WESTERN BAY OF PLENTY DISTRICT COUNCIL

Pukehina Stormwater
Catchment Management Plan

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EXECUTIVE SUMMARY

The Western Bay of Plenty District Council (WBOPDC) has identified the need for stormwater catchment management in some of the smaller settlements of the Western Bay of Plenty. This document provides an overview of the Pukehina stormwater catchment, describing the catchment's characteristics and stormwater network.

Pukehina is a small settlement east of Te Puke with a stormwater catchment area of approximately 86 Ha. The catchment is bordered by the Pacific Ocean, Waihi Estuary and farmland. The Pukehina area is zoned residential.

The existing stormwater network was analysed using the rational method calculation and an ecological assessment of the catchment was prepared by Wildland Consultants.

Network upgrades were recommended as a result of the network analysis and prior flooding reports. The recommendations are based on maximum probable development using the current Western Bay of Plenty District Council Code of Practice and District Plan constraints. Should any of the current rules or controls change, stormwater discharge constraints may be required for further development.

The estimated cost of the recommended upgrade works totaled $1,453,377.00 excl GST. This work is proposed to start in the 2007/2008 financial year and would take till the 2021/2022 financial year based on the assumed funding allocation. The maintenance cost for these additional assets will gradually increase to approximately $2,712 per annum upon completion of the capital works.

The report produced by Wildland Consultants outlines recommendations for future management to protect the stormwater receiving environment.

It is recommended that the works be added to the Long Term Council Community Plan (LTCCP) for the residents of Pukehina to discuss and review. It is also suggested that land coverage restrictions be placed on the catchment so the impervious area of the catchment does not go above 35% (or the C factor above 0.5).

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CONTENTS

1.0 INTRODUCTION

The Western Bay of Plenty District Council (WBOPDC) has identified the need for stormwater catchment management in some of the smaller settlements of the Western Bay of Plenty. This document provides an overview of the Pukehina stormwater catchment, briefly describing the catchment characteristics and stormwater network.

The existing stormwater network was assessed by checking the pipe sizes and catchments sizes and calculating flows using the rational method. This was recalculated using higher coefficients to cater for potential development.

This catchment management plan also incorporates the results of an ecological assessment of the catchment prepared by Wildland Consultants in April 2005.

2.0 DESCRIPTION OF THE CATCHMENT

Description of the Pukehina Catchment

Pukehina is a coastal settlement east of the Te Puke township with a catchment area of approximately 86 Ha. The Pukehina catchment area consists of a large proportion of "holiday" homes which are not occupied all year round. The catchment is bordered mostly by the Pacific Ocean and Waihi Estuary; a small portion is bordered by rural land (Rural G). A map showing the location of Pukehina in is Appendix A.

Land Use

The Pukehina area is predominantly zoned residential, but does include two areas of land zoned commercial. The catchment has minimal potential for subdivision. If a proposed sewage reticulation system is installed the potential for subdivision will significantly increase; this analysis does not account for this. Appendix B is a map from the WBOPDC district plan and shows the actual zoning boundaries for Pukehina.

3.0 REGULATORY INFORMATION

Western Bay of Plenty Subdivision and Development Code of Practice

The Subdivision and Development Code of Practice (COP) is in place to

> *"maximise efficient use of resources to ensure that any development in the district is to an appropriate long term, cost effective and minimum uniform standard which benefits the community".*

The COP outlines detailed requirements for the stormwater network. A summary of the main requirements that relate to the Pukehina catchment are as follows:

- The minimum design standard for a primary (piped) stormwater system in the District is a 5-year return period (20% AEP).
- The minimum design standard for stormwater systems to protect important recreation fields, and streets without alternative access is a 10-year return period (10% AEP).
- The minimum design standard for stormwater systems to protect residential property, commercial and industrial buildings is a 50-year return period (2% AEP).
- The minimum design of stormwater systems to protect major communal facilities related to supply of electricity, telecommunications and water and sewage disposal systems and bridges is a 100-year return period (1% AEP).

Western Bay of Plenty District Plan

The residential zone rules specify the following as a controlled activity:

> *"More than one dwelling per lot, subject to a minimum net land area of 350m^2 per dwelling on sewered lots and 800m^2 on unsewered lots".*

The Pukehina catchment is currently unsewered but a reticulated system is proposed.

At the time of the publication of this report "Plan Change 34" had been proposed but not yet adopted. This change would mean that coastal properties at Pukehina would be considered to be within the Primary Risk Area of the Coastal Protection Area. This means that only one dwelling, accommodation or educational facility (as per Rule 5.3.1) would be permitted. Subdivision of coastal properties would also not be permitted and only limited subdivision would be possible in the other areas.

Environment Bay of Plenty

Environment Bay of Plenty (EBOP) has approved General Authorisation No 8 to provide for relatively small stormwater discharges. This authorisation dates back to the Water and Soil Conservation Act, which permitted a Regional Council to authorise a number of minor or inconsequential uses of natural water by issuing a General Authorisation. When the Resource Management Act came into effect each General Authorisation became incorporated into the regional rules.

The provisions of General Authorisation No 8 are as follows:

> *"Clean stormwater may be discharged (excluding waste) into natural water provided that:*
>
> *a) The maximum discharge shall not exceed the flow from a 300 mm pipe on a flat grade or equivalent of 80 litres per second.*
>
> *b) The suspended solids concentration of the water discharged does not exceed 150 g/m^3.*
>
> *c) The water discharged is substantially free of grease and oil.*
>
> *d) The works shall be designed, constructed and maintained in such a manner so as not to cause erosion or flooding or to adversely affect any land or property owned or occupied by another person".*

All other discharges require consents from EBOP.

4.0 EXISTING INFORMATION

Stormwater Network

The catchment currently consists of 1394 metres of stormwater pipe, 22 manholes, 60 catch pits and 15 soak holes. The pipes in the catchment are between 150mm and 750mm in diameter, with the majority being 300mm. The oldest pipes in the catchment were laid in 1960 and the newest in 2002 with the majority of the pipes being made of concrete. Appendix B shows a map of the existing stormwater reticulation.

The farmers who own the land to the west of the settlement operate a stormwater pumping scheme under the name of the Waihi Drainage Society. This scheme involves the pumping of stormwater into the estuary.

Marine Receiving Water Quality

EBOP regularly sample three sites throughout the bathing season (the start of November till the end of March) near the Pukehina catchment. The location of the sites is shown in Appendix A. Following is a table showing the sampling sites, sample site number and the median enterococci value (cfu/100ml) for the 2003/2004 and 2004/2005 bathing seasons.

Sampling Site	*Sampling Site Number*	*Median Enterococci Result (cfu/100mL)*
Pukehina Beach Eastern Car park	**BOP160015**	**2**
Little Waihi Domain Boat Ramp	**BOP160016**	**3**
Maketu Surf Club	**BOP160017**	**4**

All the sampling results are assessed against the Marine Water Quality Guidelines, which are as follows:

Safe Mode	single sample < 140 cfu/100ml
Amber / Alert Mode	single sample > 140 cfu/100ml
Red / Action Mode	2 consecutive samples over 280 cfu/100ml

Although the median values are low in the 2003/2004 bathing season, two samples where recorded over 140 cfu/100ml at the Little Waihi site; 563 on the 27/01/2004 and >1000 on 03/02/2004. On the 27/01/04, a high

result of 530 was also recorded at the Maketu Surf Club. In the 2004/2005 bathing season no exceedances were recorded.

Ecological Characteristics

Following are sites identified as having ecological or conservation value. The information is collected from the Western Bay of Plenty District Plan and Bay of Plenty Regional Coastal Environment Plan (RCEP). A summary of this information is shown below.

Western Bay of Plenty District Plan

- Site S8 Tauranga Harbour Landward Edge

  This area is identified as visually significant and includes all the land 40 metres inland from mean high water springs (MHWS). The Tauranga Harbour is recognised in the RCEP as an "Area of Significant Conservation or Cultural Value" and also as an "Outstanding Natural Feature or Landscape".

- Site 24 Waihi Estuary

  This includes the whole water body and the land 40 metres inland from MHWS.

- Site 25 Pukehina Spit End

  This includes the undeveloped area at the northwestern end of Pukehina Beach Spit.

- Site V14/15 Pukehina Beach Road

  This area contains Sedgeland, Sandfield and Vineland.

Bay of Plenty Regional Coastal Environment Plan

- Site ASCV-7 Maketu/Waihi Estuaries

  These areas have been identified as areas of significant conservation value. This is due to the estuaries being important feeding and roosting areas for various migrant bird species, including some vulnerable species.

  The entrance to the estuaries is considered a geomorphological phenomenon of converging littoral drift, the only example in Australasia.

  The Waihi and Maketu Estuaries are also internationally significant wetlands.

Vegetation and Habitats

A previous study for Smart Growth by Wildland Consultants identified areas with the Pukehina stormwater catchment which were highly or moderately significant for protection; these are provided in the Wildland Report in Appendix C.

The drains adjacent to Pukehina Beach Road have low ecological value but upstream they provide habitat for indigenous species. These drains and the canal system adjacent to the settlement provide a habitat for indigenous fish.

5.0 CONSTRAINTS ANALYSIS

The WBOPDC data for the Pukehina catchment was used to analyse the drainage system at Pukehina using the rational method to calculate stormwater runoff.

The C factor of the existing area was calculated by finding the average C factor based on a representative sample of the Pukehina area; this was calculated at 0.41. The maximum probable development potential in the catchment was approximated by assuming a maximum impervious ratio of 35% (this equates to a C factor of 0.5). The maximum development potential, therefore, is based on current Code of Practice and District Plan requirements. Should permitted activities change the recommendations may no longer be representative. No population figures are available directly related to Pukehina. The surrounding Pongakawa and Maketu areas are predicted to increase by approximately 13% and 40%, respectively, by 2021 (based on 2001 census figures). The addition of a

reticulated sewage system in Pukehina is likely to encourage more permanent residents.

The annual exceedance probability (AEP) used was 2% (i.e. equivalent to a 50-year return period) to determine potential areas of flooding. In all cases piped reticulation was sized using a 20% AEP event, unless no safe secondary flow path was available, in which case the 2% AEP was used.

The current system was analysed using the rational method, both for the current development situation and maximum probable development.

It has been assumed in this study that no reticulated sewerage is available. If this should change the recommended upgrades in this report may not meet Councils current LOS (level of service) requirements without additional constraints on private stormwater discharges.

6.0 IDENTIFIED STORMWATER PROBLEMS

Network

The Rational method was used to check the capacity of the existing stormwater system and identify required upgrades to the system. Appendix H shows a spreadsheet of the flows for the existing system.

The removal of deficient systems has been prioritised using three categories: high, medium and low. The following criteria were used to categorise these systems.

1. High – Upgrades of deficient systems that could cause major flooding of private property if not upgraded.

2. Medium – Upgrades of deficient systems to alleviate flooding of private property.

3. Low – Upgrades of deficient systems in flooding areas that do not cause major problems and do not flood private property. The category was also used to prioritise upgrades to remove soak holes.

Deficient systems are those which do not meet Councils current Code of Practice requirements, either under existing development or maximum probable development. Details of the deficient systems are listed in Appendix E and illustrated in Appendix F.

With the upgrade of the pipe network and removal soak holes more water will be flowing into the neighbouring canals. Because of the height of the land relative to the sea level, this water cannot easily drain away. This causes the stormwater to enter the Waihi Drainage Society's scheme, increasing the workload on their pumps.

Ecological

The existing ecological values should be protected and enhanced, if possible. This includes streams, wetlands and estuaries. This will improve the quality of stormwater that is discharged into the estuary.

Pollution

Two small commercial areas exist at Pukehina but have limited pollution potential. No specific treatment systems are recommended other than the control of erosion caused by high velocity stormwater flows.

7.0 REMEDIAL METHODS

All recommended remedial methods are determined using maximum probable development information based on the current Code of Practice and District Plan constraints (see Section 5).

Network

Details of the recommended upgrades, predicted costs and proposed programme are shown in Appendices E and G. The Development Impact Fee (DIF) contribution is the estimated proportion of the cost of increasing the pipe sizes if subdivision were to occur. This was calculated by assessing the requirements and cost of upgrading the system to cater for existing development and comparing the results with the requirements and cost involved in upgrading the system to cater for potential maximum development. The difference between these two costs gives the total DIF amount.

The order of work listed in the proposed works programme (Appendix G) was established by ranking the work based on priority. The work was then grouped so work in similar areas is carried out in consecutive years. It is possible to change the order of the work within each priority category.

Methods other than a piped system were considered but topographical and space constraints prevent other options, such as ponds or swales, being used.

Appendix F contains a map showing green coloured areas which can be developed without any upgrade of the stormwater systems. Red areas require stormwater upgrades before development can occur, or restrictions placed on new stormwater discharges.

The approximate cost of the proposed capital works is $1,453,577. This work is proposed to be started in the 2007/2008 financial year and would take 15 years based on assumed funding allocation. The maintenance cost for these additional assets will gradually increase to $2,712 per annum upon completion of the capital works.

There are three options to deal with the effect of the increased stormwater into the Waihi Drainage Society's scheme. These are as follows: take over the scheme, take over the part of the scheme involving the canal the stormwater is being discharged into and thirdly, to contribute to the running of the scheme to effectively pay for the increased discharges.

Ecological

The report produced by Wildland Consultants recommends the investigation of existing stormwater discharges onto the sand dune system and the estuary. This should be considered in the design of each upgrade recommended in this report and could result in the relocation of the discharge locations, if feasible

8.0 RECOMMENDATION

It is recommended that the suggested capital works be added to the Long Term Council Community Plan (LTCCP) for the residents of Pukehina to discuss and review the proposed works programme. A suggested programme of works is given in Appendix G. Also recommended is that the management of the discharge canal be investigated.

It is also suggested that land coverage restrictions be placed on the catchment so the impervious area of the catchment does not go above 35% (or the C factor above 0.5).

APPENDIX A

Location of the Pukehina Catchment and EBOP Sampling Sites

APPENDIX B

Pukehina District Plan Zoning Area and Existing Stormwater Pipe Network

APPENDIX C

Wildland Report "Ecological Assessment of Stormwater Catchments of Pukehina, Western Bay of Plenty District"

APPENDIX D

Map of Floodable Areas

APPENDIX E

Recommended Stormwater Upgrades and Costs

Location	US	DS	Existing Diameter	Upgraded Diameter	Length	Cost per m	No. of man holes / outlets	Cost per man hole	No. of catch pits	Cost per catch pit	Total Cost	Job Cost	Priority
618 Pukehina Beach Road	CP1969	CP1970	0.300	0.450	7	$320	0	$2,900	2	$1,519.90	$5,280		
	CP1970	CO1094	0.225	0.825	77	$550	1	$2,900	0	$1,519.90	$45,250		
	CP1971	CP1972	0.300	0.450	7	$320	0	$2,900	2	$1,519.90	$5,280		
	CP1972	BX0804	0.225	0.450	6	$320	1	$2,900	0	$1,519.90	$4,820		
	BX0804	CP1970	New Pipe	0.750	190	$530	0	$2,900	0	$1,519.90	$100,700		
	MH1481	BX0804	New Pipe	0.300	135	$200	1	$2,900	0	$1,519.90	$29,900	$191,230	High
420 Pukehina Beach Road - Stage 1	MH1487	MH1488	0.300	0.525	10	$350	2	$2,900	0	$1,519.90	$9,300		
	MH1488	MH1502	0.300	0.525	70	$350	1	$2,900	1	$1,519.90	$28,920		
	MH1502	MH1503	0.300	0.525	13	$350	1	$2,900	1	$1,519.90	$8,970		
	MH1503	CO1103	0.300	0.525	15	$350	1	$2,900	1	$1,519.90	$9,670		
	CP1983	MH1487	0.300	0.450	5	$320	0	$2,900	1	$1,519.90	$3,120	$59,980	High
492 Pukehina Beach Road - Stage 1	MH1483	MH1484	0.300	0.900	36	$620	2	$3,100	0	$1,519.90	$28,520		
	MH1484	MH1485	0.300	0.900	32	$620	1	$3,100	0	$1,519.90	$22,940		
	MH1485	MH1486	0.300	0.900	63	$620	1	$3,100	0	$1,519.90	$42,160		
	MH1486	CO1095	0.300	0.900	46	$620	1	$3,100	0	$1,519.90	$31,620		
	CP1980	MH1483	0.300	0.450	7	$320	0	$3,100	1	$1,519.90	$3,760	$129,000	High

Location	US	DS	Existing Diameter	Upgraded Diameter	Length	Cost per m	No. of man holes / outlets	Cost per man hole	No. of catch pits	Cost per catch pit	Total Cost	Job Cost	Priority
218 Pukehina Beach Road - Stage 1	MH1493	MH1494	0.300	0.600	74	$390	2	$2,900	0	$1,519.90	$34,660		
	MH1494	MH1495	0.300	0.600	40	$390	1	$2,900	0	$1,519.90	$18,500		
	MH1495	MH1496	0.300	0.600	15	$390	1	$2,900	0	$1,519.90	$8,750		
	MH1496	MH1497	0.300	0.600	17	$390	1	$2,900	0	$1,519.90	$9,530		
	MH1497	CO1098	0.300	0.600	39	$390	1	$2,900	0	$1,519.90	$18,110	$89,550	High
160 Pukehina Beach Road	CP2002	CP1999	New Pipe	0.300	85	$200	0	$2,900	2	$1,519.90	$20,040		
	BX0805	CO1099	0.150	0.300	13	$200	2	$2,900	0	$1,519.90	$8,400	$28,440	High
46 Pukehina Beach Road - Stage 1	MH1498	MH1499	0.300	0.600	39	$390	2	$2,900	0	$1,519.90	$21,010		
	MH1499	MH1500	0.300	0.600	56	$390	1	$2,900	0	$1,519.90	$24,740		
	MH1500	MH1501	0.300	0.600	24	$390	1	$2,900	0	$1,519.90	$12,260		
	MH1501	CO1100	0.300	0.600	48	$390	1	$2,900	0	$1,519.90	$21,620	$79,630	High
704 Pukehina Beach Road	CP1964	BX0801	0.225	0.300	5	$200	1	$2,900	1	$1,519.90	$5,420		
	BX0801	CO1092	0.225	0.300	54	$200	1	$2,900	0	$1,519.90	$13,700	$19,120	Medium
684 Pukehina Beach Road	CP1968	BX0803	0.225	0.300	5	$200	1	$2,900	1	$1,519.90	$5,420		
	BX0803	BX0802	New Pipe	0.450	117	$320	1	$2,900	0	$1,519.90	$40,340		
	BX0802	CO1093	0.225	0.600	43	$390	1	$2,900	0	$1,519.90	$19,670	$65,430	Low

Location	US	DS	Existing Diameter	Upgraded Diameter	Length	Cost per m	No. of man holes / outlets	Cost per man hole	No. of catch pits	Cost per catch pit	Total Cost	Job Cost	Priority
492 Pukehina Beach Road - Stage 2	CP1975	CP1976	0.300	0.450	7	$320	0	$2,900	2	$1,519.90	$5,280		
	CP1976	CP1978	New Pipe	0.750	253	$530	0	$2,900	1	$1,519.90	$135,610		
	CP1978	MH1482	New Pipe	0.900	100	$620	1	$3,100	0	$1,519.90	$65,100		
	MH1482	MH1483	New Pipe	0.900	31	$620	1	$3,100	0	$1,519.90	$22,320	$228,310	Low
492 Pukehina Beach Road - Stage 3	CP1982	MH1484	New Pipe	0.450	123	$320	1	$2,900	1	$1,519.90	$43,780	$43,780	Low
Gardiner Road	CP2004	CP2006	New Pipe	0.300	110	$200	0	$2,900	2	$1,519.90	$25,040		
	CP2006	CO1101	New Pipe	0.450	50	$320	1	$2,900	0	$1,519.90	$18,900	$43,940	Low
420 Pukehina Beach Road - Stage 2	CP1988	CP1986	New Pipe	0.450	135	$320	0	$2,900	2	$1,519.90	$46,240		
	CP1986	MH1487	New Pipe	0.450	105	$320	1	$2,900	0	$1,519.90	$36,500	$82,740	Low
218 Pukehina Beach Road - Stage 2	CP1998	MH1493	New Pipe	0.600	245	$390	1	$2,900	1	$1,519.90	$99,970	$99,970	Low
46 Pukehina Beach Road - Stage 2	CP2008	MH1498	New Pipe	0.600	215	$390	1	$2,900	1	$1,519.90	$88,270	$88,270	Low

Location	US	DS	Existing Diameter	Upgraded Diameter	Length	Cost per m	No. of man holes / outlets	Cost per man hole	No. of catch pits	Cost per catch pit	Total Cost	Job Cost	Priority
Costello Cres - Stage 1	CP2012	CP2014	New Pipe	0.300	180	$200	0	$2,900	2	$1,519.90	$39,040		
	CP2014	MH1	New Pipe	0.525	102	$350	1	$2,900	0	$1,519.90	$38,600		
	MH1	CP2020	New Pipe	0.525	71	$350	0	$2,900	1	$1,519.90	$26,370		
	CP2020	CO1102	0.300	0.525	14	$350	1	$2,900	0	$1,519.90	$7,800		
	CP2013	CP2014	New Pipe	0.300	6	$200	0	$2,900	1	$1,519.90	$2,720	$114,530	Low
Costello Cres - Stage 2	CP2015	MH1	New Pipe	0.300	23	$200	1	$2,900	1	$1,519.90	$9,020		
	CP2018	CP2019	New Pipe	0.300	7	$200	0	$2,900	2	$1,519.90	$4,440		
	CP2019	CP2016	New Pipe	0.300	110	$200	0	$2,900	1	$1,519.90	$23,520		
	CP2016	MH2	New Pipe	0.450	63	$320	1	$2,900	0	$1,519.90	$23,060		
	MH1	MH2	New Pipe	0.450	75	$320	1	$2,900	0	$1,519.90	$26,900		
	CP2017	CP2016	New Pipe	0.300	6	$200	0	$2,900	1	$1,519.90	$2,720	$89,660	Low
Total											**$1,453,577**		

Costs covered by DIF's **$145,358**

Costs covered by current ratepayers **$1,308,219**

Maintenance Costs for the Additional Service

Year	Additional Cost per annum	Additional Costs - Cumulative
2007/2008	$0	$0
2008/2009	$346	$346
2009/2010	$0	$346
2010/2011	$0	$346
2011/2012	$0	$346
2012/2013	$103	$449
2013/2014	$132	$581
2014/2015	$0	$581
2015/2016	$399	$980
2016/2017	$309	$1,289
2017/2018	$243	$1,532
2018/2019	$247	$1,779
2019/2020	$220	$1,999
2020/2021	$377	$2,376
2021/2022	$336	$2,712

APPENDIX F

Map of Recommended Stormwater Upgrades

APPENDIX G

Proposed Works Programme

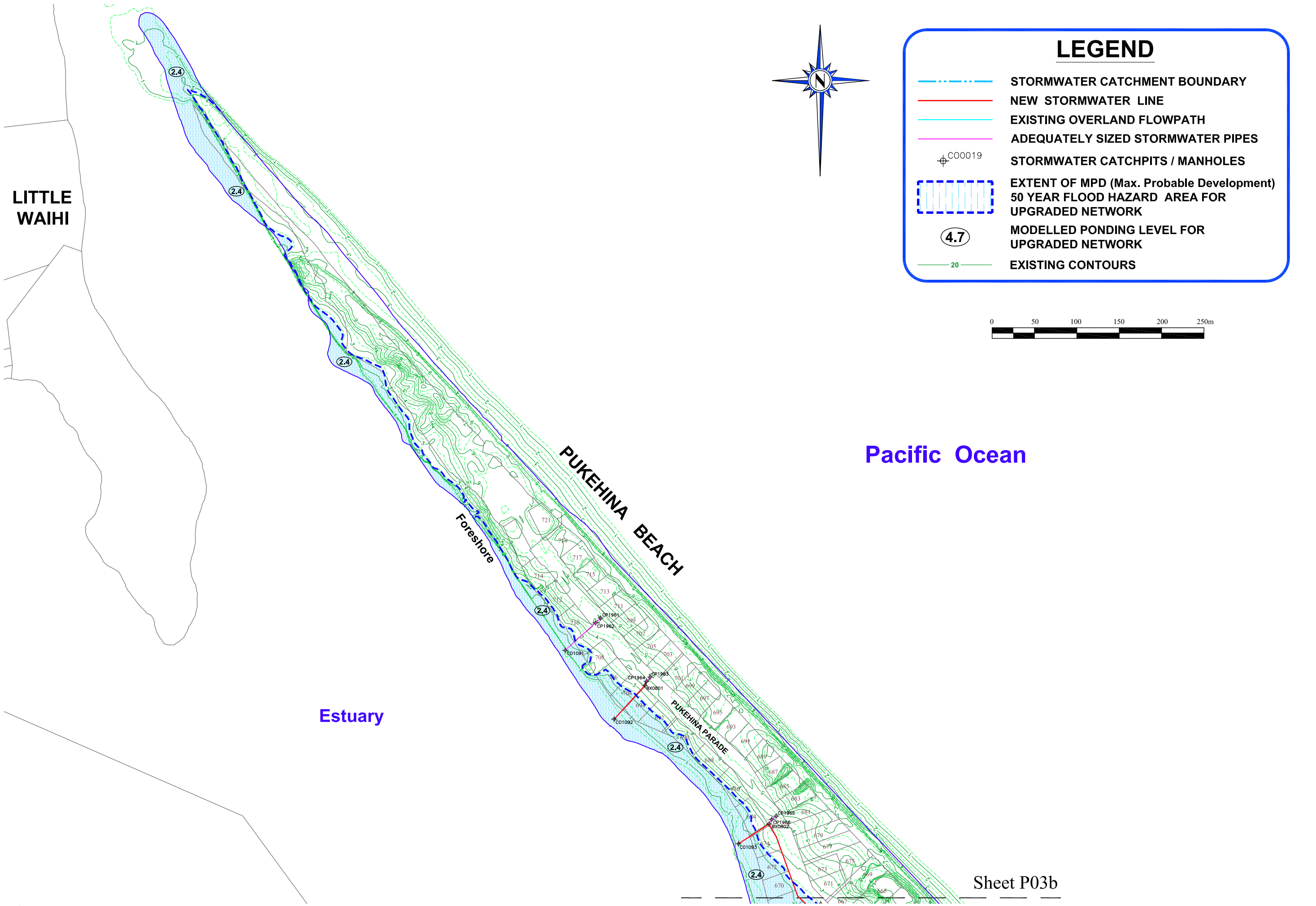
APPENDIX H

Stormwater Flow Calculations

Stormwater Flow Calculations for Existing System

Roughness Coefficient	0.013	
Run off Coefficient - existing	0.41	
Run off Coefficient - developed	0.5	
Rainfall Intensity - 5 year event 10 min	72.7	mm/hr
Rainfall Intensity - 50 year event 10 min	114.6	mm/hr

Outlet	Existing Diameter (m)	US Invert (m)	DS Invert (m)	Length	Design Capacity (L/s)	Catchment (ha)	Existing Flows				Developed Flows			
							5 year (L/s)	Under Capacity?	50 year (L/s)	Under Capacity?	5 year (L/s)	Under Capacity?	50 year (L/s)	Under Capacity?
BX0803	0.225	1.84	1.72	5.4	66.87	1	82.80	yes	130.52	yes	100.97	yes	159.17	yes
BX0804	0.225	1.11	0.91	5.5	85.54	2.27	187.95	yes	296.27	yes	229.21	yes	361.31	yes
CO1095	0.300	0.85	0.69	45.6	57.23	1.04	86.11	yes	135.74	yes	105.01	yes	165.53	yes
CO1098	0.300	0.01	-0.12	39.3	55.57	1.03	85.28	yes	134.43	yes	104.00	yes	163.94	yes
CO1099	0.150	1.45	0.61	13.4	38.09	0.89	73.69	yes	116.16	yes	89.87	yes	141.66	yes
CO1100	0.300	0.12	-0.07	47.6	61.04	1.58	130.82	yes	206.22	yes	159.54	yes	251.48	yes
CO1103	0.300	-0.09	-0.23	14.5	94.94	1.59	131.65	yes	207.52	yes	160.55	yes	253.08	yes
CO1094	0.225	2.1	0.59	76.7	62.94	2.5	206.99	yes	326.29	yes	252.43	yes	397.92	yes
SH0831	0.300	4.72	4.63	3.5	154.93	2.04	168.91	yes	266.25	yes	205.98	yes	324.70	yes
SH0832	0.225	5.36	5.33	3.9	39.34	1.34	110.95	yes	174.89	yes	135.30	yes	213.28	yes
SH0833	0.225	2.1	0.59	76.7	62.94	1.3	107.64	yes	169.67	yes	131.26	yes	206.92	yes
SH0834	0.225	4.52	4.46	4.1	54.27	0.8	66.24	yes	104.41	yes	80.78	yes	127.33	yes
SH0835	0.225	6.03	6.02	4.3	21.63	0.916	75.84	yes	119.55	yes	92.49	yes	145.80	yes
SH0836	0.150	4.75	4.74	2.1	10.50	1.35	111.78	yes	176.20	yes	136.31	yes	214.88	yes
SH0837	0.150	5.19	5.18	2	10.76	0.93	77.00	yes	121.38	yes	93.90	yes	148.03	yes
SH0838	0.300	3.83	3.82	1.9	70.09	0.85	70.38	yes	110.94	yes	85.83	yes	135.29	yes
SH0841	0.225	2.43	2.42	1.3	39.34	1.03	85.28	yes	134.43	yes	104.00	yes	163.94	yes
SH0842	0.225	2.59	2.58	1.5	36.63	0.63	52.16	yes	82.23	yes	63.61	yes	100.28	yes
SH0844	0.225	3.43	3.42	2.2	30.24	0.5	41.40	yes	65.26	yes	50.49	yes	79.58	yes
CO1092	0.225	3.29	0.67	54	98.81	0.98	81.14		127.91	yes	98.95	yes	155.98	yes
SH0839	0.300	3.55	3.5	1.6	170.80	1.75	144.90		228.40	yes	176.70	yes	278.54	yes
CO1097	0.375	0.36	0.07	31.4	168.36	1.5	124.20		195.78	yes	151.46		238.75	yes
CO1093	0.225	3.44	1.1	42.9	104.77	0.8	66.24		104.41		80.78		127.33	yes
CP2002	0.300	5.93	5.8	6.7	134.58	0.78	64.58		101.80		78.76		124.15	
MH1841	0.225	3.78	3.44	5.9	107.69	0.8	66.24		104.41		80.78		127.33	yes
SH0840	0.300	4.8	4.22	7.3	272.34	0.75	62.10		97.89		75.73		119.38	
SH0843	0.225	3.99	3.4	8.8	116.15	0.5	41.40		65.26		50.49		79.58	
SH0845	0.225	3.99	3.4	8.8	116.15	0.55	45.54		71.78		55.53		87.54	
CO1091	0.225	4.63	0.83	48.3	125.82	0.6	49.68		78.31		60.58		95.50	
CO1096	0.375	4.19	0.16	85.6	380.13	1.97	163.11		257.12		198.92		313.56	
CO1101	0.300	1.86	1.73	11	105.03	0.5	41.40		65.26		50.49		79.58	
CO1102	0.300	0.62	0.05	14	194.95	0.78	64.58		101.80		78.76		124.15	



LEGEND

- STORMWATER CATCHMENT BOUNDARY
- NEW STORMWATER LINE
- EXISTING OVERLAND FLOWPATH
- ADEQUATELY SIZED STORMWATER PIPES
- CO0019 — STORMWATER CATCHPITS / MANHOLES
- EXTENT OF MPD (Max. Probable Development) 50 YEAR FLOOD HAZARD AREA FOR UPGRADED NETWORK
- 4.7 — MODELLED PONDING LEVEL FOR UPGRADED NETWORK
- 20 — EXISTING CONTOURS

0 50 100 150 200 250m

Version : 23 June - 2006

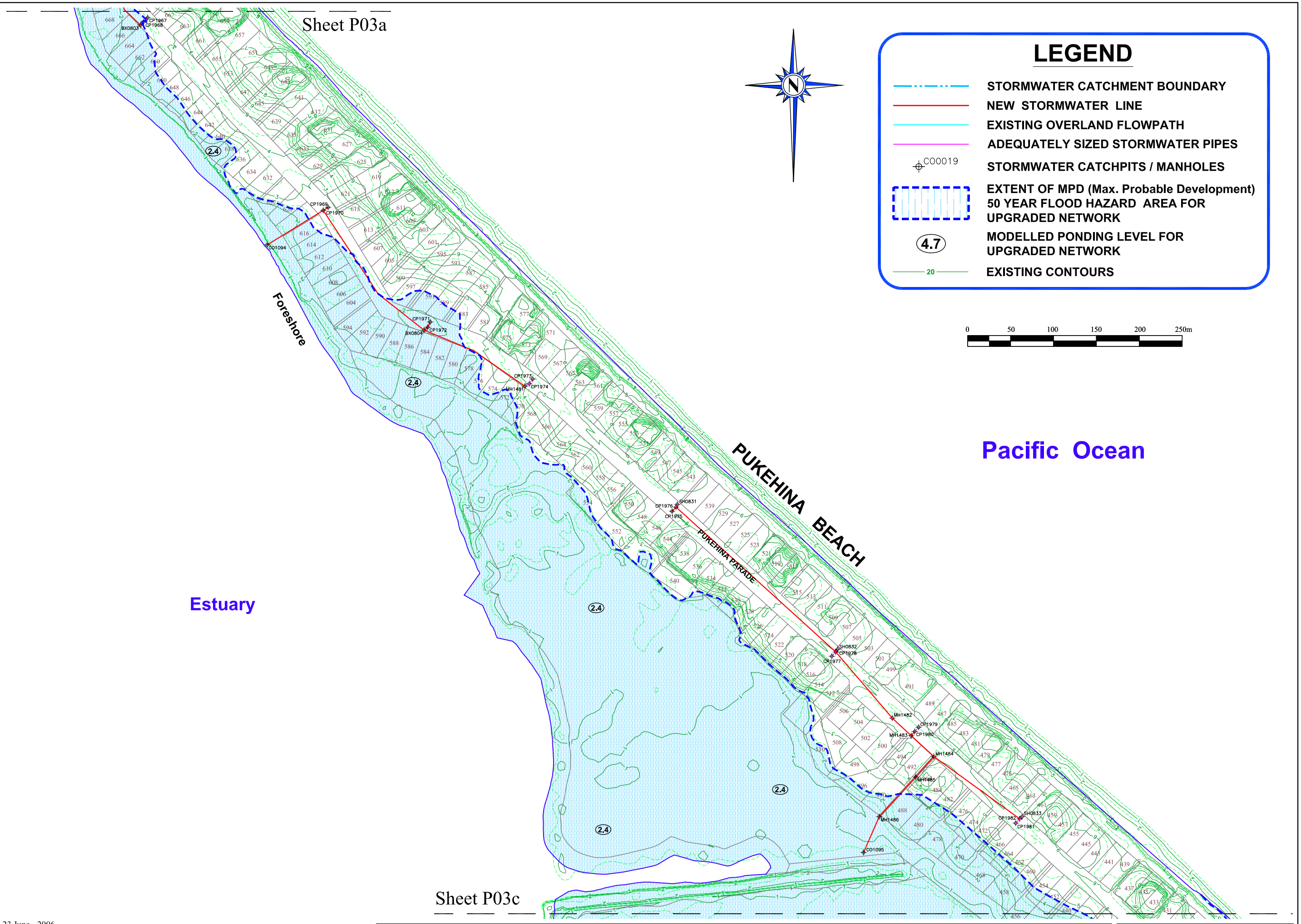
Scales: ~ 1:2000 (A1)
~ 1:4000 (A3)

Project No. : 43091.02.01
Dwg. File : Coastal Areas P01–4b_floodable.dwg Pukehina. P03a

Client	Project	Sheet Title	Job No.	Sheet No.
Western Bay of Plenty District Council	PUKEHINA CATCHMENT MANAGEMENT PLAN	PLAN FLOOD HAZARD AREA (UPGRADED NETWORK)	43091	P03a 3 of 8 shts

Duffill Watts Consulting Group

Sheet P03a



Sheet P03c

LEGEND

- STORMWATER CATCHMENT BOUNDARY
- NEW STORMWATER LINE
- EXISTING OVERLAND FLOWPATH
- ADEQUATELY SIZED STORMWATER PIPES
- CO0019 — STORMWATER CATCHPITS / MANHOLES
- EXTENT OF MPD (Max. Probable Development) 50 YEAR FLOOD HAZARD AREA FOR UPGRADED NETWORK
- 4.7 — MODELLED PONDING LEVEL FOR UPGRADED NETWORK
- 20 — EXISTING CONTOURS

0 50 100 150 200 250m

Version : 23 June - 2006

Scales: ~ 1:2000 (A1)
~ 1:4000 (A3)

Project No. : 43091.02.01
Dwg. File : Coastal Areas P01–4b_floodable.dwg Pukehina. P03b

Client	Project	Sheet Title	Job No.	Sheet No.
Western Bay of Plenty District Council	PUKEHINA CATCHMENT MANAGEMENT PLAN	PLAN FLOOD HAZARD AREA (UPGRADED NETWORK)	43091	P03b 4 of 8 shts

Duffill Watts Consulting Group

Sheet P03b

LEGEND

- STORMWATER CATCHMENT BOUNDARY
- NEW STORMWATER LINE
- EXISTING OVERLAND FLOWPATH
- ADEQUATELY SIZED STORMWATER PIPES
- C00019 — STORMWATER CATCHPITS / MANHOLES
- EXTENT OF MPD (Max. Probable Development) 50 YEAR FLOOD HAZARD AREA FOR UPGRADED NETWORK
- 4.7 — MODELLED PONDING LEVEL FOR UPGRADED NETWORK
- 20 — EXISTING CONTOURS

0 50 100 150 200 250m

PUKEHINA PARADE

PUKEHINA BEACH

PUKEHINA PARADE

Pacific Ocean

Sheet P03d

Version : 23 June - 2006

Scales: ~ 1:2000 (A1)
~ 1:4000 (A3)

Project No. : 43091.02.01
Dwg. File : Coastal Areas P01–4b_floodable.dwg Pukehina. P03c

Client	Project	Sheet Title	Job No.	Sheet No.
Western Bay of Plenty District Council	PUKEHINA CATCHMENT MANAGEMENT PLAN	PLAN FLOOD HAZARD AREA (UPGRADED NETWORK)	43091	P03c 5 of 8 shts

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Sheet P03b

LEGEND

- STORMWATER CATCHMENT BOUNDARY
- NEW STORMWATER LINE
- EXISTING OVERLAND FLOWPATH
- ADEQUATELY SIZED STORMWATER PIPES
- C00019 — STORMWATER CATCHPITS / MANHOLES
- EXTENT OF MPD (Max. Probable Development) 50 YEAR FLOOD HAZARD AREA FOR UPGRADED NETWORK
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0 50 100 150 200 250m

PUKEHINA PARADE

PUKEHINA BEACH

PUKEHINA PARADE

Pacific Ocean

Sheet P03d

Version : 23 June - 2006

Scales: ~ 1:2000 (A1)
~ 1:4000 (A3)

Project No. : 43091.02.01
Dwg. File : Coastal Areas P01–4b_floodable.dwg Pukehina. P03c

Client	Project	Sheet Title	Job No.	Sheet No.
Western Bay of Plenty District Council	PUKEHINA CATCHMENT MANAGEMENT PLAN	PLAN FLOOD HAZARD AREA (UPGRADED NETWORK)	43091	P03c 5 of 8 shts

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