Whangamata Stormwater Catchment Management Study

Catchment Management Study

Updated Issues and Options Report

Draft Version 2

Thames-Coromandel District Council

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1 Introduction

1.1 Purpose

This report has been prepared for the Thames Coromandel District Council (TCDC) to provide a basis for the management of stormwater in Whangamata. It summarises the key issues and options for stormwater management. The purpose of this investigation is to assist Council with the prioritising and planning of future stormwater capital works; with establishing land use controls and other stormwater management policies; and with system management and maintenance.

While this report forms a basis for stormwater catchment management planning, more investigation, consultation and design work is required before final selection and implementation of stormwater management options and strategies. This draft report should be refined through workshopping with TCDC officers and then further refined as a result of public consultation.

This report was released as Draft Version 1 in December 2003, and is now being released as Draft Version 2. Differences between Draft Version 1 and Draft Version 2 have been highlighted in green.

This report aims to address recent development trends and filling in gaps with information which has become available more recently. This report also aims to provide information on the overland flowpaths expected to occur during heavy rainfall events, as well as providing an assessment of existing stormwater pipe capacity.

The information in this report will assist TCDC in processing future building consent applications by providing guidance on flood hazard areas and minimum finished floor levels.

1.2 Background

The Coromandel area is one of New Zealand's premier holiday destinations. During the past century Whangamata has developed from a small gold mining and logging based settlement to a community consisting of permanent homes, holiday homes and camping grounds. Presently Whangamata is experiencing unprecedented growth in the residential and commercial sectors. It is expected that apartment style developments and other residential intensification will result in increased site coverage in residential areas. Whangamata has also increasingly become home to a number of permanent residents; however, in the summer months the population swells from around 4,000 to approximately 45,000 with absentee property owners and visitors holidaying. These factors will render some existing stormwater services unable to cope with high rainfall events. A significant increase in infrastructure expenditure is anticipated to ensure it can keep pace with development.

The town is bordered by the Otahu River to the south and the Whangamata Harbour to the north where the Wairoa Stream and Wentworth River meet the sea (Figure 1). The majority of the community lies on flat sandy dune soil with very good soakage. However, the southwest community and some other areas lie on boggy land on silty clay and/or Waihi ash soils, which have less soakage potential. All these areas are flat and low-lying so are susceptible to stormwater ponding.

Rainfall in the Coromandel varies considerably between the Eastern and Western side of the Peninsula. There are two continuously monitored rain gauges in the Coromandel Peninsula, in Matawai to the North and in Kauaeranga further to the South. The average rainfall in Matawai is 2290mm per year and in Kauaeranga 3810mm per year. Average rainfall in Whangamata is expected to be within these two figures.

On Thursday 20 June 2002 the Weather Bomb made landfall, bringing high winds and torrential rain across most parts of the upper North Island. The resulting floods and damage led to residents from many communities across the Thames-Coromandel and South Waikato Districts being evacuated from their homes and, in one case, loss of life.

This event brought torrential rainfall with intensities of up to 125mm in 25 minutes to the Coromandel Peninsula and rapidly created flood flows in local rivers reportedly equivalent to 100 year return interval flood events. In places the flows were of sufficient strength to move caravans, garages, boats and cars as well as carrying fallen trees, boulders, and many thousands of tonnes of mud through homes, properties and across roads. Whangamata appears to have fared better than other parts of the Coromandel Peninsula during this storm.

Since the Weather Bomb, there have been subsequent storms, which although smaller have impacted on Whangamata more directly resulting in localised flooding of private properties and roads. One such event occurred on the 17th – 18th May 2005 where 442 mm of rain fell over two days. (Report to Catchment Services Committee, 30th May 2005, TCDC). Environment Waikato officers suggest the Annual Exceedence Probability (AEP)[1] for this storm was estimated at 2% for the 24 hour period. Whangamata experienced moderate flooding to shops, commercial areas, and residential areas during this event, with the Volunteer Firefighters pumping out numerous properties over a two day period.

1.3 Scope of Works

TCDC is in the process of developing stormwater catchment plans for all major towns on the Coromandel Peninsula. This study has been prepared to bring together existing

[1] In this report storm events are generally expressed by their percentage Annual EXceedance Probability (AEP), whichi s the probability that a particular storm intensity will be equalled or exceeded in any one year. The even may alternatively be described in terms of its Annual Recurrence Interval (ARI), the average statistical period between events greater than or equal to the design event. Thus the 2% AEP flood event can also be described as the 50 year ARI flood event, often shortened for convenience to the Q_{50} event.

information to form the basis of a stormwater catchment study for the Whangamata township area.

A 1997 Report by Woodward-Clyde, *Whangamata and Onemana Stormwater Management*, has been reviewed in conjunction with the responses to a community questionnaire to identify areas where flooding occurs and/or the stormwater network may be under capacity.

This report summarises results of a drainage investigation including:

1. Review of pipe asset and topographic information – based on the available topographic information that includes 0.5m contour intervals from LIDAR survey information, specific survey which has been undertaken in some key areas and the Council's GIS information, principal stormwater outlets and land use.

2. Catchment Analysis –

    a. Hydraulic capacities of the piped stormwater network were assessed using the most recent Council GIS information to update the Woodward-Clyde report where new infrastructure has been installed.

    b. Hydrologic analysis to calculate expected runoff during 10 year and 50 year storm events.

    c. Estimation of overland flow path routes and directions using the LIDAR contour information.

    d. Consideration of potential reductions in outfall pipe capacity under high tidal water conditions.

    e. Critical Structure Identification and Analysis – Based on the data provided and consultation, critical culverts or other critical structures that may throttle or impede flow have been identified.

3. Options Identification – options were developed to address identified stormwater issues. However the options are at a conceptual level only and do not include detailed design or costing.

1.4 Previous Reports

A previous report prepared by Woodward-Clyde Ltd, *Whangamata and Onemana Stormwater Management* (1997), has been assessed and updated as part of this study.

A report on the water quality of the Harbour was prepared by Environment Waikato, (*Whangamata Harbour: Contaminant Loads and Water Quality,* Environment Waikato Technical Report, June 2001). The findings of this report that relate to the catchment area are summarised in section 2.5.1.

A report of the events of 12th March 1997 prepared by Airey Consultants Ltd, entitled *'Beach Road - Harbour View Road – Trailer Park Flooding'* gives an account of the unusually high tidal conditions and the flooding experienced as a consequence. Recommendations in the report include installation of flood gates on outlets '2' and '3', identified in the asset plan as asset numbers 102,868 and 102,875. We are unaware of the result of these recommendations.

1.5 Statutory Framework

1.5.1 Overview

This report for Whangamata takes into account the existing conditions/constraints and formulates options for the development and management of the Whangamata area in relation to stormwater issues, covering the following aspects:

- Statutory Framework
- Regional & Territorial Plans
- Roles & Responsibilities
- Level of Service

1.5.2 Local Government Act 2002

The Local Government Act (LGA), 2002 came into force in July 2003. Under the Act, all local authorities are required to prepare a Long Term Council Community Plan (LTCCP) at least every 3 years, covering a 10-year financial timeframe.

The plan will need to include an assessment of the community need for water and wastewater (under the Act, the definition of wastewater includes stormwater), considering the full range of options and their environmental and public health impacts. The community outcomes and priorities for each district will need to be included in the LTCCP.

As the administering local authority, TCDC will be required to provide a LTCCP which will need to include an assessment of the stormwater services provided for each community. This catchment management study at least partially addresses the required stormwater assessment and provides options as required by the Act.

1.5.3 Resource Management Act 1991

The Resource Management Act 1991 (RMA), is the principal statute in which the management of water resources and hence catchment management planning is undertaken. Although catchment management planning is not a specific requirement of the RMA, the Act stipulates both regional and territorial authorities obligations in order to achieve integrated management of water resources.

Part II, Section 5 of the RMA outlines the purpose of the Act:

"...managing the use, development, and protection of natural and physical resources in a way, or at a rate, which enables people and communities to provide for their social, economic, and cultural well being and for their health and safety."

Section 6 of the Act outlines matter of national importance, which includes:

"... The preservation of the natural character of the coastal environment (including the coastal marine area), wetlands, and lakes and rivers and their margins, and the protection of them from inappropriate subdivision, use and development."

Part III of the Act, specifically refers to the management of water resources such as river, lakes and coastal areas. The Act also controls the use of land so that the quality of water in such water bodies is maintained and/or enhanced. This is achieved by controlling:

- Discharges, contaminants, and water into water (s.15);
- The taking, use, damming and diversion of water (s.14); and
- The quantity, level and flow of water in any water body.

1.5.4 Regional & Territorial Authorities Obligations

Under the Resource Management Act 1991, the responsibilities relating to local and catchment-wide stormwater issues, protection of watercourses and coastal areas, flooding, water quality and erosion are defined for both regional and local authorities. Section 30 of the Act lists the functions of the regional councils:

"30. Functions of regional councils under this Act—

(1) Every regional council shall have the following functions for the purpose of giving effect to this Act in its region:

(a) The establishment, implementation, and review of objectives, policies, and methods to achieve integrated management of the natural and physical resources of the region:

(b) The preparation of objectives and policies in relation to any actual or potential effects of the use, development, or protection of land which are of regional significance:

(c) The control of the use of land for the purpose of—

(i) Soil conservation:

(ii) The maintenance and enhancement of the quality of water in water bodies and coastal water:

(iii) The maintenance of the quantity of water in water bodies and coastal water:

(iv) The avoidance or mitigation of natural hazards:

(v) The prevention or mitigation of any adverse effects of the storage, use, disposal, or transportation of hazardous substances:

(d) In respect of any coastal marine area in the region, the control (in conjunction with the Minister of Conservation) of—

(i) Land and associated natural and physical resources:

[(ii) The occupation of space on land of the Crown or land vested in the regional council, that is foreshore or seabed, and the extraction of sand, shingle, shell, or other natural material from that land:]

(iii) The taking, use, damming, and diversion of water:

(iv) Discharges of contaminants into or onto land, air, or water and discharges of water into water

[(iva) The dumping and incineration of waste or other matter and the dumping of ships, aircraft, and offshore installations:]
(v) Any actual or potential effects of the use, development, or protection of land, including the avoidance or mitigation of natural hazards and the prevention or mitigation of any adverse effects of the storage, use, disposal, or transportation of hazardous substances:
(vi) The emission of noise and the mitigation of the effects of noise:
(vii) Activities in relation to the surface of water:

(e) The control of the taking, use, damming, and diversion of water, and the control of the quantity, level, and flow of water in any water body, including—
(i) The setting of any maximum or minimum levels or flows of water:
(ii) The control of the range, or rate of change, of levels or flows of water:
(iii) The control of the taking or use of geothermal energy:

(f) The control of discharges of contaminants into or onto land, air, or water and discharges of water into water:

(g) In relation to any bed of a water body, the control of the introduction or planting of any plant in, on, or under that land, for the purpose of—
(i) Soil conservation:
(ii) The maintenance and enhancement of the quality of water in that water body:
(iii) The maintenance of the quantity of water in that water body:
(iv) The avoidance or mitigation of natural hazards:

(h) Any other functions specified in this Act."

Environment Waikato (EW) fulfils the role of Regional Council for the Whangamata area.

Under Section 31 of the Act, the Territorial Authorities (TAs) have the following functions:

"31. Functions of territorial authorities under this Act—

Every territorial authority shall have the following functions for the purpose of giving effect to this Act in its district:

(a) The establishment, implementation, and review of objectives, policies, and methods to achieve integrated management of the effects of the use, development, or protection of land and associated natural and physical resources of the district:

(b) The control of any actual or potential effects of the use, development, or protection of land, including for the purpose of the avoidance or mitigation of natural hazards and the prevention or mitigation of any adverse effects of the storage, use, disposal, or transportation of hazardous substances:]

(c) The control of subdivision of land:

(d) The control of the emission of noise and the mitigation of the effects of noise:

(e) The control of any actual or potential effects of activities in relation to the surface of water in rivers and lakes:

(f) Any other functions specified in this Act."

In relation to stormwater issues covered in this report, EW is responsible for control of issues relating to stormwater including stormwater discharges, erosion control, flood protection, etc. The control of such matters is usually addressed through resource consents.

TCDC are responsible for land-use and stormwater issues arising from land-use. TCDC also have ownership of any public stormwater asset and are responsible for ongoing operation and maintenance of the stormwater reticulation.

1.5.5 Relevant Policies

The following Regional Policies have been developed by EW and apply to Coromandel stormwater issues:

- Operational Waikato Regional Policy Statement;
- Proposed Regional Coastal Plan;
- Proposed Waikato Regional Plan; and
- Coastal Hazards & Development Setback Recommendations Summary Report.

The Operational Waikato Regional Policy Statement gives an overview of the significant resources and the associated management issues, objectives, policies and methods. It includes the following matters relating to water resources:

- Surface water (resources, significant resource management issues, water quality, flow regimes, and wetlands);
- Coastal waters (resources, significant resource management issues, water quality);
- Natural hazards (management and adverse effects);
- Water resources.

It should be noted that the Plan comments on water quality in streams in the Coromandel Peninsula as being generally good. Soil erosion and silting are noted as an ongoing problem along with flash floods and increasing water temperature due to the clearing of land and loss of riparian shading.

The Proposed Regional Coastal Plan sets out how EW will carry out its resource management responsibilities in the CMA (Coastal Management Area), which includes the foreshore, seabed, coastal water and area above MHWS. The plan covers rules relating to:

- Tangata Whenua perspectives and policies relating to values, participation, kaitiakitanga, protection of sites, principles of the Treaty, and Treaty claims.
- Preservation of natural character including:
  - Preservation of significant vegetation and habitat;
  - Amenity and heritage values; and
  - Protection of coastal processes.
- Water quality relating to the:
  - Taking and using of water;
  - Non-point source and point source discharges; and
  - Damming and diverting.
- Development, maintenance and removal of structures.
- Marine farming.
- Foreshore and/or seabed disturbances.
- Natural hazards – including sea-level rise.
- Surface water activities.

The Proposed Regional Coastal Plan is another regional document relating specifically to the coastal environment. The plan covers such matters as:

- Water quality maintenance.
- Coastal structures.
- Policy implementation methods.
- Discharges to the coastal receiving environment including wastewater.

The Upper Whangamata Harbour is noted in Appendix 4 of this plan as being an area of significant coastal value.

The Proposed Waikato Regional Plan covers stormwater management, discharges and the damming and diverting of water. Key points include the following:

- Stormwater Management – EW will work with TA's to:
  - Ensure TA's notify EW of significant discharge resource consent applications;
  - EW has input into district plan development; and
  - Identify and manage contaminated sites.
- Stormwater Discharge - EW will work with TA's to:
  - Find ways to mitigate adverse effect of existing SW discharges;
  - Promote development of regional SW plans; and
  - Promote alternatives methods of SW treatment and disposal.
- Damming and Diverting Water
  - Off stream dams or ephemeral stream dams;
  - Damming perennial streams; and
  - EW will integrate with TA's and share information and educational resources to inform people on the adverse effects of damming watercourses.

EW have prepared a report on sea level rise and coastal erosion for the Coromandel Peninsula as it was recognised that due to the projected sea level rise over the next 100 years, there may be a long term erosion trend in the heavily developed areas of the Peninsula. Sea level is projected to rise 0.5 m, resulting in a recession of dunes by 15-20m. The report therefore provides setback requirements for the coastal Coromandel communities and these have been incorporated into the TCDC District Plan.

The development setbacks on the eastern coast beaches of the Coromandel Peninsula have been recommended for two levels of risk: a primary development setback of 40m to allow for dynamic shoreline fluctuation and protective dune buffer, and a secondary development setback of 60m to allow for recession due to sea level rise.

The New Zealand Coastal Policy Statement is also relevant to the study area and has been taken into account in the Regional Plans.

The Thames-Coromandel District Council currently operates under a Proposed District Plan. This Plan sets out rules relating to land-use including housing, earthworks and subdivisions, and controls these activities by way of consents.

1.5.6 Engineering Standards and Level of Service

TCDC's Engineering Standards are set out in TCDC's Code of Practise for Subdivision and Development (Engineering Standards), which sets the following levels of service that are required in relation to stormwater in the Coromandel area:

- Primary piped systems must have adequate capacity to pass at least the 20% AEP (five year ARI) rain event (primary pipes in urban Whangamata are to be capable of carrying a 10% AEP 10 year ARI rain event);
- Culverts in all areas must be capable of carrying the 5% AEP (20 year) rain event;
- Open channels and overland flow paths should be capable of carrying the 2% AEP (50 year ARI) rain event to ensure that such surface water will not enter buildings; and
- Bridges must be capable of withstanding the 1% AEP (100 year) rain event.

In addition, the Council permits stormwater disposal through soak-away pits provided the applicant can demonstrate that:

- They can be economically maintained;
- The long-term soakage capacity is adequate.

Stormwater detention basins are to be self-draining without the use of pumping equipment and are not permitted to permanently hold water to be used as a water feature. Detention basins are required to be adequately landscaped and constructed so they can be economically maintained unless specifically approved.

In addition:

- Floor levels of all houses and all habitable rooms shall meet the following standards:
  - In areas covered by Flood Management Plans:
    - (i) Primary Overland Flow Areas: not less than one metre above natural ground level.
    - (ii) Secondary Overland Flow Areas: not less than 0.5 metres above natural ground level.
    - (iii) Ponding Areas: not less than 0.5m above the flood datum level stated on the planning map.
    - (iv) Overland Flow and Ponding Areas: Not less than one metre above natural ground level.
  - In areas not covered by Flood Management Plans:

Not less than 0.5 metres above predicted flood levels. Predicted flood levels are determined by reference to flooding history, a derived flood event, and existing flood protection measures.

1.6 Public Consultation

1.6.1 Questionnaire

A public questionnaire was produced and distributed by Thames-Coromandel District Council in March 2003 requesting information from residents on stormwater problems. The results from the questionnaire and site visits were used as a basis for identifying stormwater flooding issues and the areas under risk of flooding.

1.6.2 Community Board & Local Iwi

Following Council officer review, the Community Board should be presented with the information in this report for their comment as part of the consultation process.

Local Iwi should be consulted as part of the on-going development of the stormwater management plan.

2 Study Area

2.1 General Description

Whangamata is located 80km north of Tauranga on the East Coast of the Coromandel Peninsula. The town is bordered by the Otahu River to the south and the Whangamata Harbour to the north where the Wairoa Stream and Wentworth River meet the sea (Figure 1). The town is divided by the Te Anu Anu Estuary, which runs down the western side of the main part of Whangamata.

The main part of the town is fairly well developed, with few vacant sections, but is now experiencing infill development as many traditional baches are being progressively replaced with larger holiday homes, infill housing and some intensive development. There is also some residential development in the Wentworth Valley to the south and on the western side of the Te Anu Anu Estuary.

The majority of the community lies on flat sandy dune soil with very good soakage. However, the southwest community and some other areas lie on boggy land on silty clay and/or Waihi ash soils, which have less soakage potential. All these areas are flat and low-lying so are susceptible to stormwater ponding.

2.2 Stormwater Drainage System

As a general rule (and this applies to many TCDC townships) the piped stormwater reticulation serves only roadways, with private properties disposing of their stormwater by way of the excellent ground soakage available. The piped stormwater system has become more extensive since the 1997 Woodward-Clyde report (Figure 1) predominantly to the south and north.

A principal pipe system runs along Ocean Road and Williamson Road. This system is the main contributor of flow to the retention pond at Williamson Park. It is unclear whether the retention pond was designed specifically for stormwater treatment and further investigation of the characteristics of the pond is required.

All the catchments are generally flat, and have minimal hydraulic head between the land being drained and the mean high water level.

2.3 Physical Environment

2.3.1 Topography

The majority of Whangamata township has been built on the flat sandy dune areas bordered by Te Anu Anu Estuary, Whangamata Harbour, the Pacific Ocean and the Otahu River. The other two areas of the town are to the southwest (Wentworth) and the northwest, which are both on steeper land (Figure 1).

2.3.2 Geology and Soils

The Whangamata area is comprised mainly of estuarine accumulations of alluvial material and sand deposits. To the southwest and northwest the primary geological material is minden rhyolite from the volcanic eruption of the Coromandel Ranges.

2.4 Land Use

2.4.1 Existing Land Use

Whangamata is predominantly a low density, residential settlement with few areas zoned otherwise. The main zones, as designated by the Proposed District Plan[2], are Housing, Commercial, Recreational, Industrial and Extra Density. The proportions of each zoning in the study area are shown below.

Land Use	Area (%) Approximately
Industrial	2%
Commercial	2%
Recreational	3%
Extra density Residential	9%
Residential	84%

Table 2.1 Existing Land Use

2.4.2 Future Development Potential

An area of approximately 40ha has been defined in the Proposed District Plan as 'extra density residential'. This area predominantly stretches between the main commercial area on Port Road and Lowe Street and on both sides of Port Road to Beach Road. This area comprises approximately 9% of the study area.

The bulk of the development area is served by the major stormwater system on Ocean Road/Port Road that discharges either to the Lindsay Road outfall to the west or to the stormwater pond at Williamson Park. This system currently has adequate capacity, however extra density areas often result in increased runoff from roof area and paved surfaces unless soakage criteria are strictly adhered to. See Section 6 for stormwater management recommendations.

Increased development should not in theory increase runoff (given on-site soakage potential), however in reality increased development will probably result in a higher number of sites that do not utilise on-site soakage.

[2] Thames Coromandel District Council Proposed District Plan, September 1999

2.4.3 Water Quality

A study was undertaken by Environment Waikato in 2001 to investigate the contaminant load (only nutrients and faecal bacteria were considered) and water quality of the Whangamata Harbour and contributing streams. Four surveys were undertaken during summer 2001. Contaminant loads were calculated from measurements of stream flow and contaminant concentrations at sites on six streams and two stormwater outfalls flowing into the harbour. The water quality in two sub-estuaries of the harbour was also determined.

The study shows that water quality is high over large areas of the harbour during fine weather. However, in estuarine areas near the mouths of inflowing streams, concentrations of contaminants brought into the harbour in the streams can be high. In wet weather, contaminant loads in the inflowing streams can be high, so concentrations can be moderate to high over large areas of the harbour including the ebb-tide delta outside the harbour. Most of the contaminants (nutrients and faecal bacteria) come from diffuse runoff from pasture, pine forest and bush in the catchment as a whole. Under conditions of light rain, the two surveyed stormwater outfalls (at Hetherington and Achilles Roads) contributed disproportionately high loads of contaminants.

3 Hydrological Assessment

3.1 Catchment Definition

The sub-catchment boundaries used for the 1997 report were not available to Opus for this study, so updating the catchment information has proved difficult. It is, however, clear that the 1997 report considered principally road runoff (with a small adjustment for 'run on' from private properties).

Since the release of Draft Version 1 of this report, aerial LIDAR survey has been completed, which has been used to ascertain the road areas contributing to pipe flow. Using contour information generated from the LIDAR survey, catchment areas were identified for each pipe network. In order to calculate the flow entering each pipe, the catchment was divided up according to the approximate areas that would contribute flow to catch pits and therefore enter a section of the pipe. The contributing flow through each segment of pipe was then calculated. As the flow progresses through the network, it will invariably be joined with flow from additional branches within the same pipe network. The contributing area from these branches is then summed to calculate the cumulative total flow expected through a pipe network.

3.2 Pipe Flow Estimation

The Rational Method was used in conjunction with site specific rainfall data produced by NIWA's High Intensity Rainfall Design System (HIRDS) Version 2 to determine the peak flows for the design storm event as per the Code of Practice. The HIRDS rainfall data is provided in Table 3.1.

ARI	Duration				
(yr)	10m	20m	30m	1h	24h
2	13	19	23	32	107
5	<u>18</u>	26	32	56	143
10	21	30	37	53	166
20	24	35	43	61	189
50	29	40	50	71	218
100	32	45	55	78	240

Table 3.1 – Rainfall (mm) [design storm underlined]

The peak flow is assumed to occur under an average rainfall of duration just equal to the time necessary for all of the catchment to begin contributing - the Time of Concentration. A Time of Concentration of 10 minutes has been used to calculate peak pipe flows in pipe tributaries.

A Rational Formula runoff coefficient, C, of 1.0 was assumed in the Woodward-Clyde report. This figure is an amalgamation of the normal C value for impervious roads (0.85) plus an allowance for up to half as much pervious area again to contribute (berms and private properties – 50% x 0.3 = 0.15). For the sake of consistency, this same figure has been used in the present study to compare and update the earlier report.

Once the catchment area contributing to each section of pipe had been determined it was possible to calculate the stormwater flow through each pipe (downstream pipes include the cumulative upstream flow area). The stormwater flow rate was calculated using the rational method:

$$Q = CiA$$

Note that there were instances where there was insufficient information to calculate the pipe capacity. This includes pipes where either the diameter or the gradient is unknown. Early in the study, this problem was identified and TCDC initiated a study to obtain as much of the missing information as possible. The new data was then imported into the calculations.

Appendix A gives details of the calculations carried out.

3.3 LIDAR survey information

As recommended earlier, an aerial laser survey of Whangamata was completed early in the study completed as part of Version 2 of this report. The purpose of the survey was to collect contour information, to help identify flood prone areas and overland flow paths as part of a hazard mapping study.

The aerial laser survey was carried out using a LIDAR technique. LIDAR, or LIght Detection And Ranging, uses a high frequency laser mounted under an aircraft to gather high resolution information on land surface, river-bed and coastal topography. LIDAR surveys can collect contour information to 0.15m intervals. The raw data gathered is then processed into digital topography which is 'tied' to known survey data. LIDAR is being increasingly used for hazard mapping purposes, especially in low lying areas where there has traditionally been little GIS information.

The Whangamata LIDAR survey was carried out in November 2004 as part of a survey carried out for the whole Coromandel area. A contour interval of 0.5m was used.

Figure 2 shows the 0.5m contour lines for Whangamata, which have been tied in to the Earth Gravity Model 1996 (EGM) datum. The EGM includes an approximation of mean sea level, which is reasonable for preliminary work, but is not suitable for design purposes. This approximate sea level needs to be converted to local or observed mean sea level, a process which has not yet been carried out for Whangamata.

4 Hydraulic Assessment

4.1 Stream Capacity

There are no streams in the study area.

4.2 Culvert Capacity

There are no major culverts (as distinct from piped stormwater reticulation) that we are aware of in the study area.

4.3 Stormwater Disposal by Soakage

TCDC requires private properties in Whangamata to be drained by soakage to ground. In general the Whangamata sandy soils provide excellent soakage, and this system works well (this was confirmed by the responses to the stormwater questionnaire).

Woodward Clyde, in their 1997 report[3], carried out an assessment of soakage in various parts of Whangamata and concluded that:

- The existing TCDC soakpit design was appropriate for continued use.
- On-site soakage should continue to be used in the sand-based areas north of Otahu Rd.
- In other areas (including Moana Point) and on other soils a specific soakage investigation should be undertaken.

Soakage systems do however require some maintenance, and it appears that some systems may have clogged or otherwise deteriorated over time. Opus personnel noted during the course of on-site inspections that private stormwater has been diverted onto the road reserve in a number of places around Whangamata.

A major recommendation of this study is that TCDC should continue to require on-site soakage as the principal means of disposal in sandy soils. In these areas soakage is sufficiently favourable to support a high degree of site imperviousness, however Council should take steps to ensure that the systems installed receive periodic maintenance and are capable of complete replacement in future if they should become defective.

Providing there is a high-level commitment by both Council and property owners to maintaining effective soakage systems it should not be necessary to impose limitations on percentages of site impervious areas. Otherwise, controls are likely to be necessary.

[3] *Whangamata and Onemana Stormwater Management*, Woodward Clyde, 1997

4.4 Existing Piped Stormwater Reticulation Capacity

The capacity of the existing Whangamata stormwater reticulation was assessed by Woodward Clyde in their 1997 report[4]. Where sufficient pipe catchment information was available Woodward Clyde also made an assessment of anticipated stormwater flows for a range of storms, so that (within the limits imposed by incomplete information) it was possible to determine the overall adequacy of the stormwater reticulation system.

Woodward Clyde's assessment was limited by several significant factors:

- Uncertainty regarding the actual areas draining to the pipe system
- Data was missing for a number of pipes
- Uncertainty regarding the actual extent of impervious area (existing and future)

The single, most-significant issue was, and remains, the accurate definition of pipe catchment areas. This issue has been somewhat alleviated with the acquisition of 0.5m LIDAR generated contour information. The pipe system is designed to serve road carriageways only, with berms and properties draining by soakage. Woodward Clyde assumed that some runoff from private properties would also flow to the pipe system. For the purpose of their capacity calculations they adjusted the rational formula runoff coefficient, 'C', from 0.85 (as applicable to the sealed carriageway) to 1.0. This artificially high C value increases calculated flows to include an allowance for a surrounding pervious area equivalent to half the carriageway area (or a smaller mixed pervious/impervious area).

No improved catchment information was available to Opus to justify any change to these assumptions. Therefore, the assessment of pipe flows and capacities carried out for this study are based on the same assumptions as made by Woodward Clyde in their report.

To improve on these assumptions, detailed inspection and assessment of the discharge from properties and of the carriageway runoff collection system would need to be carried out.

4.4.1 Pipe Extensions and Upgrades

As part of the work for Version 1 of this report, the capacities of those parts of the stormwater reticulation that are new or have been extended or upgraded since 1997 were calculated using the same assumptions as the earlier report.

For small pipe extensions upstream of the existing pipe system a simplified analysis was carried out to avoid the need to analyse every individual pipe. Pipe capacities were checked by finding the catchment area they were capable of serving in a 5-year, 10 minute duration rainfall event (calculated using the Colebrook-White formula with k=0.6mm), and

[4] ibid

comparing this with the apparent catchment area served by the pipe from asset/contour plans.

From this investigation, we concluded that the recent pipe extensions are all of satisfactory capacity.

There have been four sizeable system upgrades carried out to the north of the study area since 1997 and there has been an upgrade of the Hetherington Road outfall to the west. The four new systems in Mako Road, Aickin Road, Casement Road and the northern end of Port Road were checked and confirmed as having adequate capacity for the design rainfall event.

Of the four major pipe systems considered, the Hetherington Road upgrade (which was recommended in the 1997 report) is closest to its design capacity. Obviously this is subject to the assumptions regarding catchment area/runoff coefficients discussed above. If the recommendations from this report relating to on-site soakage for drainage of private properties are followed, this pipe system should not need further upgrading.

4.4.2 Effect of Tide Level

It had been Opus' intention to review the effects of tide levels on the capacity of the piped stormwater systems, however it has proved difficult to obtain both tide levels and pipe data in terms of a common datum. Further analysis is warranted once the appropriate level data becomes available.

4.5 Pipe Hydraulics

As part of the work carried out for Version 2 of this report, an hydraulic analysis of all the pipes in the Whangamata network was carried out to determine the capacity of all main pipes. Sump leads and short lengths of pipe at street intersections were not included in this analysis. The actual pipe capacity was then compared with the required capacity for a 5year ARI storm event with a duration of 10 minutes. The purpose of this was to establish which pipes are sufficiently sized and which pipes are likely to require an upgrade.

The hydraulic analysis should be viewed as an initial screening only. A detailed assessment of each pipe length should be carried out as part of the detailed design process prior to upgrading.

4.5.1 Pipe Capacity Calculation

Pipe capacities were calculated using the Colebrook-White equation:

$$Q = -2A \cdot \sqrt{2gDS} \cdot \log_{10}\left(\frac{k_s}{3.7D} + \frac{2.51\nu}{D \cdot \sqrt{2gDS}}\right)$$

A friction factor of k=1.5mm was used in the pipe capacity calculations.

Pipe invert levels at the upstream and downstream nodes as well as the pipe length were used to calculate the grade of the pipe. In some instances very low grades were calculated; this resulted in a very low calculated pipe capacity (e.g. pipe 401422 with a 600mm diameter, a grade of 8.4x10-6m/m and a calculated capacity of 18L/s). However, in most instances the pipe grades appear to be realistic.

Note that actual pipe capacities are governed by the slope of the hydraulic grade line rather than the bed slope as considered here. Accordingly, these calculations should be reviewed as somewhat conservative.

Nominal pipe diameters have been used in these calculations. Actual internal diameters should be used in preliminary and detailed design once pipe class has been confirmed.

4.5.2 Pipe Comparison and Upgrade Calculations

The expected runoff for each catchment area (for a 5 year storm event) was compared with the calculated capacity of the pipe associated with that catchment area. We could then determine whether or not the pipes have sufficient capacity.

If a pipe was found to have insufficient capacity, an appropriate diameter was calculated based on the required pipe capacity. Manning's formula was used to calculate an appropriate pipe diameter and this value was then checked using the Colebrook-White equation. Manning's formula is given below:

$$Q = \frac{A \cdot R^{2/3} \cdot S^{1/2}}{n}$$

4.5.3 Results

The results from the analysis of the provided data show that out of 266 pipes, 119 pipes within the Whangamata Township are sufficiently sized, 147 pipes are undersized. Pipe gradient information was missing for 5 pipes; a pipe gradient was estimated for these pipes based on the assumption that pipe gradient would be equivalent to the average gradient in the catchment of that pipe.

Appendix A shows a list of pipes that are likely to require upgrading along with the proposed upgrade size. The undersized pipes will first require inspection to determine the validity of the data used in calculations. If the data is confirmed to be correct, then the pipe will require an upgrade; recommended pipe sizes have been calculated for each of the undersized pipes. If, in future the data is updated or otherwise found to be incorrect then the required pipe size will need to be re-evaluated. Accompanying this data is a list of pipes where insufficient information exits to calculate a pipe capacity. We suggest that an inspection of these pipes takes place so that any upgrade requirements may be determined.

The spreadsheet attached in Appendix A separates the pipes out into their respective catchments, with each catchment assigned an arbitrary name. The pipe networks within each catchment were then broken down further into branches; this making it easier to see the cumulative increase in catchment area in each successive downstream pipe. For each of the pipes, the following items are listed: road that pipe is in, asset ID, downstream pipe, pipe length, flow area contributing to the pipe, total area contributing to flow in the pipe, expected flow rate through the pipe, pipe diameter and the calculated capacity of the pipe. Also included are relevant notes.

4.5.4 Data Related Issues

The GIS information used in this study was supplied by TCDC and is relatively complete. However, assumptions were at times required to account for missing and/or ambiguous data. Such assumptions primarily included:

- Assumed pipe gradient based on gradient of ground level (estimated based on LIDAR information)
- Changes in flow direction to calculate meaningful gradients
- Connection of pipes where it was apparent that they had been erroneously separated

In some cases the pipe size decreases as flow moves through the network, (in the case of catchment X[A+B+C+D+E]). It would be unusual for this to be the case, and it is possible that the GIS data is inaccurate.

The issues mentioned above have been noted and highlighted on maps of the piping network, which are included in Appendix 7.

4.6 Main Street Upgrade

Under a separate commission, and as part of the "Whangamata Main Street Upgrade Project", Opus has carried out detailed design for stormwater upgrading in the Port Road commercial area. TCDC was anxious to ensure that below-ground stormwater infrastructure was upgraded where required before carrying out extensive above-ground streetscape works.

The upgrade includes new stormwater piping in Port Rd from Lincoln Road to Casement Road. Also included was a stormwater upgrade for a service lane to the West of Port Road between Lincoln and Casement Roads. The design consisted of new cesspits and pipes connecting into the existing concrete pipe in Lincoln Road.

It is expected that the stormwater upgrade will reduce ponding in the kerb and channel in Port Road, which from time to time threatens shops in Port Road and adjacent areas.

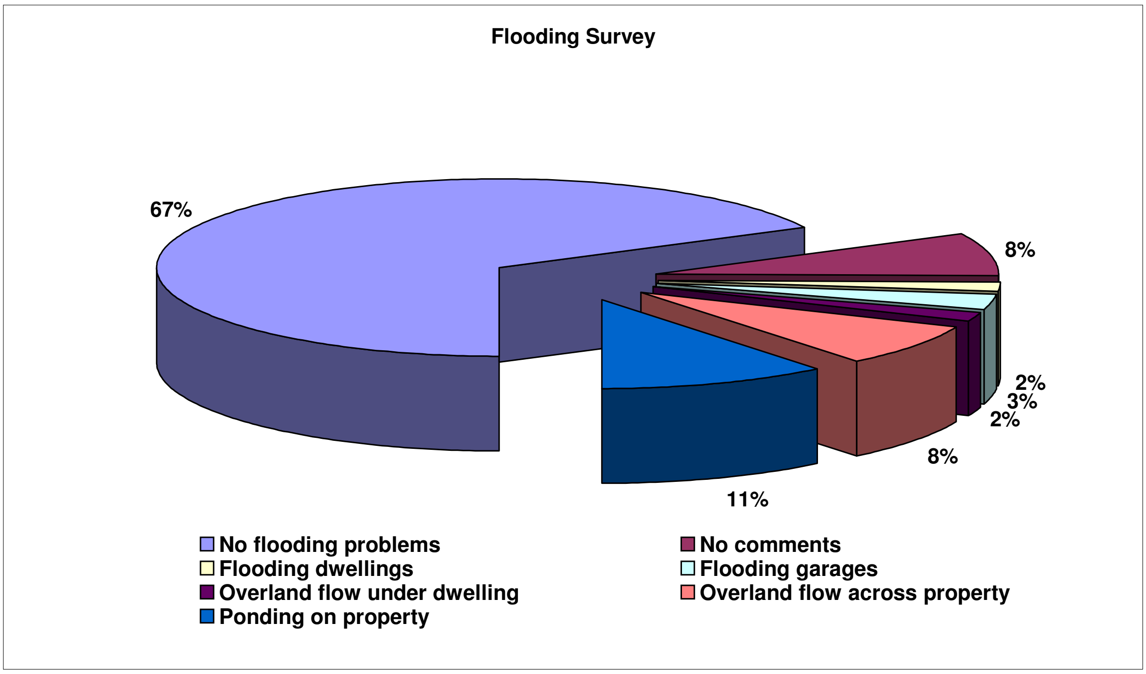
5 Assessment of Stormwater Problems

5.1 Public Questionnaire Assessment

During the production of Version 1 of this report, a public questionnaire was produced and distributed to Whangamata rate-payers by Thames-Coromandel District Council requesting information on stormwater and flooding problems. The results from the questionnaire, together with confirmatory inspections by Opus assessors in the more serious cases, were used as the basis for identifying stormwater flooding issues and the areas under risk of flooding. Of 3996 surveys sent out, a total of 1223 responses were received. Each questionnaire response was categorised by the significance of flooding reported as follows:

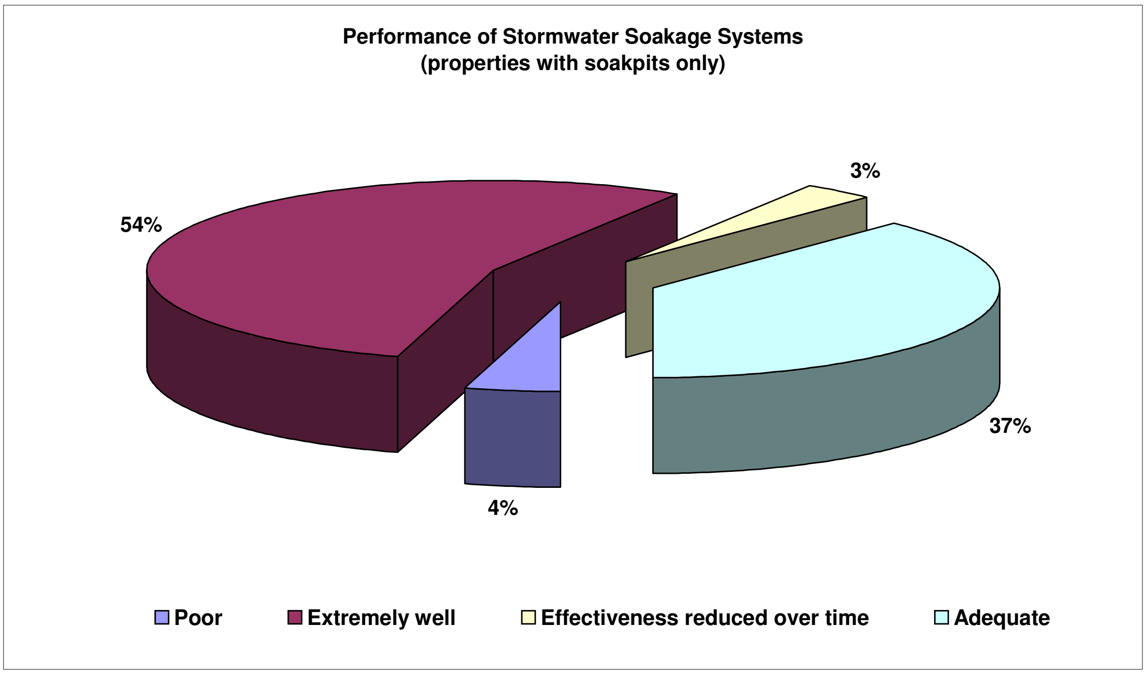
- Flooding of dwellings i.e. habitable floor levels.
- Flooding of garages/sheds
- Overland flow under dwellings
- Overland flow across property
- Ponding on property
- No flooding problems

The questionnaire responses indicate that 67% of residents have no flooding problems and the remaining 33% do experience flooding problems to some degree. A total of 2% have had their dwellings flooded, 3% garages flooded, 11% ponding on property, 2% overland flow under dwellings, and 8% overland flow across property. A graphical representation of the distribution and the nature of flooding problems is shown below:



The survey results indicate that most of the flooding problems (84%) have occurred more than once a year. This may be due to the severe storm events that occurred in the two years prior to the survey. About 3% have experienced more than 0.5m depth of flooding, 43% more than 5cm depth of flooding, 44% up to 5cm depth of flooding and 10% up to 1cm depth of flooding (measured in height above ground).

The questionnaire responses indicate that 29% do not have a soakage pit on their property (or presumably are not aware of it) and the rest (71%) have a soakage pit, of which 54% record soakage to be working extremely well. A graphical representation of the soakage performance is shown below:



A summary of questionnaire responses is provided in Appendix C.

5.2 Flooding Issues

This stormwater investigation has identified several flooding issues in the Whangamata township area based on the questionnaire survey, site visits and reticulation deficiencies. These are summarised below:

5.2.1 Blockage of Pipe Outfalls

A number of stormwater pipe outfalls discharge to open beach or active tidal channels. These outfalls (particularly those discharging below mean high water spring tide level) are vulnerable to blockage by sand or debris, which may seriously reduce system capacity. The low heads and shallow gradients that the pipes are laid to may mean that there is insufficient hydraulic head available to scour the sand blockage clear, even with a full pipe. Sand and silt build-up can occur over a very short period of time.

Ongoing maintenance is likely to be only partially successful; due to the short time taken for the pipes and culverts to become blocked again, maintenance would have to be very intensive to keep pipes and culverts clean.

The best long-term solution to silt build-up in pipes and culverts is to ensure pipes and culverts are designed above the silting level.

5.2.2 Natural Sand Basins

Around Whangamata (particularly behind the coastal foredunes) are a number of natural sand basins that are lower than surrounding ground. Some of these basins are quite deep – up to 3.5 m – making it impractical in many cases to connect these areas to the piped stormwater reticulation. Unfortunately in the past dwellings have been built in these depressions without regard to flood potential. The most serious flood problems identified in this study relate to houses built in these depressions without adequate freeboard above ponding and/or overflow levels.

Some residents indicated that flooding in these basins is related as much to the groundwater level rising above ground level as it is to surface water running into the area from outside. Insufficient groundwater data is available to confirm the validity of these claims.

Regardless of whether flooding in these basins is from groundwater mounding or stormwater inundation, the most appropriate flood mitigation measure is for all future houses in these basins to be constructed at a suitable level above ponding and/or natural overflow levels.

5.3 17th – 18th May 2005 Flooding

On the 17th-18th May 2005 a rainfall event occurred where over 440mm of rain fell in approximately 48 hours. This event had an estimated return period of 150 years in Whangamata, and caused localised flooding to a number of places within the Coromandel. The rainfall covered a period of approximately one and a half days with periods of heavy rain.

On the 17th May, Opus carried out a site survey which assessed ponding in carriageway and private properties. A number of photos were taken which provide details of ponding and flooding. Appendix F includes a CD with the photo essay; each photo name records where the photo was taken.

Most of the May 2005 flooding can be attributed to two main causes; flow from roads entering private properties, and ponding in local low-lying areas.

5.4 Overland Flow Path Estimation

Using a combination of the LIDAR data, existing pipe network information and knowledge of areas with a history of flooding, the location of potential overland flow paths were estimated and mapped.

The LIDAR information, plotted at 0.5m intervals showed local low points and areas. Flow direction through these areas is indicated in Appendix 5 with the use of arrows. Where the direction of the flow is uncertain, double headed arrows have been used. The arrows should be considered a general guide to flowpath location only; in relatively flat topography flowpaths can easily be diverted by relatively minor surface features like landscaping or walls/fences.

In most cases, overland flow paths occur in road reserve, either in the kerb and channel area, or in the road side swale area. In some areas however, it appears the overland flow path traverses private property. Such private properties with existing houses will require further stormwater management. This is discussed in more detail in Section 6. Any building consents for the properties in these areas need to be issued with caution. The overland flow path estimation is a guide only and seeks to highlight a potential flood risk warning to consenting staff. Any building consents for the properties in these areas need to be issued with caution, to ensure the proposed building is free from flooding and the overland flowpath is not obstructed. Levels on the Overland Flow Path Figure are metres above local ground level, not taking into account the invert level of any existing open channel.

Site specific information should be collected and calculated prior to issuing building consents in – or close to – overland flow path areas.

5.5 Other Stormwater Issues

5.5.1 Water Quality Issues

The major issues associated with stormwater quality are as follows:

- Road runoff - particularly from high-volume roads – is a major source of contaminants: metals, hydrocarbons, trace organics, litter, and suspended sediments.
- Spillages of fuel at petrol stations will contribute contaminants to the stormwater system unless appropriate interceptors are installed.
- Silt and sand contamination which pollutes waterways with sedimentation and blocks pipes and sumps reducing their capacity.
- Local industrial activities may contribute contaminants through spillages, stormwater runoff from processing areas, litter, etc.

- Agricultural activities are a major source of non-point source contaminants, but these are not connected to the town stormwater reticulation.
- Litter is a relatively low-level contaminant, but is highly visible and attracts disproportionate public attention.

5.5.2 Williamson Park Pond

The Williamson Park pond receives stormwater from a 1200 mm dia pipe, providing a degree of treatment, peak flow attenuation and soakage disposal of flows. The presence of the pond reduces the frequency of discharge across the beach and any associated scouring.

One neighbour expressed concern about the potential for the pond to flood to a depth that would threaten their home. Survey of the pond conducted as part of this study indicates that this is unlikely.

Other residents expressed concern regarding the unattractive and potentially unsafe condition of the pond with litter and broken glass being a hazard.

6 Stormwater Management Options

Two broad options exist for the management of stormwater in Whangamata.

- A comprehensive primary piped reticulation system can be installed to serve the entire Whangamata community, conveying stormwater to beach and estuary outfalls.

- Stormwater disposal from private properties can continue to be principally by soakage to the sandy soils, with the piped system merely serving roadways.

This section discusses these broad strategies and the associated issues before focussing on specific infrastructure upgrades to address specific problems.

6.1 Comprehensive Reticulation Option

Stormwater reticulation is the option adopted by most urban communities who do not enjoy the favourable soakage experienced in much of Whangamata. To implement this option at Whangamata would involve substantial upgrading and extension of virtually the entire township reticulation. This approach has a number of disadvantages:

- Upgrading involves huge costs (although a proportion of this cost may be recoverable from the future beneficiaries if a robust financial contributions policy is implemented).

- Whangamata's topography is flat, necessitating low pipe gradients and larger pipe sizes (and therefore still higher costs).

- Many of the beach and harbour outfalls are susceptible to blockage by shifting sand. Consequently there is a risk that the system will not be fully available when it is needed most.

6.2 Continuation of Existing Stormwater Disposal Regime

The current stormwater regime, involving soakage disposal for private properties and piped reticulation for roadways is favoured since:

- Most of Whangamata is underlain by free-draining sands

- The soakage component reduces total flows arriving at the pipe system and slows the time of concentration of these flows.

- This regime minimises pipe reticulation costs.

Opus recommends that private properties on the sandy soils north of Otahu Road continue to utilise ground soakage as their principal means of stormwater disposal. Elsewhere soakage should also be utilised where practicable, however each development site will need a specific soakage investigation and design.

During the course of this study consideration was given to setting limits on the percentage of site imperviousness in an attempt to limit stormwater runoff. It quickly became apparent that such controls are not justified *providing* effective on-site soakage systems are installed and maintained. Woodward Clyde found that the soakage capacity of Whangamata sands exceeds the rate of rainfall in a 5-year storm event with a duration of 10 minutes. It should therefore be feasible to provide soakage disposal even on highly impervious sites (such as commercial or high-density residential areas). In these cases the soakage devices may well have to be constructed underneath paved areas, and appropriate maintenance provisions will need to be made.

6.3 Proposed Stormwater Management Strategy

A suggested strategy for stormwater management for the Whangamata area is as follows (refer also the Engineering Standards in Section 1.4.6):

- Bridge crossings should be sized to convey the 100-year ARI flood event.
- Main stream channels and their associated flood plains should be capable of passing the 100-year flood event without causing damaging flooding.
- Other overland flow paths should be sized to convey the 50-year ARI storm event, unless measures are in place to manage these extreme events by storage and/or soakage.
- All roads should have a suitable stormwater disposal system to avoid uncontrolled spillage of stormwater onto private properties. Flows from extreme events (up to 50 year ARI) should be managed by either providing adequate overland flow paths or by utilising the storage and soakage available within the road drainage system.
- Piped reticulation should be designed to convey the 5-year ARI flow from roadways. Measures should be incorporated in design to pond or convey flows from bigger events without causing damaging flooding.
- Private properties should drain by soakage. South of Otahu Rd full soakage investigations will be required for design of soakage systems.
- Private property owners should be encouraged to upgrade defective private drains/soakpits/driveway culverts and implement other private flood mitigation works where required.
- Building floor levels should be constructed a sufficient height above surrounding roads/flowpaths/ponding areas. Some of the sand basins in Whangamata extend over several properties, and an overflow point some distance from the house concerned may determine flood level. Some of these hydraulic controls may not be immediately obvious from within the property concerned. We recommend that these basins are identified, surveyed and minimum floor levels set.

- It may be practicable to drain some sand basins by extending existing pipe reticulation (where pipe levels are satisfactory). Such infrastructure should reduce the extent of 'nuisance' flooding occurring, but should not be considered to have alleviated flooding in extreme events. Minimum building floor levels should still be observed as noted above.

- Filling of existing sand basins is a possibility, but will usually be impracticable due to the existence of dwellings, roads, etc. Care should be taken with any filling to ensure that the fill material has similar soakage characteristics to the underlying sandy soils.

- Other flood-prone dwellings should be protected in priority order based on the magnitude and frequency of flooding and the degree of community benefit involved.

- Public stormwater infrastructure should receive regular inspection and maintenance. In particular coastal outfalls should be cleared regularly, roads should be swept and cesspits cleaned.

- TCDC should consider measures to ensure that on-site soakage systems are maintained fully operational. Options might include education, TCDC inspection or testing, or requiring owners to submit 'warrants of fitness' from suitable independent assessors on a regular basis. This initiative needs further thought and investigation, since many on-site systems are difficult to locate, let-alone review.

6.4 Road Drainage

This report makes a global recommendation that carriageway drainage should be provided and/or upgraded where necessary on all roads to control stormwater. There are two main options for achieving this:

- Kerb and channel

- Grass swales in road berms

Grass swale drains have been favoured in this report for the following reasons:

- They may be laid at relatively flat grades without risk of blockage.

- Peak stormwater flows can be reduced by soakage through the swale base

- Some storage of peak flows can take place within the swale.

- Times of concentration are maximised, thereby reducing peak flows

- Swales are typically cheaper than kerb and channel, and piped reticulation may also be reduced.

- Swales are in keeping with the beach settlement 'feel' of Whangamata.
- Stormwater treatment occurs within the swale.

6.5 Maintenance

A fundamental assumption of stormwater planning is that sufficient maintenance will be undertaken to allow the stormwater system to operate at capacity when required. Regrettably this does not always appear to have been the case in Whangamata in the past.

The following maintenance works are recommended as a matter of priority:

- Roads should be swept regularly (suggested frequency is every 3 months, with greater frequency on principal roads, in commercial areas, and in areas subject to wind-blown sand).
- Cesspits should be cleaned every 3 months
- All stormwater outfalls should be inspected at least monthly. Drifting sand, litter and any obstructions should be cleared as required so that pipe capacity is not impaired.
- "Lost" manholes should be located, raised to surface level where necessary and entered into Council's GIS system.

6.6 Stormwater Quality Options

Options considered to improve stormwater quality and protect the downstream receiving environment include:

- Implementation of source control or pollution prevention techniques at high-risk industrial and commercial sites (e.g. oil separators, grit and/or grease traps).
- Implementation of spill contingency plans for spills of substances into the stormwater system from high-risk sites (e.g. fuel stations, trucking depots, etc.)
- Implementation of source control or pollution prevention techniques for roadways and public areas: regular cesspit cleaning and street sweeping, provision of litter traps, planting
- Provision of drainage swales to treat stormwater. In addition to their stormwater treatment role, swales also provide a measure of stormwater detention and soakage disposal.
- Implementation of appropriate site development controls for new buildings and developments, and carrying out of checks on on-site drainage facilities.

- Consider opportunities for installation of catchment-wide stormwater treatment devices to capture and reduce contaminants (e.g. ponds, wetlands, litter traps, etc.). In particular we suggest that stormwater treatment might be considered on drains serving high-volume roads, commercial and industrial areas. Therefore the pipe outfalls in Lindsay Rd, Aickin Rd, Hetherington Rd and Port Rd are suitable candidates for stormwater treatment devices.

6.7 Specific Upgrading Options

Table 6.1 identifies a range of specific stormwater issues by location together with potential management measures. A preliminary order-of-magnitude cost has also been estimated to give a rough indication of the level of funding that may be required. Note however that the proposals are conceptual only, and no preliminary design has been undertaken.

The stormwater management options considered in Table 6.1 are intended to alleviate the major flooding problems i.e. flooding of dwellings and garages. In some cases there is insufficient information to fully evaluate an option and further investigation has been recommended. In some cases it is likely that physical works alone cannot mitigate flooding issues, and some planning, regulatory or policy measures may be required.

Street	Issues	Options	Relative Cost[1,2]			Data and Investigations Required
River Flooding Areas						
	River flooding is outside the scope of this study	A study into the potential effects of flooding of the main river systems upon the township of Whangamata is recommended. The wider tidal estuaries adjacent to Whangamata are expected to have adequate capacity.				
Localised Flooding Areas						
Aberdeen	105, Flooding due to blocked cesspits	Existing cesspits at intersection of Aberdeen/Chartwell are to be retrofitted with back entry blocks, along with upgrade of pipe in Chartwell Avenue (between Aberdeen and Charleston – see pipe upgrade table)	$90k	$108k	$119k	
Achilles	406B, Flooding in private property due to flow from road	Option 1: Raise crossing to prevent inflow from road reserve Option 2: Install 240m 225mm diameter pipe to existing pipe in Ocean Road	$88k	$106k	$116k	
Aickin Rd	102, Flooding in private property due to contour of property forming local low point	Construction of apartments is planned for this site. Detailed stormwater management options have been outlined in separate letter by Opus to TCDC dated 25th May 2005	n/a	n/a	n/a	
	111 Flooding in private property and garage due to lack of kerbing and stormwater system in road	Install stormwater pipes and cesspits in road	$14k	$17k	$19k	
Barbara Ave	118, 120, 121A, 123, 125A, and 125B, Barbara Ave reported flooding issues. It appears that this area may receive run-off from the service lane behind the shops, which is not well serviced in terms of stormwater reticulation.	Provide local stormwater reticulation in the service lane connected to the existing reticulation in Lincoln Rd. Catchpits should be installed to capture surface water. The adequacy of individual on-site soakage disposal of runoff from roof and paved areas should be investigated. Similar but less severe stormwater problems are reported adjacent to the service lane on the other side of Lincoln Rd. It would be sensible to extend the stormwater reticulation in this direction also.	***$108k**	**†$130k**	**‡$143k**	Investigate adequacy of on-site disposal systems. Confirm levels and adequacy of downstream reticulation.
Barrowclough Rd	203 & 219, Flooding into private property and garage caused by undersized cesspit lead	Replace existing cesspit with double and increase connection size from 150mm to 300mm diameter	$28k	$34k	$38k	
Beach Road/Martyn Road	Flooding into private property and garage due to undersized outfall pipe work	Outfall pipe size needs to be increased	$118k	$142k	$156k	
Beverley Rd	114 & 116, Flooding to private property and houses due to house being constructed in local low point and runoff from road	Install kerb & channel, cesspits and pipework in road	$37k	$44k	$49k	
Casement Road	225, Corner of Casement and Martyn	Option 1: Lower Martyn Road to allow Overland Flow Path to direct water away from property Option 2: Install back entry cesspits to replace existing cesspits	$7.5k n/a	n/a $156k	n/a $172k	
	A number of properties along Casement Road have either been flooded or have reported stormwater problems. These properties tend to be low-lying and receive run-off from the road.	Install a road drainage swale along at least one side of Casement Rd. If practicable, consider extending the stormwater reticulation from Casement Rd into this area to drain the swale. Ideally swale drains should be installed both sides of Casement Rd, however the accompanying cost estimate is for the one-side-only minimum option.	*$145k	†$174k	‡$191k	Carry out a topographic survey to ensure that it is practicable to drain Casement Rd basin into the existing reticulation.
	Flooding on-road in vicinity of industrial area impedes access and disrupts work	Install channel for water to flow from Casement Road to estuary and reduce flooding in road	$10k	$12k	$13k	
Diana Ave	115, Flooding of properties and garages caused by lack of kerbing or stormwater system	Requires additional cesspits and pipework	$38k	$46k	$51k	
Esplanade Drive	A number of houses at the northern	Opus considered an open swale alongside the car park in Esplanade Drive (both sides	$19k	$22k	$25k	Carry out topo survey of the low-lying area

Street	Issues	Options	Relative Cost[1,2]			Data and Investigations Required
	end of Esplanade Drive have been flooded. These houses are in natural depressions and run-off from the carpark opposite may exacerbate the problem.	of Graham St), together with a piped stormwater drain connecting with the existing reticulation in Graham St. Unfortunately, this may not be practicable. Further survey is needed to confirm. Without such drainage works there is little that can be done other than enforcing appropriate floor levels for new buildings.				and confirm whether it is practical to drain towards the existing stormwater system in Graham St.
Harbour View Road	614, Flooding into private property due to lack of kerbing or stormwater system	Requires additional cesspits and pipework	$67k	$80k	$89k	
Hetherington Road	310, flooding into private property due to lack of cesspits	Option 1: Raise kerb and channel in vicinity of property to restrict flow from road Option 2: Owner to Install and maintain onsite soakage system	$8.9k	$11k	$12k	
Kiwi Rd	101A & B, Water appears to be entering private property from road	Option 1: Construct bund in vicinity of property to keep water out	$9k	n/a	n/a	
	122 & 128, Flooding into private property and garage from road	Option 1: Construct overland flow path from Kiwi Road to depression in Golf Course via walkway to golf course adjacent to 128, ensuring flow is directed away from private properties. Allow depression in golf course to act as soak pit.	n/a	$14k	n/a	
		Option 2 (solution for entire length of Kiwi Road) Install 500m of 375 mm diameter pipe to existing system in Williamson Road.	n/a	n/a	$56k	
Mooloo Crescent	Houses *and road* are in a deep natural sand basin, with no natural outlet.	There is no apparent solution. The basin is probably too low to drain into nearby stormwater reticulation. It is probably also impracticable to cut down the foredunes to permit drainage to the beach as this might also permit seawater entry. The house sections are well developed, so that filling of the basin would be difficult. House-raising may be practicable as a private work. Policy measures are recommended relating to maximum impervious surfaces and height of building floors above the surrounding dune level. It is possible that water from the cul-de-sac of St Patricks Row may be flowing to Mooloo Cr via a walkway which connects the two. This should be investigated and if necessary, stormwater should be addressed from St Patricks Row.	$19k	$22k	$25k	A more detailed topographic survey of the basin and house floor levels is recommended.
Ocean Road	210, House lower than kerb and channel	Option 1: Owner to install private onsite soakage system Option 2: Owner to install private pump to pump stormwater to council pipe	n/a	n/a	n/a	
Pipi Road	130, Three properties in this area have flooding problems. It appears that these houses receive road run-off.	Option 1: Provide additional catchpit capacity by re-building existing catchpits or installing additional pits. Option 2: Drainage swales on both sides of Pipi Rd may also assist. Option 3: Lay 240m 300m diameter stormwater pipe	$22k n/a n/a	n/a $33k	n/a $86k	Review capacity of existing reticulation. Perceived pipe-entry problem may in fact be due to pipe capacity shortfall.
Pohutukawa Crescent/Otahu Road	110 Pohutukawa Crescent & 801 Otahu Road have been flooded. The houses are located in natural sand basins behind the dunes.	Upgrade road drainage by constructing an open swale. Extend existing stormwater reticulation to serve swale.	*$36k	†$43k	‡$48k	Carry out topo survey of the low-lying area and confirm that it is practical to drain towards the existing stormwater system.
Port Road	114A & B, experiences flooding of properties and shops because stormwater system is undersized	Option 1: Increase pipe size from cesspit to existing stormwater pipe, 10m of 225mm diameter	$5.4k	$6.5k	$7k	
	1000 and 1001 Port Road report flooding problems. These are low-lying properties and receive road run-off. Collection of road run-off in this area appears to be inadequate.	Replace the inadequate road catchpits with a new double catchpit each side of Port Rd. Provide increased maintenance to ensure any blockage is promptly rectified.	$6k	†$7k	‡$7.3k	
Ranfurly Rd	307B, Flooding private property, and basement garage due to lack of kerb and channel in road	Install pipe and cesspits	$61k	$73k	$80k	
St Patricks Row	120B, Flooding in cul-de-sac, possibly entering Mooloo Cr via walkway which connects the two streets	Investigate the option of allowing stormwater to flow through sand dunes to beach	$16k	$19k	$21k	
Sylvia Road	118, Flooding to private property due	Install kerb and channelling in road	$5.4k	$73k	$81k	

Street	Issues	Options	Relative Cost[1,2]			Data and Investigations Required
	to lack of kerb and channel in road					
Park Ave	104 & 106, Flooding of driveway preventing vehicle access caused by direct discharge into open drain	Existing pipe is undersized. Replace with 70m of 375mm diameter pipe	$27k	$32k	$35k	
Tuck Road	Area around 215 -219 Tuck Road has had a number of reported flooding problems. These houses have a low-lying basin located at the back of the sections and appear to receive road run-off from Tuck Road.	Option 1: Carry out maintenance on existing soak pit in road reserve to improve performance Option 2: Install 150m 225mm diameter pipe to existing pipe in The Square/Rutherford Road Option 3: Install 190m225mm diameter pipe to existing pipe in Port Road	$2k n/a n/a	n/a $35k n/a	n/a n/a $40k	Confirm level and adequacy of downstream reticulation in relation to area to be drained.
Wattle Place	Flooding to factory accessways and properties	Construct a surface channel from end of road to estuary. Ensure existing kerb and channel is not blocked with gravel by cleaning out on a regular basis.	$9k	$11k	$12k	
Whangamata Motor Camp	The motor camp has had overland flow, which has resulted in flooding of the camp ground in past years.	More investigation is required to adequately define source and extent of problem. May possibly be aided by construction of additional catchpit capacity in Barbara Ave. Address this area through specific flood investigation prior to any redevelopment.	$16k	$19k	$21k	Confirm nature and extent of stormwater problem.
Williamson Golf Course	A number of properties surrounding the golf course report some stormwater issues. The golf course is bounded by a number of mounds resulting in ponding between the golf course and the houses bordering the course. The golf course also reports issues, which are probably related to water ponding on site.	A site survey is needed to confirm levels and define the precise nature of the problem. The golf course represents a large pervious area, and it may be practicable to utilise the soakage potential of the site. Once survey is available it may be practicable to re-contour to move flood-waters away from the private properties and manage them on the golf course	$19k	$22k	$25k	A specific investigation is required to determine the reason for the reported house flooding. A soils/soakage investigation is therefore also recommended.
Winifred Ave	101, flooding of café, due to inadequate stormwater system and cesspits	Option 1: Install soak pit in car park Option 2: Install gobi blocks in car park	$34k	$112k	$123k	
		Sub-total local works	**$1,065k**	**$1,604**	**$1,860k**	
General Stormwater Issues						
Overland Flow	Lack of adequate road drainage is resulting in road run-off entering low-lying properties	Install stormwater swales in road berms where practicable. Kerb and channel may be a suitable alternative in some cases, but is less in keeping with the beach settlement 'feel' of Whangamata. Kerb & channel provides no ponding or soakage of flows and is usually more expensive also.				Conduct a town-wide assessment of adequacy of carriageway drainage for all streets.
Ponding	Resulting from a number of sand basins around the Whangamata township	Provide pipe reticulation to drain these basins where it is practicable to do so. Elsewhere regulate to control minimum floor levels, etc.				
Coastal Stormwater Outfalls	Blockage by sand drifts.	Implement a regular inspection and maintenance regime for stormwater outfalls. Clear away accumulated sand as necessary.				Draw up and implement a maintenance schedule. Investigate outfall configurations that will minimise blockage risk.
Williamson Park Stormwater Pond	Public perceive the pond as unattractive and potentially hazardous	. Either construct sediment forebay with litter boom, or install a gross pollutant trap upstream of pond. Landscaping and planting of pond and environs is also recommended.	$30,000 (forebay option)			
	The steep banks around the stormwater pond may present a hazard	Establish dense planting to discourage human access, install fences or re-batter pond slopes	$15,000 (planting option)			
Groundwater mounding	Widespread soakage disposal may lead to elevation of the groundwater level, which may be sufficient to cause ponding in the low-lying sand basins.	Install monitoring to determine existence/magnitude of problem.	$60,000			Install groundwater level monitoring points, and monitor for at least one year.

Street	Issues	Options	Relative Cost[1,2]			Data and Investigations Required
Piped Upgrades	Upgrade pipes identified as having inadequate capacity (refer Appendix A)		**$5,696k**	**$6,834k**	**$7,518k**	

[1] For further details see Appendix E
[2] Does not include maintenance costs
** Draft Version 1 report cost*
†Draft Version 1 report cost plus 20%
‡Draft Version 1 report cost plus 32%

Table 6.1 Stormwater Management Options

7 Recommendations

The following recommendations arise from the study to date as well as previous studies. Several recommendations require additional investigations to be made before a definitive scope of physical works and cost estimate can be prepared.

7.1 Policy Recommendations

- Private properties should drain to on-site soakage systems and piped public stormwater reticulation should be designed to serve generally roadways only.
- No new building should be permitted within any identified 100 year ARI flood hazard area. Where the 100-year flood level is not available but a flood hazard has been identified, a specific engineering assessment should be undertaken prior to the issuing of any building consents.
- Road drainage should be provided principally by open swales rather than kerb and channel.
- In the absence of specific study, all new buildings shall be constructed at least 300 mm above road level and 500 mm above the surrounding dune overflow level (whichever is higher).
- Flood hazard areas and existing flood problems reported in this study should be entered onto Council's hazard register until such time as the flood hazard is removed.
- That TCDC develop a financial contributions policy to enable infrastructure to be provided or upgraded to meet future development requirements.
- No development should be permitted that will worsen the flooding experienced by any existing flood-prone property.
- Private property owners should be educated regarding the importance of installing and maintaining adequate on-site soakage facilities. Similarly they should be discouraged from importing soil or carrying out landscaping/siteworks that will reduce the infiltration capacity of the ground.
- Private on-site soakage facilities should be configured to allow capture of litter, leaves and sediment in an easily cleaned chamber prior to the soakage chamber so that the soakage device does not become clogged.

7.2 Catchment-Wide Recommendations

- That TCDC develop and implement a programme of regular cesspit and stormwater outlet inspections and maintenance works (refer section 6.5).
- All undersized or otherwise inadequate cesspits in roadways should be removed and replaced with standard 675x450 mm cesspits. Soakage disposal may be

encouraged by constructing cesspits without concrete bases, however the ground-water contaminant potential of such devices will need to be considered.

- Provide and/or upgrade as necessary the roadside swales on all roads to eliminate the uncontrolled runoff of stormwater.

7.3 Localised Flooding Areas

- Implement the stormwater system upgrading recommended in table 6.1, after undertaking such additional investigations as are necessary.

7.4 Further Study or Investigation

- That TCDC arrange for soakage testing to be carried out in areas of known flooding. In conjunction with this investigation carry out an assessment of a sample of existing on-site soakage systems to determine whether these systems are contributing to existing flooding problems, and/or whether they can be enhanced to mitigate existing flooding problems.

- Investigate whether river flooding is likely to contribute to flooding in any part of Whangamata Township.

- That TCDC arrange for an on-the-ground appraisal to be made of the performance of the Whangamata stormwater reticulation during wet weather flows.

- That in conjunction with further investigation, preliminary design of stormwater management options be carried out for areas with known flooding problems.

- That flood modelling be carried out to provide amore confident estimation of flood levels and consequently, finished floor levels of buildings

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Constants

C	1.00	
K	1.50	mm

Catchment	Path	Road	Pipe ID	To Pipe	Pipe L	Total Area	Total Area	Rain Depth	Rainfall Int	Flow Rate	Calc Capacity	Pipe D	Indicative Pipe Upgrade
					m	*m^2*	*Ha*	*mm*	*mm/hr*	*L/s*	*L/s*	*mm*	*mm*
A	A	HARBOUR VIEW ROAD	101249	401427	11.6	2318	0.2318	11.35	68.1	44	27	225	300
		BEACH ROAD	401427	404128	48.5	4636	0.4636	11.35	68.1	88	71	300	375
		BEACH ROAD	404128	Outfall	40.0	4636	0.4636	11.35	68.1	88	71	300	375
B	A	HARBOUR VIEW ROAD	101252	101251	38.9	15713	1.5713	11.35	68.1	297	60	225	450
		MARTYN ROAD	101251	401428	1.8	17193	1.7193	11.35	68.1	325	64	225	450
		MARTYN ROAD	401428	401429	34.3	17193	1.7193	11.35	68.1	325	66	300	525
		MARTYN ROAD	401429	401430	81.2	17193	1.7193	11.35	68.1	325	102	300	525
		MARTYN ROAD	401430	401431	23.6	21208	2.1208	11.35	68.1	401	78	300	600
		BEACH ROAD	401431	401432	9.8	21208	2.1208	11.35	68.1	401	141	300	600
		BEACH ROAD	401432	Outfall	19.9	21208	2.1208	11.35	68.1	401	141	300	600
C	*A*	*BEACH ROAD*	*401433*	*Outfall*	*37.3*	*3030*	*0.303*	*11.35*	*68.1*	*57*	*281*	*375*	
D	*A*	*BEACH ROAD*	*403837*	*Outfall*	*37.4*	*3030*	*0.303*	*11.35*	*68.1*	*57*	*72*	*225*	
E	A	TUCK STREET	401392	403244	29.5	3628	0.3628	11.35	68.1	69	411	225	
		PORT ROAD	403244	401391	31.2	8616	0.8616	11.35	68.1	163	74	300	450
		PORT ROAD	401391	401390	53.7	8616	0.8616	11.35	68.1	163	74	300	450
		PORT ROAD	401390	401387	77.3	9916	0.9916	11.35	68.1	188	9	300	525
	B	BARROWCLOUGH ROAD	401389	101206	23.6	3910	0.391	11.35	68.1	74	449	225	
		PORT ROAD	101206	401387	27.1	5495	0.5495	11.35	68.1	104	51	225	300
	A+B	PORT ROAD	401387	401434	126.3	20502	2.0502	11.35	68.1	388	78	450	525
	C	HARBOUR VIEW ROAD	401386	102420	14.7	5530	0.553	11.35	68.1	105	469	225	
		PORT ROAD	102420	401434	27.7	7115	0.7115	11.35	68.1	135	51	225	375
	A+B+C	PORT ROAD	401434	401435	67.0	34274	3.4274	11.35	68.1	648	175	525	
		PORT ROAD	401435	401437	28.7	36384	3.6384	11.35	68.1	688	718	525	
		BEACH ROAD	401437	401438	27.1	36384	3.6384	11.35	68.1	688	899	600	
		BEACH ROAD	401438	401439	35.6	36384	3.6384	11.35	68.1	688	496	600	675
		BEACH ROAD	401439	Outfall	17.4	38504	3.8504	11.35	68.1	728	2162	1050	
F	A	RUTHERFORD ROAD	401385	401384	9.6	3153	0.3153	11.35	68.1	60	163	300	
		RUTHERFORD ROAD	401384	401440	7.6	4474	0.4474	11.35	68.1	85	74	225	300
		RUTHERFORD ROAD	401440	401442	51.4	4474	0.4474	11.35	68.1	85	142	375	
		BARROWCLOUGH ROAD	401442	401441	231.7	11758	1.1758	11.35	68.1	222	124	375	525

Catchment	Path	Road	Pipe ID	To Pipe	Pipe L	Total Area	Total Area	Rain Depth	Rainfall Int	Flow Rate	Calc Capacity	Pipe D	Indicative Pipe Upgrade
					m	m^2	Ha	mm	mm/hr	L/s	L/s	mm	mm
		MAKO ROAD	401441	Outfall	121.1	21302	2.1302	11.35	68.1	403	219	450	600
G	A	WINIFRED AVENUE	101199	101198	2.7	3605	0.3605	11.35	68.1	68	74	225	
		WINIFRED AVENUE	101198	401381	69.6	3605	0.3605	11.35	68.1	68	32	225	300
		WINIFRED AVENUE	401381	401379	20.5	4906	0.4906	11.35	68.1	93	106	300	
		PORT ROAD	401379	401361	108.3	8356	0.8356	11.35	68.1	158	68	450	525
	B	HUNT ROAD	401363	401362	11.0	1422	0.1422	11.35	68.1	27	738	225	
		HUNT ROAD	401364	401362	10.8	1422	0.1422	11.35	68.1	27	696	225	
		PORT ROAD	401362	401361	45.2	2844	0.2844	11.35	68.1	54	58	375	
	A+B	HETHERINGTON ROAD	401361	401360	64.9	13876	1.3876	11.35	68.1	262	112	375	525
		HETHERINGTON ROAD	401360	401359	120.9	15541	1.5541	11.35	68.1	294	134	375	525
	C	CASEMENT ROAD	101197	101195	31.8	3092	0.3092	11.35	68.1	58	50	225	300
		CASEMENT ROAD	101195	401370	173.3	6475	0.6475	11.35	68.1	122	19	225	375
		CASEMENT ROAD	401370	401369	92.6	8202	0.8202	11.35	68.1	155	88	300	375
		HETHERINGTON ROAD	401369	401359	18.2	8202	0.8202	11.35	68.1	155	79	300	450
	A+B+C	HETHERINGTON ROAD	401359	403899	38.9	26048	2.6048	11.35	68.1	493	161	450	525
		HETHERINGTON ROAD	403899	401358	34.8	26903	2.6903	11.35	68.1	509	242	525	675
		HETHERINGTON ROAD	401358	401357	43.6	29133	2.9133	11.35	68.1	551	366	525	600
		HETHERINGTON ROAD	401357	401356	28.4	29988	2.9988	11.35	68.1	567	366	525	600
		HETHERINGTON ROAD	401356	401343	166.9	30508	3.0508	11.35	68.1	577	943	600	
	D	THE SQUARE	401443	401447	62.0	4699	0.4699	11.35	68.1	89	67	300	375
		THE SQUARE	401447	401446	109.9	5932	0.5932	11.35	68.1	112	180	375	
		MARTYN ROAD	401446	401445	58.2	9663	0.9663	11.35	68.1	183	81	375	525
		MARTYN ROAD	401445	401343	74.6	10538	1.0538	11.35	68.1	199	67	450	675
	A+B+C+D	MARTYN ROAD	401343	404106	20.9	45513	4.5513	11.35	68.1	861	1286	675	
		HETHERINGTON ROAD	404106	401342	2.8	45973	4.5973	11.35	68.1	870	1502	675	
		HETHERINGTON ROAD	401342	401341	6.0	45973	4.5973	11.35	68.1	870	1199	675	
		HETHERINGTON ROAD	401341	401324	59.0	45973	4.5973	11.35	68.1	870	542	600	750
		HETHERINGTON ROAD	401324	404129	79.0	47309	4.7309	11.35	68.1	895	400	600	825
		HETHERINGTON ROAD	404129	404130	51.0	48875	4.8875	11.35	68.1	925	216	675	1200
		HETHERINGTON ROAD	404130	401323	4.4	50303	5.0303	11.35	68.1	952	216	675	1200
		HETHERINGTON ROAD	401323	Outfall	88.1	50303	5.0303	11.35	68.1	952	216	675	1200
H	A	CASEMENT ROAD	403673	403674	138.1	5024	0.5024	11.35	68.1	95	140	375	
		CASEMENT ROAD	403674	Outfall	150.6	13510	1.351	11.35	68.1	256	111	375	525
I	A	SHARYN PLACE	100655	400973	7.4	1512	0.1512	11.35	68.1	29	20	225	300
		SHARYN PLACE	400973	Outfall	48.2	3024	0.3024	11.35	68.1	57	43	300	375
J	*A*	*SHARYN PLACE*	*404131*	*403762*	*48.3*	*4724*	*0.4724*	*11.35*	*68.1*	*89*	*126*	*375*	

Catchment	Path	Road	Pipe ID	To Pipe	Pipe L	Total Area	Total Area	Rain Depth	Rainfall Int	Flow Rate	Calc Capacity	Pipe D	Indicative Pipe Upgrade
					m	m^2	Ha	mm	mm/hr	L/s	L/s	mm	mm
		SHARYN PLACE	403762	400952	26.8	5788	0.5788	11.35	68.1	109	182	375	
	B	SHARYN PLACE	403240	400952	65.3	3858	0.3858	11.35	68.1	73	182	375	
	A+B	SHARYN PLACE	400952	400964	73.6	9646	0.9646	11.35	68.1	182	443	525	
		SHARYN PLACE	400964	Outfall	62.1	12882	1.2882	11.35	68.1	244	860	675	
K	A	SHARYN PLACE	100689	100690	7.4	2428	0.2428	11.35	68.1	46	46	225	
		SHARYN PLACE	100690	Outfall	38.6	2428	0.2428	11.35	68.1	46	46	225	
L	A	CHARTWELL AVENUE	101179	401339	28.6	3164	0.3164	11.35	68.1	60	58	225	
	B	CHARTWELL AVENUE	101208	401393	25.5	2985	0.2985	11.35	68.1	56	22	225	375
		CHARTWELL AVENUE	401393	401339	131.7	5016	0.5016	11.35	68.1	95	26	375	525
	A+B	LORRAINE PLACE	401339	401340	95.1	11910	1.191	11.35	68.1	225	368	525	
		LORRAINE PLACE	401340	404142	88.7	21675	2.1675	11.35	68.1	410	1331	750	
		MAYFAIR AVENUE	404142	400974	10.8	21675	2.1675	11.35	68.1	410	1780	750	
	C	MAYFAIR AVENUE	402173	400974	102.4	1913	0.1913	11.35	68.1	36	158	300	
	A+B+C	MAYFAIR AVENUE	400974	Outfall	79.5	26788	2.6788	11.35	68.1	507	1780	750	
M	*A*	*TAMAKI ROAD*	*101176*	*401337*	*5.7*	*2805*	*0.2805*	*11.35*	*68.1*	*53*	*21*	*225*	*375*
		TAMAKI ROAD	401337	401336	38.2	4356	0.4356	11.35	68.1	82	204	375	
		TAMAKI ROAD	401336	401335	16.9	7039	0.7039	11.35	68.1	133	204	375	
		TAMAKI ROAD	401335	401334	76.1	9722	0.9722	11.35	68.1	184	114	375	
		TAMAKI ROAD	401334	401333	13.3	9722	0.9722	11.35	68.1	184	202	375	
		PORT ROAD	401333	404132	51.7	9722	0.9722	11.35	68.1	184	47	225	375
		PORT ROAD	404132	401332	49.2	14374	1.4374	11.35	68.1	272	139	375	525
		PORT ROAD	401332	401331	80.2	14374	1.4374	11.35	68.1	272	139	375	525
		MAYFAIR AVENUE	401331	401330	98.1	17619	1.7619	11.35	68.1	333	141	375	525
		MAYFAIR AVENUE	401330	Outfall	52.5	20511	2.0511	11.35	68.1	388	152	450	675
N	A	HAMPTON ROAD	100658	400953	70.2	2068	0.2068	11.35	68.1	39	16	225	300
	B	HAMPTON ROAD	100659	400953	22.9	2403	0.2403	11.35	68.1	45	76	225	
	A+B	HAMPTON ROAD	400953	Outfall	65.6	4471	0.4471	11.35	68.1	85	140	300	
O	A	AJAX ROAD	401328	401326	40.9	7557	0.7557	11.35	68.1	143	17	300	450
		AJAX ROAD	401326	401325	16.3	8541	0.8541	11.35	68.1	162	278	450	
		PORT ROAD	401325	401013	84.4	14918	1.4918	11.35	68.1	282	199	450	
		PORT ROAD	401013	401014	107.8	17516	1.7516	11.35	68.1	331	141	450	
		PORT ROAD	401014	401015	33.0	20232	2.0232	11.35	68.1	383	228	375	450
		PORT ROAD	401015	401016	94.1	21507	2.1507	11.35	68.1	407	185	375	525

Catchment	Path	Road	Pipe ID	To Pipe	Pipe L	Total Area	Total Area	Rain Depth	Rainfall Int	Flow Rate	Calc Capacity	Pipe D	Indicative Pipe Upgrade
					m	m^2	Ha	mm	mm/hr	L/s	L/s	mm	mm
		PORT ROAD	401016	401017	61.6	21507	2.1507	11.35	68.1	407	204	375	525
	B	ACHILLES AVENUE	401022	401023	14.5	8936	0.8936	11.35	68.1	169	237	225	
		ACHILLES AVENUE	401023	404133	15.7	8936	0.8936	11.35	68.1	169	230	375	
		ACHILLES AVENUE	404133	401020	25.3	10904	1.0904	11.35	68.1	206	797	600	
		ACHILLES AVENUE	401020	401019	74.4	11888	1.1888	11.35	68.1	225	1013	600	
		ACHILLES AVENUE	401019	401017	37.9	13344	1.3344	11.35	68.1	252	1013	600	
	A+B	PORT ROAD	401017	Outfall	23.2	35638	3.5638	11.35	68.1	674	1632	825	
P	A	WAVERLY PLACE	401012	401011	86.5	2893	0.2893	11.35	68.1	55	77	300	
		HILTON DRIVE	401011	401010	91.2	6855	0.6855	11.35	68.1	130	192	375	
		PORT ROAD	401010	Outfall	40.9	8626	0.8626	11.35	68.1	163	3197	600	
Q	A	CHEVRON CRESCENT	401002	401003	70.8	2770	0.277	11.35	68.1	52	333	300	
		THE DRIVE	401003	403852	37.6	5856	0.5856	11.35	68.1	111	623	375	
		THE DRIVE	403852	401004	48.7	6761	0.6761	11.35	68.1	128	623	375	
		THE DRIVE	401004	401005	28.0	7863	0.7863	11.35	68.1	149	615	375	
		THE DRIVE	401005	401006	44.5	8493	0.8493	11.35	68.1	161	408	375	
		THE DRIVE	401006	401007	52.7	8493	0.8493	11.35	68.1	161	147	375	450
		THE DRIVE	401007	Outfall	73.5	8493	0.8493	11.35	68.1	161	83	300	450
	B	THE DRIVE	401008	Outfall	42.6	5524	0.5524	11.35	68.1	104	112	300	
R		PARK AVENUE	401009	Outfall	66.3	3383	0.3383	11.35	68.1	64	41	300	375
S	A	PARK AVENUE	400998	400999	50.6	1646	0.1646	11.35	68.1	31	98	300	
		AVALON PLACE	400999	401001	61.6	3216	0.3216	11.35	68.1	61	111	300	
	B	AVALON PLACE	100790	401001	57.5	408	0.0408	11.35	68.1	8	28	225	
	C	AVALON PLACE	401000	401001	79.2	0	0	11.35	68.1	0	259	300	
	A+B+C	AVALON PLACE	401001	Outfall	63.3	5857	0.5857	11.35	68.1	111	100	300	375
T	*A*	*AVALON PLACE*	*403808*	*403809*	*16.7*	*3475*	*0.3475*	*11.35*	*68.1*	*66*	*72*	*225*	
		AVALON PLACE	*403809*	*Outfall*	*31.9*	*3475*	*0.3475*	*11.35*	*68.1*	*66*	*72*	*225*	
U	A	WEKA STREET	401489	401488	15.1	5776	0.5776	11.35	68.1	109	136	375	
		WEKA STREET	401488	401486	111.1	5776	0.5776	11.35	68.1	109	136	375	
	B	PAPANUI ROAD	401491	401487	112.5	6349	0.6349	11.35	68.1	120	41	375	450
		PAPANUI ROAD	401490	401487	100.0	4854	0.4854	11.35	68.1	92	33	300	450
		RURU STREET	401487	403901	82.0	13953	1.3953	11.35	68.1	264	35	375	450
		RURU STREET	403901	401486	12.6	13953	1.3953	11.35	68.1	264	57	450	825

Catchment	Path	Road	Pipe ID	To Pipe	Pipe L	Total Area	Total Area	Rain Depth	Rainfall Int	Flow Rate	Calc Capacity	Pipe D	Indicative Pipe Upgrade
					m	m^2	Ha	mm	mm/hr	L/s	L/s	mm	mm
	A+B	WEKA STREET	401486	401484	159.3	22017	2.2017	11.35	68.1	416	565	525	
		WEKA STREET	401484	401480	47.0	24401	2.4401	11.35	68.1	462	804	600	
	C	HAUTURU STREET	101363	401485	106.5	2951	0.2951	11.35	68.1	56	29	225	300
		LINTON CRESCENT	401485	401483	148.9	7182	0.7182	11.35	68.1	136	81	300	375
		LINTON CRESCENT	401483	401480	57.7	11471	1.1471	11.35	68.1	217	249	450	
	D	LINTON CRESCENT	401481	401482	80.8	7504	0.7504	11.35	68.1	142	110	300	375
		LINTON CRESCENT	401482	401480	121.1	14879	1.4879	11.35	68.1	281	208	450	525
	A+B+C+D	OTAHU ROAD	401480	401479	113.3	53852	5.3852	11.35	68.1	1019	1356	750	
	E	OTAHU ROAD	101344	401479	159.3	2094	0.2094	11.35	68.1	40	100	300	
	A+B+C+D+E	KOTUKU STREET	401479	401477	115.0	55946	5.5946	11.35	68.1	1058	1518	900	
	F	KOTUKU STREET	401478	401477	50.5	3183	0.3183	11.35	68.1	60	122	300	
	A+B+C+D+E+F	KOTUKU STREET	401477	Outfall	108.4	59129	5.9129	11.35	68.1	1119	1518	900	

V	A	MCKELLAR PLACE	101323	401475	69.1	3858	0.3858	11.35	68.1	73	32	225	300
		MCKELLAR PLACE	401475	401476	115.2	4964	0.4964	11.35	68.1	94	87	300	
		MCKELLAR PLACE	401476	Outfall	47.8	7589	0.7589	11.35	68.1	144	87	300	375

W	A	GIVEN AVENUE	101380	101381	13.8	5279	0.5279	11.35	68.1	100	4	225	300
		GIVEN AVENUE	101381	401492	6.9	5279	0.5279	11.35	68.1	100	63	225	300
		GIVEN AVENUE	401492	401493	180.1	9109	0.9109	11.35	68.1	172	57	300	450
		GIVEN AVENUE	401493	SPLIT	102.0	16859	1.6859	11.35	68.1	319	25	300	825
	B	OTAHU ROAD	401499	SPLIT	93.7	9822	0.9822	11.35	68.1	186	57	300	525
	SPLIT												
	C1	OTAHU ROAD	101393	401504	218.6	13340.5	1.33405	11.35	68.1	252	3	150	450
		OTAHU ROAD	401504	Outfall	54.5	21370.5	2.13705	11.35	68.1	404	47	450	1050
	C2	OTAHU ROAD	401497	401496	50.5	13340.5	1.33405	11.35	68.1	252	225	400	
		PATUWAI DRIVE	401496	404105	111.6	13340.5	1.33405	11.35	68.1	252	91	300	450
		PATUWAI DRIVE	404105	401495	41.5	13340.5	1.33405	11.35	68.1	252	194	400	450
		PATUWAI DRIVE	401495	401494	58.5	13340.5	1.33405	11.35	68.1	252	164	375	450
		PATUWAI DRIVE	401494	Outfall	84.4	19420.5	1.94205	11.35	68.1	367	164	375	450

X	A	PHILOMEL ROAD	403228	401396	93.6	714	0.0714	11.35	68.1	14	25	300	
		PHILOMEL ROAD	403227	401396	94.3	714	0.0714	11.35	68.1	14	25	300	
		PHILOMEL ROAD	101218	401396	89.1	714	0.0714	11.35	68.1	14	30	225	
		PHILOMEL ROAD	401396	401395	155.0	7504	0.7504	11.35	68.1	142	68	300	450
		PHILOMEL ROAD	401395	401394	81.9	7504	0.7504	11.35	68.1	142	54	300	450
		PORT ROAD	401394	401397	27.7	10187	1.0187	11.35	68.1	193	38	300	525

Catchment	Path	Road	Pipe ID	To Pipe	Pipe L	Total Area	Total Area	Rain Depth	Rainfall Int	Flow Rate	Calc Capacity	Pipe D	Indicative Pipe Upgrade
					m	*m^2*	*Ha*	*mm*	*mm/hr*	*L/s*	*L/s*	*mm*	*mm*
		PORT ROAD	401397	401398	22.6	15287	1.5287	11.35	68.1	289	130	375	525
		PORT ROAD	401398	401399	28.0	15287	1.5287	11.35	68.1	289	114	375	525
Two Parallel Pipes		PORT ROAD	401399	401401	66.8	7643.5	0.76435	11.35	68.1	145	78	375	525
		PORT ROAD	403230	401401	117.1	7643.5	0.76435	11.35	68.1	145	144	375	525
		PORT ROAD	401401	404137	17.2	20243	2.0243	11.35	68.1	383	144	375	600
		PORT ROAD	404137	401406	37.7	20927	2.0927	11.35	68.1	396	144	375	600
	B	OCEAN ROAD	403225	401403	105.9	0	0	11.35	68.1	0	61	300	
		OCEAN ROAD	401403	401402	123.4	4794	0.4794	11.35	68.1	91	61	300	375
	C	BEVERLEY TERRACE	401405	404136	63.1	7081	0.7081	11.35	68.1	134	64	300	450
		BARBARA AVENUE	404136	401404	48.2	9696	0.9696	11.35	68.1	183	68	300	450
		BARBARA AVENUE	401404	401402	22.0	9696	0.9696	11.35	68.1	183	68	300	450
	B+C	OCEAN ROAD	401402	401406	99.8	16741	1.6741	11.35	68.1	317	13	300	675
	A+B+C	PORT ROAD	401406	401407	89.7	38976	3.8976	11.35	68.1	737	168	375	675
		PORT ROAD	401407	404107	79.6	41104	4.1104	11.35	68.1	778	157	450	675
		PORT ROAD	404107	404138	11.7	43663	4.3663	11.35	68.1	826	264	450	675
	D	DIANA AVENUE	101227	401412	16.1	5127	0.5127	11.35	68.1	97	62	225	300
		BARBARA AVENUE	401412	401411	114.8	5127	0.5127	11.35	68.1	97	74	375	
		BARBARA AVENUE	401411	403231	8.2	7367	0.7367	11.35	68.1	139	148	375	
		BARBARA AVENUE	403231	401410	4.5	9607	0.9607	11.35	68.1	182	102	375	525
		BARBARA AVENUE	401410	401409	62.4	9607	0.9607	11.35	68.1	182	166	450	
		PORT ROAD	401409	403892	43.2	9607	0.9607	11.35	68.1	182	307	450	
		PORT ROAD	403892	404138	12.7	9607	0.9607	11.35	68.1	182	307	450	
	A+B+C+D	LINCOLN ROAD	404138	403851	10.4	53270	5.327	11.35	68.1	1008	322	525	675
		LINCOLN ROAD	403851	401416	24.4	56536	5.6536	11.35	68.1	1069	322	525	675
		LINCOLN ROAD	401416	401413	99.8	56536	5.6536	11.35	68.1	1069	322	525	675
	E	CHARLESTON AVENUE	401415	401413	64.8	3275	0.3275	11.35	68.1	62	100	300	
	A+B+C+D+E	LINCOLN ROAD	401413	401349	145.1	63284	6.3284	11.35	68.1	1197	259	525	675
		LINCOLN ROAD	401349	403850	205.5	70678	7.0678	11.35	68.1	1337	462	675	
		LINCOLN ROAD	403850	401348	38.4	70678	7.0678	11.35	68.1	1337	462	675	
		LINDSAY ROAD	401348	401347	91.6	74273	7.4273	11.35	68.1	1405	357	450	675
		LINDSAY ROAD	401347	401346	45.5	74273	7.4273	11.35	68.1	1405	317	450	675
		LINDSAY ROAD	401346	403791	42.0	76714	7.6714	11.35	68.1	1451	317	450	825
		LINDSAY ROAD	403791	Outfall	83.7	79380	7.938	11.35	68.1	1502	678	600	825

Y	A	OCEAN ROAD	401417	401419	86.4	0	0	11.35	68.1	0	53	300	
		OCEAN ROAD	401419	401420	38.7	2515	0.2515	11.35	68.1	48	90	300	
		OCEAN ROAD	401420	401421	105.2	2515	0.2515	11.35	68.1	48	108	375	
		OCEAN ROAD	401421	401422	60.2	7010	0.701	11.35	68.1	133	81	375	450

Catchment	Path	Road	Pipe ID	To Pipe	Pipe L	Total Area	Total Area	Rain Depth	Rainfall Int	Flow Rate	Calc Capacity	Pipe D	Indicative Pipe Upgrade
					m	*m^2*	*Ha*	*mm*	*mm/hr*	*L/s*	*L/s*	*mm*	*mm*
		OCEAN ROAD	401422	401512	119.0	23930	2.393	11.35	68.1	453	18	600	750
	B	GRAHAM STREET	401425	401424	90.3	1911	0.1911	11.35	68.1	36	127	375	
		BEVERLEY TERRACE	401426	401424	61.6	7004	0.7004	11.35	68.1	132	40	300	450
		GRAHAM STREET	401424	401423	38.7	10155	1.0155	11.35	68.1	192	283	450	
		GRAHAM STREET	401423	401512	23.3	10155	1.0155	11.35	68.1	192	414	450	
	A+B	OCEAN ROAD	401512	403902	202.8	40259	4.0259	11.35	68.1	762	715	750	
	C	LOWE STREET	102419	401448	28.0	4632	0.4632	11.35	68.1	88	24	225	300
		LOWE STREET	401448	403902	24.8	5940	0.594	11.35	68.1	112	168	300	
	A+B+C	OCEAN ROAD	403902	401450	63.4	59769	5.9769	11.35	68.1	1131	383	600	750
		OCEAN ROAD	401450	401451	136.4	69675	6.9675	11.35	68.1	1318	383	600	750
		OCEAN ROAD	401451	401452	26.3	69675	6.9675	11.35	68.1	1318	1031	675	750
	D	WILLIAMSON ROAD	401459	404139	97.9	14501	1.4501	11.35	68.1	274	89	375	600
		WILLIAMSON ROAD	404139	404140	161.7	26181	2.6181	11.35	68.1	495	169	450	675
		WILLIAMSON ROAD	404140	401461	65.7	32538	3.2538	11.35	68.1	616	328	600	750
		WILLIAMSON ROAD	401461	401462	21.6	32538	3.2538	11.35	68.1	616	591	750	
		WILLIAMSON ROAD	401462	401463	47.3	34395	3.4395	11.35	68.1	651	916	750	
		WILLIAMSON ROAD	401463	404141	39.7	46935	4.6935	11.35	68.1	888	635	750	
		WILLIAMSON ROAD	404141	401467	14.0	46935	4.6935	11.35	68.1	888	635	750	825
		WILLIAMSON ROAD	401467	401466	71.9	49281	4.9281	11.35	68.1	932	686	750	825
	E	SYLVIA ROAD	101297	401470	59.6	876	0.0876	11.35	68.1	17	4	225	375
		SYLVIA ROAD	401470	401469	46.8	3720	0.372	11.35	68.1	70	61	300	375
		SYLVIA ROAD	401469	401468	89.2	3720	0.372	11.35	68.1	70	73	300	375
		SYLVIA ROAD	401468	401466	49.7	6042	0.6042	11.35	68.1	114	95	300	375
	D+E	WILLIAMSON ROAD	401466	401465	116.5	62918	6.2918	11.35	68.1	1190	881	825	900
		WILLIAMSON ROAD	401465	401464	44.1	70324	7.0324	11.35	68.1	1330	318	825	1200
		WILLIAMSON ROAD	401464	401453	51.7	70868	7.0868	11.35	68.1	1341	265	825	1200
		OCEAN ROAD	401453	401452	18.1	72036	7.2036	11.35	68.1	1363	652	825	1200
	F	GIVEN AVENUE	101308	401472	78.6	4107	0.4107	11.35	68.1	78	20	225	375
		SYLVIA ROAD	101307	401472	65.0	2245	0.2245	11.35	68.1	42	14	225	375
		GIVEN AVENUE	401472	401473	43.1	9320	0.932	11.35	68.1	176	30	300	600
		GIVEN AVENUE	401473	401474	50.4	10880	1.088	11.35	68.1	206	54	300	600
		GIVEN AVENUE	401474	401507	127.6	13342	1.3342	11.35	68.1	252	87	375	600
		OCEAN ROAD	401507	401506	106.2	18525	1.8525	11.35	68.1	350	117	375	600
		OCEAN ROAD	401506	401505	18.0	18525	1.8525	11.35	68.1	350	170	450	600
	G	RANGI AVENUE	101319	401509	26.7	1694	0.1694	11.35	68.1	32	7	225	375
		RANGI AVENUE	401509	401510	67.1	4456	0.4456	11.35	68.1	84	52	300	375
		RANGI AVENUE	401510	401511	94.5	5780	0.578	11.35	68.1	109	79	300	375

Catchment	Path	Road	Pipe ID	To Pipe	Pipe L	Total Area	Total Area	Rain Depth	Rainfall Int	Flow Rate	Calc Capacity	Pipe D	Indicative Pipe Upgrade
					m	m^2	Ha	mm	mm/hr	L/s	L/s	mm	mm
		RANGI AVENUE	401511	401508	87.1	7670	0.767	11.35	68.1	145	67	300	450
		RANGI AVENUE	401508	401505	47.0	9476	0.9476	11.35	68.1	179	193	375	450
	F+G	OCEAN ROAD	401505	401456	57.1	29265	2.9265	11.35	68.1	554	79	375	825
		OCEAN ROAD	401456	401455	100.5	33795	3.3795	11.35	68.1	639	111	375	825
		OCEAN ROAD	401455	401454	79.7	40675	4.0675	11.35	68.1	769	491	825	
		OCEAN ROAD	401454	401452	79.4	40675	4.0675	11.35	68.1	769	1132	825	
	A+B+C+D+E+F+G	OCEAN ROAD	401452	403889	61.6	188659	18.8659	11.35	68.1	3569	2064	975	1200
		OCEAN ROAD	403889	Outfall	14.4	188659	18.8659	11.35	68.1	3569	2064	975	1200
Z	A	TANGAROA ROAD	101394	101395	7.1	4466	0.4466	11.35	68.1	84	70	225	300
		TANGAROA ROAD	101395	Outfall	43.4	4466	0.4466	11.35	68.1	84	70	225	300
α	A	AICKIN ROAD	401355	401353	156.6	10500	1.05	11.35	68.1	199	197	375	
		AICKIN ROAD	401353	401351	75.7	15176	1.5176	11.35	68.1	287	167	375	450
		CASEMENT ROAD	401351	Outfall	77.1	17979	1.7979	11.35	68.1	340	472	525	
β	A	PACIFIC VIEW DRIVE	100698	100697	48.4	376	0.0376	11.35	68.1	7	88	225	
		PACIFIC VIEW DRIVE	100697	400969	55.0	842	0.0842	11.35	68.1	16	109	225	
		PACIFIC VIEW DRIVE	400969	400968	56.2	1748	0.1748	11.35	68.1	33	353	300	
		PACIFIC VIEW DRIVE	400968	400967	38.7	2597	0.2597	11.35	68.1	49	361	300	
		PACIFIC VIEW DRIVE	400967	400966	25.2	2597	0.2597	11.35	68.1	49	317	300	
		PACIFIC VIEW DRIVE	400966	400965	22.7	3564	0.3564	11.35	68.1	67	280	300	
		PACIFIC VIEW DRIVE	400965	400970	34.9	4406	0.4406	11.35	68.1	83	339	300	
		THE DRIVE	400970	400971	37.3	4406	0.4406	11.35	68.1	83	532	375	
		THE DRIVE	400971	Outfall	11.8	4406	0.4406	11.35	68.1	83	1034	375	
γ		THE DRIVE	100709	100708	14.7	878	0.0878	11.35	68.1	17	244	225	
		THE DRIVE	100708	100707	39.4	878	0.0878	11.35	68.1	17	153	225	
		THE DRIVE	100707	400972	45.0	878	0.0878	11.35	68.1	17	31	225	
		THE DRIVE	400972	400996	93.9	2532	0.2532	11.35	68.1	48	208	300	
		THE DRIVE	400996	400997	89.5	6332	0.6332	11.35	68.1	120	545	375	
		THE DRIVE	400997	Outfall	42.0	8115	0.8115	11.35	68.1	154	648	375	

Note 1: Red Highlighted Pipes are assumed to be 225. In many instances they are large (ie 600mm) but appear to be connecting cesspits
Note 2: The pipe grade for blue italicised entries have been based on the ground level gradients
Note 3: Assuming that existing cesspits and manhols are adequate with upgraded pipe. Detailed design to assess adequacy of cesspits and manholes.

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Thames Coromandel District Council

Whangamata Stormwater Catchment Management Plan Outlet Erosion Analysis

October 2003

Opus: *an accomplished work, a creation, an achievement*

Thames Coromandel District Council

Whangamata Stormwater Catchment Management Plan Outlet Erosion Analysis

December 2003

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Contents

EXECUTIVE SUMMARY

A field survey of all locatable stormwater outlets discharging within the beach and estuary has been carried out in order to identify areas of significant erosion and necessary remedial options required.

The following items have been considered and assessed during the field inspection:

- Culvert size and condition.
- Local erosion in the channel and on the surrounding banks.
- Special features such as sills limiting fish passage.
- The presence and condition of flap gates, including discolouration or odours.
- Requirements such as rock headwall protection, reno mattress outlet protection, rock outlet protection.

Please note, all of the outlets inspected do not require a fish passage assessment, as the stormwater does not flow to any other waterway.

Each outlet has been identified by asset number, which is detailed on the attached aerial map in Appendix A.

The survey information including photographs of each locatable outlet has been documented in Appendix B.

The following outlets along the main surf beach could not be located:

- 50948 (sump/catchpit in dunes was found but no culvert outlet).
- 102968 (catchpit exists on road in line with where outlet should be. Major dune erosion has occurred in this area with large trees undermined).
- 51011 (catchpit exists, could not locate outlet, refer survey summary).
- Outlet from 103045 (sump/catchpit in dunes was found but no culvert outlet).
- 50502 (catchpit exists on road in line with where outlet should be).
- 50547 (no outlet exists).
- 51007 (catchpit exists, could not locate outlet, refer survey summary).
- This may be a result of a recent storm, which has eroded the banks in some areas, undermined walkways and shifted sand.

The following outlets along Moanu Anu Anu River could not be located:

- 102506 (could not locate outlet).
- 99341 (no catchpit present on carriageway, open drain present, refer survey summary).
- 50110 (embankment heavily vegetated, manholes located but no outlet, refer survey summary).
- 50120 (embankment heavily vegetated, manholes located but no outlet, refer survey summary).

- 102507 (could not locate outlet, refer survey summary).

The following outlets could not be located:

- 102950 (Otahu Road, Manhole present, unable to locate outlet).

RECOMMENDATION

It is recommended that the remedial works detailed in Appendix B be carried out in order to eliminate any further erosion.

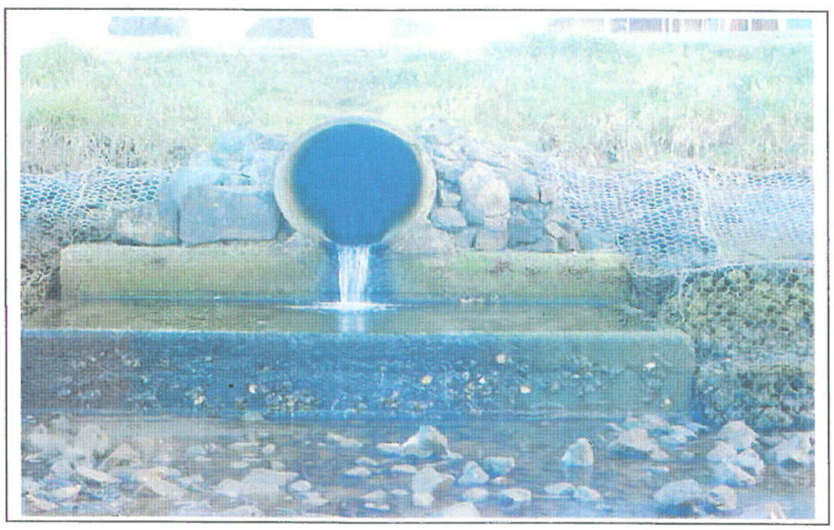
APPENDIX A:

Map Detailing Stormwater Outlets in Whangamata

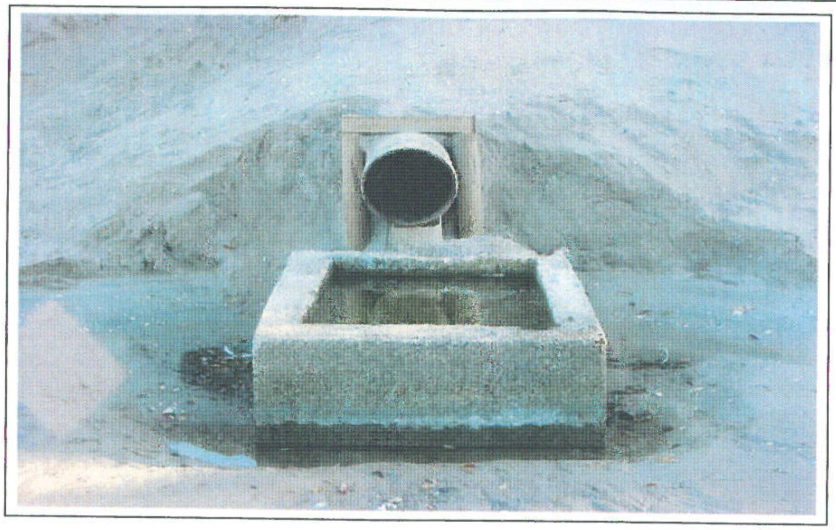
APPENDIX B:

Survey Summary with Photographs

ASSET NUMBER:	50820
LOCATION:	Kotuku Street
CULVERT SIZE:	1000mm corrugated iron culvert
CONDITION:	SW flows into concrete spill basin before reaching the beach. Concrete7d rock around outlet. Banks are stabilised by rock riprap in wire netting. SW has strong sulphur smell. No erosion around outlet or sedimentation in culvert evident.
RECOMMENDATION:	None



ASSET NUMBER:	50883
LOCATION:	Kotuku Street
CULVERT SIZE:	900mm concrete culvert
CONDITION:	SW flows into concrete spill basin before reaching the beach. Concreted rock around outlet. Banks are stabilised by rock riprap in wire netting. No erosion around outlet or sedimentation in culvert evident.
RECOMMENDATION:	None.



ASSET NUMBER: 50965
LOCATION: Off Patuwai Drive
CULVERT SIZE: 375mm concrete culvert
CONDITION: SW flows into concrete spill basin before reaching the beach. A timber cradle supports the outlet. Some erosion around the cradle exists. No sedimentation within the culvert is evident. Culvert appears dry.

RECOMMENDATION: Place rock riprap around the outlet to support the bank.

ASSET NUMBER: 50976
LOCATION: Off Pohutakawa Crescent
CULVERT SIZE: 375mm concrete culvert
CONDITION: Culvert outlet is supported on top of a low timber retaining wall which acts as a cradle. 3x horizontal steel grates are at the outlet. No sedimentation within the culvert or erosion around the outlet is evident. The surrounding banks are vegetated/stabilised with dune grass.
RECOMMENDATION: None

ASSET NUMBER: 50550
LOCATION: Off Port Road Under Wharf
CULVERT SIZE: 225mm PVC Pipe
CONDITION: PVC pipe exists under the wharf with its outlet surrounded by concrete and rock. No erosion or sedimentation is evident.

RECOMMENDATION: None

ASSET NUMBER: 103033
LOCATION: End of Bond Street
CULVERT SIZE: 225mm concrete culvert
CONDITION: Culvert outlet is at road level. SW falls through vegetation and rock down a bank to the beach. The outlet is supported against a timber post connected by a metal strap. No sedimentation or erosion is
RECOMMENDATION: None

ASSET NUMBER: 50535
LOCATION: Off Beach Road
CULVERT SIZE: GIS shows this as a 300mm culvert
CONDITION: Culvert outlet could not be located due to overgrowth. A catchpit exists in the carpark and is in line with the photo above. Concrete spillway is full on soil and grass. No surrounding erosion is evident.

RECOMMENDATION: Clear vegetation, unblock culvert and clean spillway.

ASSET NUMBER: 102857
LOCATION: Off beach Road
CULVERT SIZE: 225mm concrete culvert
CONDITION: Outlet is at beach level and is 50% blocked. A 0.5m high by 1m long concrete headwall exists on either side of outlet to channel SW flow. A piece of concrete within the channel is partially restricting SW flow. The surrounding bank is vegetated with no sign of erosion.

RECOMMENDATION: Remove debris from outlet. Remove concrete that is partially restricting flow.

ASSET NUMBER: 102866
LOCATION: End of Harbour View Road
CULVERT SIZE: 300mm concrete culvert
CONDITION: Outlet is at beach level with a 0.5m bank behind to the road level. Bank is vegetated with no sign of erosion. The end of the culvert is chipped at the outlet. No rock support exists around the outlet but is not required. No sedimentation evident.
RECOMMENDATION: None

ASSET NUMBER: 50530
LOCATION: End of Harbour View Road
CULVERT SIZE: 300mm concrete culvert
CONDITION: Outlet extends approximately 5m from the bank. Concrete headwall exists around outlet. No sedimentation or erosion is evident.

RECOMMENDATION: None

ASSET NUMBER: 102871
LOCATION: End of Beach Road near proposed marina
CULVERT SIZE: 300mm corrugated iron culvert
CONDITION: Outlet exists at road level. Bank is vegetated and no erosion exists. No sedimentation exists within the culvert. No rock support is around the outlet for support.

RECOMMENDATION: Place minor rock riprap around outlet.

ASSET NUMBER: 50142
LOCATION: Heatherington Rd at estuary bridge
CULVERT SIZE: 675mm concrete culvert
CONDITION: Concrete headwall exists around the outlet. SW flows into mangroves. No erosion or sedimentation evident.

RECOMMENDATION: None

ASSET NUMBER: 99340
LOCATION: Casement Road
CULVERT SIZE: Open Drain
CONDITION: Open drain within industrial area that flows toward the estuary mangroves. Culverts under crossings 50% blocked with sediment and rubbish. No bank erosion as banks are heavily vegetated.

RECOMMENDATION: Clear drain and remove rubbish.

ASSET NUMBER: 50061
LOCATION: End of Awarua Place
CULVERT SIZE: 600mm concrete culvert
CONDITION: Concrete blocks support the bank around the outlet. No erosion or sedimentation evident. Outlet end is crumbling.

RECOMMENDATION: None

ASSET NUMBER: 25607
LOCATION: Off Pipi Road
CULVERT SIZE: 300mm concrete culvert
CONDITION: Concrete headwall exists around culvert outlet, good condition. SW flows out to harbour. No erosion evident, slight sedimentation build up around apron.

RECOMMENDATION: None.

ASSET NUMBER:	25620
LOCATION:	Off Durrant Drive
CULVERT SIZE:	300mm concrete culvert??
CONDITION:	Culvert outlet has separated from concrete headwall. Headwall badly damaged and requires replacement. SW flows out to harbour. No sedimentation evident, scouring present under apron.
RECOMMENDATION:	Replace headwall structure, rock riprap outflow.

ASSET NUMBER:	26666
LOCATION:	Off Patiki Place
CULVERT SIZE:	300mm concrete culvert
CONDITION:	Concrete culvert outlet in good condition. SW flows out towards harbour. Banks vegetated. No erosion and slight sedimentation build up evident.
RECOMMENDATION:	None.

ASSET NUMBER: 26666
LOCATION: Off Patiki Place
CULVERT SIZE: 300mm concrete culvert
CONDITION: Concrete culvert outlet in good condition. SW flows out towards harbour. Banks vegetated. No erosion and slight sedimentation build up evident.

RECOMMENDATION: None.

ASSET NUMBER: 26701
LOCATION: Off Tukere Drive
CULVERT SIZE: 375mm concrete culvert
CONDITION: Concrete culvert outlet in good condition. SW flows out towards harbour. Banks heavily vegetated, outlet partially blocked with vegetation. No erosion or sedimentation evident.

RECOMMENDATION: Trim/ remove vegetation.

ASSET NUMBER:	26712
LOCATION:	Off Tukere Drive
CULVERT SIZE:	375mm concrete culvert??
CONDITION:	Concrete culvert outlet in good condition. SW flows out towards harbour. Outlet 50% blocked, sedimentation build up. No erosion evident.

RECOMMENDATION:	Clean open channel. Remove excess vegetation.

ASSET NUMBER: 26716
LOCATION: Off Tukere Drive
CULVERT SIZE: 300mm concrete culvert
CONDITION: Concrete culvert outlet in ok condition. SW flows out towards harbour. Banks heavily vegetated. No erosion or sedimentation evident.

RECOMMENDATION: Trim excess vegetation. Low priority.

ASSET NUMBER: 26720
LOCATION: Off Tukere Drive
CULVERT SIZE: 300mm concrete culvert
CONDITION: Concrete culvert outlet in good condition. SW flows directly into harbour. No erosion or sedimentation evident.

RECOMMENDATION: None.

ASSET NUMBER: 26724
LOCATION: Off Tukere Drive
CULVERT SIZE: 300mm concrete culvert
CONDITION: Concrete culvert outlet in ok condition. SW flows out towards harbour. Banks heavily vegetated. No erosion or sedimentation evident. Outlet channel partially blocked.

RECOMMENDATION: Clear debris. Low priority.

ASSET NUMBER: 50022
LOCATION: Off Moana Anu Anu Avenue
CULVERT SIZE: 300mm concrete culvert
CONDITION: Concrete headwall exists around culvert outlet, concrete apron suffering erosion and minor scouring present under apron. SW flows out to harbour. No sedimentation evident.

RECOMMENDATION: Replace headwall structure or place grouted rock underneath and around outfall area.

ASSET NUMBER: 50062
LOCATION: Off Awarua Place
CULVERT SIZE: 525mm concrete culvert
CONDITION: Concrete culvert outlet in ok condition. SW flows directly into harbour. Embankment protected by a 'Gobi mat' type protection system. No erosion or sedimentation evident.

RECOMMENDATION: None.

ASSET NUMBER: 50102
LOCATION: Off Harry Watt Drive
CULVERT SIZE: 225mm concrete culvert
CONDITION: Concrete culvert outlet in good condition. SW flows down embankment out towards harbour. Banks heavily vegetated. No erosion or sedimentation evident.

RECOMMENDATION: None.

ASSET NUMBER:	50103
LOCATION:	Off Harry Watt Drive
CULVERT SIZE:	525mm concrete culvert
CONDITION:	Concrete headwall exists around culvert outlet, concrete apron cracked/ broken at outfall. Scouring present under apron. SW flows out to harbour. No sedimentation evident.
RECOMMENDATION:	Trim excess vegetation. Replace concrete apron and/ or provide grouted rock support underneath apron.

ASSET NUMBER: 50120
LOCATION: Off Waireka Place
CULVERT SIZE: ??
CONDITION: Unable to locate outlet. Heavily vegetated embankment. Manhole present in reserve.
RECOMMENDATION: Clear vegetation, locate culvert outlet and assess condition.

ASSET NUMBER: 50110
LOCATION: Off Waireka Place
CULVERT SIZE: ??
CONDITION: Unable to locate outlet. Heavily vegetated embankment. Manhole present in reserve.
RECOMMENDATION: Clear vegetation, locate culvert outlet and assess condition.

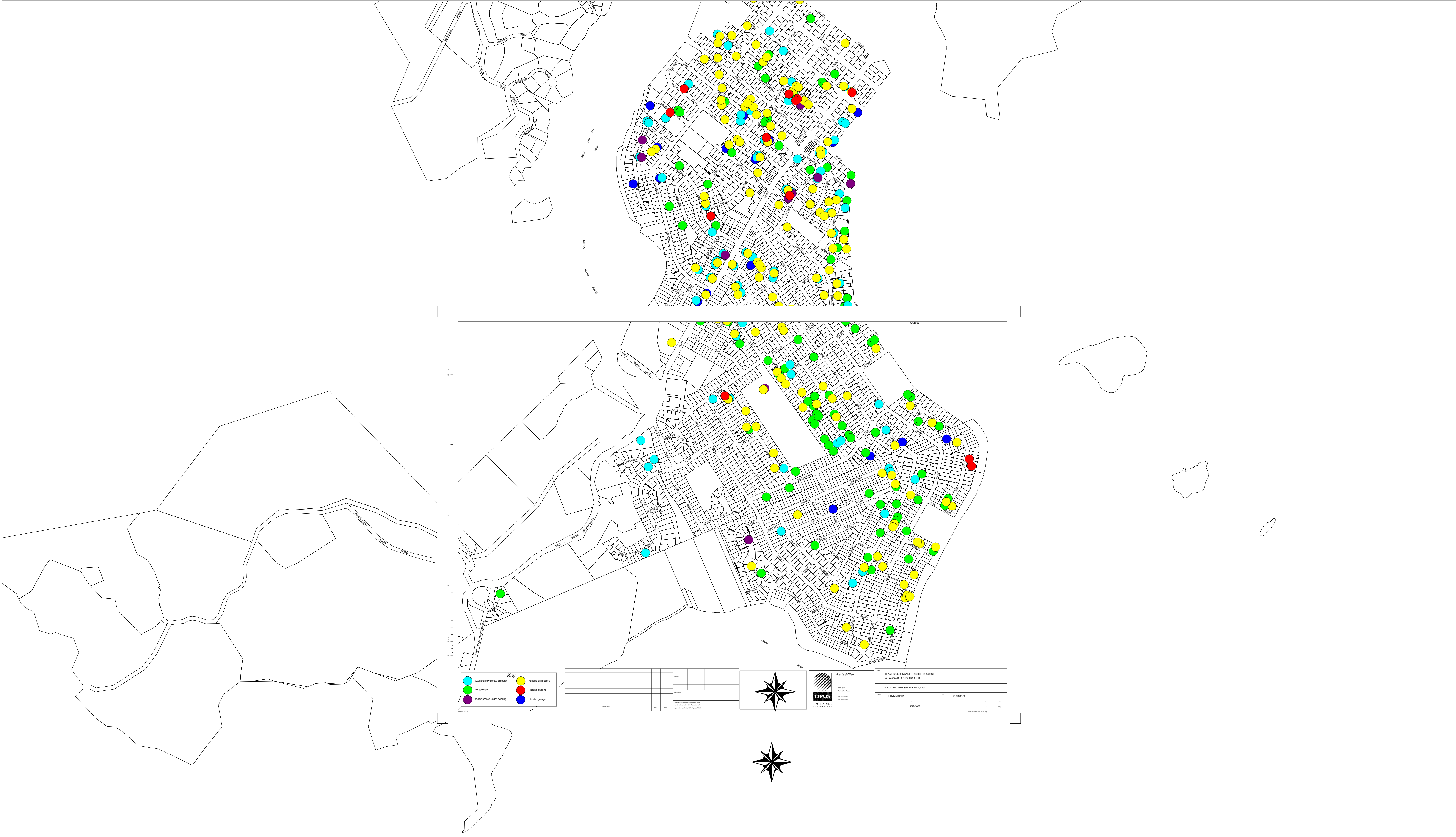
ASSET NUMBER: 50549

LOCATION: Off Port Road (Wharf)

CULVERT SIZE: 600mm+ (3/4 buried)

CONDITION: Culvert outlet ¾ buried under sand. Culvert joint at 2 pipe lengths from outlet separated. Photo taken at mid tide.

RECOMMENDATION: May need to investigate raising level of culvert outlet above shore level. Further investigation required.



Key
Overland flow across property
No comment
Water passed under dwelling
Ponding on property
Flooded dwelling
Flooded garage
SH25 - WAIHI-WHANGAMATA
Otahu
River
POHUTUKAWA
DRIVE
ROAD
Auckland Office
OPUS
INTERNATIONAL CONSULTANTS
THAMES COROMANDEL DISTRICT COUNCIL
WHANGAMATA STORMWATER
FLOOD HAZARD SURVEY RESULTS
PRELIMINARY
2-67866.69
8/12/2003
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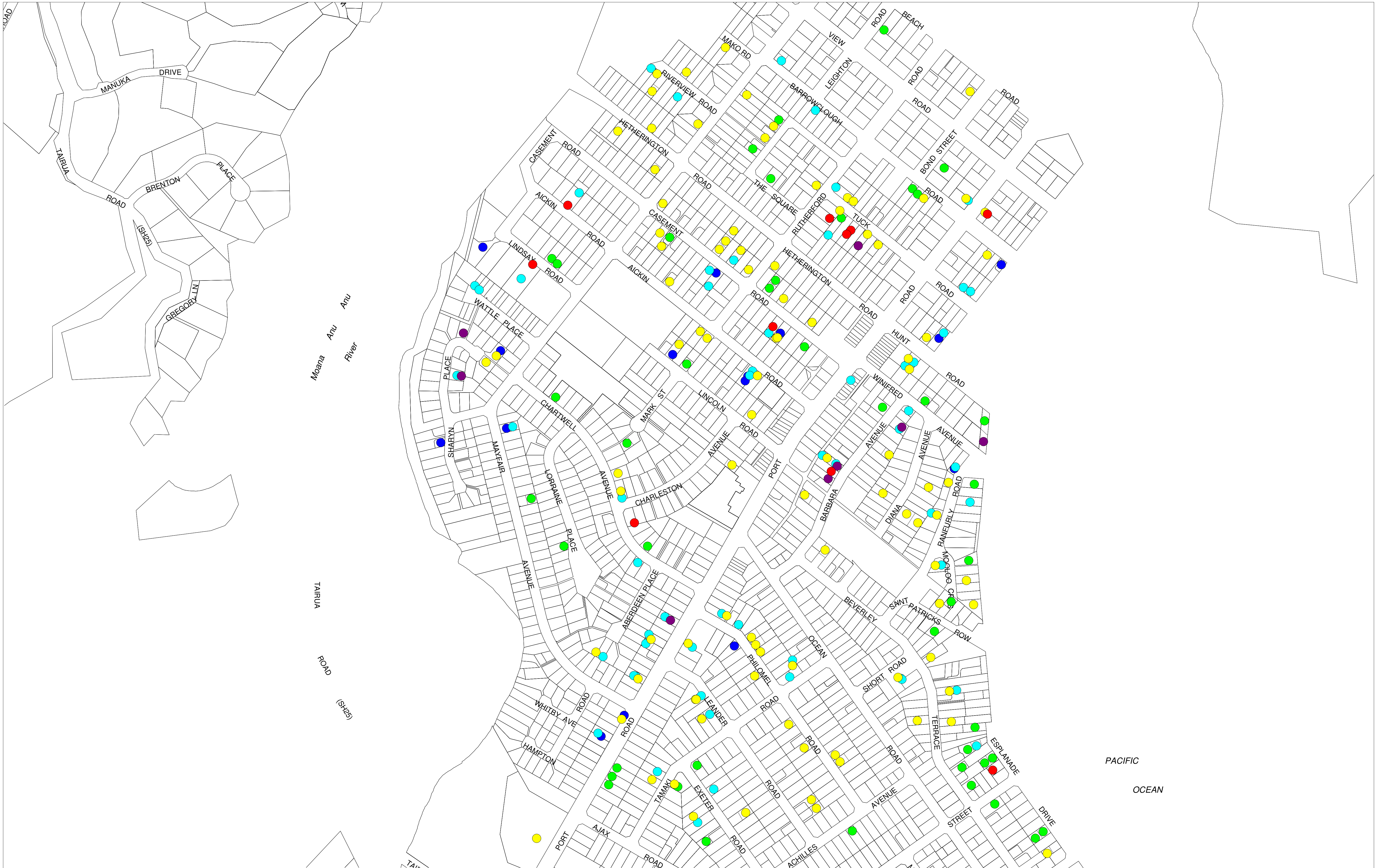

Key

- Overland flow across property
- No comment
- Water passed under dwelling
- Ponding on property
- Flooded dwelling
- Flooded garage

	BY	CHECKED	DATE
DESIGN			
APPROVED			

AMENDMENT	APP'D	DATE

N

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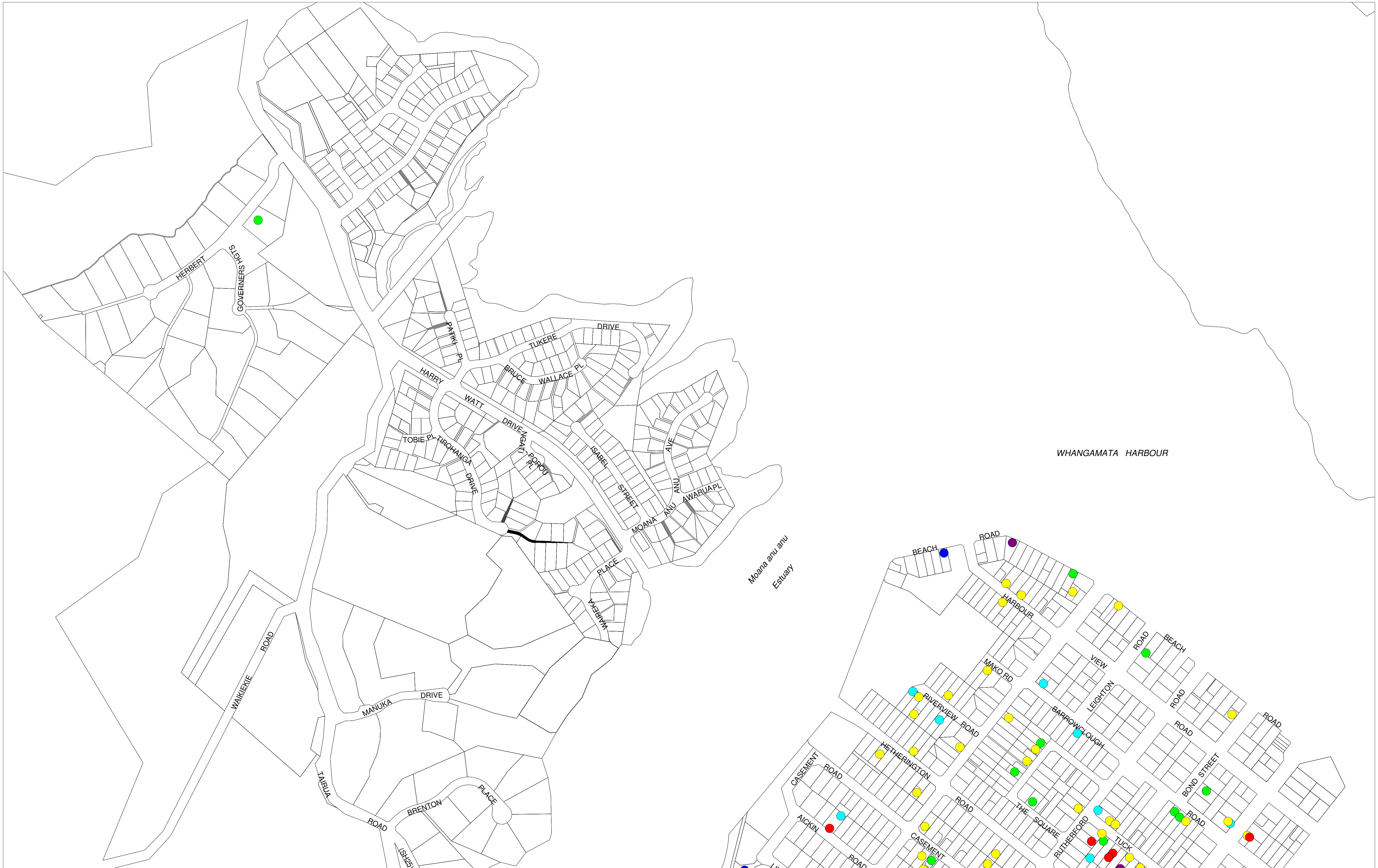
TITLE
THAMES COROMANDEL DISTRICT COUNCIL
WHANGAMATA STORMWATER

FLOOD HAZARD SURVEY RESULTS

STATUS	PRELIMINARY	FILE	2-67866.69		
SCALE	PLOT DATE 8/12/2003	FEATURE IDENTIFIER	CODE	SHEET 2	REVISION R0

GRAPHIC SCALES

ORIGINAL SHEET SIZE A3 [420x297]



Key

- Overland flow across property
- Ponding on property
- No comment
- Flooded dwelling
- Water passed under dwelling
- Flooded garage

			BY	CHECKED	DATE
		DESIGN			
		APPROVED			
AMENDMENT	APP'D	DATE			

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TITLE

THAMES COROMANDEL DISTRICT COUNCIL
WHANGAMATA STORMWATER

FLOOD HAZARD SURVEY RESULTS

STATUS	PRELIMINARY	FILE	2-67866.69		
SCALE	PLOT DATE	FEATURE IDENTIFIER	CODE	SHEET	REVISION
	8/12/2003			3	R0

GRAPHIC SCALES

ORIGINAL SHEET SIZE A3 [420x297]

Property Number	Property Street	SW Problems?	Flooding Problem	Depth of Flooding	Frequency of Flooding	Stormwater Comments
301	Achilles Ave	Yes	Overland flow across Property	Up to 1 cm	More than once per year	Stormwater flowing over after a heavy rain. It floods the gutters and flows over into our dwelling
425	Achilles Ave	Yes				No problem with our property, but on road outside large puddles of water accumulate after rain. This can be a real traffic hazard - cars hit the puddles unexpectedly. The puddles take days to drain.
515	Achilles Ave	Yes				Regular cleaingin of stormwater drain at corner of Achilles/ocean rd is required to avoid excessive backup in gutters.
109	Aickin Rd	Yes	Ponding on property	Up to 1 cm	More than once per year	Ponding occurs only during very heavy continual rain. Soaks away within 30 minutes.
123	Aickin Rd	Yes	Ponding on property	Greater than 5 cm	More than once per year	
125	Aickin Rd	Yes	Ponding on property	Greater than 5 cm	More than once per year	
212a	Aickin Rd	Yes	Ponding on property	Up to 5 cm	More than once per year	
32	Aileen Pl	Yes	Overland flow across Property	Greater than 5 cm	More than once per year	Council need to urgently upgrade their culvert at the end of Aileen Place.
109	Apperly St	Yes	Ponding on property	Up to 1 cm	More than once per year	On our boundary to the esplanade reserve in front of house is lower and can't flow out. I believe some fill will improve this. Heavy rain build up to - pond.
108	Avalon Place	Yes	Overland flow across Property	Greater than 0.5 m	More than once per year	The small creek at back of section joining onto Park has blocked up & lies dormant, it used to flow to main SW. It is now dirty, smelling & very unhygenic
123	Barbara Ave	Yes	Water hs enterd dwelling	Greater than 5 cm	Once per year	Ifo & photos given to Opus. See scan for other info
123	Barbara Ave	Yes	Water hs enterd dwelling	Greater than 5 cm	Once every 2-5 years	See scan for details.
143	Barbara Ave	Yes				Ponding at end of street. I have commented on previous occasion about the frequent unsighlty ponding near the beach access on Winifred St, when I have been contacted by telephone.
113b	Barbara Ave	Yes	Ponding on property	Greater than 5 cm	More than once per year	Water in heavy rain flows onto lower right hand side of property, off the footpath verge and the driveway entrance.
118b	Barbara Ave	Yes	Ponding on property	Up to 1 cm	Once per year	Minor ponding on front lawn - run off from driveway
103	Barrowclough Rd	Yes	Ponding on property	Up to 5 cm	More than once per year	Ponding only in heavy rain, but soaks away resonably soon.
107	Barrowclough Rd	Yes	Water has entred garages/ sheds	Up to 1 cm	Once every 2-5 years	
205	Barrowclough Rd	Yes	Ponding on property	Up to 5 cm		We have ponding on the roadside outside our front gate every tiem it rains.
311	Barrowclough Rd	Yes	Overland flow across Property	Greater than 5 cm	More than once per year	
207 & 209	Barrowclough Rd	Yes				Roadside flooding occurs as drainange is inadequate fro rd runoff. Road runoff has nowhare to go so has to wait until it soaks away, this is sand soil so dows soakawya fairly quickely.
504b	Barrowclough Rd	Yes	Overland flow across Property	Up to 5 cm	More than once per year	ponds at front of property between roadway and garage
503	Beach Rd	Yes				Mr McQuarters overseas until Oct so unable to answer. However we have had a flood in the house caused by the storm water problems
519	Beach Rd	No	Water has passed under dwelling		Once per year	
603	Beach Rd	No	Water has entred garages/ sheds		Once per year	As not at property when it rains, are not aware of any flooding. We have been told by neighbours that our back yard hs been under water on occasion. I think this is when there has been excessive rain. Not been aware of any water getting into garage
407a	Beach Rd	Yes	Ponding on property	Up to 5 cm	More than once per year	
104	Bellona Rd	Yes		Up to 5 cm		In heavy rain water alsmost completely spreads acorss the road in Grham, which comes dwon Bellona, which is where our property is situated. Takes a long time for water to subside. Photos
107	Bellona Rd	Yes	Ponding on property	Greater than 5 cm	More than once per year	Not on Property. Roadside Ponding at intersection of bellona rd & Graham St. Water cannot enter sump in vicinity
109	Bellona Rd	Yes				No flooding on our property but when heavy rain, road gets completely flooded cnr of Graeme st & Bellona Rd
111	Bellona Rd	Yes	Ponding on property	Up to 5 cm	More than once per year	whenever it rains there is ponding on the corner of Bellona rd & Graham st, this flows onto grass border in fromt of 111 Belona. House was built on elevated site so fear of flooding of house is not a problem.
115	Bellona Rd	Yes	Ponding on property	Up to 5 cm	More than once per year	Ponding occurs form runoff from road, is only when heavy rain occurs. Uslually last for 1/2 to 1 hr after rain stops. Being a holiday house we do not see it as a problem. Sandy nature of the ground copes adequately
131	Bellona Rd	Yes	Ponding on property	Up to 5 cm	More than once per year	After heavy rain water collects at kerb/grass on edge of secton. Also on cnr Bellona/Low st, is bad. I seems most roads having some problem - Cnr Low/syliva and also Kiwi Rd
207	Bellona Rd	Yes				road lacks kerbing & channeling. Heavy rain or extended rain causes ponding alongside both road verges. Happens 10-12 x per yr, often depth greater than 5cm. Requires gumboots to leave property on foot.
209	Bellona Rd	Yes		Up to 5 cm	More than once per year	Ponding in front of property every tiem it rains. Area bordering front of section, where would normally be a footpath, is low lying. Watershed from the rd does not drain readily causing regular ponding directly in front of our exit
212	Bellona Rd	Yes	Ponding on property	Greater than 5 cm	More than once per year	Large puddle forms on road boundary when we drive out.
218	Bellona Rd	Yes				
219	Bellona Rd	Yes				see letter attached relating to a complaint to council 2 years ago for which they have not had a response.
223	Bellona Rd	Yes	Ponding on property	Up to 5 cm	More than once per year	Almost always ther is a small ponding just off the fron of my property. The main area is right at the entrance of driveway. I am surprised that the water just does not soak away.
227	Bellona Rd	Yes		Greater than 5 cm	More than once per year	After heavy rain the grass road berm ponds water, which extends for entrie length of road frontage, but doesn't quite encroach into my section. It takes 4-5 hrs to drain away.
304	Bellona Rd	Yes		Greater than 5 cm	More than once per year	Ponding Between road & property. We don't have SW drains down our street. Hence flooding.
306	Bellona Rd	Yes				
200b	Bellona Rd	Yes	Overland flow across Property	Up to 5 cm	Once per year	Road outside our property floods in heavy rain. Water then flows across our section. There are catchpits on road but appear to be in the wrong place
324a	Bellona Rd	Yes	Overland flow across Property	Up to 5 cm	More than once per year	Water form downpipe on NW side of dwelling scouring out driveway and ponding on road frontage
324b	Bellona Rd	Yes	Overland flow across Property	Up to 5 cm	More than once per year	In heavy rain the stormwater drains are inadequate at 324 Bellona rd. Overflow runs down driveway & creates flooding at entranceway and has no run-off
212	Beverley Tce	Yes	Ponding on property	Up to 5 cm	More than once per year	The ponding occurs at the unsealed driveway entranct to the property due to a lower/uneven surface. The other area is the cul-d-sac @ the bottom of St Patrick row. This needs to be filled as ponding is common here and remains for weeks
213	Beverley Tce	Yes	Ponding on property	Up to 5 cm	More than once per year	We are in process of rebuilding & the ground level has to be lowered velow road level, this could possibly cause road runoff to come into the section
232	Beverley Tce	Yes	Ponding on property	Up to 5 cm	More than once per year	subject property has access form Beverly Tce & Explanade. Situated at end of esplanade(nthn). Rain rapidly results in ponding at Esplanade entrance.
248	Beverley Tce	Yes				Water pools on sides of road after heavy rain (Beverly Terrace)
102b	Beverley Tce	Yes	Ponding on property	Up to 1 cm	More than once per year	Owned 1 yr. SW is running over ground now, but in future am going to concrete the drive,w hich is stopping back down to my section, which is going to bring a lot more water. Do I soakhole the drive ater & roof water or do I take roof water to the road.
244a	Beverley Tce	Yes				Property OK. Concern ponding on road - no kerb & channell
100	Bond Rd	Yes				Have had dialogue with council regardin SW at road forntage. See attached drawing and council correspondence
203	Bond Rd	Yes	Ponding on property	Up to 1 cm	More than once per year	During heavy rain water ponds on road verge then onto property
110	Brook Pl	Yes	Ponding on property	Up to 5 cm	Once every 2-5 years	Has not been a problem. Ponding & Flooding in extreme weathr conditions only.
111	Brook Pl	Yes				Stormwater drains at the end of Kotuku St very frequently have adreadful smell (empty into the Otahu Estuary) This cannot be purley stormwater. Sewage contamination? Please include in your investigations
105	Casement Rd	Yes				At moment think there is some sort of blocakge. Apart form that we have no problems with water on or around our property
106	Casement Rd	Yes	Ponding on property	Up to 1 cm	More than once per year	Ponds on low point of rear lawn. SW kerbing on road front does not have enough fall - ponding occures and silt left when finally dried up.
114	Casement Rd	Yes	Ponding on property	Up to 5 cm	More than once per year	since 1947,at road frontage of property, there has been ponding. Have had to build a mound across rd frontage to prevent surface water entering property. Sw drqain installed early 70's thru our land with a sump & grate at the street. Higher than SW pond.
200	Casement Rd	Yes	Ponding on property	Up to 1 cm	Once every 2-5 years	Occasionally get ponding on front part of section, around driveway area which is lowest point. This is sicne existing rd was widened. Extended bitumen directs water onto our section in heavy downpors, water cannot soak as water table risen
207	Casement Rd	Yes	Overland flow across Property	Up to 5 cm	More than once per year	Our house & section are fine. Heavy rain casues SW to gather in road frontage in undulation. Kerbing & channeling will eliminate this problem
221	Casement Rd	Yes	Ponding on property	Up to 5 cm	More than once per year	SW accumulates at the end of property by the road. Every time it rains water flows off the road,s ettles in the curb over our driveway entracne & down the frontage. No other pondng or floddin occurs on property
224	Casement Rd	Yes	Ponding on property	Greater than 5 cm	Once per year	
118a	Casement Rd	Yes				On road frontage, greater than 5cm every time it rains
118b	Casement Rd	Yes				Ponds of water on road entrance - if there was kerbing & footpath, also soakhole grates this would be alleviated
208 a&b	Casement Rd	Yes	Ponding on property	Up to 5 cm	More than once per year	Ponding along roadside every time ite rains heavy. Makes grass very boggy all winter as do not have any footpaths, so get your shoes mucky everytime you go out the gate
219a	Casement Rd	Yes				Roading frontage ponding (up to 5cm) after rain stays for several days after rainfall. No kerb & channel
219b	Casement Rd	Yes	Ponding on property	Up to 5 cm	More than once per year	Kerb & channelling our street would rectify this problem
104b	Charleston Ave	Yes	Ponding on property	Up to 5 cm	More than once per year	
116	Chartwell Ave	Yes				

Property Number	Property Street	SW Problems?	Flooding Problem	Depth of Flooding	Frequency of Flooding	Stormwater Comments
122	Chartwell Ave	Yes	Water hs enterd dwelling	Up to 1 cm	More than once per year	Water seeps in onto floor of bedroom when there is a bad storm formeast side of house. Hope something can be done (sorry have difficulty writing) was never informed why I had this problem with flooding.
202	Chartwell Ave	Yes	Ponding on property	Up to 1 cm	More than once per year	Concer - cesspit road, Chartwell/Charleston intersection blocks regularly. Detritus adjacent property and water backs up on road. Potential to enter garage. Water on rd at times a metre deep. Also? Capacity S/W reticulation in road (checking? & upgrade)
203	Chartwell Ave	Yes	Overland flow across Property	Up to 5 cm	Once per year	
224	Chartwell Ave	Yes				Only Minor. Water runs off the neighbours drive area into my stormwater pit. This is nor a major issue but will eventually fill my pit with debris. I believe that each property owner should provide drainage on their own property
101	Chevron Cres	Yes	Overland flow across Property	Greater than 5 cm	More than once per year	There seems to be a water spring on the property, and drainage is worse when it rains. Water reacheds top of basement floor.
105a	Chevron Cres	Yes	Overland flow across Property	Up to 5 cm	More than once per year	Water flows down drive into two water traps which drains into a soak pit which filles up & water overflows, carries on under & around the house
108	Diana Ave	Yes	Ponding on property	Up to 5 cm		Concerned about ponding thay may occur in heavy rains as property in front, one to left, have been built up. Prior to thes alterations ponding was not a problem - see scan
115	Diana Ave	Yes	Ponding on property	Greater than 5 cm	More than once per year	no kerbing on our road edge, each time we have significant rain ponding occurs on the rd edge & this blocks our pedestrian access to road. Ponding usually taked 3-4 hrs to clear by infiltrating into the ground.
120 & 120b	Diana Ave	Yes	Ponding on property	Up to 5 cm	More than once per year	After prolonged rainfall SW ponds on carriageway & berm sometimes for several days rain has stopped. More notes on scan.
205	Esplanade Dr	Yes				flooding inarea forn to back (adjacent ot property)
215	Esplanade Dr	Yes			More than once per year	On the Esplanade adjacent to sealed roadway every time it rains.
111 a & b	Esplanade Dr	Yes				Problem is on road. 1) water remains in kerbside drain, as property is bridged, slows movement to main drain. 2) water remains on rd sth side of crossing (ponds) for weeks. 3)both cause water & sand on our tyres to enter our garaging.
115b	Esplanade Dr	Yes	Ponding on property	Greater than 5 cm	More than once per year	Everytime it rains we get water ponding at our gate, sometimes it is as deep as 80mm. People who park there car on kerb cannot get out wihtout getting water up over their shoes.
203b	Esplanade Dr	Yes	Water hs enterd dwelling	Up to 1 cm	Less than once every 5 years	after heavy rain, ponds form either side of sealed rd on verges. Leaves only about 1m of unponded tarseal. Afew years agon covered grass verge & onto concrete floor of house, weeting carpets & flooring. Kerb & channel would help
205a	Esplanade Dr	Yes				No problems on our property but we have the problem with SW Pondong on Esplanade's northern end where we live. NO footpaths, gutters or culverts so water sits at sides of road.
209b	Esplanade Dr	Yes	Overland flow across Property	Greater than 5 cm	More than once per year	Ponding on roadside adjacen to property, every time rains. If heavy rain pond occurs right across driveway, making walking access difficult. Did not oocure before rd was raised and tarsealed.
209c	Esplanade Dr	Yes				Ponding on road verge at esplanade drive extension (greater than 5cm) for several days after rain as there is no kerb or channelling to assist drainage
102	Exeter Rd	Yes	Overland flow across Property	Up to 5 cm	More than once per year	Section is lowest point on road. No concrete guttrings,w ater runs form both directions to lowest spot. Runs down drive into section & also onto neighbours lawn at 104.
110b	Exeter Rd	Yes	Ponding on property	Up to 5 cm	More than once per year	Ponding occurs where driveway joins the road/footpath kerb & channel would solve the problem
111b	Exeter Rd	Yes				Puddles form after rain at top of the driveway
102	Fernleigh Gl	Yes	Overland flow across Property	Up to 5 cm	More than once per year	not bad. Water runs off all uphill section and passes over our property, then thru neighbours.
104	Fernleigh Gl	Yes	Overland flow across Property	Up to 5 cm	Once per year	Sectin has numerous drains now connected to Covneil SW drain in reserve. However in heavy rain events, water from road, drvieway and neighbouring is toomuch for drainage system
124	Given Ave	Yes				Water accumulates on road edge & lays ther for several days after heavy rain. This has caused a rut 120mm deep x 500mm wide x 10m long & is damagin car. Edge of tarseal beginning to fragment. No probs on section.
200	Given Ave	Yes	Ponding on property	Greater than 5 cm	More than once per year	After heavy rain water builds up on side of Motiti st, as ther is no kerbing and the water cannot reach the drainage. Needs to be kerb & channeled
209	Given Ave	Yes	Overland flow across Property	Up to 5 cm	More than once per year	Because there has never been kerbing on the main rd, there is flooding on section after every downpour, & especially after heavy rain, water has reached front of verandah, & we can't leave the place for several hours
211	Given Ave	Yes	Ponding on property	Up to 5 cm	More than once per year	no real probem, heavy rainfall creats roadside ponding only.
220	Given Ave	Yes	Ponding on property			SW/ponding takes place at front of section due to no runoff, kerbing etc on roadside. No problems on section of dwelling. SW/ponding occures regardless of level or quantity by rainfall.
222	Given Ave	Yes	Ponding on property	Greater than 5 cm	More than once per year	the problem is on the street verge at front of property. Run off from road, no drainage
226	Given Ave	Yes		Greater than 5 cm	More than once per year	SW flooding on Given Ave in heavy rain.
240	Given Ave	Yes	Ponding on property	Greater than 5 cm	More than once per year	The Council stormwater intakes are sited on road above surrounding area.
309	Given Ave	Yes		Greater than 5 cm	More than once per year	Ponding ocurs to sides and sometimes acroos Given Ave. NO kerb & channel or Sw drainage. Ratepayer 19yrs, over due for kerb & channel and a SW system. Only improvement made in 19yrs is one street lgiht, still a very dark road.
327	Given Ave	Yes				
217a	Given Ave	Yes		Greater than 5 cm	More than once per year	Ponding on road. Everytime it rains on roadise which can remain for 24-48 hours after rain stops.
224a	Given Ave	Yes				Large poolin at roadside because of no kerb and channelling
304a	Given Ave	Yes	Overland flow across Property	Greater than 5 cm	More than once per year	Water ponds between pavememtna rea andour section. This is because there is no footpaths and drains to collect water away
308b	Given Ave	Yes				Outside property water floods and ponds across road upt to 5cm after heavy rain. Remains for several days
319/2	Given Ave	Yes	Overland flow across Property	Greater than 5 cm	More than once per year	heavy rain, creates huge puddling on edge of the road on 2 sectins in front. We are a back section & both back sections have soak holes & have a rise. Don not have problems even in a downpour.
101	Graham St	Yes	Overland flow across Property	Greater than 5 cm	More than once per year	Pooling in heavy rain on road.
202	Graham St	Yes		Greater than 5 cm	More than once per year	ponding roadside adjacent to property.
500	Graham St	Yes				Water pools outside proeprty
610	Harbour View Rd	Yes	Ponding on property	Up to 5 cm	More than once per year	In heavy rain
613	Harbour View Rd	Yes	Ponding on property	Up to 5 cm	More than once per year	SW has ponded on our property ever since council filled the area behind us.
614	Harbour View Rd	Yes	Ponding on property	Up to 5 cm	Once per year	Unsatisfactory stormwater drainage form verges leading to lonstnading ponding at roadside & muddy verges
224	Hauturu St	Yes				Have noticed after heavy rain that water form property on back boundary - being higher than mine, any runoff seeps into my property - gets quite wet, but sandy nature copes with seepage.
11	Herbert Dr	Yes				Herbert drive has no road/kerb gutter & as such we have some SW runoff formt he road area down our driveway. Presume ths will be eliminated when roading is upgraded?
306	Hetherington Rd	Yes	Ponding on property	Greater than 5 cm	More than once per year	There was once a drain running along the boundary of 304&306 but it was mostly filled in when 304 was redevloped. Put a pipe with holes right thru the forn lawn but it didn't stop the ponding.
303b	Hetherington Rd	Yes	Ponding on property	Up to 5 cm	More than once per year	The drive (common between 303 A & B) ponds regularly after heavy rain.
113	Hilton Dr	Yes	Overland flow across Property	Up to 1 cm	More than once per year	Cosntant wet grass verge form inadequate drainage on neighbouring sections. Water flows form corner of The Drive down Hilton Drive
104	Hinemoa St	Yes	Ponding on property	Up to 5 cm	Once per year	only minor
102a	Hinemoa St	Yes	Ponding on property	Greater than 5 cm	More than once per year	Ponding occurs on road frontage due to poor council road alignment. Lack of footpaths & kerb & channelling in this area lead to this ponding
112a	Hinemoa St	Yes				
112b	Hinemoa St	Yes	Ponding on property	Greater than 5 cm	More than once per year	Road runoff ponds on road onto property for sevral hours after heavy rain
104a	Hunt Rd	Yes	Ponding on property	Up to 5 cm		Unsure of frequency, try not to go when raining. The ater runs down the road & collects outside property & then onto drive. Have put a small drain in but it still colelcts & is causing some udnerscouring of cobblestones. No Kerb & channel
103	Island View Rd	Yes				With heavy rain, ponding occurs at Roadside
110	Kiwi Rd	Yes	Ponding on property	Up to 5 cm	More than once per year	My driveway and fornt lawn gets very boggy and wet in the rainy weather.
120	Kiwi Rd	Yes	Ponding on property	Greater than 5 cm	More than once per year	Every time it rains severe ponding occurs at our access driveways to property. Neighbour has filled his entrance to stem problem but now water is directed in our direction.Problem is on East side of Kiwi in may places. Kerb & channel should fix problem.
121	Kiwi Rd	Yes	Ponding on property	Up to 5 cm	More than once per year	
123	Kiwi Rd	Yes				Ponds form on Kiwi rd between forn boundary and edge of road after most rain, up to 10cm deep dependant on amount of rain. Solution: to Kerb, Channel. Ask greenies & Iwi
138	Kiwi Rd	Yes	Ponding on property	Greater than 5 cm	More than once per year	As we have no stormwater drains, kerbing (or footpaths) we are subjected to flooding after rain.
148	Kiwi Rd	No	Overland flow across Property	Greater than 5 cm	More than once per year	Draiange in Kiwi rd, is non existent and when rains we become owners of Lakeside Properties. There is no Drain or even a footpath. Ponding can at times encroach onto the road & into adjacent properties.
221	Kiwi Rd	Yes	Ponding on property	Greater than 5 cm	More than once per year	In heavy rain the road frontage is always badly flooded, right across the frontage of the section.
216b	Leander Rd	Yes	Ponding on property	Up to 5 cm	More than once per year	Pondingissues in only along the roadside. Ther is no guttering or kerbing. Makes walking hard after rain as ther is no where dry to walk except on the road. Solutions - footpath, kerbing on road with SW channels
218b	Leander Rd	Yes	Ponding on property	Greater than 5 cm	Once per year	For as long as had property, every rainfall there is significant ponding at the end of our road and drive
202	Leighton Rd	Yes				
104	Lincoln Rd	No	Ponding on property	Up to 5 cm	Once per year	

Property Number	Property Street	SW Problems?	Flooding Problem	Depth of Flooding	Frequency of Flooding	Stormwater Comments
122a	Lincoln Rd	Yes				In heavy rain outside drainage is often blocked causing road flooding of parking area.
29	Lindsay Rd	Yes				drain holds water & all rubbish floaats doen. Are building at present and are unable to use land on toher side of drain, new need to pipe this so it can be utlilised. Are rated on this byt current SW prevents using it.
111	Lindsay Rd	Yes	Water has entred garages/ sheds	Greater than 5 cm	Once per year	the building on 107 Lindsay has no SW guttering on any of the buildings. All rain water is dicharfed straigh onto the gound. This problem needs to be addressed to comply with council regulations. I would be happ to meet with somebody on site to explain
106 & 108	Lindsay Rd	Yes				Manhole adjacent to properties accorss the road, blows its lid off in flash flooding.
303	Linton Cres	Yes	Overland flow across Property	Up to 1 cm	More than once per year	Overland flow onto property is created form nextdoor property soakholes being non existent. Their total water form their roof collection virtually flows onto our property
419	Linton Cres	Yes	Ponding on property	Up to 1 cm	More than once per year	Ponding occures near fron door when downpipe overflows in heavy rain. Presumalby caused through inadequate soakage pit.
100a	Linton Cres	Yes			More than once per year	
310b	Linton Cres	Yes	Ponding on property	Greater than 5 cm	More than once per year	The stormwater system for the share driveway at Linton court (310 Linton cres) is unable to cope with normal to heavy rainfall causing driveway cobble stones to subside.
610b	Linton Cres	Yes	Overland flow across Property	Up to 5 cm	More than once per year	The Property at the back of our house has downpipes that go to ground only. Apparent stormwater system.
129	Lorraine Pl	Yes				
100	Lowe St	Yes				Wherever water remains after rain we need drainage of same. Keb & Channel would help to drain water. After many years of paying rates we deserve needed Kerb & channel & footpaths to walk along
102	Lowe St	Yes	Ponding on property	Greater than 5 cm	More than once per year	
105	Mako Rd	Yes	Ponding on property	Up to 5 cm	More than once per year	No drainage on street, water ponds on front of section & on driveway. Would like to meet with someone from Council on Mako st site.
105	Marie Cres	Yes	Ponding on property	Greater than 5 cm	More than once per year	
116b	Mark St	Yes				
522	Martyn Rd	Yes	Ponding on property	Up to 5 cm	More than once per year	
607	Martyn Rd	Yes	Ponding on property	Greater than 5 cm	Once per year	Water accumulates on low ground between our place and next door drains away quickly and is not a problem
905b	Martyn Rd	No	Ponding on property		Once every 2-5 years	Over 20 yrs , property fronting Martyn rd has some ponding with heavy rain at fornt & inside boundary but not a problem really as only in heavy rain 12-14 hrs. Is gone within hour of rain stopping.
207	Mary Rd	Yes	Ponding on property	Up to 5 cm	More than once per year	Stormwater regularly ponds at the entrance to the property and adjacent to the road and forn of section.
302	Mary Rd	Yes	Overland flow across Property	Up to 1 cm	More than once per year	Floods on road in front of section
311	Mary Rd	Yes	Ponding on property	Up to 5 cm	More than once per year	at road edge afeter heavy rain ponding occures. Usually drains quickly but if cars aim for water(as they do) the roads edge develops into a trough & starts to undermine the ashphalt & throws stones & debri across lawn
314	Mary Rd	Yes	Water has entred garages/ sheds	Greater than 5 cm	Less than once every 5 years	
121b	Mayfair Ave	Yes				Problem is that sometimes after heavy rain the sink isdie the kitchen blocks and I wonder if is too much for drainange pipes which I believe channel surplus water thru the Lorraine Pl area
109	McKellar Pl	Yes	Water has passed under dwelling	Up to 5 cm	More than once per year	
11b	McKellar Pl	Yes	Ponding on property	Up to 5 cm	More than once per year	I need advice on where best to direct the stormwater form the building, thanks
107	Moa St	Yes	Ponding on property	Greater than 5 cm	More than once per year	Water ponds on property of edge of road. Cars pass through this to park, causing area to become muddy and slushy
102	Mooloo Cres	Yes				SW accumulates north end of Ranfurly rd & Mooloo Cres by the carpark area. Sometimes lays for days.
106	Mooloo Cres	Yes	Ponding on property	Greater than 5 cm	More than once per year	after heavy rain water accumulates on grass verge. Water flos form both ends of Mooloo to this low point. Extends across Mooloo and can exceed depth of 200cms. Extends up drive,cars cannt enter or exit. Common occurance. Happy to meet on site to discuss
111	Mooloo Cres	Yes		Greater than 5 cm	More than once per year	After heavy rain, water ponds at bottom of the hill, blocking the road. There is NO stormwater system in our street.
112	Mooloo Cres	Yes	Ponding on property	Greater than 0.5 m	More than once per year	the road is not passable several times a year (after every heavy rain). A pond forms directly outside 106 Mooloo crescent.
105a	Moore Pl	Yes	Ponding on property	Greater than 5 cm	More than once per year	Happens during heavy rain, large pool of Sw acorss entry to section. House is elevated, so in so 'internal' issue. Pooling stays for a while before dissipating into the ground.
103	Motiti St	Yes	Ponding on property	Greater than 5 cm	More than once per year	ponding occures in slight hollow form properties boundary to the road. Owned since 1981 and no footpath or appropriate drive access in that itme. Have pd approx 22k and recived very little. Basic requirements.
519	Ocean Rd	Yes	Overland flow across Property	Up to 1 cm	More than once per year	soakpit cannot always cope with stormwater form downpipe at times of ehavy rain.
807	Ocean Rd	Yes	Ponding on property	Up to 5 cm		water ponds at road edge only
210a	Ocean Rd	Yes	Ponding on property		More than once per year	ponds up to hubcaps on car. 210 lowest section on Ocean rd. Prior to 208 rasing property, would enter my property & pond on his, now stops at mine
600B	Ocean Rd	Yes				not on property but on road frontage adjacent to it.
618a	Ocean Rd	Yes	Water has entred garages/ sheds	Up to 5 cm	Once every 2-5 years	
206	Otahu Rd	Yes	Ponding on property	Up to 5 cm	More than once per year	In Heavy, continuos rain, the firve floods in from of house. A small fieldtile drain has been installed, does not cope. Water will drain into gorund when rain stops.
425	Otahu Rd	Yes	Water has entred garages/ sheds	Greater than 5 cm	Once every 2-5 years	Natural drainage was to rear of property. Once built on they raised section above ours hence nowhere for draiange to go but into our garage. Now have soakholes for roof as not practical to get to road. Now only floods into garage when surface water
501	Otahu Rd	Yes	Ponding on property	Up to 1 cm	More than once per year	Two downpipes form house roof sputing and on off conservatory roof, which drains into steel 200l drums, which is inadequate in a downpour. Causes surface flooding in & around the paving stone area
524	Otahu Rd	Yes	Ponding on property	Up to 5 cm	More than once per year	We observed the problem water entering form the neighbours garage downpipe. A faulty drain has since been fixed and the overall problem amy be somewhat alleviated.
800	Otahu Rd	No	Overland flow across Property	Greater than 0.5 m	More than once per year	On corner of Otahu & Tangaroa Roads. See scans for notes
200b	Otahu Rd	Yes				On rainy days, ponding occurs on roadside at entrance to property
241a	Otahu Rd	Yes	Ponding on property	Up to 5 cm	More than once per year	Not sure how severe problem could be as only owned property for less than 2 years and not there all the time.
251a	Otahu Rd	Yes	Ponding on property	Up to 5 cm	More than once per year	
602 /1	Otahu Rd	Yes	Ponding on property			ponding on road verge at entrance to garage, after heavy rain
701b	Otahu Rd	Yes				Floodinh of street, property to property. SW pipe at beachend of Otahu rd, access 17, should be lowered to beach level & estended beyond base of sandbank, to eliminate erosion of sandbank
703a	Otahu Rd	Yes	Ponding on property	Up to 5 cm	More than once per year	The area (cnr Otahu/Pohutukawa cres/Tangaroa) is support by a pump. A combination of a power cut & heavy rain results in heavy ponding.
107	Pacific View Dr	Yes	Overland flow across Property	Greater than 5 cm	More than once per year	Floods wheneveer ther is heavy rain. Front footpath/roadside verge keeps gettingw ahsed out by water running off neighbouring properties. Has been been filled with gravel/stones buts keeps washign away. Maybe concrete would help.
207	Papanui Rd	Yes	Water has entred garages/ sheds	Up to 5 cm	More than once per year	During heavy rain water runs down drive & into front of garage. Slope is towards garage & slightly down hill & lip to garage not great enough. Was on section prior to purchase. Excavation woud solve, not a major problem thoughr
311	Papanui Rd	Yes				See attached correspondence
104	Park Ave	Yes	Ponding on property	Up to 1 cm	More than once per year	The water is being held back on our property by the concrete walls.sides of the drain. Draing thru this area is open and a hazard. Should be piped and covered.
115	Park Ave	Yes	Overland flow across Property	Up to 1 cm	More than once per year	There are 2 pipes that emit water across the footpath to the gutter. This usually occurs after a prolonged rain.
120	Park Ave	Yes	Ponding on property	Up to 5 cm	More than once per year	Have had an engineer undetake test drillings. 80% of section is compacted clay, which provides no drainage. Soakage pit would not help. Extensvie works required to provide an acceptable standard, as section ponds even with normal rain
124	Park Ave	Yes		Greater than 5 cm	More than once per year	There is some ponding on the property next to mine (to the left), but it goes away pretty quickly.
127	Park Ave	Yes	Overland flow across Property	Up to 5 cm	More than once per year	Water runs down section form reserve bush behind section
102	Philomel Rd	Yes	Overland flow across Property	Up to 5 cm	More than once per year	during heavy rains, experience runoff form the road, causing flooding which has been known to flood as far as steps to front terrace. Runoff caused thru lack of footpath or guttering across front of property
105	Philomel Rd	Yes	Water has entred garages/ sheds	Up to 5 cm	Once per year	
110	Philomel Rd	Yes	Ponding on property	Up to 5 cm	More than once per year	Water is ponding on council berm outside our property
207	Philomel Rd	Yes	Ponding on property	Greater than 5 cm		on roadside
212	Philomel Rd	Yes	Ponding on property	Up to 5 cm	More than once per year	Our soakage accommodates rain run off form our own roof via downpipes. Our problem is that neighbour (214a) has directed downpipe runoff onto the grass & facing our south boundary
106a	Philomel Rd	Yes	Ponding on property	Greater than 5 cm	More than once per year	
108a	Philomel Rd	Yes	Ponding on property	Greater than 5 cm	More than once per year	road runoff enters properly in the vicinity of the driveway and ponds in driveway. Not critical or threatening to dwelling depth 0.3m (most xmas holidays) and lats 1-2 days
113a	Philomel Rd	Yes	Ponding on property	Up to 5 cm	More than once per year	
201a	Philomel Rd	Yes	Ponding on property	Greater than 5 cm	Once per year	Extensive street flooding following rain

Property Number	Property Street	SW Problems?	Flooding Problem	Depth of Flooding	Frequency of Flooding	Stormwater Comments
214a	Philomel Rd	No	Ponding on property	Up to 5 cm	More than once per year	the problem is at the entranct to driveway. Water pond and turns into mud, we have phone Council and asked for stones to be dumped but this has not happened.
101	Pipi Rd	Yes				There is stormwater flooding after heavy rain adjacent to the property
102	Pipi Rd	Yes	Ponding on property	Greater than 5 cm	More than once per year	After heavy rain
103	Pipi Rd	Yes	Ponding on property	Up to 5 cm	More than once per year	Flooding on roadside
105	Pipi Rd	Yes				There have been no problems on my property, but there is a lot of ponding on the carpark and the street corner of Pipi and Island View rd.
126	Pipi Rd	Yes	Water hs enterd dwelling	Up to 5 cm	Less than once every 5 years	basement dwelling flooded when ground water level rose & prevented soakage drain operating correctly (abnormal heavy rain)
130a	Pipi Rd	Yes	Water hs enterd dwelling	Greater than 5 cm		Lower deck was flooded to 5+cm. Firebrigade pumped out. 3 drain pits were dug out $1400 cost to us. SW drain seems to be coping with drainage to drain hole on the dunes, although this needs clearing to keep hole free fo vegetation. Needs attending to
119	Pohutukawa Cres	Yes			Once per year	Stormwater on road at Otahu, Tangaroa, Poutukawa road junction up to knee depth.
205	Port Rd	Yes	Ponding on property	Up to 5 cm	More than once per year	Ponding in front of house as heavy rain drains form Park road and area in formt of 205.
306	Port Rd	Yes				Ponding on the Port road outside property everytime it rains.
648	Port Rd	Yes	Overland flow across Property	Greater than 5 cm	More than once per year	My opinion is that the SW cesspit & drain is inadequate to cope with ehavy rain. Have experienced flloding form footpath to halfway up Port rd, several times a yar. Cuasing great inconvenience to motorists & shoppers
308-310	Port Rd	Yes				
313b	Port Rd	Yes	Overland flow across Property	Greater than 5 cm	More than once per year	Low point of road at our property entrance. Water form road floods entrance frequently
	Port Rd	Yes	Ponding on property	Up to 5 cm	More than once per year	On school grounds
102	Ranfurly Rd	Yes				adjacent to property
105	Ranfurly Rd	Yes	Ponding on property	Greater than 5 cm	More than once per year	Low lying area in front of 101&105 Ranfurly. During heavy rain runoff form Winifred Ave pons on the corner of the two rds - backing up to my property insever rains ponding over rd up to 200mm. Rd verge in front of property is regularly sodden.
106	Ranfurly Rd	Yes	Overland flow across Property	Greater than 5 cm	More than once per year	Occurs on the road by our property
217	Rangi Ave	Yes		Up to 5 cm	More than once per year	Ponding in the street when get heavy rain
106	Riverview Rd	Yes	Ponding on property	Up to 5 cm	More than once per year	Water ponds in front of house near road. It gets runoff formt he road as there is no kerb & channel or footpaths
113	Riverview Rd	No	Ponding on property	Greater than 5 cm	More than once per year	
115	Riverview Rd	No	Overland flow across Property	Greater than 5 cm	Once every 2-5 years	
111b	Riverview Rd	Yes	Ponding on property	Up to 5 cm	Once every 2-5 years	only occurs after prolonged periods of rain and after heavy rainfall. Well away form dwelling & not considered a problem. Has only happened a couple of this in last few years.
200	Rutherford Rd	Yes	Ponding on property	Greater than 5 cm	More than once per year	Ponding in front of property when it rains or whenever hose is used on driveway
305	Rutherford Rd	Yes	Ponding on property	Up to 5 cm	More than once per year	Occurs during rain - pond forms as road is higher than berm. Would be corrected if kerbing & channeling was there.
105	Seaview Rd	Yes	Ponding on property	Greater than 0.5 m	More than once per year	
105	Seaview Rd	Yes	Ponding on property	Greater than 0.5 m	More than once per year	
207	Seaview Rd	Yes	Ponding on property	Up to 5 cm	More than once per year	Ponds at front (road side) of property
211	Seaview Rd	Yes				Seaview Road has no stormwater drains & rain ponding disposes through seepage on road verges.
1006	Seaview Rd	Yes				prob is the pond & overflow out to sea thru a culvert in the dunes. Allows water form sea in during spring/high tides & storms or water out during torrential rains hence pond overflows. Correct SW drainage & re-stocking of sand dunes wil overcome.
100b	Seaview Rd	Yes				see scan
121	Sharyn Pl	Yes	Ponding on property	Greater than 5 cm	More than once per year	Every time it rains water runs off walkway and floods onto property. Have contacted Council on many occasions re this problem, have looked at it but nothing happened. Have had to build up back section to 100mm above walkway making walkway impossible to us
131	Sharyn Pl	Yes	Water has passed under dwelling	Up to 5 cm	More than once per year	owest part of property is driveway, water gathers here every downpour. Uup to 100mm in places, takes ages to drain, because of reserve & estaury nearby, Considering putting in own drain. Only had property 9mths, still learning extent of problem
140a	Sharyn Pl	Yes	Water has entred garages/ sheds			Water floods into carport with heavy rain. I don't know too much only moved in Feb 2003 and been away 2 months of that time. Not too serious.
110	St Patricks Row	Yes	Ponding on property	Greater than 5 cm	More than once per year	At End of street by Beach always large water area and is a problem for access with pedestrians/traffic
111	St Patricks Row	Yes				Ponding on ground adjacent to parking area at end of St Patricks Row, continuous problem 10 fo 12 mths in year. Large port hole if dry, large wet undraining hole if wet.
116	Sylvia Rd	Yes	Ponding on property	Up to 5 cm	More than once per year	During Heavy rain, water pools on front lawn (neighbours also) Some is run off form road. Recently spent $hundreds to raise level of lawn to minimise effect.
200	Sylvia Rd	Yes				bad ponding on the corner of Sylvia & Lowe street every time it rains causing verges to get very slushy
202	Sylvia Rd	Yes	Ponding on property	Up to 5 cm		usure of frquency as not always there - holiday hse. Dip in fornt of section & heavy rainwater runs off road in higher parts of section and collects ther. Drain away relatively quickly.
211	Sylvia Rd	Yes		Up to 5 cm	More than once per year	Large SW ponds aftern heavy rain on grass verge. Pwn property slopes to road so proble is contained between slope & road on Council grass verge.
213	Sylvia Rd	Yes	Ponding on property	Greater than 5 cm	More than once per year	We get ponding on the grass verge in front of our property
219	Sylvia Rd	Yes				The ponding that occurs in heavy rain is not a problem. Eventually soaks away.
225	Sylvia Rd	Yes				Property itself downs't have a problem. Surface flooding occurs in front of property i.e. Road/path - creates a pond/puddle when raining but soon drains away
227	Sylvia Rd	Yes		Up to 5 cm	More than once per year	Pondoig on road enge
303	Sylvia Rd	Yes	Water has entred garages/ sheds	Up to 5 cm	More than once per year	Absentee Owner, not there during winter much. Occasionally there is stormwater ponding on the road outside our property in heavy rain.
316	Sylvia Rd	Yes	Overland flow across Property	Greater than 5 cm	Once per year	water ponds at end of drive washing out metal - not exactly on property but makes muddy mess at times.
318	Sylvia Rd	Yes	Overland flow across Property	Greater than 5 cm	More than once per year	At fron of property, by road, a very large 'puddle/pool' occures after heavy rain. Proble in way the road is constructed - it drains onto property as the land is below the road surface because of the camber. Problem increased when sewerage pipes installed
320	Sylvia Rd	Yes	Ponding on property	Greater than 5 cm	More than once per year	Huge ponds form outside property on street frontage in line with proporsed driveway to garage.
401	Sylvia Rd	Yes				Flooding of street where rain does not get away, which in heavy rain is right across the road
119b	Sylvia Rd	Yes				Water is captured on road sides extensivley to a depth of 200mm in heavy down falls, directly outside our property
301b	Sylvia Rd	Yes		Greater than 5 cm		SW on road frontage not abel to reach drain due to uneven levels along edge of tarseal - after heavy rain.
324b	Sylvia Rd	Yes	Ponding on property	Up to 5 cm	More than once per year	ponding in fairly large area by front of house on driveway. (but clears fairly quick one heavy rain stops)
324c	Sylvia Rd	Yes				ponding in entrance of driveway owing to the absence of kerbing or channleing. At times of ehavy rain going right across roadway.
488	Tairua Rd	Yes	Ponding on property	Up to 1 cm	More than once per year	Water logged ground from road run off every heavy rain
115	Tamaki Rd	Yes	Ponding on property		More than once per year	no footpath. No kerb & channel. Grass verge much higher than cobblestones. Other area of concern Tamaki Rd - Exeter rod junction and Tamaki & Ajax Rd
115 /2	Tamaki Rd	Yes		Up to 1 cm	More than once per year	Ponding is on road front of property Exeter rd. Dissapages after time. No need for kerb & channel;. Would only exacerbate problem.
201a	Tamaki Rd	Yes				Please channel & curb the street. Exeter & Tamaki
300b	Tamaki Rd	Yes	Overland flow across Property		More than once per year	overland flow on to road forntage. Makes access onto property extremely untidy, metal filling would probably fix the problem
112	Tangaroa Rd	Yes	Ponding on property	Greater than 5 cm	More than once per year	Every time it rains. With one of the highest rated streets, something should be done. I guess with no footpath makes it wworse outside no its even worse.
114	Tangaroa Rd	Yes	Ponding on property	Greater than 5 cm	More than once per year	After any reasonable rainfall ponding occurs at the road frontage. (5cm+ deep and up tp 2 m circumference) creating a hazard for traffic in Tangaroa Rd, This also occures at intervals along road. No kerbing, channeling or drainage appears present.
119	Tangaroa Rd	Yes	Ponding on property	Greater than 5 cm	More than once per year	On road frontage - council property
121	Tangaroa Rd	Yes				tangoroa rod is frequently flooded after heavy rain.
204	Tangaroa Rd	Yes	Ponding on property	Greater than 5 cm	More than once per year	Not in position to answer as have been building over the last 12 mths. However noticed several ponding problems at the endge of road alon Tangaroa rd.
114a	Tangaroa Rd	Yes	Ponding on property	Greater than 5 cm	More than once per year	right on roadside & front of property ther is no runoff from road. Water ponds, in heavy rain covers road, in easier rain ponds 75% of raod, blocking access to our section.
115a	Tangaroa Rd	Yes	Ponding on property	Up to 5 cm	More than once per year	We would like to point out that there is no stormwater control on Tangaroa Rd & ther is allways poinding along both sides of the road
133b	Tangaroa Rd	Yes				NO road channelling in Tangaroa rd, wter accumulates at the bottom of the drive on the edge of the roadside (& berm) every time we get rain
107	The Drive	Yes	Ponding on property	Up to 5 cm	More than once per year	Water accumulates in back left hand corner due to the lay of land. Also water floods road outside & enters property of 109.
110	The Drive	Yes	Ponding on property	Up to 1 cm	More than once per year	At back of section, every time ihave heavy rain, the ground is water-logged, can't actually see it, but when you walk on it it squelches. And is extremely slippery. Doesn't seem to drain away sufficiently.
200	The Drive	Yes	Overland flow across Property	Up to 1 cm	Once per year	The property is on the lower side of a hill and surface water runs down in heavy rain form higher sections.
206	The Drive	Yes	Overland flow across Property	Up to 1 cm	Once every 2-5 years	

Property Number	Property Street	SW Problems?	Flooding Problem	Depth of Flooding	Frequency of Flooding	Stormwater Comments
106	The Square	Yes				There is a problem with ponding on road verge at our front gate.
211	The Square	Yes	Ponding on property	Up to 5 cm	More than once per year	Ponding occurs at entrance to property whenever there is ehavy rain
215	The Square	Yes	Ponding on property	Up to 5 cm	More than once per year	Ponding on edge of road adjacent properties 211, 213 & 215 The Square
217	The Square	Yes		Up to 5 cm	More than once per year	ponding on road frontage
207a	The Square	Yes		Greater than 5 cm		Ponding occurs where driveway meets road. (no kerb & channel). Occurs after heavy rain & takes a day or 2 to draw away. No problem ON poreprty. Ponding occurs serveral other place in the Square also.
215	Tuck Rd	Yes	Water hs enterd dwelling	Greater than 5 cm	More than once per year	Water has been noted to rise up in toilet
220	Tuck Rd	Yes	Ponding on property	Greater than 5 cm	More than once per year	no footpaths or culverts. Crown in road
102 & 104	Tuck Rd	Yes	Overland flow across Property	Up to 5 cm	More than once per year	water from road flows onto property causing problem see scan Water under & in dwelling used to occuremore than once a year. Since insallled SW pipes to drain council road to our property it has not occurred.
207a	Tuck Rd	Yes	Ponding on property	Up to 5 cm	More than once per year	The road needs kerbing & channelling to remove the ponding in the street.
219a	Tuck Rd	Yes		Greater than 5 cm	More than once per year	Pondin on grass verg directly informt o property, also across the dirveway by the street (approx 1/2m in depth). Every time a decent amount of rain
111	TuiRd	Yes	Ponding on property	Up to 5 cm	More than once per year	Stormwater form roadway ponds at the entrance to the property after heavy rain.
122	TuiRd	Yes				Mostlu in winter, problem when rains. Have to where gumboots in & out of property as rain floods grass verge. Have no footpaths & all seems to flood into my entrance area. Also cnr of Moa & Tuis flood over to meet with winter rains. Takes a while to drain
216	TuiRd	Yes	Ponding on property	Up to 5 cm	More than once per year	Water ponds at end of driveway on council verge. After every reasonable heavy reainfall. Water drians away after a period of time.
2892	Waihi Whangamata Rd	Yes	Overland flow across Property	Up to 5 cm	More than once per year	Neighbours properties above, all discharge their SW to fround/soakholes. In heavy rain ground becomes saturated & floows down thru ash layers & eventually exits onto our place causing slipping
122 & 124	Wattle Pl	Yes	Overland flow across Property	Greater than 0.5 m	More than once per year	have open drain at rear of property which has been piped for other industrial dwellings in the street, but Council hasn't piped & filled any further which is quite baffling considering there is a Swoutlet for street.
122 & 124	Wattle Pl	Yes				have only owne the 2 properties 8mths.Alpha Marine Systems lease the buildings & were previous owners - they have said there has been water ponding on street up to doors, after heavy rain
114	Waverley Pl	Yes	Ponding on property	Up to 5 cm	More than once per year	A bit of section & garden work would allow flow on to the street
110b	Waverley Pl	Yes	Ponding on property	Up to 1 cm	More than once per year	After very heavy raint henorther side will sit under wter, has been up to 2 days after severe rain & our concrete tiles on drive are lifting in places where water sits & undermines the drive
100A	Weka St	Yes				than 5cm deep. Occurs more than once a year. At times of torrential downpours SW drain on corner of Weka and Linton Cr doesn't cope.
17	Widdison Pl	Yes		Greater than 5 cm	Once every 2-5 years	Yes to all except 'C'. Water has flooded down the frive onto the fornt step & into the house. I have had new drainage done.
107	Williamson Rd	Yes	Ponding on property	Greater than 5 cm	More than once per year	footpath is higher than area that floods. No backfill done when footpath was laid.
123	Williamson Rd	Yes				Only problem is the road cess pit which hasrecently been completed. Is right in driveway to the side, so that one car wheel always has to go over it. Have seen no others in town right in entrance way.
300a	Williamson Rd	Yes				We did have ponding problems but this may have been solved with recent work in our area.
309 / 2	Williamson Rd	Yes		Up to 5 cm	More than once per year	Grass Verge nees building to the same level as drive crossing. Floods on both sides when raining.
120	Winifred Ave	Yes	Water has passed under dwelling	Up to 5 cm	More than once per year	Stormwater ponding at property vehicle crossing
201	Winifred Ave	Yes	Overland flow across Property	Up to 5 cm	More than once per year	road runoff onto my property due to no kerb & channel. Due to the high rates we pay we should not have to put up with this.
108a	Winifred Ave	Yes				No kerb & channeling on st front. Huge puddles in heavy rain on roadside. Stones & water wash over path slowly causing bigger hols in rd edge. Huge lake forms at beach end of winifred as nowhere to go.
120 /1	Winifred Ave	Yes				Deep pool of water forms on rd outside property in 2 places. Have complained over years. Attemspt to fix have failed. Needs proper assessment by engineer & probably need a channel in rd or a drain. Neighbour thinks concll work man broke pipe,

TCDC Utilities Capital Works Programme

Whangamata Stormwater Catchment Study

Conceptual Costings — Whangamata Pipe Upgrades

ESTIMATE SUMMARY

Item	Description	Base Estimate	Contingency	Funding Risk
A	**Project Property Cost, Consultation, planning, consents, Internal Council Project Management**	**$ 392,808.17**		
B	**Investigation and Reporting**	**$ 157,123.27**		
C	**Design and Project Documentation**	**$ 235,684.90**		
1	**CONSTRUCTION**	$ 785,616.34		
	MSQA (Mgmt Systems and Quality Assurance)			
2	**Construction Supervision**	$ 196,404.08		
	Physical Works			
3	Preliminary & General	$ 356,612.05		
4	Traffic Management and Temporary Works	$ 5,349.18		
5	Service Relocations	$ -		
6	Stormwater upgrade work	$ 3,566,120.45		
7	Landscaping	$ -		
8	Contract Close-out	$ -		
9	Unscheduled Items	$ -		
D	**Total Construction**	**$ 3,928,081.68**		
Total Base Estimate		**$ 5,695,718.43**		
E	**Expected Contingency (20%) with Option 2**	**20%**	**$1,139,143.69**	
Expected Estimate			**$6,834,862.12**	
F	**Safety Contingency (10%) with Option 3**		**10%**	**$ 683,486.21**
Upper Bound Estimate				**$ 7,518,348.33**

Date of estimate:	**Cost Index**
Estimate prepared by:	**Signed**
Estimate internal peer review by:	**Signed**
Monte Carlo Analysis by:	**Signed**

Notes:

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5: Item D1 makes up 2% of total cost

TCDC Utilities Capital Works Programme

Whangamata Stormwater Catchment Study

Conceptual Costings — Aberdeen Rd

ESTIMATE SUMMARY

Item	Description	Base Estimate	Contingency	Funding Risk
	Project Property Cost, Consultation, planning, consents,			
A	**Internal Council Project Management**	**$ 7,106.00**		
B	**Investigation and Reporting**	**$ 2,842.40**		
C	**Design and Project Documentation**	**$ 4,263.60**		
1	**CONSTRUCTION**	$ 1,421.20		
	MSQA (Mgmt Systems and Quality Assurance)			
2	**Construction Supervision**	$ 3,553.00		
	Physical Works			
3	Preliminary & General	$ 3,230.00		
4	Traffic Management and Temporary Works	$ 1,000.00		
5	Service Relocations	$ 7,500.00		
6	Stormwater upgrade work	$ 56,100.00		
7	Landscaping	$ -		
8	Contract Close-out	$ 3,230.00		
9	Unscheduled Items	$ -		
D	**Total Construction**	**$ 71,060.00**		
Total Base Estimate		**$ 90,246.20**		
E	**Expected Contingency (20%)**	**20%**	**$ 18,049.24**	
Expected Estimate			**$ 108,295.44**	
F	**Safety Contingency (10%)**	**10%**		**$ 10,829.54**
Upper Bound Estimate				**$ 119,124.98**

Date of estimate:	**Cost Index**
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Monte Carlo Analysis by:	**Signed**

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TCDC Utilities Capital Works Programme

Whangamata Stormwater Catchment Study

Conceptual Costings — Achilles Ave

ESTIMATE SUMMARY

Item	Description	Base Estimate	Contingency	Funding Risk
	Project Property Cost, Consultation, planning, consents,			
A	**Internal Council Project Management**	**$ 6,941.00**		
B	**Investigation and Reporting**	**$ 2,776.40**		
C	**Design and Project Documentation**	**$ 4,164.60**		
1	**CONSTRUCTION**	$ 1,388.20		
	MSQA (Mgmt Systems and Quality Assurance)			
2	**Construction Supervision**	$ 3,470.50		
	Physical Works			
3	Preliminary & General	$ 3,155.00		
4	Traffic Management and Temporary Works	$ 1,000.00		
5	Service Relocations	$ 7,500.00		
6	Stormwater upgrade work	$ 54,600.00		
7	Landscaping	$ -		
8	Contract Close-out	$ 3,155.00		
9	Unscheduled Items	$ -		
D	**Total Construction**	**$ 69,410.00**		
Total Base Estimate		**$ 88,150.70**		
E	**Expected Contingency (20%)**	**20%**	**$ 17,630.14**	
Expected Estimate			**$ 105,780.84**	
F	**Safety Contingency (10%)**	**10%**		**$ 10,578.08**
Upper Bound Estimate				**$ 116,358.92**

Date of estimate:	**Cost Index**
Estimate prepared by:	**Signed**
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Monte Carlo Analysis by:	**Signed**

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TCDC Utilities Capital Works Programme

Whangamata Stormwater Catchment Study

Conceptual Costings Aickin Rd

ESTIMATE SUMMARY

Item	Description	Base Estimate	Contingency	Funding Risk
	Project Property Cost, Consultation, planning, consents,			
A	**Internal Council Project Management**	**$ 1,141.25**		
B	**Investigation and Reporting**	**$ 456.50**		
C	**Design and Project Documentation**	**$ 684.75**		
1				
	CONSTRUCTION	$ 228.25		
	MSQA (Mgmt Systems and Quality Assurance)			
2	**Construction Supervision**	$ 570.63		
	Physical Works			
3	Preliminary & General	$ 518.75		
4	Traffic Management and Temporary Works	$ 1,000.00		
5	Service Relocations	$ 1,500.00		
6	Stormwater upgrade work	$ 7,875.00		
7	Landscaping	$ -		
8	Contract Close-out	$ 518.75		
9	Unscheduled Items	$ -		
D	**Total Construction**	**$ 11,412.50**		
Total Base Estimate		**$ 14,493.88**		
E	**Expected Contingency (20%)**	**20%**	**$ 2,898.78**	
Expected Estimate			**$ 17,392.65**	
F	**Safety Contingency (10%)**	**10%**		**$ 1,739.27**
Upper Bound Estimate				**$ 19,131.92**

Date of estimate:	**Cost Index**
Estimate prepared by:	**Signed**
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Monte Carlo Analysis by:	**Signed**

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TCDC Utilities Capital Works Programme

Whangamata Stormwater Catchment Study

Conceptual Costings — Barrowclough Rd

ESTIMATE SUMMARY

Item	Description	Base Estimate	Contingency	Funding Risk
A	**Project Property Cost, Consultation, planning, consents, Internal Council Project Management**	**$ 2,244.00**		
B	**Investigation and Reporting**	**$ 897.60**		
C	**Design and Project Documentation**	**$ 1,346.40**		
1	**CONSTRUCTION**	$ 448.80		
	MSQA (Mgmt Systems and Quality Assurance)			
2	**Construction Supervision**	$ 1,122.00		
	Physical Works			
3	Preliminary & General	$ 1,020.00		
4	Traffic Management and Temporary Works	$ 1,000.00		
5	Service Relocations	$ 1,500.00		
6	Stormwater upgrade work	$ 17,900.00		
7	Landscaping	$ -		
8	Contract Close-out	$ 1,020.00		
9	Unscheduled Items	$ -		
D	**Total Construction**	**$ 22,440.00**		
Total Base Estimate		**$ 28,498.80**		
E	**Expected Contingency (20%)**	**20%**	**$ 5,699.76**	
Expected Estimate			**$ 34,198.56**	
F	**Safety Contingency (10%)**	**10%**		**$ 3,419.86**
Upper Bound Estimate				**$ 37,618.42**

Date of estimate:	**Cost Index**
Estimate prepared by:	**Signed**
Estimate internal peer review by:	**Signed**
Monte Carlo Analysis by:	**Signed**

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TCDC Utilities Capital Works Programme

Whangamata Stormwater Catchment Study

Conceptual Costings Beach Rd

ESTIMATE SUMMARY

Item	Description	Base Estimate	Contingency	Funding Risk
A	**Project Property Cost, Consultation, planning, consents, Internal Council Project Management**	**$ 9,325.25**		
B	**Investigation and Reporting**	**$ 3,730.10**		
C	**Design and Project Documentation**	**$ 5,595.15**		
1	**CONSTRUCTION**	$ 1,865.05		
	MSQA (Mgmt Systems and Quality Assurance)			
2	**Construction Supervision**	$ 4,662.63		
	Physical Works			
3	Preliminary & General	$ 4,238.75		
4	Traffic Management and Temporary Works	$ 1,250.00		
5	Service Relocations	$ 4,500.00		
6	Stormwater upgrade work	$ 79,025.00		
7	Landscaping	$ -		
8	Contract Close-out	$ 4,238.75		
9	Unscheduled Items	$ -		
D	**Total Construction**	**$ 93,252.50**		
Total Base Estimate		**$ 118,430.68**		
E	**Expected Contingency (20%)**	**20%**	**$ 23,686.14**	
Expected Estimate			**$ 142,116.81**	
F	**Safety Contingency (10%)**	**10%**		**$ 14,211.68**
Upper Bound Estimate				**$ 156,328.49**

Date of estimate:	**Cost Index**
Estimate prepared by:	**Signed**
Estimate internal peer review by:	**Signed**
Monte Carlo Analysis by:	**Signed**

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TCDC Utilities Capital Works Programme

Whangamata Stormwater Catchment Study

Conceptual Costings Beverly Rd

ESTIMATE SUMMARY

Item	Description	Base Estimate	Contingency	Funding Risk
	Project Property Cost, Consultation, planning, consents,			
A	**Internal Council Project Management**	**$ 2,909.50**		
B	**Investigation and Reporting**	**$ 1,163.80**		
C	**Design and Project Documentation**	**$ 1,745.70**		
1	**CONSTRUCTION**	$ 581.90		
	MSQA (Mgmt Systems and Quality Assurance)			
2	**Construction Supervision**	$ 1,454.75		
	Physical Works			
3	Preliminary & General	$ 1,322.50		
4	Traffic Management and Temporary Works	$ 1,250.00		
5	Service Relocations	$ 4,500.00		
6	Stormwater upgrade work	$ 20,700.00		
7	Landscaping	$ -		
8	Contract Close-out	$ 1,322.50		
9	Unscheduled Items	$ -		
D	**Total Construction**	**$ 29,095.00**		
Total Base Estimate		**$ 36,950.65**		
E	**Expected Contingency (20%)**	**20%**	**$ 7,390.13**	
Expected Estimate			**$ 44,340.78**	
F	**Safety Contingency (10%)**	**10%**		**$ 4,434.08**
Upper Bound Estimate				**$ 48,774.86**

Date of estimate:	**Cost Index**
Estimate prepared by:	**Signed**
Estimate internal peer review by:	**Signed**
Monte Carlo Analysis by:	**Signed**

Notes:

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5: Item D1 makes up 2% of total cost

TCDC Utilities Capital Works Programme

Whangamata Stormwater Catchment Study

Conceptual Costings Casement Rd

ESTIMATE SUMMARY

Item	Description	Base Estimate	Contingency	Funding Risk
	Project Property Cost, Consultation, planning, consents,			
A	**Internal Council Project Management**	**$ 594.00**		
B	**Investigation and Reporting**	**$ 237.60**		
C	**Design and Project Documentation**	**$ 356.40**		
1	**CONSTRUCTION**	$ 118.80		
	MSQA (Mgmt Systems and Quality Assurance)			
2	**Construction Supervision**	$ 297.00	$ 6,140.25	
	Physical Works			
3	Preliminary & General	$ 270.00	$ 5,835.00	
4	Traffic Management and Temporary Works	$ 1,500.00		
5	Stormwater upgrade work			
	Option 1	$ 3,900.00		
	Option 2		$ 115,200.00	
6	Landscaping	$ -		
7	Contract Close-out	$ 270.00	$ 5,835.00	
8	Unscheduled Items	$ -		
D	**Total Construction**	**$ 5,940.00**	**$ 122,805.00**	
Total Base Estimate		**$ 7,543.80**	**$ 130,252.05**	
E	**Expected Contingency (20%)**	**20%**	**$ 26,050.41**	
Expected Estimate			**$ 156,302.46**	
F	**Safety Contingency (10%)**	**10%**		**$ 15,630.25**
Upper Bound Estimate				**$ 171,932.71**

Date of estimate:	**Cost Index**
Estimate prepared by:	**Signed**
Estimate internal peer review by:	**Signed**
Monte Carlo Analysis by:	**Signed**

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TCDC Utilities Capital Works Programme

Whangamata Stormwater Catchment Study

Conceptual Costings — Casement Rd

ESTIMATE SUMMARY

Item	Description	Base Estimate	Contingency	Funding Risk
	Project Property Cost, Consultation, planning, consents,			
A	**Internal Council Project Management**	**$ 792.00**		
B	**Investigation and Reporting**	**$ 316.80**		
C	**Design and Project Documentation**	**$ 475.20**		
1	**CONSTRUCTION**	$ 158.40		
	MSQA (Mgmt Systems and Quality Assurance)			
2	**Construction Supervision**	$ 396.00		
	Physical Works			
3	Preliminary & General	$ 360.00		
4	Traffic Management and Temporary Works	$ 1,000.00		
5	Stormwater upgrade work	$ 6,200.00		
6	Landscaping	$ -		
7	Contract Close-out	$ 360.00		
8	Unscheduled Items	$ -		
D	**Total Construction**	**$ 7,920.00**		
Total Base Estimate		**$ 10,058.40**		
E	**Expected Contingency (20%)**	**20%**	**$ 2,011.68**	
Expected Estimate			**$ 12,070.08**	
F	**Safety Contingency (10%)**	**10%**		**$ 1,207.01**
Upper Bound Estimate				**$ 13,277.09**

Date of estimate:	**Cost Index**
Estimate prepared by:	**Signed**
Estimate internal peer review by:	**Signed**
Monte Carlo Analysis by:	**Signed**

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TCDC Utilities Capital Works Programme

Whangamata Stormwater Catchment Study

Conceptual Costings — Chartwell Ave

ESTIMATE SUMMARY

Item	Description	Base Estimate	Contingency	Funding Risk
	Project Property Cost, Consultation, planning, consents,			
A	**Internal Council Project Management**	**$ 5,956.50**		
B	**Investigation and Reporting**	**$ 2,382.60**		
C	**Design and Project Documentation**	**$ 3,573.90**		
1	**CONSTRUCTION**	$ 1,191.30		
	MSQA (Mgmt Systems and Quality Assurance)			
2	**Construction Supervision**	$ 2,978.25		
	Physical Works			
3	Preliminary & General	$ 2,707.50		
4	Traffic Management and Temporary Works	$ 1,000.00		
5	Service Relocations	$ 3,000.00		
6	Stormwater upgrade work	$ 50,150.00		
7	Landscaping	$ -		
8	Contract Close-out	$ 2,707.50		
9	Unscheduled Items	$ -		
D	**Total Construction**	**$ 59,565.00**		
Total Base Estimate		**$ 75,647.55**		
E	**Expected Contingency (20%)**	**20%**	**$ 15,129.51**	
Expected Estimate			**$ 90,777.06**	
F	**Safety Contingency (10%)**	**10%**		**$ 9,077.71**
Upper Bound Estimate				**$ 99,854.77**

Date of estimate:	**Cost Index**
Estimate prepared by:	**Signed**
Estimate internal peer review by:	**Signed**
Monte Carlo Analysis by:	**Signed**

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TCDC Utilities Capital Works Programme

Whangamata Stormwater Catchment Study

Conceptual Costings Diana Ave

ESTIMATE SUMMARY

Item	Description	Base Estimate	Contingency	Funding Risk
	Project Property Cost, Consultation, planning, consents,			
A	**Internal Council Project Management**	**$ 3,014.00**		
B	**Investigation and Reporting**	**$ 1,205.60**		
C	**Design and Project Documentation**	**$ 1,808.40**		
1				
	CONSTRUCTION	$ 602.80		
	MSQA (Mgmt Systems and Quality Assurance)			
2	**Construction Supervision**	$ 1,507.00		
	Physical Works			
3	Preliminary & General	$ 1,370.00		
4	Traffic Management and Temporary Works	$ 1,250.00		
5	Service Relocations	$ 3,000.00		
6	Stormwater upgrade work	$ 23,150.00		
7	Landscaping	$ -		
8	Contract Close-out	$ 1,370.00		
9	Unscheduled Items	$ -		
D	**Total Construction**	**$ 30,140.00**		
Total Base Estimate		**$ 38,277.80**		
E	**Expected Contingency (20%)**	**20%**	**$ 7,655.56**	
Expected Estimate			**$ 45,933.36**	
F	**Safety Contingency (10%)**	**10%**		**$ 4,593.34**
Upper Bound Estimate				**$ 50,526.70**

Date of estimate:	**Cost Index**
Estimate prepared by:	**Signed**
Estimate internal peer review by:	**Signed**
Monte Carlo Analysis by:	**Signed**

Notes:

1: These estimates are exclusive of escalation and GST

2: Item A makes up 10% of total cost

3: Item B makes up 4% of total cost

4: Item C makes up 6% of total cost

5: Item D1 makes up 2% of total cost

TCDC Utilities Capital Works Programme

Whangamata Stormwater Catchment Study

Conceptual Costings — Esplanade Dr

ESTIMATE SUMMARY

Item	Description	Base Estimate	Contingency	Funding Risk
	Project Property Cost, Consultation, planning, consents,			
A	**Internal Council Project Management**	**$ -**		
B	**Investigation and Reporting**	**$ 10,728.00**		
C	**Design and Project Documentation**	**$ 8,000.00**		
1				
	CONSTRUCTION	$ -		
	MSQA (Mgmt Systems and Quality Assurance)			
2	**Construction Supervision**	$ -		
	Physical Works			
3	Preliminary & General	$ -		
4	Traffic Management and Temporary Works	$ -		
5	Service Relocations	$ -		
6	Stormwater upgrade work	$ -		
7	Landscaping	$ -		
8	Contract Close-out	$ -		
9	Unscheduled Items	$ -		
D	**Total Construction**	**$ -**		
Total Base Estimate		**$ 18,728.00**		
E	**Expected Contingency (20%)**	**20%**	**$ 3,745.60**	
Expected Estimate			**$ 22,473.60**	
F	**Safety Contingency (10%)**	**10%**		**$ 2,247.36**
Upper Bound Estimate				**$ 24,720.96**

Date of estimate:	**Cost Index**
Estimate prepared by:	**Signed**
Estimate internal peer review by:	**Signed**
Monte Carlo Analysis by:	**Signed**

Notes:

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TCDC Utilities Capital Works Programme

Whangamata Stormwater Catchment Study

Conceptual Costings Harbourview Rd

ESTIMATE SUMMARY

Item	Description	Base Estimate	Contingency	Funding Risk
	Project Property Cost, Consultation, planning, consents,			
A	**Internal Council Project Management**	**$ 5,285.50**		
B	**Investigation and Reporting**	**$ 2,114.20**		
C	**Design and Project Documentation**	**$ 3,171.30**		
1	**CONSTRUCTION**	$ 1,057.10		
	MSQA (Mgmt Systems and Quality Assurance)			
2	**Construction Supervision**	$ 2,642.75		
	Physical Works			
3	Preliminary & General	$ 2,402.50		
4	Traffic Management and Temporary Works	$ 1,250.00		
5	Service Relocations	$ 3,000.00		
6	Stormwater upgrade work	$ 43,800.00		
7	Landscaping	$ -		
8	Contract Close-out	$ 2,402.50		
9	Unscheduled Items	$ -		
D	**Total Construction**	**$ 52,855.00**		
Total Base Estimate		**$ 67,125.85**		
E	**Expected Contingency (20%)**	**20%**	**$ 13,425.17**	
Expected Estimate			**$ 80,551.02**	
F	**Safety Contingency (10%)**	**10%**		**$ 8,055.10**
Upper Bound Estimate				**$ 88,606.12**

Date of estimate:	**Cost Index**
Estimate prepared by:	**Signed**
Estimate internal peer review by:	**Signed**
Monte Carlo Analysis by:	**Signed**

Notes:

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TCDC Utilities Capital Works Programme

Whangamata Stormwater Catchment Study

Conceptual Costings — Hetherington Rd

ESTIMATE SUMMARY

Item	Description	Base Estimate	Contingency	Funding Risk
	Project Property Cost, Consultation, planning, consents,			
A	**Internal Council Project Management**	**$ 704.00**		
B	**Investigation and Reporting**	**$ 281.60**		
C	**Design and Project Documentation**	**$ 422.40**		
1	**CONSTRUCTION**	$ 140.80		
	MSQA (Mgmt Systems and Quality Assurance)			
2	**Construction Supervision**	$ 352.00		
	Physical Works			
3	Preliminary & General	$ 320.00		
4	Traffic Management and Temporary Works	$ 1,000.00		
5	Service Relocations	$ 1,500.00		
6	Stormwater upgrade work	$ 3,900.00		
7	Landscaping	$ -		
8	Contract Close-out	$ 320.00		
9	Unscheduled Items	$ -		
D	**Total Construction**	**$ 7,040.00**		
Total Base Estimate		**$ 8,940.80**		
E	**Expected Contingency (20%)**	**20%**	**$ 1,788.16**	
Expected Estimate			**$ 10,728.96**	
F	**Safety Contingency (10%)**	**10%**		**$ 1,072.90**
Upper Bound Estimate				**$ 11,801.86**

Date of estimate:	**Cost Index**
Estimate prepared by:	**Signed**
Estimate internal peer review by:	**Signed**
Monte Carlo Analysis by:	**Signed**

Notes:

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5: Item D1 makes up 2% of total cost

TCDC Utilities Capital Works Programme

Whangamata Stormwater Catchment Study

Conceptual Costings Kiwi Ave

ESTIMATE SUMMARY

Item	Description	Base Estimate	Contingency	Funding Risk
	Project Property Cost, Consultation, planning, consents,			
A	**Internal Council Project Management**	**$ 715.00**		
B	**Investigation and Reporting**	**$ 286.00**		
C	**Design and Project Documentation**	**$ 429.00**		
1				
	CONSTRUCTION	$ 143.00		
	MSQA (Mgmt Systems and Quality Assurance)			
2	**Construction Supervision**	$ 357.50	$ 500.00	$ 2,341.13
	Physical Works			
3	Preliminary & General	$ 325.00	$ 1,750.00	$ 3,423.75
4	Traffic Management and Temporary Works	$ 1,500.00		
5	Service Relocations	$ -		
6	Stormwater upgrade work			
	Option 1 - Construct Overland Flow Path	$ 5,000.00		
	Option 2 - Construct Bund		$ 5,000.00	
	Option 3 - Install Pipe			$ 38,475.00
7	Landscaping	$ -		
8	Contract Close-out	$ 325.00	$ 1,750.00	$ 3,423.75
9	Unscheduled Items	$ -		
D	**Total Construction**	**$ 7,150.00**	**$ 10,000.00**	**$ 46,822.50**
Total Base Estimate		**$ 9,080.50**	**$ 12,073.00**	**$ 50,736.63**
E	**Expected Contingency (20%)**	**20%**	**$ 2,414.60**	
Expected Estimate			**$ 14,487.60**	
F	**Safety Contingency (10%)**	**10%**		**$ 5,073.66**
Upper Bound Estimate				**$ 55,810.29**

Date of estimate:	**Cost Index**
Estimate prepared by:	**Signed**
Estimate internal peer review by:	**Signed**
Monte Carlo Analysis by:	**Signed**

Notes:

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2: Item A makes up 10% of total cost

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5: Item D1 makes up 2% of total cost

TCDC Utilities Capital Works Programme

Whangamata Stormwater Catchment Study

Conceptual Costings — Mooloo Cres

ESTIMATE SUMMARY

Item	Description	Base Estimate	Contingency	Funding Risk
A	**Project Property Cost, Consultation, planning, consents, Internal Council Project Management**	$ -		
B	**Investigation and Reporting**	$ 10,728.00		
C	**Design and Project Documentation**	$ 8,000.00		
1	**CONSTRUCTION**	$ -		
	MSQA (Mgmt Systems and Quality Assurance)			
2	**Construction Supervision**	$ -		
	Physical Works			
3	Preliminary & General	$ -		
4	Traffic Management and Temporary Works	$ -		
5	Service Relocations	$ -		
6	Stormwater upgrade work	$ -		
7	Landscaping	$ -		
8	Contract Close-out	$ -		
9	Unscheduled Items	$ -		
D	**Total Construction**	$ -		
Total Base Estimate		**$ 18,728.00**		
E	**Expected Contingency (20%)**	**20%**	**$ 3,745.60**	
Expected Estimate			**$ 22,473.60**	
F	**Safety Contingency (10%)**	**10%**		**$ 2,247.36**
Upper Bound Estimate				**$ 24,720.96**

Date of estimate:	**Cost Index**
Estimate prepared by:	**Signed**
Estimate internal peer review by:	**Signed**
Monte Carlo Analysis by:	**Signed**

Notes:

1: These estimates are exclusive of escalation and GST

2: Item A makes up 10% of total cost

3: Item B makes up 4% of total cost

4: Item C makes up 6% of total cost

5: Item D1 makes up 2% of total cost

TCDC Utilities Capital Works Programme

Whangamata Stormwater Catchment Study

Conceptual Costings Pipi Rd

ESTIMATE SUMMARY

Item	Description	Base Estimate	Contingency	Funding Risk
A	**Project Property Cost, Consultation, planning, consents, Internal Council Project Management**	**$ 1,716.00**		
B	**Investigation and Reporting**	**$ 686.40**		
C	**Design and Project Documentation**	**$ 1,029.60**		
1	**CONSTRUCTION**	$ 343.20		
	MSQA (Mgmt Systems and Quality Assurance)			
2	**Construction Supervision**	$ 858.00	$ 1,125.00	$ 3,558.00
	Physical Works			
3	Preliminary & General	$ 780.00	$ 2,250.00	$ 4,530.00
4	Traffic Management and Temporary Works	$ 1,500.00		
5	Service Relocations	$ 1,500.00		
6	Stormwater upgrade work			
	Option 1 - Construct Overland Flow Path	$ 12,600.00		
	Option 2 - Construct Bund		$ 15,000.00	
	Option 3 - Install Pipe			$ 60,600.00
7	Landscaping	$ -		
8	Contract Close-out	$ 780.00	$ 2,250.00	$ 4,530.00
9	Unscheduled Items	$ -		
D	**Total Construction**	**$ 17,160.00**	**$ 22,500.00**	**$ 71,160.00**
Total Base Estimate		**$ 21,793.20**	**$ 27,400.20**	**$ 78,493.20**
E	**Expected Contingency (20%)**	**20%**	**$ 5,480.04**	
Expected Estimate			**$ 32,880.24**	
F	**Safety Contingency (10%)**	**10%**		**$ 7,849.32**
Upper Bound Estimate				**$ 86,342.52**

Date of estimate:	**Cost Index**
Estimate prepared by:	**Signed**
Estimate internal peer review by:	**Signed**
Monte Carlo Analysis by:	**Signed**

Notes:

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5: Item D1 makes up 2% of total cost

TCDC Utilities Capital Works Programme

Whangamata Stormwater Catchment Study

Conceptual Costings Port Rd

ESTIMATE SUMMARY

Item	Description	Base Estimate	Contingency	Funding Risk
	Project Property Cost, Consultation, planning, consents,			
A	**Internal Council Project Management**	**$ 429.00**		
B	**Investigation and Reporting**	**$ 171.60**		
C	**Design and Project Documentation**	**$ 257.40**		
1				
	CONSTRUCTION	$ 85.80		
	MSQA (Mgmt Systems and Quality Assurance)			
2	**Construction Supervision**	$ 214.50		
	Physical Works			
3	Preliminary & General	$ 390.00		
4	Traffic Management and Temporary Works	$ -		
5	Service Relocations	$ -		
6	Stormwater upgrade work	$ 3,900.00		
7	Landscaping	$ -		
8	Contract Close-out	$ -		
9	Unscheduled Items	$ -		
D	**Total Construction**	**$ 4,290.00**		
Total Base Estimate		**$ 5,448.30**		
E	**Expected Contingency (20%)**	**20%**	**$ 1,089.66**	
Expected Estimate			**$ 6,537.96**	
F	**Safety Contingency (10%)**	**10%**		**$ 653.80**
Upper Bound Estimate				**$ 7,191.76**

Date of estimate:	**Cost Index**
Estimate prepared by:	**Signed**
Estimate internal peer review by:	**Signed**
Monte Carlo Analysis by:	**Signed**

Notes:

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5: Item D1 makes up 2% of total cost

TCDC Utilities Capital Works Programme

Whangamata Stormwater Catchment Study

Conceptual Costings — Ranfurly Rd

ESTIMATE SUMMARY

Item	Description	Base Estimate	Contingency	Funding Risk
A	**Project Property Cost, Consultation, planning, consents, Internal Council Project Management**	**$ 4,796.00**		
B	**Investigation and Reporting**	**$ 1,918.40**		
C	**Design and Project Documentation**	**$ 2,877.60**		
1	**CONSTRUCTION**	$ 959.20		
	MSQA (Mgmt Systems and Quality Assurance)			
2	**Construction Supervision**	$ 2,398.00		
	Physical Works			
3	Preliminary & General	$ 2,180.00		
4	Traffic Management and Temporary Works	$ 1,250.00		
5	Service Relocations	$ 3,000.00		
6	Stormwater upgrade work	$ 39,350.00		
7	Landscaping	$ -		
8	Contract Close-out	$ 2,180.00		
9	Unscheduled Items	$ -		
D	**Total Construction**	**$ 47,960.00**		
Total Base Estimate		**$ 60,909.20**		
E	**Expected Contingency (20%)**	**20%**	**$ 12,181.84**	
Expected Estimate			**$ 73,091.04**	
F	**Safety Contingency (10%)**		**10%**	**$ 7,309.10**
Upper Bound Estimate				**$ 80,400.14**

Date of estimate:	**Cost Index**
Estimate prepared by:	**Signed**
Estimate internal peer review by:	**Signed**
Monte Carlo Analysis by:	**Signed**

Notes:

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2: Item A makes up 10% of total cost

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4: Item C makes up 6% of total cost

5: Item D1 makes up 2% of total cost

TCDC Utilities Capital Works Programme

Whangamata Stormwater Catchment Study

Conceptual Costings St Patricks Row

ESTIMATE SUMMARY

Item	Description	Base Estimate	Contingency	Funding Risk
A	**Project Property Cost, Consultation, planning, consents, Internal Council Project Management**	**$ -**		
B	**Investigation and Reporting**	**$ 8,000.00**		
C	**Design and Project Documentation**	**$ 8,000.00**		
1	**CONSTRUCTION**	$ -		
	MSQA (Mgmt Systems and Quality Assurance)			
2	**Construction Supervision**	$ -		
	Physical Works			
3	Preliminary & General	$ -		
4	Traffic Management and Temporary Works	$ -		
5	Service Relocations	$ -		
6	Stormwater upgrade work	$ -		
7	Landscaping	$ -		
8	Contract Close-out	$ -		
9	Unscheduled Items	$ -		
D	**Total Construction**	**$ -**		
Total Base Estimate		**$ 16,000.00**		
E	**Expected Contingency (20%)**	**20%**	**$ 3,200.00**	
Expected Estimate			**$ 19,200.00**	
F	**Safety Contingency (10%)**	**10%**		**$ 1,920.00**
Upper Bound Estimate				**$ 21,120.00**

Date of estimate:	**Cost Index**
Estimate prepared by:	**Signed**
Estimate internal peer review by:	**Signed**
Monte Carlo Analysis by:	**Signed**

Notes:

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4: Item C makes up 6% of total cost

5: Item D1 makes up 2% of total cost

TCDC Utilities Capital Works Programme

Whangamata Stormwater Catchment Study

Conceptual Costings Sylvia Rd

ESTIMATE SUMMARY

Item	Description	Base Estimate	Contingency	Funding Risk
A	**Project Property Cost, Consultation, planning, consents, Internal Council Project Management**	**$ 429.00**	**$ 5,005.00**	
B	**Investigation and Reporting**	**$ 171.60**	**$ 2,002.00**	
C	**Design and Project Documentation**	**$ 257.40**	**$ 3,003.00**	
1	**CONSTRUCTION**	$ 85.80	$ 1,001.00	
	MSQA (Mgmt Systems and Quality Assurance)			
2	**Construction Supervision**	$ 214.50		
	Physical Works			
3	Preliminary & General	$ 195.00	$ 2,275.00	
4	Traffic Management and Temporary Works	$ 1,000.00		
5	Service Relocations	$ -		
6	Stormwater upgrade work	$ 2,900.00	$ 45,500.00	
7	Landscaping	$ -		
8	Contract Close-out	$ 195.00	$ 2,275.00	
9	Unscheduled Items	$ -		
D	**Total Construction**	**$ 4,290.00**	**$ 50,050.00**	
Total Base Estimate		**$ 5,448.30**	**$ 61,061.00**	
E	**Expected Contingency (20%)**	**20%**	**$ 12,212.20**	
Expected Estimate			**$ 73,273.20**	
F	**Safety Contingency (10%)**	**10%**		**$ 7,327.32**
Upper Bound Estimate				**$ 80,600.52**

Date of estimate:	**Cost Index**
Estimate prepared by:	**Signed**
Estimate internal peer review by:	**Signed**
Monte Carlo Analysis by:	**Signed**

Notes:

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5: Item D1 makes up 2% of total cost

TCDC Utilities Capital Works Programme

Whangamata Stormwater Catchment Study

Conceptual Costings Park Ave

ESTIMATE SUMMARY

Item	Description	Base Estimate	Contingency	Funding Risk
	Project Property Cost, Consultation, planning, consents,			
A	**Internal Council Project Management**	**$ 2,112.00**		
B	**Investigation and Reporting**	**$ 844.80**		
C	**Design and Project Documentation**	**$ 1,267.20**		
1	**CONSTRUCTION**	$ 422.40		
	MSQA (Mgmt Systems and Quality Assurance)			
2	**Construction Supervision**	$ 1,056.00		
	Physical Works			
3	Preliminary & General	$ 960.00		
4	Traffic Management and Temporary Works	$ 1,000.00		
5	Service Relocations	$ -		
6	Stormwater upgrade work	$ 18,200.00		
7	Landscaping	$ -		
8	Contract Close-out	$ 960.00		
9	Unscheduled Items	$ -		
D	**Total Construction**	**$ 21,120.00**		
Total Base Estimate		**$ 26,822.40**		
E	**Expected Contingency (20%)**	**20%**	**$ 5,364.48**	
Expected Estimate			**$ 32,186.88**	
F	**Safety Contingency (10%)**	**10%**		**$ 3,218.69**
Upper Bound Estimate				**$ 35,405.57**

Date of estimate:	**Cost Index**
Estimate prepared by:	**Signed**
Estimate internal peer review by:	**Signed**
Monte Carlo Analysis by:	**Signed**

Notes:

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2: Item A makes up 10% of total cost

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4: Item C makes up 6% of total cost

5: Item D1 makes up 2% of total cost

TCDC Utilities Capital Works Programme

Whangamata Stormwater Catchment Study

Conceptual Costings Tuck Rd

ESTIMATE SUMMARY

Item	Description	Base Estimate	Contingency	Funding Risk
	Project Property Cost, Consultation, planning, consents,			
A	**Internal Council Project Management**	**$ 162.80**		
B	**Investigation and Reporting**	**$ 65.12**		
C	**Design and Project Documentation**	**$ 97.68**		
1				
	CONSTRUCTION	$ 32.56		
	MSQA (Mgmt Systems and Quality Assurance)			
2	**Construction Supervision**	$ 81.40	$ 1,370.00	$ 1,722.00
	Physical Works			
3	Preliminary & General	$ 74.00	$ 1,200.00	$ 1,520.00
4	Traffic Management and Temporary Works	$ 1,000.00		
5	Service Relocations	$ -		
6	Stormwater upgrade work			
	Option 1	$ 480.00		
	Option 2		$ 24,000.00	
	Option 3			$ 30,400.00
7	Landscaping	$ -		
8	Contract Close-out	$ 74.00	$ 1,200.00	$ 1,520.00
9	Unscheduled Items	$ -		
D	**Total Construction**	**$ 1,628.00**	**$ 27,400.00**	**$ 34,440.00**
Total Base Estimate		**$ 2,067.56**	**$ 29,128.16**	**$ 36,520.16**
E	**Expected Contingency (20%)**	**20%**	**$ 5,825.63**	
Expected Estimate			**$ 34,953.79**	
F	**Safety Contingency (10%)**	**10%**		**$ 3,652.02**
Upper Bound Estimate				**$ 40,172.18**

Date of estimate:	**Cost Index**
Estimate prepared by:	**Signed**
Estimate internal peer review by:	**Signed**
Monte Carlo Analysis by:	**Signed**

Notes:

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2: Item A makes up 10% of total cost

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4: Item C makes up 6% of total cost

5: Item D1 makes up 2% of total cost

TCDC Utilities Capital Works Programme

Whangamata Stormwater Catchment Study

Conceptual Costings Wattle Pl

ESTIMATE SUMMARY

Item	Description	Base Estimate	Contingency	Funding Risk
	Project Property Cost, Consultation, planning, consents,			
A	**Internal Council Project Management**	**$ 731.50**		
B	**Investigation and Reporting**	**$ 292.60**		
C	**Design and Project Documentation**	**$ 438.90**		
1	**CONSTRUCTION**	$ 146.30		
	MSQA (Mgmt Systems and Quality Assurance)			
2	**Construction Supervision**	$ 365.75		
	Physical Works			
3	Preliminary & General	$ 332.50		
4	Traffic Management and Temporary Works	$ 1,000.00		
5	Service Relocations	$ -		
6	Stormwater upgrade work	$ 5,650.00		
7	Landscaping	$ -		
8	Contract Close-out	$ 332.50		
9	Unscheduled Items	$ -		
D	**Total Construction**	**$ 7,315.00**		
Total Base Estimate		**$ 9,290.05**		
E	**Expected Contingency (20%)**	**20%**	**$ 1,858.01**	
Expected Estimate			**$ 11,148.06**	
F	**Safety Contingency (10%)**	**10%**		**$ 1,114.81**
Upper Bound Estimate				**$ 12,262.87**

Date of estimate:	**Cost Index**
Estimate prepared by:	**Signed**
Estimate internal peer review by:	**Signed**
Monte Carlo Analysis by:	**Signed**

Notes:

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2: Item A makes up 10% of total cost

3: Item B makes up 4% of total cost

4: Item C makes up 6% of total cost

5: Item D1 makes up 2% of total cost

TCDC Utilities Capital Works Programme

Whangamata Stormwater Catchment Study

Conceptual Costings — Whangamata Motor Camp

ESTIMATE SUMMARY

Item	Description	Base Estimate	Contingency	Funding Risk
A	**Project Property Cost, Consultation, planning, consents, Internal Council Project Management**	**$ -**		
B	**Investigation and Reporting**	**$ 8,000.00**		
C	**Design and Project Documentation**	**$ 8,000.00**		
1	**CONSTRUCTION**	$ -		
	MSQA (Mgmt Systems and Quality Assurance)			
2	**Construction Supervision**	$ -		
	Physical Works			
3	Preliminary & General	$ -		
4	Traffic Management and Temporary Works	$ -		
5	Service Relocations	$ -		
6	Stormwater upgrade work	$ -		
7	Landscaping	$ -		
8	Contract Close-out	$ -		
9	Unscheduled Items	$ -		
D	**Total Construction**	**$ -**		
Total Base Estimate		**$ 16,000.00**		
E	**Expected Contingency (20%)**	**20%**	**$ 3,200.00**	
Expected Estimate			**$ 19,200.00**	
F	**Safety Contingency (10%)**	**10%**		**$ 1,920.00**
Upper Bound Estimate				**$ 21,120.00**

Date of estimate:	**Cost Index**
Estimate prepared by:	**Signed**
Estimate internal peer review by:	**Signed**
Monte Carlo Analysis by:	**Signed**

Notes:

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2: Item A makes up 10% of total cost

3: Item B makes up 4% of total cost

4: Item C makes up 6% of total cost

5: Item D1 makes up 2% of total cost

TCDC Utilities Capital Works Programme

Whangamata Stormwater Catchment Study

Conceptual Costings — Williamson Golf Course

ESTIMATE SUMMARY

Item	Description	Base Estimate	Contingency	Funding Risk
	Project Property Cost, Consultation, planning, consents,			
A	**Internal Council Project Management**	**$ -**		
B	**Investigation and Reporting**	**$ 10,728.00**		
C	**Design and Project Documentation**	**$ 8,000.00**		
1				
	CONSTRUCTION	$ -		
	MSQA (Mgmt Systems and Quality Assurance)			
2	**Construction Supervision**	$ -		
	Physical Works			
3	Preliminary & General	$ -		
4	Traffic Management and Temporary Works	$ -		
5	Service Relocations	$ -		
6	Stormwater upgrade work	$ -		
7	Landscaping	$ -		
8	Contract Close-out	$ -		
9	Unscheduled Items	$ -		
D	**Total Construction**	**$ -**		
Total Base Estimate		**$ 18,728.00**		
E	**Expected Contingency (20%)**	20%	**$ 3,745.60**	
Expected Estimate			**$ 22,473.60**	
F	**Safety Contingency (10%)**	10%		**$ 2,247.36**
Upper Bound Estimate				**$ 24,720.96**

Date of estimate:	**Cost Index**
Estimate prepared by:	**Signed**
Estimate internal peer review by:	**Signed**
Monte Carlo Analysis by:	**Signed**

Notes:

1: These estimates are exclusive of escalation and GST

2: Item A makes up 10% of total cost

3: Item B makes up 4% of total cost

4: Item C makes up 6% of total cost

5: Item D1 makes up 2% of total cost

TCDC Utilities Capital Works Programme

Whangamata Stormwater Catchment Study

Conceptual Costings — Winifred Ave

ESTIMATE SUMMARY

Item		Description	Base Estimate	Contingency	Funding Risk
		Project Property Cost, Consultation, planning, consents,			
A		**Internal Council Project Management**	**$ 2,699.40**		
B		**Investigation and Reporting**	**$ 1,079.76**		
C		**Design and Project Documentation**	**$ 1,619.64**		
	1				
		CONSTRUCTION	$ 539.88		
		MSQA (Mgmt Systems and Quality Assurance)			
	2	**Construction Supervision**	$ 1,349.70	$ 4,146.90	
		Physical Works			
	3	Preliminary & General	$ 1,227.00	$ 3,891.00	
	4	Traffic Management and Temporary Works	$ 1,500.00		
	5	Service Relocations			
	6	Stormwater upgrade work			
		Option 1	$ 23,040.00		
		Option 2		$ 76,320.00	
	7	Landscaping	$ -		
	8	Contract Close-out	$ 1,227.00	$ 3,891.00	
	9	Unscheduled Items	$ -		
D		**Total Construction**	**$ 26,994.00**	**$ 82,938.00**	
Total Base Estimate			**$ 34,282.38**	**$ 93,023.58**	
E		**Expected Contingency (20%)**	**20%**	**$ 18,604.72**	
Expected Estimate				**$ 111,628.30**	
F		**Safety Contingency (10%)**	**10%**		**$ 11,162.83**
Upper Bound Estimate					**$ 122,791.13**

Date of estimate:	**Cost Index**
Estimate prepared by:	**Signed**
Estimate internal peer review by:	**Signed**
Monte Carlo Analysis by:	**Signed**

Notes:

1: These estimates are exclusive of escalation and GST

2: Item A makes up 10% of total cost

3: Item B makes up 4% of total cost

4: Item C makes up 6% of total cost

5: Item D1 makes up 2% of total cost


P
120





15








50


Vibes
TRAVEL
Chances





STREAM
BRIDGE
206/2.59


TE WEITI
STREAM
BRIDGE
206/2.59


ALPHA MARINA SYSTEMS
FACTORY TO LEASE


WAIKIEKIE STREAM