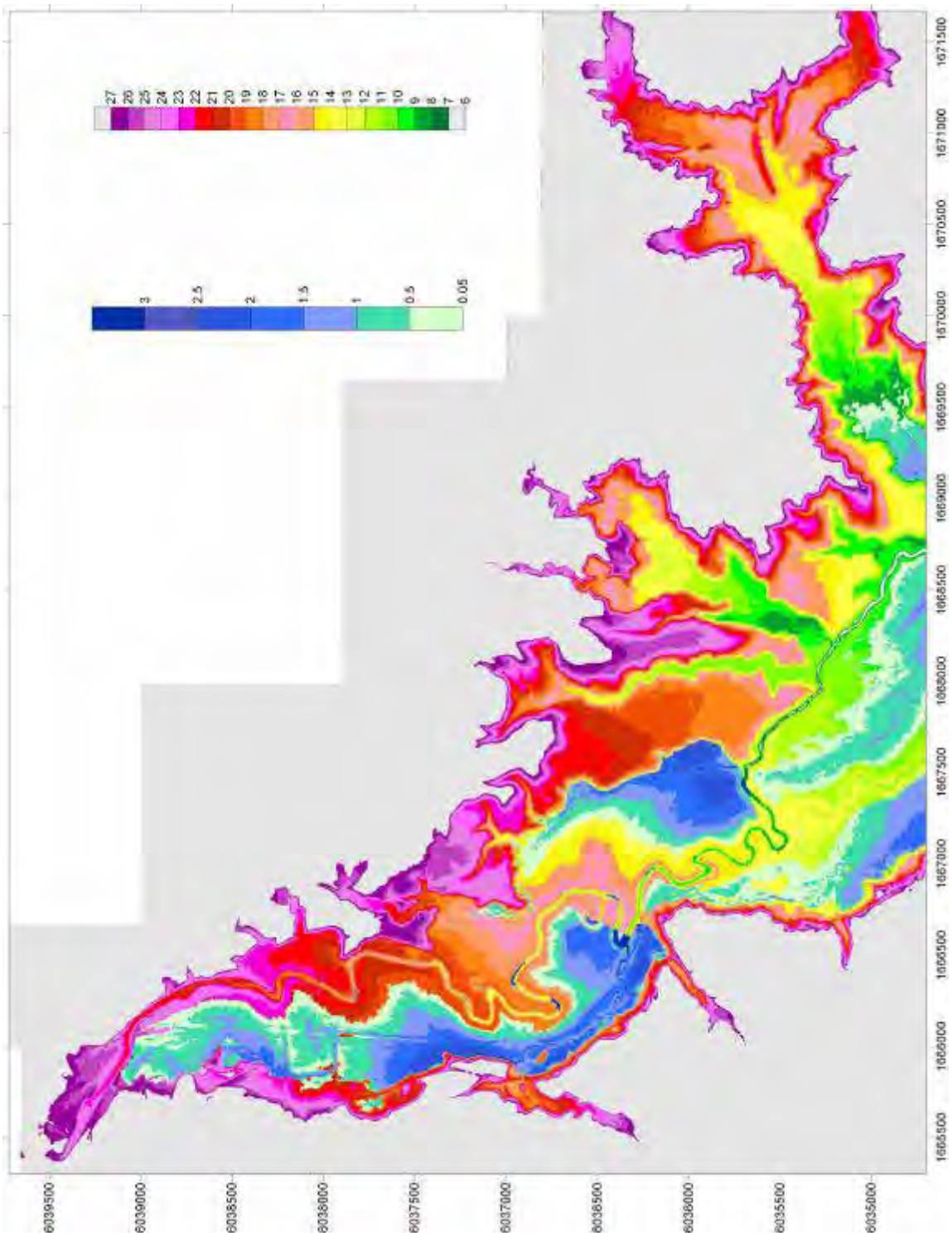

Figure 27: Maximum flood extent from Ahikiwi to Mamaranui in 100 year ARI flood (100ym4.jpg)

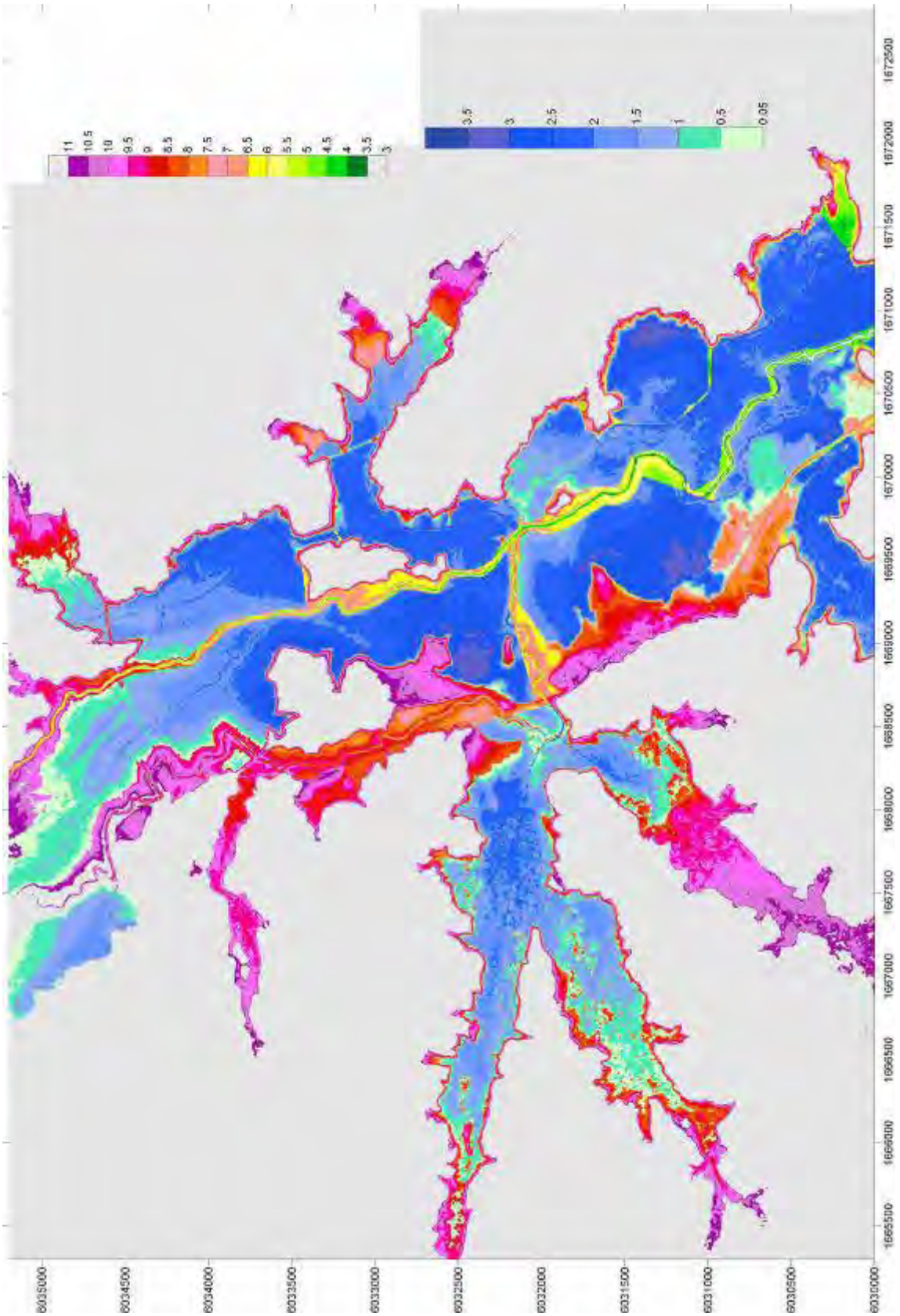

Figure 28: Maximum flood extent from Mamaranui to Waitukuhuruhuru Stream (State Highway 12 dip) in 100 year ARI event (100ym3.jpg)

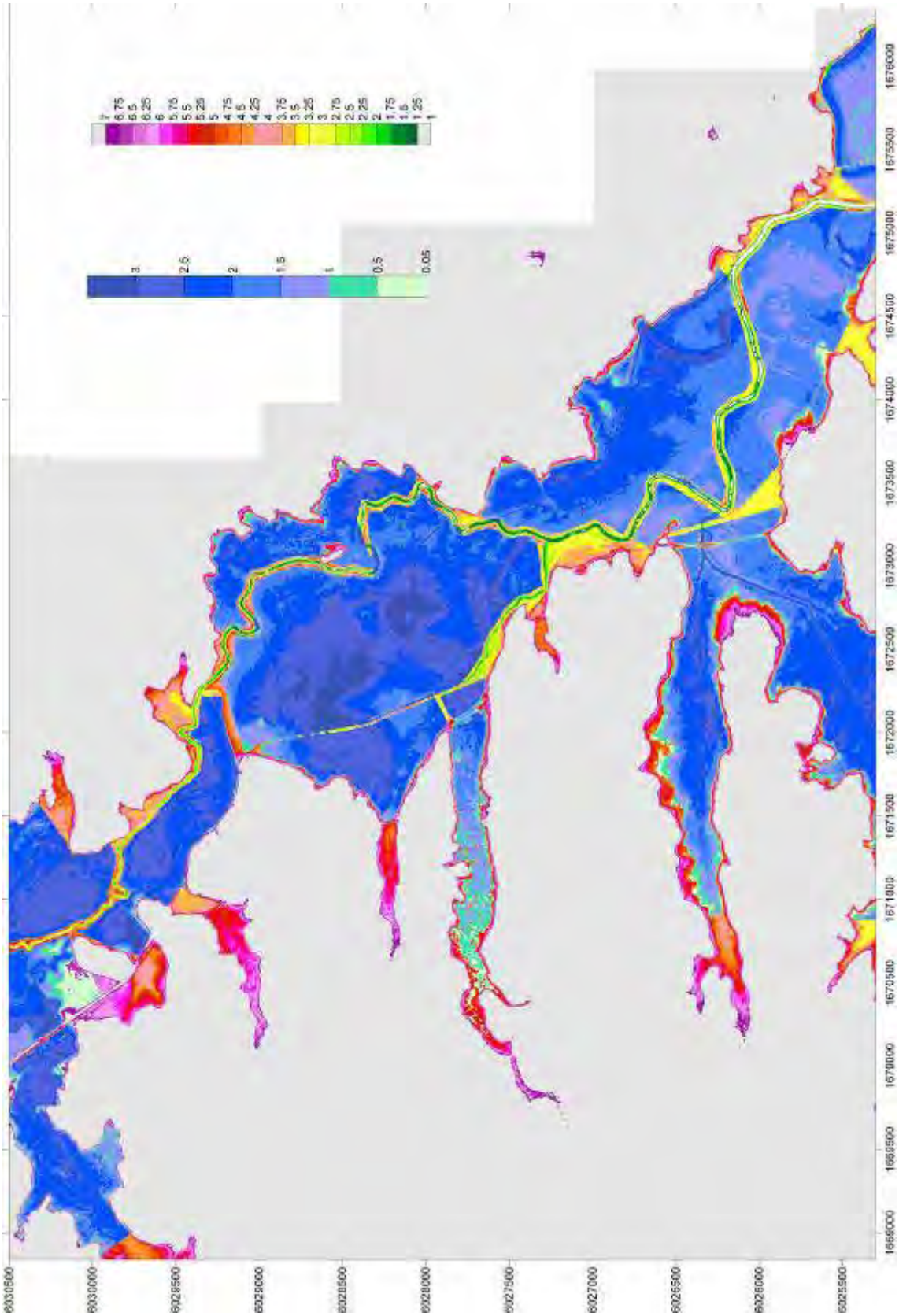

Figure 29: Maximum flood extent from Waitukuhuruhuru Stream (State Highway 12 dip) to Parore Road in 100 year ARI event (100ym2.jpg)

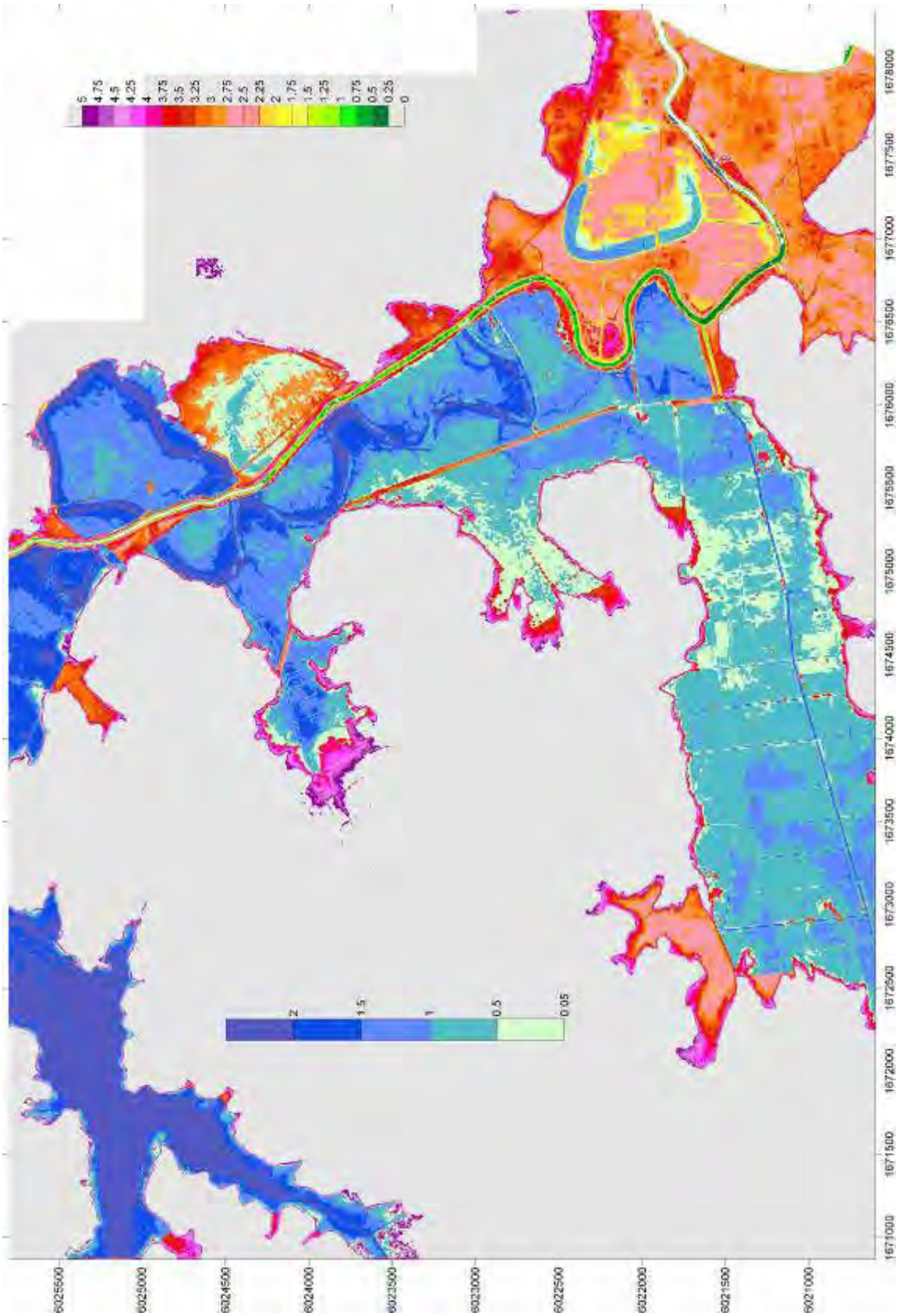

Figure 30: Maximum flood extent from Parore Road to Dargaville in 100 year ARI flood (100ym1.jpg)

Appendix D Kaihu River cross sections

The following list includes the source cross sections, which were used to interpolate cross sections at intervals not greater than 250m. It also includes those of the interpolated cross sections that were modified, usually by adding a left or right berm. Most of the cross sections extend only from the left to the right river bank. Sources of the surveyed sections are Reyburn and Bryant Ltd (R&B) surveys in 1996, 1999, 2001, and 2005, and NRC survey in 2008.

Name	Chainage (m)	Surfer plan point ref.	Source	Notes
CS34	0		R&B 2001	Upstream of Opouteke Rd bridge
CS33	1130		R&B 2001	In Gorge
CS32	1820		R&B 2001	Recorder site
Upper Kaihu no. 8	2550		NRC 2008	Whole valley section, upstream of Lidar cover
Upper Kaihu no. 7	3220		NRC 2008	Whole valley section, upstream of Lidar cover
CS30	3370		R&B 2001	Upstream side of Kaihu settlement. Whole valley section, upstream of Lidar cover
Upper Kaihu no. 6	3800		NRC 2008	Just downstream of bridge at Kaihu settlement. Whole valley section, upstream of Lidar cover
Upper Kaihu no. 5	4360		NRC 2008	Whole valley section, upstream of Lidar cover
Upper Kaihu no. 4	4890		NRC 2008	At Marae on Wood Rd (from topomap). Whole valley section, upstream of Lidar cover
Upper Kaihu no. 3	5370		NRC 2008	Whole valley section, upstream of Lidar cover
Upper Kaihu no. 2	5960		NRC 2008	Whole valley section, upstream of Lidar cover
CS29	6150		R&B 2001	Just upstream of Waipapataniwha Stream confluence. Whole valley section, upstream of Lidar cover
	7319			Whole valley section taken from LIDAR
	7594			Whole valley section taken from LIDAR
	7774	1		River and left floodplain from LIDAR
	7890	3		Copy of CS28 raised 4m
	8652	18		Interpolated section, left berm added from contour plan (small true left floodplain upstream of Maropiu Rd)
	8906	24		Interpolated section, left berm added from contour plan (small true left floodplain upstream of Maropiu Rd)

Name	Chainage (m)	Surfer plan point ref.	Source	Notes
CS28	9160	29	R&B 1993	Left berm added from contour plan (small true left floodplain upstream of Maropiu Rd)
	9648	37		Interpolated section, left berm added from contour plan (left side berm downstreamof Maropiu Rd)
	9892	40		Interpolated section, left berm added from contour plan (left side berm downstreamof Maropiu Rd)
	10380	50		Copy of CS27 raised 6m
CS27	14330	124	R&B 1993	
	16274	158		Interpolated section, left berm added from contour plan (narrow left side floodplain upstream of Waihue Rd)
	16552	165		Interpolated section, left berm added from contour plan (narrow left side floodplain upstream of Waihue Rd)
CS26	16830	174	R&B 1999	Waihue Rd. Bridge treated as a cross section
CS25	17510	191	R&B 1999	
	18298	208		Interpolated section, left berm added from contour plan (narrow left side floodplain beside high ground upstream of Waiatua confluence)
CS24	18560	215	R&B 1999	Left berm added from contour plan (narrow left side floodplain beside high ground upstream of Waiatua confluence)
	18815	222		Interpolated section, left berm added from contour plan (narrow left side floodplain beside high ground upstream of Waiatua confluence)
CS23	19580	243	R&B 1999	
	19890	250		Interpolated section, right berm added from contour plan (Edwards stopbank on right)
	20045	253		Interpolated section, right berm added from contour plan (Edwards stopbank on right)
CS22	20200	256	R&B 1999	Right berm added from contour plan
	20445	262		Interpolated section, right berm added from contour plan (Edwards stopbank on right)
	20690	268		Interpolated section, right berm added from contour plan (Edwards stopbank on right)
	20935	274		Interpolated section, right berm added from contour plan (Edwards stopbank on right)
	21180	280		Interpolated section, right berm added from contour plan (Edwards stopbank on right)
CS21	21230	281	R&B 1999	Downstream end Edwards stopbank

Name	Chainage (m)	Surfer plan point ref.	Source	Notes
CS20	22820	322	R&B 1999	
CS19	23720	348	R&B 1999	
CS18	24260	363	R&B 1999	
Bottleneck No. 1	24790	377	R&B 2005	
Bottleneck No. 2	24910	381	R&B 2005	
Bottleneck No. 3	24990	382	R&B 2005	
CS16	26630	422	R&B 1999	
CS15	28180	461	R&B 1999	
	28500	469		Interpolated section, right berm added from contour plan (narrow right side floodplain just downstream of Rotu Stream confluence)
	28710	475		Interpolated section, right berm added from contour plan (narrow right side floodplain just downstream of Rotu Stream confluence)
CS14	28920	481	R&B 1999	Right berm added from contour plan (narrow right side floodplain just downstream of Rotu Stream confluence)
CS13	29570	498	R&B 1999	
CS12	30560	519	R&B 1999	
CS11	31220	531	R&B 1999	
CS10	32290	553	R&B 1999	
CS9	32550	558	R&B 1999	Parore Bridge waterway (true left bridge only) modelled as a cross section with additional sections at 32560 and 32570. True right bridge water is treated as a weir in floodplain branch Brown.
	32843	564		Interpolated section, right berm added from contour plan (narrow right side floodplain, downstream of Parore Rd between river and old rail embankment)
	33117	568		Interpolated section, right berm added from contour plan (narrow right side floodplain, downstream of Parore Rd between river and old rail embankment)
CS8	33390	574	R&B 1999	
CS7	34470	593	R&B 1999	
S16	34830	596	NRC 2008	

Name	Chainage (m)	Surfer plan point ref.	Source	Notes
S15	35400	607	NRC 2008	
CS6	35560	609	R&B 1999	
S14	35610	610	NRC 2008	
S13	35880	615	NRC 2008	
S12	36320	622	NRC 2008	
S11	36460	624	NRC 2008	
S10	36740	630	NRC 2008	
S9	37220	636	NRC 2008	
S8	37630	642	NRC 2008	
S7	37830	645	NRC 2008	
CS3	37950	647	R&B 1999	
S6	38060	649	NRC 2008	
S5	38290	652	NRC 2008	
CS2	38520	655	R&B 1999	
S4	38860	659	NRC 2008	
S3	39470	668	NRC 2008	
S2	39710	672	NRC 2008	
S1	39920	675	NRC 2008	
	40050	677		Copy of S1 at river mouth

Appendix E Floodplain branch details

Most of the floodplain cross sections were extracted from the gridded LIDAR data, with over 790 being created by this method. A few approximate estimated sections are used where major tributary streams such as Taita, Rotu, and Mangatara cross the floodplain to the Kaihu River. A few bridge sections surveyed by NRC were used. The Mangawhare floodplain branch was more approximately treated, with sections being created by inspection of the contour map with 0.25m vertical interval. Where floodgated branches join the Kaihu River, there is usually an artificial cross section outside the floodgate. These are included in the total cross section count.

Branch	Length (m)	No. sections	No. links to river	Notes
Maropiu	3385	44	6	Free outflow to river through 2 drains at downstream end
Settlement	1955	21	5	Free outflow to river through big drain
Maitahi	4380	54	8	Link allows overflow from Taita over SH12. Weir represents river bank at outlet to Kaihu, with culvert at same grid point to keep low flow level below general ground level.
Mamaranui	2080	28	2	Joins Maitahi through surveyed bridge – modelled as cross section
Waiatua	2290	26	1	Joins Waihue
Waihue	2240	24	2	Free outflow to river through large drain.
Cemetery	2565	30	5	Link allows overflow from Taita right bank. Free outflow to river through large drain.
Frith	2840	36	7	Link allows overflow from downstream end of Waiatua. Free outflow toriver through large drain. Link allows overflow to NDL.
Dip	1405	17		Link allows overflow of SH12 to Cemetry. Culvert controls flow under stock race / SH12
Ndl	635	8		Link allows overflow from Frith. Outlet to Frith floodgated.
Taita	4535	45		Link allows overflow of SH12 to Maitahi. SH12 bridge modelled as cross section.
Taitamid	1905	25		Tributary of Taita
Taitasouth	975	13		Tributary of Taita
Bush	1735	24	3	Link allows overflow of Rotu stopbank to Pouto. Link allows overflow from downstream end of Cemetry branch. Free outflow to river through old channel.
Rotu	3175	34		Lower reach represented by 8 approximate estimate cross sections.

Branch	Length (m)	No. sections	No. links to river	Notes
Pouto	2070	26	5	Link allows overflow from Bush. Floodgated outlet to Rotu
Pouto-east	1655	21	3	Free outflow to river by drains.
Poutowest	1180	18		Link allows overflow from Pouto. Floodgated outlet to Rotu.
Spillway	2215	28	5	Free outflow toriver through large drain.
Antispillway	400	6	2	Free outflow to river by large drain.
Korariwhero	2850	37		Weirs represent SH12 bridge and rail embankment crossing.
Korarinorth	1910	24		Tributary to Korariwhero west of SH12
Korarisouth	1835	22		Tributary to Korariwhero west of SH12
Brown	2070	25	4	Weir allows overflow of Parore Rd. Another weir at same grid point allows flow through true right bridge section on Parore Rd. Free outflow to river by drain downstream of Parore Rd
Mangatara	5400	61		Link allows overflow of SH12 to Parore-rb. Lower reach represented by 5 approximate estimate cross sections. Floodgated at outlet to Kaihu River.
Parore-rb	3570	37	6	Joins Mangatara upstream of flood gate
Scottys	885	13		Joins Parore-rb through box culvert. Link allows overflow of SH12 to Parore-rb
Antibrown	575	10		Link allows overflow from Parorelb. Link allows overflow from Kaihu over left side of Parore Rd. Joins Kaihu river through flood gate.
Parorelb	1205	19	2	Link allows overflow to Antibrown. Floodgates at river bank and old rail embankment.
Valley	830	14	1	Floodgates at river bank and old rail embankment.
Baylys	1090	19		Joins Parore-rb through bridge, represented as a culvert in model. Link allows overflow of SH12 to Parore-rb
Baylysouth	385	6		Joins Baylys
Beach	1225	14	3	Floodgated at outlet to Kaihu River. Floodgate dimensions assumed.
Mangawhare	590	9	1	Cross sections taken from contour plan, not directly from gridded LIDAR data. Floodgated, assumed dimensions.

Appendix F Hydraulic model boundary conditions

Type of inflow	Branch	Chainage (m)	Second chainage if distributed (m)	Hydrograph and fraction
Point Source	Kaihu	2550	0	Waingarara
Point Source	Kaihu	6442	0	Waipapataniwha
Distributed Source	Kaihu	2063	7026	0.7 Ahikiwi
Distributed Source	maropiu	400	2425	0.3 Ahikiwi
Distributed Source	maropiu	2475	2800	Te Kawa
Distributed Source	Kaihu	15163	16830	0.35 Maropiu
Distributed Source	settlement	500	2455	0.4 Maropiu
Distributed Source	maitahi	0	1680	0.2 Maropiu
Distributed Source	maropiu	2955	3785	0.05 Maropiu
Distributed Source	mamaranui	0	2040	Mamaranui
Distributed Source	waihue	0	2240	Waihue
Distributed Source	waiatua	0	2290	Waiatua
Distributed Source	ndl	0	615	0.1 Frith
Distributed Source	bush	0	1735	0.2 Frith
Distributed Source	cemetry	0	2565	0.35 Frith
Distributed Source	frith	0	2840	0.35 Frith
Distributed Source	taitamid	0	1905	0.2 Taita
Distributed Source	taita	0	3285	0.8 Taita
Distributed Source	taitasouth	0	975	Maitahi
Distributed Source	dip	400	1785	Dip
Distributed Source	pouto-east	0	1655	0.2 Parore
Distributed Source	brown	100	2085	0.2 Parore
Distributed Source	spillway	200	2415	0.3 Parore
Distributed Source	pouto	0	2050	0.3 Parore
Distributed Source	poutowest	0	1160	Pouto
Distributed Source	rotu	0	1930	Rotu
Distributed Source	korariwhero	1000	3675	0.2 Babylon
Distributed Source	korarinorth	500	2410	0.4 Babylon
Distributed Source	korarisouth	1000	2835	0.4 Babylon
Distributed Source	parore-rb	0	3570	0.56 Valley
Distributed Source	antibrown	0	545	0.05 Valley
Distributed Source	parorelb	0	1095	0.12 Valley
Distributed Source	valley	0	680	0.12 Valley
Distributed Source	beach	200	1375	0.25 Valley
Distributed Source	scottys	200	1035	Scottys
Distributed Source	baylys	80	1120	Baylys
Distributed Source	mangatara	0	4950	Mangatara
Point Source	Kaihu	38290	0	Okahu