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Engineers & Consultants

Whangamata Stormwater Master Plan

Strategic Context and Risks

Draft

Prepared for Thames Coromandel District Council by Morphum Environmental Ltd
December 2019

09 377 9779 | info@morphum.com | www.morphum.com

Engineers & Consultants

Document Control

Client Name: Thames Coromandel District Council

Project Name: Whangamata SWMP

Project Number: P01993

Document: Strategic Context and Risks

Revision History

Status	Date Issued	Author	Reviewed By	Released By
Draft		C. Davis	G. Lees	B. Carter

Reviewed by:

Reviewer: Greer Lees **Signature:**

Released by:

Reviewer: Barry Carter **Signature:**

Level 1, 86 Symonds Street, Grafton, Auckland 1010
09 377 9779 | info@morphum.com | www.morphum.com

Executive Summary

Masterplan Overview

The Whangamata Stormwater Master Plan (SMP) will investigate potential improvements to the stormwater network with the objective of enabling the Thames Coromandel District Council (TCDC) to meet community expectations of Levels of Service (LoS) now and in the future, in an economically and environmentally responsible manner.

The final SMP will include a prioritised future stormwater capital works programme based on concept scoped projects; investigate and draft potential land use controls and other stormwater management policies; and incorporate system management and maintenance requirements for the Whangamata area.

The phases of the SMP are as follows:

1. Strategic Context and data review,
2. Risk Review and workshop,
3. Issues and Options – issues identification supported by shared assumptions and criteria developed in the Strategic Context phase and options developed through three main workstreams:
    a. Flooding
    b. Water Quality
    c. Asset Condition
4. Consolidation of options and multi criteria assessment (MCA)
5. Project Scoping-concept scoping of preferred options
6. Stormwater Master Plan

This Document: Strategic Context and Data Review

The Stormwater Master Plan itself will be an integrated approach to stormwater management, encompassing flooding, water quality, and asset management issues. This report summarises the first two phases of the wider project to develop the Whangamata Stormwater Master Plan (SMP).

A strategic review of relevant legislative and policy documents has been completed along-side regional and district data sets relating to stormwater management, land use, and the receiving environment. A list of documents and data sets is included as an appendix to this report. Legislative, environmental and land use changes have also been considered to provide a future facing lens on planning and prioritising stormwater management.

Strategic Themes

The following strategic themes have been developed based on the current and future context of stormwater management in Whangamata. We recommend that these guide the Whangamata SMP and form part of the criteria used to assess projects. The themes are:

1. **Requirements under the existing comprehensive (stormwater) discharge consent**, and changes likely to be required for the 2031 renewal of the consent.
2. **Appropriate infrastructure solutions** considering the geology, topography, land use and development projections and existing infrastructure.
3. **Coastal hazards and flooding** – Coastal inundation, Sea Level Rise (SLR) and Climate Change.
4. **Social and community drivers** to implement and prioritise investment.

The following issues have been identified for Whangamata in relation to stormwater management that are discussed in more detail in the body of this document.

- Understanding the rate of development and the future development typology.
- Level of service and condition of current stormwater infrastructure.
- Traditional infrastructure solutions (pipes) compared to Water Sensitive Infrastructure (green assets).
- Implications of sea level rise and climate change.
- Contaminants generated on land and discharged to the estuary and coastal environments.
- Changing expectations of the community.

Recommendations and Next Steps

We have developed several recommendations. They are categorised under each of our strategic themes. Figure 1 shows how the recommendations are inter-relate and create a timeline for the Masterplan over 10 years.

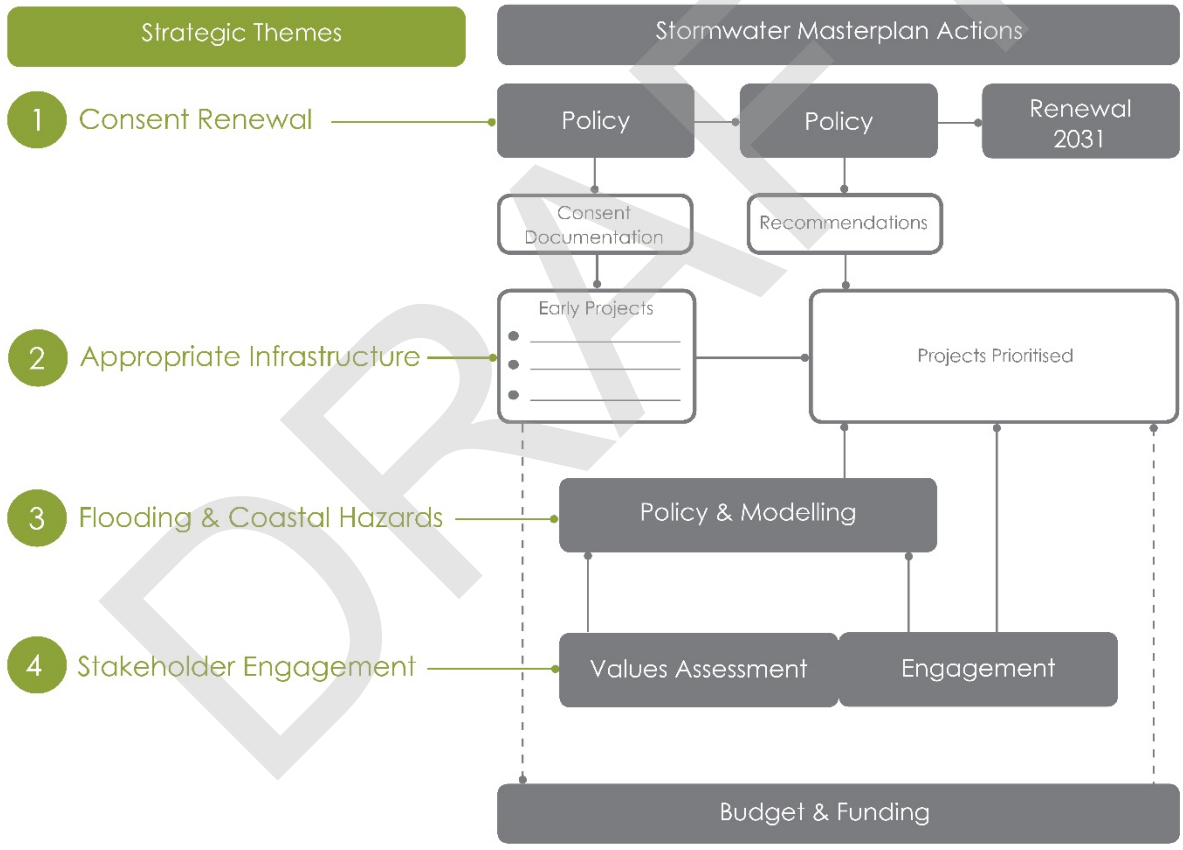

Figure 1: Overview of Strategic Themes and Implementation in the 10-year Stormwater Masterplan

1. Use the above strategic themes as criteria to prioritise stormwater projects.
2. Recommendations related to regulations include:
    a. Meet current consent conditions. This may include preparing the following documents:
        - Stormwater Quality Improvement Programme
        - Stormwater Management Plan to outline for operational requirements.
        - Produce a Municipal Stormwater Network Operation Annual Report.

   b. Respond to the resource consent condition to implement Low Impact Design (LID) or Water Sensitive Urban Design (WSUD) in reticulated catchments develop a WSUD Implementation Plan.
   c. Work with WRC to discuss what data is critical to support the consent renewal in 2031
3. Recommendations related to appropriate stormwater solutions includes:
   a. Three projects outlined in section 4.2 above be progressed to concept design to communicate to stakeholders what, how and why these solutions are appropriate for these locations. Proposed locations are:
      - **Williamson Park Pond** (see Figure 2 for an indicative coastal wetland for stormwater management)
      - **Port Road/Beach Road**
      - **Eastern end of Harbour View Road and Beach Road** (see Figure 3 for an indicative overland conveyance method stormwater management).
   b. Ensure WSUD principles are being used in the development and design of all stormwater solutions
   c. Hold investment in hard engineering solutions until the recommendations of section 4.3 Flooding and Coastal Hazards Planning, are considered and complete.
   d. Provision of conveyance, treatment and soakage through constructed swales to help to manage design events and overland flows (Figure 3).
   e. Targeted treatment devices for contaminants particularly in commercial and industrial
   f. Invest in maintenance for public infrastructure and support private infrastructure management.
4. Recommendations related to adaptation to be resilient against flooding and sea level rise include:
   a. Develop the key adaptation strategy(ies) to reduce the impacts of flooding across Whangamata by demarcating overland flow paths for the maximum probable event and minimising the need for pumping and bunding/wall solutions.
   b. Develop the key adaptation strategy to reduce coastal inundation and erosion through retreating from coastal edges and minimising the need for hard engineering solutions. Consider essential services (food, water supply and transport) and apply adaptation rules/management overlay to those services.
      Consider that in retreat scenario(s) existing buffers are currently amenity and recreational areas. Offsetting those amenity areas may be required.
5. The recommendation related to stakeholder engagement is to complete a stakeholder engagement plan and include internal stakeholders as the first stakeholder group.

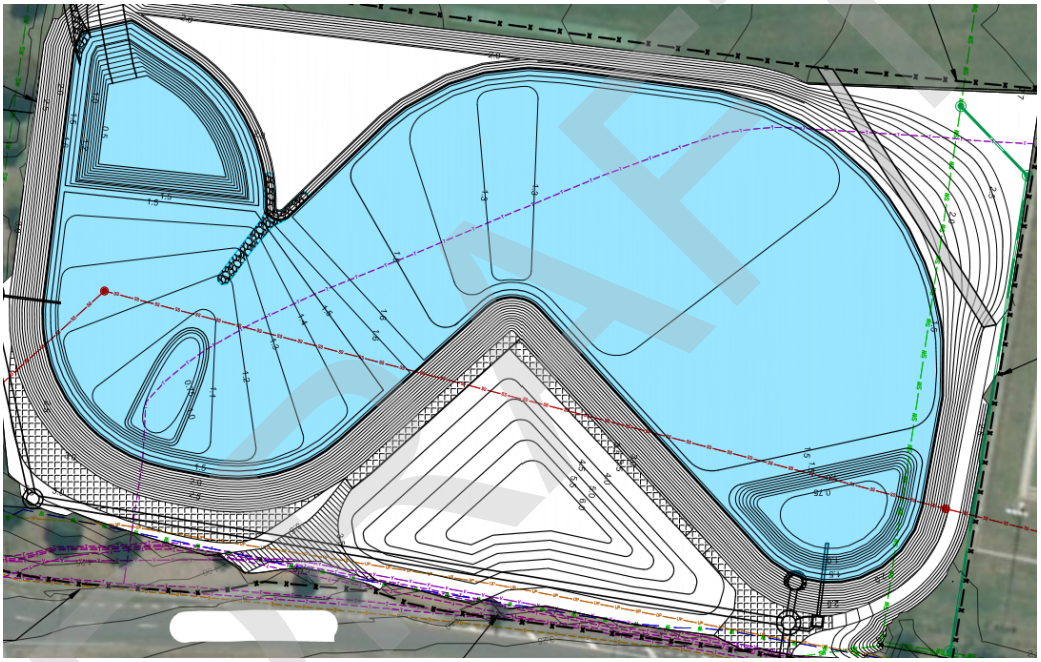

Figure 2: Indicative coastal wetland with amenity (Credit Morphum and DCM Urban).

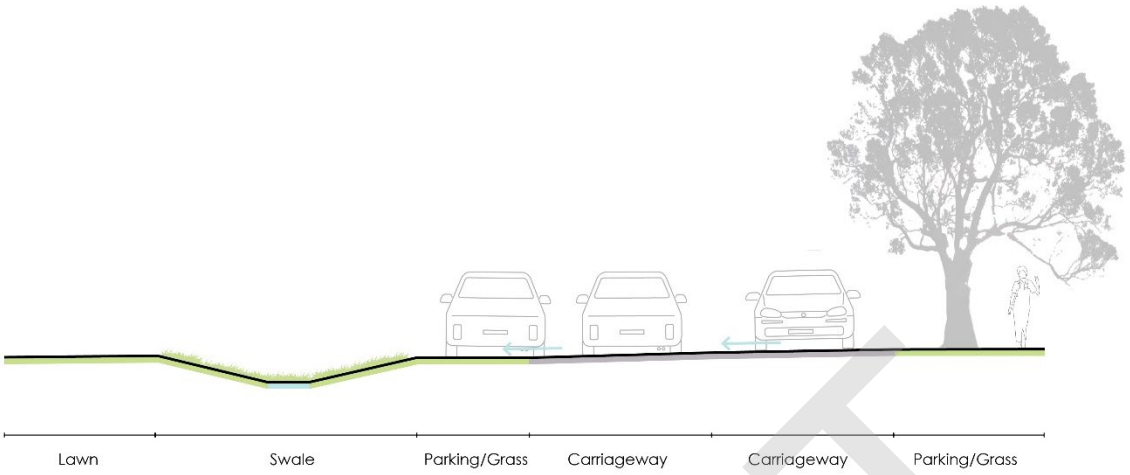

Figure 3: Potential roadside swale for stormwater conveyance and to encourage soakage.

Data Gaps to Fill

We have reviewed 34 data sets to perform the required analysis on this project. We have identified data gaps which are appended to this document. Table 1 summarises the critical data sets that are of low quality that we recommend be improved as part of the SMP developed. They have been ranked using a scoring system where the lowest quality data and the highest criticality for the SMP creates the maximum score (of 9). See section 5.0 for more information on the scoring for each data set.

Table 1: Data gaps to fill based on rating (quality and criticality to the SMP)

#	Dataset	Data Score*	Data Purpose and Gaps	Recommended Actions (N = now, P = progressively, A = accept risk)
1	**Geology/soil types**	9	Gives a baseline to assess soakage potential for stormwater devices. Missing Whangamata Town.	**N** - Summarise soakage information (possibly from building consents).
2	**Receiving Environment Water Quality Monitoring**	9	Consent requirement.	**N** - Implement a water quality monitoring programme.
3	**Flood Hazard - TCDC**	9	Higher definitions of flood risk. Not undertaken in Whangamata to date.	**N** - Undertake for Whangamata with definition of flood risk categories.
4	**Renewals/forward works program (Roading)**	9	As above.	**N** - Required in order to determine synergies with future works in Sw/3 Waters.
5	**SW management devices**	9	Does not exist.	**N** - Document devices from development engineers/asset team and record in GIS.
6	**Parks and Reserves**	6	Areas feasible for public SW treatment devices. Some parks/recreation areas on aerial imagery are not indicated within GIS layer, and some are not parks (e.g. are carparks or buildings).	**N** - Update public and open spaces appropriate for future WSD devices.

7	**Utilities Plant**	6	Need to separate out asset types in this layer to distinguish between valves and pump stations.	**N** – Check infrastructure located within flood risk areas and coastal erosion setback.
8	**Asset Management Plan data extract (asset finder)**	9	Useful in order to determine synergies with future works in 3 Waters and the roading space. Has not been provided to date/ not available.	**P** – align if/when this is available.
9	**Renewals/forward works program (SW)**	9	As above. FWP being created as part of this SMP. Renewals has not been provided to date/ not available.	**P** – align if/when this is available. Work completed in the network since 2005 can be documented through development engineers/ asset team and ensure recorded in GIS.
10	**Sites of Significance to Maori**	9	No significant cultural areas for Whangamata recorded in data received.	**P** - Use iwi engagement to inform this.
11	**Structure plans/future growth**	9	To understand rate of development and land use changes over time. Only one area marked as future growth.	**P** - Confirm with policy team for data.
12	**Historic heritage area**	6	No historic areas mapped for Whangamata. Use Stakeholder engagement to inform this.	**P** - Stakeholder engagement
13	**Geocoded complaints (RFS Whangamata Geocoded)**	6	Opus 2005 data has not been digitised but comparisons have been made. Current 2019-2020 complaints missing. **Recognise users/owners who don't complain or who may have given up thinking their issues will be addressed.**	**P** - Use exiting complaints to overlay with proposed reticulated network upgrade layer (when developed) and in detailed design stages to determine if issues are being addressed.
14	**Sub-Catchments**	6	SMP has now created model sub-catchments.	**P** - Ground truth progressively.

*Refer section 5.0 for scoring method.

Draft Document Notes

Agreement will be sought in the TCDC Risk Workshop as to which data gaps should be filled and how they are filled (i.e. field work, further data sources, etc.).

The following information has been requested from TCDC and may exist which will alter the above recommendations:

1. Request from TCDC Consent Compliance - Env health data (Receiving Environment monitoring for Whangamata Harbour) was required by the consent. WRC don't have it.
2. Request from TCDC Consent Compliance - Stormwater Quality Improvement Programme was required by the consent.
3. Request from TCDC Consent Compliance - Annual reports – called 'Municipal Stormwater Network Operation Annual Report'.
4. List of SW capital works completed in the last 15 years – we understood from the project inception meeting that this was minimal. Additionally, have any swales been built in Whangamata since 2005 – how are they operating?

5. Map/list of roading upgrades undertaken since 2005 and/or planned in next 10 years.
6. Maintenance programme for private soak (recommendation of the Opus CMP).
7. Are street cleaning, sump cleaning and pipe clearing programmed, 3 monthly (recommendation of the Opus CMP)?
8. Groundwater monitoring bores were previously in place to record the groundwater level in winter (present 2004-2006). Is this still undertaken and is there also water quality samples taken that would indicate salination?

Contents

Figures

Tables

1.0 Purpose and Scope

The Stormwater Master Plan will provide a framework for improvements to the stormwater network for Whangamata with the objective of enabling the Thames Coromandel District Council (TCDC) to meet community expectations of levels of service now and in the future, in an economically and environmentally responsible manner.The final SMP will include a prioritised stormwater capital works programme based on concept scoped projects; investigate and draft potential land use controls and other stormwater management policies; and incorporate system management and maintenance requirements for the Whangamata area.

The Stormwater Master Plan itself will be an integrated approach to stormwater management, encompassing flooding, water quality, and asset management issues (Figure 4). This report summarises the first two phases of the wider project to develop the Whangamata Stormwater Master Plan (SMP).

The scope to develop the SMP is as follows:

1. Strategic Context and Data Review (this report).
2. Risk Review and Workshop (this report).
3. Issues and options-Supported by consistent shared underlying assumptions as developed in the Data Review/ Strategic Overview phase the three main workstreams will be developed to identify issues and options:
    a. Flooding
    b. Water Quality
    c. Asset Condition
4. Consolidation of options-Multi Criteria Option Assessment.
5. Project Scoping-concept scoping of preferred options
6. Stormwater Master Plan.

The Stormwater Master Plan itself will be an integrated approach to stormwater management, encompassing flooding, water quality, and asset management issues. This report summarises the first two phases of the wider project to develop the Whangamata Stormwater Master Plan (SMP).

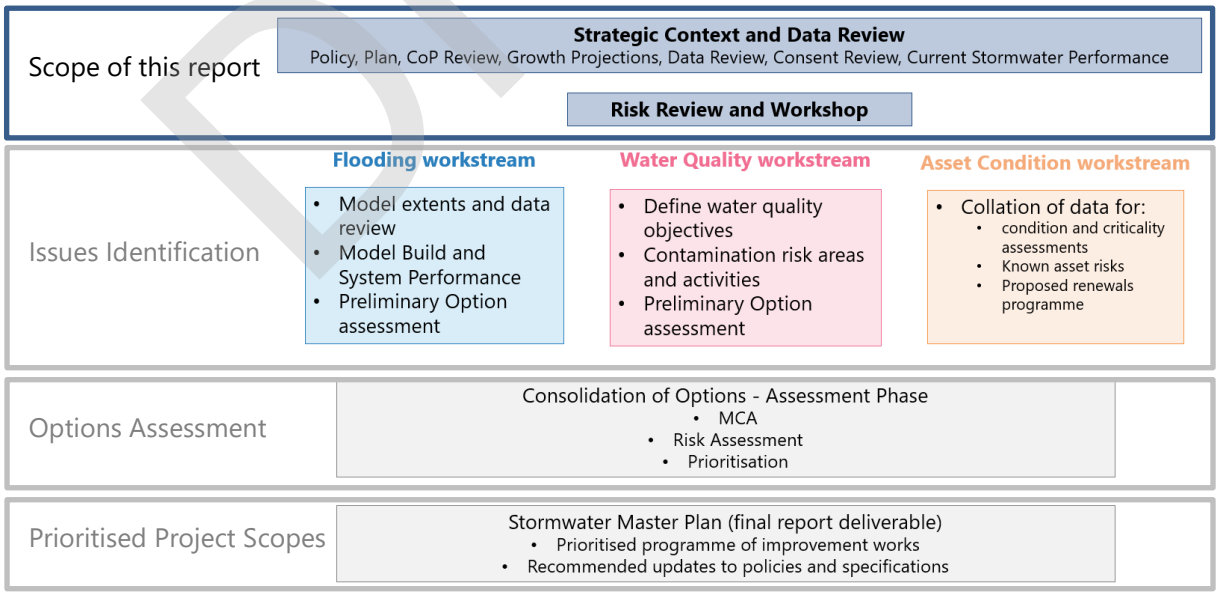

Figure 4: Scope and Method for Stormwater Master Plan Development

The strategic context and risk review will drive the scope of the flooding, water quality and asset condition workstreams and provide high-level criteria with which the options can be assessed at the options assessment phase.

2.0 Methodology

The methodology for the first two phases of the SMP is summarised below.

1. Strategic Context and Data Review

The purpose of this phase was to consolidate the available data and ensure that the strategic context is understood. This included recent changes to national and regional policy, technical specifications, consent requirements, and future growth forecasts. This phase also identified currently known and suspected risks relating to the performance of the Whangamata stormwater system. This ensured that the project development through the three technical workstreams (flooding, water quality and asset management) are underpinned by a sound body of knowledge and integrated thinking and the final master plan is consistent with TCDC requirements.

The method steps undertaken were:

- Review of existing stormwater reports, management devices, AMP/Renewals Programme, growth projections, development limitations, records of known issues (i.e. wall map), current consent requirements and matters outside the consent requirements that may be having an effect (i.e. erosion or receiving environment health).
- Review existing known operational issues (maintenance, flood/tide gates, etc.).
- Review and scope likely stormwater contamination sources.
- Effects of climate change/coastal policy – i.e. MfE guidelines and sea level rise.
- Changes to National Policy Statement for Freshwater (NPS-FM) and possible future requirements considering the current consent expiring in 2031.
- Waikato Regional Council guidance and policies in association with the District Plan and Subdivision Code of Practice.
- Digitise known issues (from previous data sets where possible, i.e. Opus data).

2. Risk Review and Workshop

A workshop will present the findings of the strategic context and gap analysis to inform TCDC as to any issues that could warrant further investigation. These strategy themes and gaps will inform the identification of risks which will allow any planning and investigation work to be prioritised. The workshop will involve a round table discussion and information sharing session with representatives from within Council to ensure as many risks and opportunities as possible are shared and considered at an early stage. This would include representation from other asset owners such as roading and operation and maintenance personnel.

The outcomes of these two phases will confirm the detailed scoping and programming for the next phase(s).

3.0 Background

The town of Whangamata has developed from a small gold mining and logging based settlement to a community consisting of permanent homes, holiday homes and camping grounds. Whangamata has increasingly become home to permanent residents, whilst over the summer months the population swells with holiday home owners and visitors.

Whangamata is a coastal settlement, with the Otahu River to the south and the Whangamata Harbour, fed by the Wentworth River, Te Weiti and Waikiekie streams which discharge into the harbour in the north (Figure 6). The soil conditions of Whangamata vary from the flat sandy dune soil, which provides very good soakage, to silty clay and/or Waihi ash soils that have less soakage potential. The low lying south west area of Whangamata is susceptible to stormwater ponding / surface flooding (Figure 5, Figure 7).

Historically, the primary stormwater management approach has been via ground soakage. However, the increase of infill subdivision and construction of larger or second dwellings and associated driveways and garages etc has increased impermeable surfaces. This reduces the area available for soakage and increases the likelihood of ponding / flooding on private properties and road reserves.

Recent storm events have caused flooding and have raised concerns about the extent and capacity of the existing stormwater system, and the potential impacts of climate change. There is a need for these matters to be accounted for in TCDC's future planning.

The following section gives an overview of the background research and information that has been undertaken for Whangamata.

Figure 6: Overview of rivers, estuaries and harbours of Whangamata.

Figure 5: Flooding in Whangamata June 2018 (Photo Credit: NZherald.co.nz[1]).

Figure 7: Golf Course flooded by the Wentworth River September 2019 (credit: Stuff.co.nz[2]).

3.1 Catchment Overview

The following section gives an overview of the catchment values, stormwater assets, coastal receiving environments and land use of Whangamata.

Types of stormwater contaminants, the associated land use and environmental impact is described in section 3.2 to 3.4.

3.2 Catchment Values

Whangamata township is a beach town, highly valued for outstanding natural features and views, beach amenity and surf breaks (Figure 8 and Figure 9). It is not surprising that many parks and reserves are found on the coastal boundary (Figure 10).

Figure 8: Whangamata Wharf.

Figure 9: Whangamata ocean beach has a regionally significant surf break.

Figure 10: Social and community features of Whangamata.

3.3 Stormwater Assets and Coastal Receiving Environment

The reticulated stormwater system in Whangamata only services roads with private properties disposing stormwater via onsite soakage. The main stormwater pipe conveys stormwater along Ocean Road and Williamson Road to the retention pond in Williamson Park (Figure 12).

The receiving environments are the Otahu River/Estuary in the south (Figure 11), Moanaanuanu Estuary on the north western side and the Pacific Ocean to the east (Figure 13).

Figure 11: Paddleboarders on the Otahu River.[3]

Figure 12: Outlet to the Williamson Park stormwater pond[4].

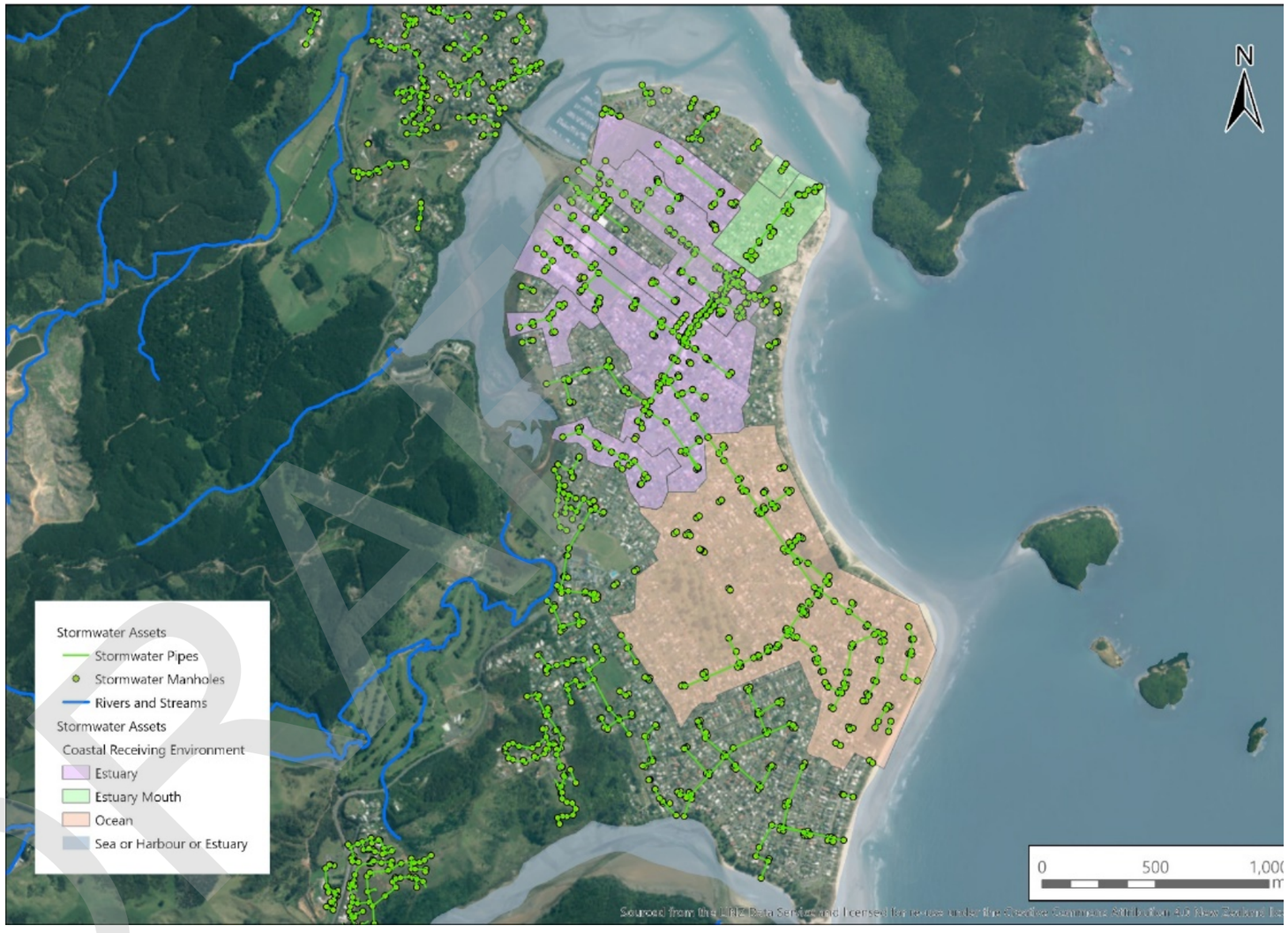

Figure 13: Stormwater Assets, rivers, streams and coastal receiving environments for Whangamata.

[3] Accessed on 11/10/2019 Stuff.co.nz: https://www.stuff.co.nz/travel/destinations/nz/75300688/beaches-not-the-only-thing-whangamata-has-on-offer
[4] Accessed on 11/10/2019 TCDC Website: https://www.tcdc.govt.nz/Your-Council/News-and-Media/News-and-Public-Notices/News-Archived-Articles/December-2017/October-2017/Works-going-on-around-the-District/

3.4 Land Use and Stormwater Contaminants

Land use in Whangamata is predominantly residential, with pockets of industrial on Martyn Road and Hetherington Road and commercial (pedestrian core) along Port Road. (Figure 15). The health of estuaries and coastal environments is directly related to the land use and activities that occur on the land. In built urban environments, stormwater runs off impervious surfaces picking up contaminants and transports them into waterways and the coast (Figure 14).

The commercial and industrial areas are highly trafficked areas so are the most likely to be the highest source of stormwater contaminants for the Whangamata township and these contaminant discharge into the sheltered Moanaanuanu Estuary (Figure 15).

Figure 14: Rubbish is conveyed from stormwater pipes onto beaches.[5]

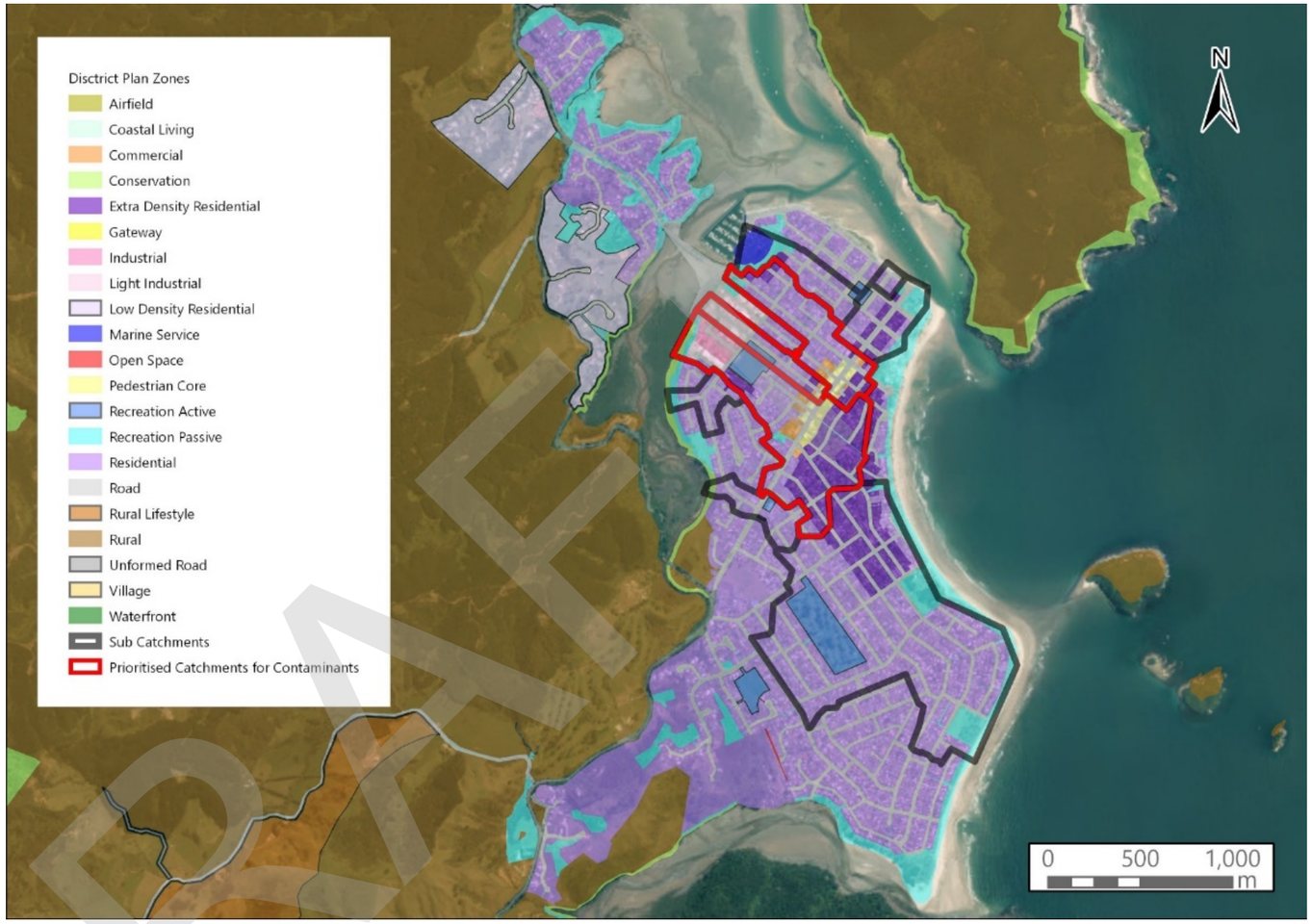

Figure 15: Land-use (TCDC District Plan, 2010) and sub-catchment contaminant potential.

The types of **industrial and commercial stormwater contaminants** include:

1. **Heavy metals**: Copper, zinc, tin and lead from rooftops, building facades, gutters, car brake pads, tyres and downpipes.
2. **Petrol, Diesel and Tyre Rubber**: fuel and oils from vehicles contain Polycyclic Aromatic Hydrocarbons (PAHs).
3. **Plastics and other litter**. Cigarette butts, rubbish and other debris gets washed from commercial areas (shops, cafes, restaurants) into the stormwater network and out into marine environment.

The types of **residential stormwater contaminants** include:

1. **Fertilisers and Gardening Waste.** Lawn clippings and fertilisers that enter the stormwater network and/or watercourses.
2. **Wastewater overflows**. Wastewater contains nutrients, microbes and viruses.
3. **Sediment** released from stream erosion and land-based development can have adverse effects on coastal ecosystems.
4. **Soaps and Cleaning Chemicals**.
5. **Dyes and Paints**: washing paint brushes or dyes into stormwater drains is lethal to aquatic life. It can take decades for the receiving stream or wetland to recover.

[5] Accessed from Sea voice news website on 11/10/2019 http://seavoicenews.com/2019/01/22/cigarette-butts-are-the-oceans-largest-source-of-trash/

3.5 Findings of the Whangamata Stormwater Catchment Management Study (Opus, 2005)

The Whangamata Stormwater Catchment Management Study by Opus (2005) undertaken for TCDC is a foundation study as it highlighted keys issues and options for stormwater management in Whangamata. The purpose of the catchment management study was to assist TCDC with prioritising and planning stormwater capital works, policies and maintenance (Opus, 2005). The study summarised results of drainage investigations including:

1. Review of pipe assets and topographic information
2. Catchment analysis
3. Options at a theoretical level to address identified stormwater issues.

The stormwater issues from the study were as follows:

1. Using the 10% AEP design standard, over 50% were undersized.
2. Number of ambiguous or missing data meant that assumptions were made including:
    a. Pipe gradient (based on LiDAR information),
    b. Flow direction,
    c. Pipe connections.
3. A TCDC public questionnaire survey of 1223 respondents found that 33% of residents experienced flooding of some sort (habitable floors, garages, overland flow under dwellings or property, ponding). Of flooding issues, 84% had occurred in 2004-2005.
4. Tidal stormwater outlets are suspectable to blockages by sand and debris as the low-lying and flat terrain gives insufficient hydraulic head to flush sand blockages. On-going maintenance of the outlets is likely to be intensive. A long-term solution was proposed to design pipes so they are above silting level.
5. Water quality issues associated with stormwater are identified to be:
    a. Road contaminants – heavy metals, hydrocarbons, litter and sediment,
    b. Petrol station spills,
    c. Local industrial activities- source of spills and litter,
    d. Sedimentation,
    e. Non-point source contaminants, nutrients and faecal matter from agricultural activities.

Stormwater Management Options – Opus Report

The Opus report (2005), identified two overarching options for stormwater management in Whangamata:

1. Comprehensive reticulated stormwater system to service the entire Whangamata community from private properties, roads, public space to beach and estuary outlets. However, this option has the following issues:
    a. Upgrades will be high cost as resizing and improvements will be required.
    b. Flat topography - low pipe gradients and larger pipe sizes.

2. Beach and estuary outlets are suspectable to sand blockages.Stormwater is reticulated to service roadways and private properties continue to use soakage. This was a favoured option due to the following:
    a. Geology of Whangamata- free draining sands.
    b. Reduction in total flows and slows the time of concentration of flow.
    c. Minimises pipe reticulation costs.

4.0 Strategic Themes

The following strategic themes have been developed based on the current and future context of stormwater management in Whangamata (Figure 16). We recommend that these guide the Whangamata SMP and form part of the criteria used to assess projects. The themes are:

1. **Requirements under the existing comprehensive (stormwater) discharge consent**, and changes likely to be required for the 2031 renewal of the consent.
2. **Appropriate infrastructure solutions** considering the geology, topography, land use and development projections and existing infrastructure.
3. **Coastal hazards and flooding** – Coastal inundation, Sea Level Rise (SLR) and Climate Change.
4. **Social and community drivers** to implement and prioritise investment.

Each of these themes are described in the sections below with a description of the issue(s), how this drives decision making and recommendations and projects to reduce data gaps (Figure 16).

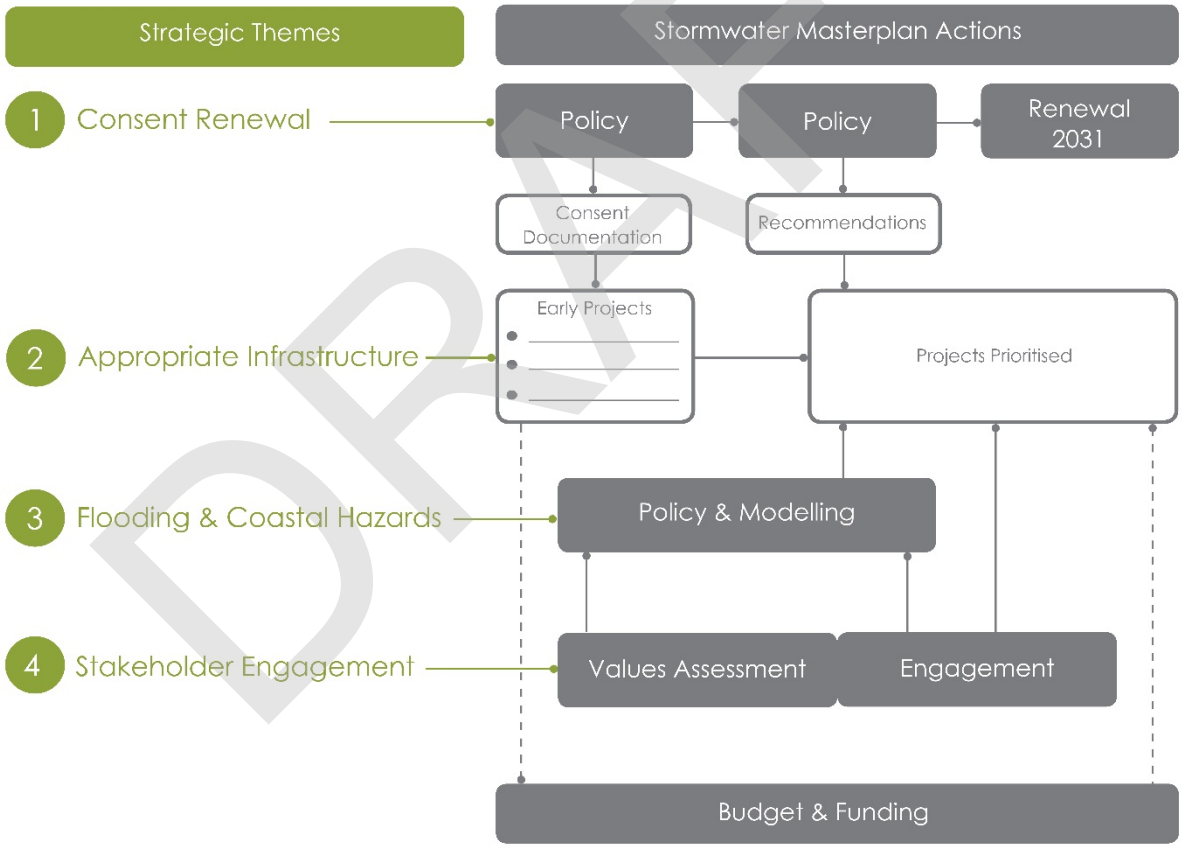

Figure 16: Four strategic themes to inform policy, recommendations and discrete projects in the next 10 years, before stormwater discharge consent renewal in 2031.

4.1 Consenting Requirements and Future Changes of Legislative Requirements.

TCDC is required under the existing stormwater discharge consent to adhere to current conditions of consent and well as plan for the likely changes to stormwater management when the consent is renewed in 2031. These changes to requirements are outlined in the sections 4.1.1 and 4.1.4 below.

4.1.1 Current consenting requirements

The current resource consent is a comprehensive discharge consent issued in 2011 (Whangamata Urban Area is under resource consent number 105667). It will expire in 2031. The consent "requires the consent holder (TCDC) to manage stormwater to minimise discharges that are likely to adversely affect receiving environments".

The consent conditions and requirements are outlined below and allows TCDC to (TCDC, Consent Evaluation Document, 2011):

> *"Divert and discharge urban stormwater runoff and associated contaminants at multiple locations to land, the Te Weite Stream, Waikiekie Stream, Moanaanuanu River Estuary, Otahu Estuary, Whangamata Harbour and such other locations as may be covered by this consent in the future in accordance with the conditions of this consent, and use discharge structures in the general vicinity of Whangamata Urban Area that is reticulated by the Thames Coromandel District Council municipal stormwater network."*

The consent conditions require the consent holder (TCDC) to manage stormwater to minimise discharges that are likely to adversely affect receiving environments after reasonable mixing in the following ways:

1. Dissolved oxygen must remain above 80% saturation in estuary and coastal waters.
2. pH must remain between 6 and 9
3. Reduce the discharge of suspended sediments which smother benthic environments
4. Biological growths
5. Water temperature to remain less than 25° C (less than 3 degrees difference)
6. Turbidity remains less than 25 NTU between August and December
7. Ammoniacal nitrogen must be less than 0.88 grams of nitrogen per cubic metre and other contaminants must not exceed United States Environmental Protection Agency (EPA) National Recommended Water Quality Criteria- Maximum Concentration (USEPA, 2009[6]).

The following conditions are also required:

1. To monitor stormwater discharge effects, environmental health data through periodic or continuous monitoring is required.
2. Best practice stormwater management including Low Impact Design (LID) or Water Sensitive Urban Design (WSUD) in reticulated catchments. Other best practice management outlined includes:
    a. Regular catchpit cleaning
    b. Catchpit are designed to retain gross pollutants e.g. litter
    c. Commercial and/or industrial site investigations
    d. Implementing stormwater management measures
    e. Incident response monitoring

[6] Table of exceedances for heavy metals and other pollutants can be found at https://www.epa.gov/wqc/national-recommended-water-quality-criteria-aquatic-life-criteria-table#table.

3. Investigation and remediation of uncontrolled wastewater overflows.
4. Prepare a Stormwater Quality Improvement Programme including:
    a. Public education programme,
    b. Site inspections,
    c. Removal illicit wastewater connections,
    d. Retrofit catchpits,
    e. Retrofit treatment to high risk catchments.
5. Stormwater Management Plan to outline for operational requirements.
6. Produce a Municipal Stormwater Network Operation Annual Report.

4.1.2 The National Policy Statement for Freshwater Management (2014)

The current National Policy Statement for Freshwater Management (MfE, NPS-FM, 2014 as amended 2017) gives regional councils guidance on how to manage freshwater resources. It requires councils to set freshwater objectives, set limits and methods for how water is utilised and requires the involvement of tangata whenua in freshwater management (MfE, 2017).

Environmental health data was required to be collected by the resource consent. A minimal amount was collected before the consent was granted and is referred to in the decision report. More will be required to be collected and used to prove effect (or lack of) in the future. We recommend a discussion with WRC is held to confirm their requirements and planning for the NPS-FM.

4.1.3 Current requirements under New Zealand Coastal Policy Statement (2010)

New Zealand Coastal Policy Statement (NZCPS, 2010) gives national guidance for the management of coastal water. Coastal water is defined in the Resource Management Act (RMA) as "as seawater with a substantial freshwater component, and seawater found in fiords, inlets, embayments, harbours and estuaries".

Freshwater management objectives and actions are intrinsically linked to the coast, as coastal water quality is affected by the freshwater that discharges into it.

The seven objectives in the NZCPS (2010) are:

1. "To safeguard the integrity, form, functioning and resilience of the coastal environment and sustain its ecosystems, including marine and intertidal areas, estuaries, dunes and land,"
2. "To preserve the natural character of the coastal environment and protect natural features and landscape values"
3. "To take account of the principles of the Treaty of Waitangi, recognise the role of tangata whenua as kaitiaki and provide for tangata whenua involvement in management of the coastal environment"
4. "To maintain and enhance the public open space qualities and recreation opportunities of the coastal environment"
5. "To ensure that coastal hazard risks taking account of climate change, are managed by:
    a. locating new development away from areas prone to such risks;
    b. considering responses, including managed retreat, for existing development in this situation; and
    c. protecting or restoring natural defences to coastal hazards."
6. "To enable people and communities to provide for their social, economic, and cultural wellbeing and their health and safety, through subdivision, use, and development"
7. "To ensure that management of the coastal environment recognises and provides for New Zealand's international obligations regarding the coastal environment, including the coastal marine area."

4.1.4 Consent renewal in 2031

The regional stormwater discharge consent for the Coromandel region is due for renewal in 2031. Currently, the Ministry for the Environment (MfE) are proposing changes to the National Policy Statement for Freshwater Management (NPS-FM), Resource Management Act and new National Environmental Standards for Freshwater and Wastewater which looks at the following actions (MfE, 2019):

1. Tighter regulation of sediment from earthworks and urban development
2. Improved management of stormwater and wastewater
3. No further loss of wetland and streams

The direction and future requirements will implement national policy and guidance that is consistent regarding stormwater and wastewater discharges to improve ecosystem health (MfE, 2019). Promotion of Waster Sensitive Design (WSD) is a reoccurring theme that offers benefits over traditional stormwater design by (MfE, 2019):

1. "reducing the volume of stormwater through infiltration, attenuation and detention
2. providing some level of treatment through uptake from plant species and deposition of sediment
3. creating significant amenity benefits by providing green spaces for recreation and habitat."

It is likely that stormwater network providers will be required to provide a risk management plan to plan for future demands, urban growth and intensification.

The existing consent conditions requires the impact of stormwater on the receiving environment to be measured after "reasonable mixing". Estuarine and harbour environments have different tidal exchange rates depending on the topography, catchment size and flow rates, the amount of seawater exchange between the estuary and ocean (Hume *et al.*, 2007). Whangamata is classified as a permanently open tidal lagoon which has a narrow entrance to the sea, constrained by a spit or sand barrier (Hume *et al.*, 2016). In general, this type of tidal lagoons has good flushing as the river input is lower in comparison to tidal influx so hydrodynamic processes are dominated by tides (Hume *et al.*, 2016). However, at Whangamata 48% of catchment area discharges to the sheltered Moanaanuanu Estuary which has flushing constrained by the marina and Hetherington Road Bridge (catchment area shown in green, Figure 13). The remaining sub-catchments discharge to the harbour, estuary mouth (17%) and ocean (35%).

4.1.5 Recommendations related to regulations

Based on the current consenting requirements and the likely policy and regulatory framework into the future the above recommendations have been consolidated:

Meet current consent conditions by talking to WRC about their requirements for consent compliance, what data should be collected to support the consent renewal (i.e. receiving environment/environmental health data, and a definition of reasonable mixing) and possible consolidation of consent conditions listed above. This may include preparing the required documentation:

1. Stormwater Quality Improvement Programme
2. Stormwater Management Plan to outline for operational requirements.
3. Produce a Municipal Stormwater Network Operation Annual Report.

The stormwater quality improvement programme and management plan required by the consent should be prepared to outline stormwater operational requirements and maintenance with a focus on

contaminant management. Best practice is accepted to be at source contaminant management, sub-catchment treatment and green infrastructure conveyance. This includes:

1. Illicit discharges programme for educating, monitoring and source tracking of issues.
2. Private land owners' education on stormwater management, treatment, maintenance and contaminant generation.
3. Wastewater overflows monitoring and improvements.
4. Sediment control programme – new developments/building sites.

To respond to the resource consent condition above "Best practice stormwater management including Low Impact Design (LID) or Water Sensitive Urban Design (WSUD) in reticulated catchments."

To respond to the changing requirements for contaminant management which the consent renewal will require, by developing a **WSUD Implementation Plan to implement** best practice including at source contaminant management, sub-catchment treatment and green infrastructure conveyance.

The WSUD implementation plan could be split into two parts:

1. WSUD analysis of key site parameters for options assessment and prioritisation to inform the masterplan (what WSUD devices goes where and when),
2. Stakeholder engagement and education plan which can be divided into two focus groups:
    a. Private properties and "bach" owners with a focus on private stormwater (soakage devices),
    b. public stormwater management and the community's acceptance and adoption of WSUD in the network (i.e. swales).

Although WSUD infrastructure is a requirement of the consent, it is also supported by the recommendations of the section on appropriate stormwater infrastructure solutions (section 4.2).

4.2 Appropriate Stormwater Infrastructure Solutions

Stormwater infrastructure solutions should consider the local geology, topography, and rainfall scenarios. Best practice under the NPS-SM and resource consent conditions recommends WSUD and at source management and treatment of stormwater contaminants. In addition, the type of WSUD treatment will depend on the type of contaminants that are being targeted for treatment (Figure 17).

Whangamata is a coastal town with added complexities of flooding and erosion from the sea-ward coast, flooding from the inland river systems that created the now suburban sandspit, it's flat topography, sandy soils (mostly) and it's limited existing pipe network (both in extent and capacity).

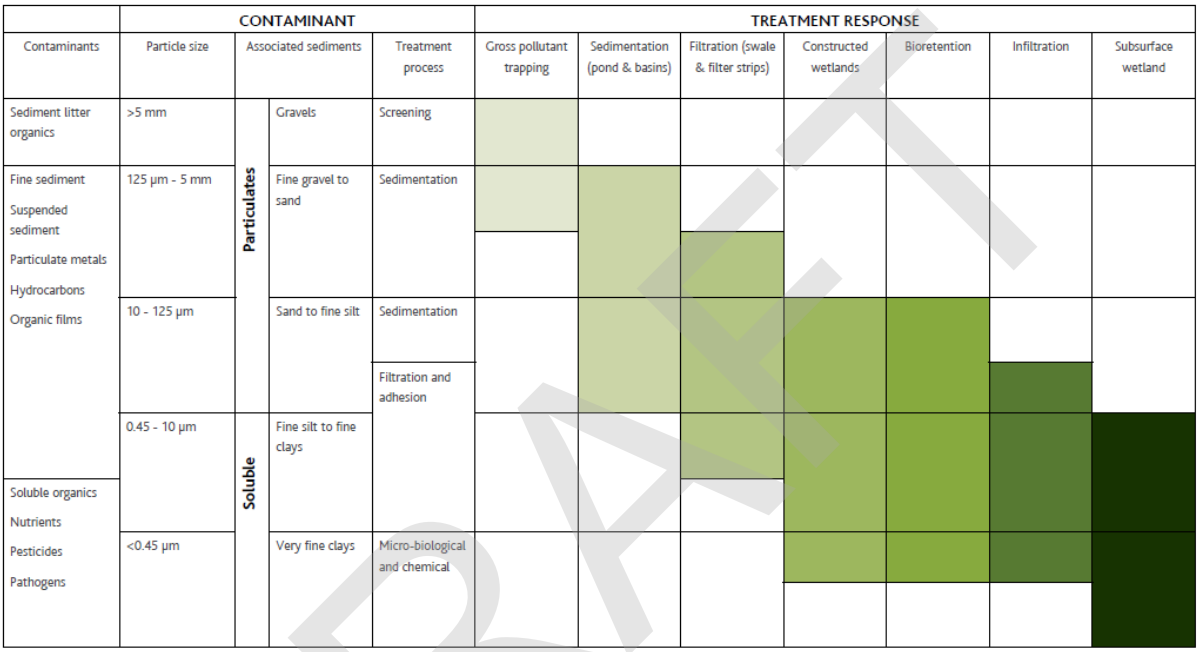

Figure 17: Targeted stormwater treatment through complementary practices (Lewis *et al.*, 2015).

The current stormwater network at Whangamata relies on traditional piped infrastructure to service the roads and public spaces and soakage for all private disposal (capable of managing a 1 in 10 year rain event and must be maintainable). The current design standard for the primary stormwater system is to convey a 10-year storm event (10% Annual Exceedance Probability, AEP), culverts a 20 year (5% AEP), open channels and overland flow paths a 50 year event (2% AEP) and bridges designed for a 100 year (1%) rain event according to Opus 2005. The TCDC Code of Practice for Stormwater, 2013 states the primary system must convey a 5 year (20% AEP) rain event. From the previous analysis completed in 2005 using the 10% AEP design standard, over 50% were undersized (Opus, 2005).

The Opus report (2005) recommended stormwater is reticulated to service roadways and private properties continue to use soakage. This is a favoured option to due to the existing soakage potential, the hydraulic effect of reducing total runoff and slowing the time of concentration of flow.

Soakage has been tested extensively in Whangamata and soakage north of Oteha Road is known to be excellent whereas south of Oteha Road soakage needs to be verified on a case-by-case basis (Opus, 2005). Soakage is understood to be able to cope with a 10% return period event although the maintenance of soakage devices is unlikely to be managed and many devices/property areas are likely to be insufficiently sized to cope with an event of this size. In larger events and following prolonged rainfall, these devices are also likely to be overwhelmed and secondary flow paths are not defined or

managed in Whangamata. Our preliminary work reinforces the reports of flooding around the peninsula that in large events, houses are flooded due the lack of managed secondary flow paths.

Costs developed in the Opus 2005 report (in 2005 dollars) to bring the pipe network up to the design standard (conveying a 10% AEP without surcharging) were estimated to be $6.7M-$9.3M. Costs of recommended swales, supporting investigations (such as soakage testing), design and consenting were not included in the estimates. For information, this is approximately $8.9M and $12.3M in today's dollars (using the Reserve Bank New Zealand inflation calculator). The costs also didn't cover operational expenditure (OPEX) for increased maintenance of existing private and public infrastructure. A significant investment in this order, should be made ensuring the most appropriate infrastructure solutions are developed for the location.

Public perception, and ultimately the community's engagement in understanding the issues involved with alleviating flooding is essential to the success of any capital works plan. We would recommend engagement with the community to discuss what the current perception is of appropriate infrastructure solutions, and then engage with them on the risks, themes and opportunities raised by this report. We believe this will demonstrate to the community how and why the proposed approach will alleviate flooding and other stormwater issues and why there are constraints and limitations to what can be achieved.

Three demonstration projects have been outlined to address how this approach could realise a water sensitive design solution in three known problem areas:

1. **Williamson Park Pond** – Issues with unattractive and unsafe condition of pond, litter and perception of the pond causing localised flooding. Traditional Infrastructure solutions are not recommended by consent and will be less effective in the future (history of pipes getting silted up, and rainfall event intensities).
    a. Proposal to investigate a redesigned wetland providing flood attenuation, treatment and amenity value. Maximise conveyance along Williamson Road with the existing pipe network supplemented by swales and investigate options for overland flow conveyance up to 1% AEP plus anticipated climate change rainfall. This will optimise use of soakage, provide treatment for the stormwater discharged and provide improved amenity for Williamson Park. An indicative example is provided in Figure 18.

2. **Port Road/Beach Road** – Issues with localised flooding, gross pollutants and the outlet.
    a. Proposal to investigate gross pollutant management in main commercial/shopping area, on-road treatment (raingardens) and sub-catchment stormwater device(s) maximising swale conveyance to maximise soakage and manage flooding. This will manage gross pollutants, provide an above ground and visible stormwater system through the raingardens and sub-catchment devices and reduce the reliance on the piped network which tends to get blocked at the outlet and suffer from reduced capacity in the pipes due to sand/blockages.

3. **Eastern end of Harbour View Road and Beach Road** – issues with coastal inundation and flooding from river.
    a. Proposal to investigate floor levels and localised solutions to reduce the extent of damage to property from potential flooding events. Identify and formalise overland flow paths using existing public land.

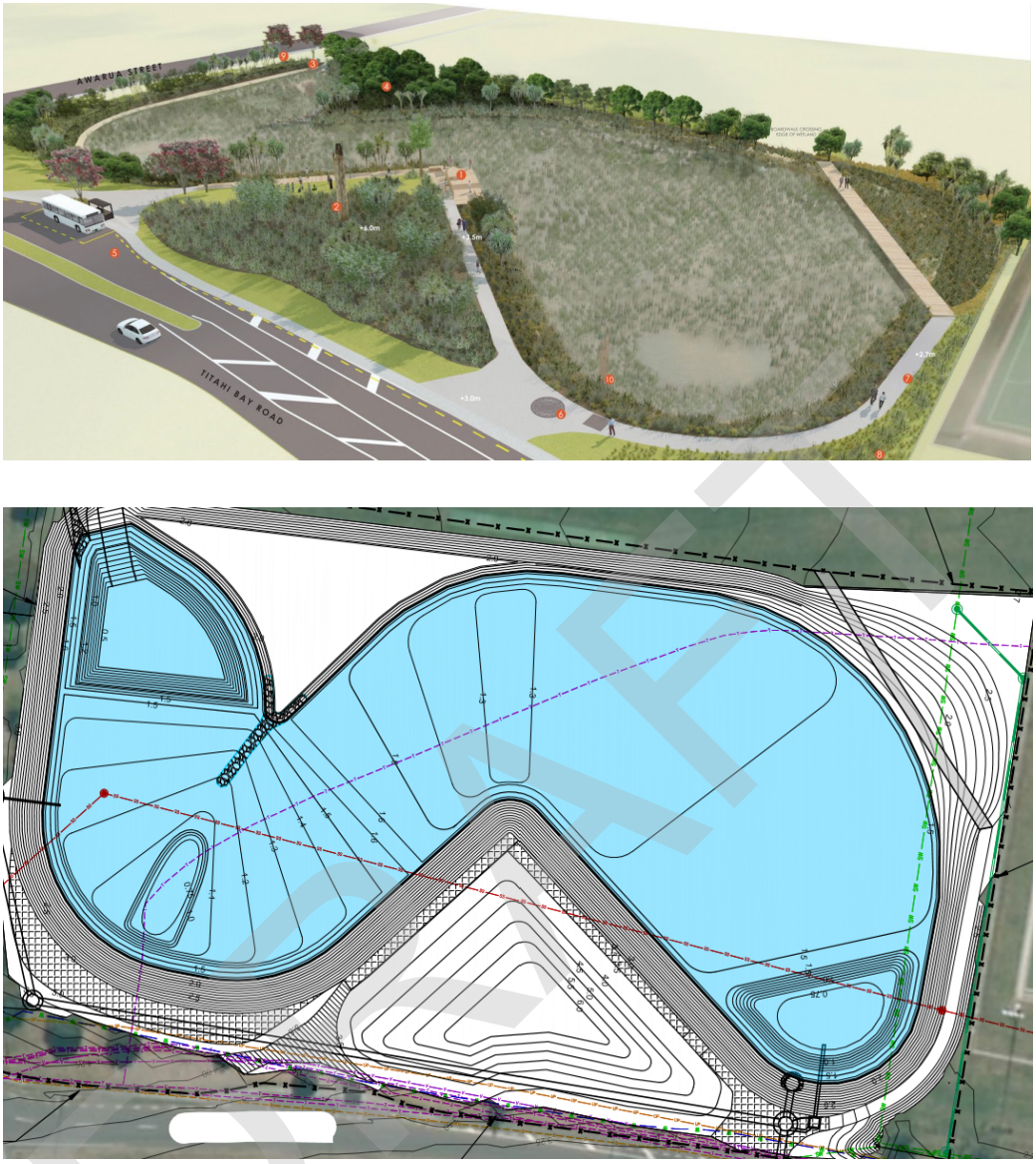

Figure 18: Indicative coastal wetland with amenity value (Credit Morphum and DCM Urban).

4.2.1 Recommendations related to appropriate stormwater solutions

To ensure appropriate solutions are being designed and proposed for Whangamata by taking into account the flat topography, sandy soils and beach environment and by utilising the wide road reserves for WSUD and to optimise soakage potential. We recommend:

1. Three projects outlined in section 4.2 above be progressed to concept design to communicate to stakeholders what, how and why these solutions are appropriate for these locations. The objectives will be to grow the community's understanding and expectation of stormwater management and WSUD. The design would need to incorporate community and Mana Whenua inputs.
2. Ensure WSUD principles are being used in the development and design of all stormwater solutions. Following the development of the WSUD Implementation Plan, develop, adapt or adopt a WSUD design guidance/standard that incorporates WSUD principles – including the amenity and shade potential of planted systems.

3. Put a hold on any investment in stormwater infrastructure (particularly hard engineering solutions and pipes), until the recommendations of section 4.3 Flooding and Coastal Hazards Planning, are considered and complete.
4. Provision of conveyance, treatment and soakage through constructed swales to help to manage design events and overland flows (Figure 19).
5. Targeted treatment devices for contaminants particularly in commercial and industrial areas.
6. Consider semi-saline wetlands in coastal inundation areas.
7. Invest in maintenance for outfalls and existing pipes and catchpits. Invest in maintenance programme and support of private infrastructure management.
8. Create a management overlay to demarcate different requirements for maintenance for private soakage devices where different soakage performance has been recorded or identified (i.e. south and north of Otahu, and in the north part of Whangamata across the SH25 bridge, Opus, 2005). This management overlay may also demarcate other management requirements such as rules for stormwater treatment in commercial and industrial zones.

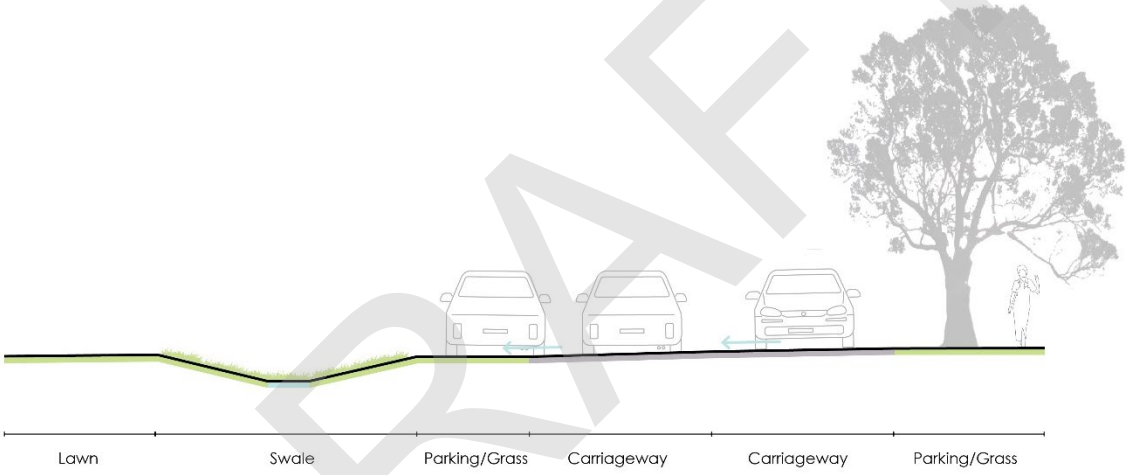

Figure 19: Potential roadside swale for stormwater conveyance and to encourage soakage.

4.3 Flooding and Coastal Hazards Planning: Sea Level Rise and Climate Change

Understanding of climate change and projected sea level rise over timescales and different scenarios is complex and multifaceted (MfE, 2017, Smith *et al.*, 2011). The increasing frequency of coastal inundation impacts on low relief coastal infrastructure such as parks, footpaths and roads, pipe networks, communities and low-lying ecosystems are challenging to resolve and plan for (Smith *et al.*, 2011). Further to sea level rise, high storm-tides and large waves contribute to storm erosion and flooding on the open coast of the region (MfE, 2017). These processes can combine in a number of ways to inundate low-lying coastal margins or cause coastal erosion (MfE, 2017, Figure 20).

New Zealand Coastal Policy Statement (NZCPS) and the Waikato Regional Policy Statement (RPS) require governing bodies to identify coastal hazard zones so that development and land use can be restricted within these zones. Predicted changes over 100 years and associated predicted climate change effects are also required (TCDC, 2018). The main coastal hazard risks include; flooding (from catchment and tides), coastal erosion and tsunami (MfE, 2017. TCDC District Plan, section 34, TCDC 2018).

A risk-based approach to coastal hazards is assessed by a combination of the probability of the impact occurring and the consequence of the impact, where the consequence relates to damage to infrastructure and people. TCDC adopted a risk based Coastal Management Strategy in 2018 to provide strategic direction for the management of coastal assets, erosion and the risk of coastal inundation (TCDC, 2018).

Ocean beaches are dynamic and naturally fluctuate through accretion and erosive phases over long periods of time (Dahm and Gibberd, 2015). The Current Coastal Erosion Line (CCEL) along Whangamata ocean beach is the shoreline width that is susceptible to erosion with existing sea level (TCDC District Plan, 2018). The District Plan (DP) encourages the avoidance of the development of large structures between the CCEL and the ocean however any existing structures e.g. dwellings, are permitted by existing resource consent (TCDC District Plan, 2018). Site specific assessments of coastal hazard risk is recommended for new resource consents within the CCEL zone (TCDC District Plan, 2018).

The Future Coastal Protection Line (PCPL) is the additional shoreline width along Whangamata ocean beach that has the potential for erosion that is intensified by predicted sea level rise of 0.9 m over the next 100 years (TCDC District Plan, 2018). The area between the CCEL and the PCPL needs to managed to protect the coastal zone from on-going and potential erosion into the future. Beach restoration, hard or soft defences may move this predictive line landward or seaward however, the changes over time are largely unknown due to the uncertainties with sea level predictions (MfE, 2017). Any greenfield developments should have planning restrictions to avoid areas prone to coastal hazards (New Zealand Coastal Policy Statement, objective 5, 2010).

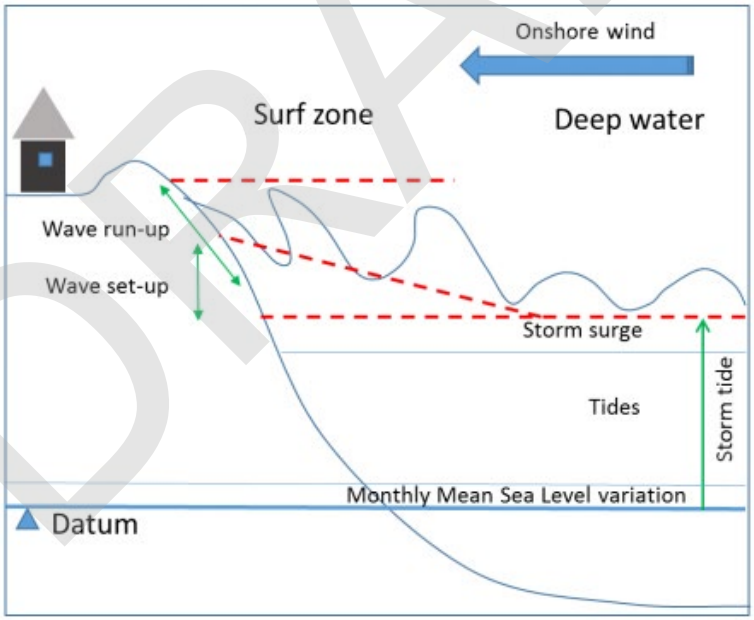

Figure 20: Schematic of the processes contributing to coastal inundation (Stephens *et al.,* 2013).

4.3.1 Sea Level Rise Adaptation

To assist in decision-making, the Ministry for the Environment recommends that planning for the impacts of coastal hazards follow a 10-step decision cycle (Figure 21, MfE, 2017). The MfE decision cycle is based around ten stages:

1. Preparation and Context
2. Hazard and Sea- Level Rise Assessments

3. Values and Objectives
4. Vulnerability and Risk
5. Identify Options and Pathways
6. Options Evaluation
7. Adaptive Planning Strategy
8. Implementation Plan
9. Monitor
10. Review and Adjust

Community engagement forms the hub of the decision cycle, with the ultimate decision on future actions resting with community based on best practice guidance (MfE, 2017).

Stage Five of this decision cycle identifies adaptive options for a sea level rise and coastal inundation response strategy (MfE, 2017):

1. Accommodate: modifying existing assets and infrastructure that incorporate likely hazard risk e.g. raise floor levels, provide formalised overland flow pathways.
2. Retain and Defence: hard or soft defences to prevent coastal inundation to enable continued existing uses and values e.g. seawalls or dunes.
3. Retreat from areas affected by inundation and allow low lying areas to naturally adjust to rising seas and increased coastal inundation.
4. Avoidance: through the planning process remove infrastructure and assets from the hazard zone through land use changes.

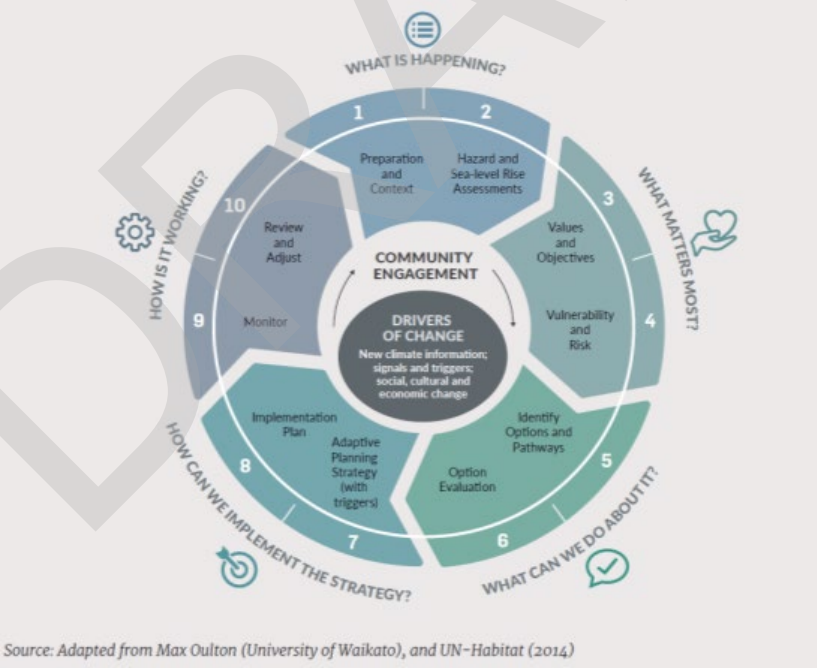

Figure 21: The 10-step decision cycle grouped around five questions (MfE, 2017).

Figure 22: Coastal Inundation – Projected Sea Level Rise of 0.5m, 1.0m and the worst case scenario (including tsunami and storm surge)

Source: MfE, Waikato Regional Council, Coastal Inundation Tool, 2017), River Flood Hazard (WRC, 2019), beach amenity and community facilities from the Thames Coromandel District Plan, 2010) and building outlines.

4.3.2 Recommendations related to adaptation

We recommend progressing a small number of WSUD projects while overland flow and sea level rise constraints are identified and responses/areas formulated and consulted on. This will be informed by the Shoreline Management Plans that are being developed by TCDC and considering coastal erosion (cyclical and long term due to sea level rise) and inundation patterns impacting on land-use.

We also recommend considering not investing in infrastructure, particularly not hard infrastructure, in vulnerable areas until coastal management strategies are developed.

To address **potential flooding issues from rainfall, groundwater and catchment flows, we recommend that TCDC:**

1. Develop the key adaptation strategy(ies) to reduce the impacts of flooding across the town by demarcating overland flow paths for the maximum probable event and minimising the need for pumping and bunding/wall solutions. This could include:
    a. Create formalised overland flow paths along roads that are wide and shallow however in some cases this may require use of private land and relocating some houses.
    b. Consider modelling the OLFPs for Probably Maximum Precipitation and 1% AEP+ Climate Change to understand the implications and effects.
2. Prioritise the OLFP's (a proposed prioritisation method is included in section 6.0) and programme their demarcation and development.
3. Retreat from flood prone areas (rivers and catchment flow) – retire land and allow inundation. This can result in a change in current uses and values that are incompatible with increased levels and frequencies of coastal inundation. This could mean offsetting lost amenity space and value.

This may be being defined through the Shoreline Management Plans currently being developed (TCDC Website, May 2019). Coordinate with their findings.

To address **potential coastal inundation, erosion, sea level rise and climate change, we recommend**:

4. A review of current coastal setbacks (CCEL and PCPL) considering projected SLR and wave action. Consider this be extended around the peninsula.
5. Develop the key adaptation strategy to reduce coastal inundation and erosion through:
    a. Adapt/Retain strategies – undertake active management strategies to build resilience and minimise impacts of sea level rise to maintain current uses and values. Defend is not considered a feasible solution in this geology (active coastal environment), infrastructure resilience (i.e. the reliability of power supply for pumped solutions) and budget constraints (this is often a temporary solution).
    b. Retreat from coastal edges by developing and consulting on the likely and maximum (foreseeable) inundation scenarios in the lifespan of stormwater assets (100-200 years). This will minimise the need for pumping and bunding/wall solution in the future. This may include undertaking a 10-step decision cycle programme/plan to plan for long term (Figure 21).
6. Implement recommendations from "The Eastern Seaboard Coastal Management Plan: Coastal Strategy for the Tairua, Pauanui and Whangamata Ocean and Estuarine Shorelines" (Dahm and Gibberd, 2015). With priority on the following recommendations:
    a. Continuation to restore and protection of native dune vegetation species along Whangamata Beach. Actions include progressively reducing exotic species which displace native dune vegetation and degrade natural function of dune systems.
    b. Manage erosion with soft engineering options including beach nourishment and dune planting.

c. Removal of derelict structures and non-functional hard structures.
d. Investigate blue infrastructure habitat enhancement opportunities for existing and necessary infrastructure such as wharfs and marinas. Bio-engineering the shape and material of coastal structures provides a habitat for marine species e.g. textured and hollowed out surface of a breakwater can serve as a habitat crayfish and fishes. There is an opportunity for design of these structures on the permanently and periodically submerged structures.

7. Consider essential services (food, water supply and transport) and apply adaptation rules/management overlay to those services. For example, if the town is cut off in a flood event, is the supermarket accessible for those that will be isolated in Whangamata township?
8. Consider that in the retreat scenario(s) the existing buffer that many coastal towns have is currently amenity and recreational areas. Offsetting those amenity areas will be required. This is true for Whangamata (see Figure 10: Social and community features of Whangamata.). New overland flow paths could be developed to be multipurpose amenity, green space and overland flow.

While the above are being defined/modelled and mapped, concepts for the priority projects outlined in section 4.2 can be progressed and consulted on as they are not directly in the coastal/inundation areas.

4.4 Stakeholder and Community Engagement

The process for integrated and adaptive stormwater management in a coastal setting requires stakeholder, community and mana whenua engagement at its core to be successful. Understanding of social and cultural drivers will assist council in prioritising and implementing investment.

4.4.1 Stakeholder Definitions

Stakeholders can be defined at a local scale, community members who live in certain area as well as a wider group of people that have an interest in a certain topic, place or idea at a regional, national and even global scale e.g. conservation groups or beach front property owners (MfE, 2017).

The Local Government Act 2002 and the Resource Management Act 1991 require councils to adhere to and consider the principles of the Treaty of Waitangi/ Te Tiriti o Waitangi (LGA, 2002). If Mana Whenua (territorial rights) have been identified as project partners, engagement should begin at project concept stage and in advance of project deadlines to ensure enough time is given for scheduling. For this Masterplan it is recommended that an Iwi partnership is developed.

There are four potential levels of engagement that a stakeholder engagement programme can have which are listed in Table 1. We recommend an Involve-to-Empowerment model be used to drive the implementation of the Stormwater Masterplan over 10 years.

Table 2: Level of stakeholder engagement, goals and examples of approach.

Level of engagement commitment	Goal	Promise to stakeholders	Examples of approach
Inform	To provide stakeholders with sufficient information to make them aware of the project and decide if they would like to be further involved.	We will keep you informed	Letter drop

Level of engagement commitment	Goal	Promise to stakeholders	Examples of approach
Consult	To obtain stakeholder feedback on analysis, alternatives and/or decisions	We will keep you informed, listen to and acknowledge your concerns and aspirations.	Stakeholders submit written responses or attend drop-in days to provide feedback and ideas.
Involve	To work directly with stakeholders throughout the process to ensure that their concerns and aspirations are consistently understood and considered.	We will work with you to ensure that your concerns and aspirations are directly reflected in the alternatives developed and provide feedback on how stakeholder input influenced the decisions.	Groups of stakeholders meet with Council and talk through ideas, concerns and aspirations. Council staff to provide feedback.
Empower	To place the final decision making in the hands of the stakeholders	We will implement what you decide.	Council present ideas, solutions and alternatives to decision-makers who may deputise to make final decisions.

4.4.2 Stakeholder Engagement at Whangamata

The following section identifies possible social and cultural drivers to assist council in prioritising and implementing investment. This initial values assessment will need to be informed by a stakeholder engagement plan to ensure that these drivers represent the stakeholders. The likely drivers are (not in prioritised order):

- Flooding, coastal inundation and coastal erosion:
  - Flooding of floor levels, properties and garages
  - Loss of land on beach front properties and damage to infrastructure (erosion)
  - Flooding of roads, accessways and footpaths
  - Flooding of public spaces and other community facilities e.g. parks
  - Flooding or loss of land for businesses
- Ecological and environment:
  - Degradation and loss of habitats and species
  - Natural character, protection of natural features and landscape values.
  - Coastal processes and dynamic ocean beaches.
- Recreational, amenity and sense of place:
  - Surf breaks
  - Fisheries and boating
  - Parks and public spaces
  - Amenity values for coastal lifestyle and beach living

4.4.3 Recommendation related to stakeholder engagement

Complete a stakeholder engagement plan. Include internal stakeholders as the first stakeholder group.

5.0 Gap Analysis and Risk Assessment

Using the information compiled in the strategic themes section, the following gaps in knowledge/data have been identified for the Whangamata SMP. These are:

- Understanding the rate of development and the future development typology
- Level of service and condition of current stormwater infrastructure
- Traditional infrastructure solutions (pipes) vs Water Sensitive Infrastructure (green assets)
- Implications of sea level rise and climate change
- Contaminants generated on land and discharged to the estuary and coastal environments
- Changing expectations of the community

These gaps in knowledge could be informed by improved data sets. 34 relevant data sets were reviewed regarding stormwater management and prioritised using the following method:

1. A quality rating score where good = 1, moderate =2, poor/missing = 3
2. A criticality rating score for this SMP where high = 3, moderate =2, low =1)
3. The resulting score provides a maximum of 9 points for data sets that are most critical and of poorest quality which has guided our recommendation for the data gaps to be prioritised.

This method has resulted in the data gaps and prioritisation presented in Table 3 where 15 data sets are ranked with a moderate or poor-quality score, and are considered critical for this SMP (i.e. scores of 6 and 9). Recommendations on whether these data gaps are worth filling now, progressively over several years, or not at all (i.e. accepting the risk) are included in the table according to the risk assessed to the stormwater masterplan.

A total of nine data sets are ranked with a good data quality rating score:

1. River environment – major named waterways (national dataset)
2. Contours (LiDAR)
3. District Plan Zones (Land use)
4. Location of groundwater bores (Regional bore database for groundwater)
5. Potential contaminated land sites
6. 3 Waters Area of Service
7. Beach amenity zones
8. Outstanding natural features or landscapes
9. Marine habitat types (Department of Conservation)

Appendix 1 contains a full list of data sets and prioritised gaps.

Table 3: Prioritised gap analysis of data for the Whangamata Stormwater Master Plan (SMP).

Count	Dataset	Description	Type	Data Rating: Good = 1 Moderate =2 Poor/missing = 3	Criticality for SMP: High = 3, Moderate =2, Low =1	Overall Score (Data rating x Criticality)	Data Gaps	Recommended Actions (N = now, P = progressively, A = accept risk)
1	**Geology/soil types**	Regional geology	Polygon	3	3	9	Gives a baseline to assess soakage potential for stormwater devices. Missing Whangamata Town.	**N** - Summarise soakage information (possibly from building consents).
2	**Receiving Environment Water Quality Monitoring**	Water quality data for the estuary and harbour	Point	3	3	9	Consent requirement.	**N** - Implement a water quality monitoring programme.
3	**Flood Hazard - TCDC**	Area of flood hazard at district level	Polygon	3	3	9	Higher definitions of flood risk. Not undertaken in Whangamata to date.	**N** - Undertake for Whangamata with definition of flood risk categories.
4	**Renewals/forward works program (Roading)**	Future works overlay	Spreadsheet	3	3	9	As above.	**N** - Required in order to determine synergies with future works in Sw/3 Waters.
5	**SW management devices**	Ponds, wetlands, raingardens, swales	Polygon	3	3	9	Does not exist.	**N** - Document devices from development engineers/asset team and record in GIS.
6	**Parks and Reserves**	Areas of council owned land designated as parks and reserves	Polygon	2	3	6	Areas feasible for public SW treatment devices. Some parks/recreation areas on aerial imagery are not indicated within GIS layer, and some are not parks (e.g. are carparks or buildings).	**N** - Update public and open spaces appropriate for future WSD devices.
7	**Utilities Plant**	Three waters infrastructure - pump and inspection locations.	Point	2	3	6	Need to separate out asset types in this layer to distinguish between valves and pump stations.	**N** – Check infrastructure located within flood risk areas and coastal erosion setback.
8	**Asset Management Plan data extract (asset finder)**	Detail on operational management of stormwater assets	Spreadsheet	3	3	9	Useful in order to determine synergies with future works in 3 Waters and the roading space. Has not been provided to date/ not available.	**P** – align if/when this is available.
9	**Renewals/forward works program (SW)**	Future works overlay	Spreadsheet	3	3	9	As above. FWP being created as part of this SMP. Renewals has not been provided to date/ not available.	**P** – align if/when this is available.
10	**Sites of Significance to Maori**	Areas of significance to mana whenua	Polygon	3	3	9	No significant cultural areas for Whangamata recorded in data received.	**P** - Use iwi engagement to inform this.
11	**Structure plan**	Areas where Greenfields and intensification are proposed	Polygon	3	3	9	To understand rate of development and land use changes over time. Only one area marked as future growth.	**P** - Confirm with policy team for data.
12	**Historic heritage area**	Historical character retained	Polygon	2	3	6	No historic areas mapped for Whangamata. Use Stakeholder engagement to inform this.	**P** - Stakeholder engagement
13	**Geocoded complaints (RFS's Whangamata Geocoded)**	Flooding and OLFP complaints geocoded within Whangamata	Point	2	3	6	Opus 2005 data has not been digitised but comparisons have been made. Current 2019-2020 complaints missing. **Recognise users/owners who don't complain or who may have given up thinking their issues will be addressed.**	**P** - Use exiting complaints to overlay with proposed reticulated network upgrade layer (when developed) and in detailed design stages to determine if issues are being addressed.
14	**Sub-Catchments**	SW sub-catchments as demarcated within Opus Report	Polygon	2	3	6	SMP has now created model sub-catchments.	**P** - Ground truth progressively.
15	**Flood Hazard - Regionwide WRC**	Area of flood hazard at regionwide level	Polygon	2	3	6	Whangamata specific flood, rain and coastal inundation modelling.	**N/A** - SMP scope includes this. Review interactions with receiving environment models.

6.0 Preliminary Prioritisation of Catchments

Morphum have completed a preliminary prioritisation of catchments using the following criteria. Additional discussion on criteria and weighting is required before prioritising investigations and planning/scoping of capital works.

1. Land-use (commercial and industrial generate higher levels of contaminants)
2. Receiving environment (assuming the estuarine environment is more susceptible to contamination) (Figure 23).
3. Complaints (reported flooding) and or catchments with the most intersections with (refined/verified) OLFP's
4. Areas/buildings inundated by SLR are deprioritised to allow for retreat policies to be developed (vertical and horizontal).

Additional criteria (require additional data or analysis) could be:

5. Catchments with most critical assets.
6. Catchments with pipes affected by sediment.
7. Overlaps with other critical infrastructure/facilities (Civil Defence).
8. Overlaps with roading/transport upgrade forward works plan.

Figure 23: Whangamata piped sub-catchments by receiving environment.

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Appendix 1 Data Gap Analysis

Count	Dataset	Description	Type	Data Rating: Good = 1 Moderate =2 Poor/missing = 3	Criticality for SMP: High = 3, Moderate =2, Low =1	Overall Score	Data Gaps	Recommended Actions (N = now, P = progressively, A = accept risk)
1	**Geology/soil types**	Regional geology	Polygon	3	3	9	Gives a baseline to assess soakage potential for stormwater devices. Missing Whangamata Town.	**N** - Summarise soakage information (possibly from building consents).
2	**Receiving Environment Water Quality Monitoring**	Water quality data for the estuary and harbour	Point	3	3	9	Consent requirement.	**N** - Implement a water quality monitoring programme.
3	**Flood Hazard - TCDC**	Area of flood hazard at district level	Polygon	3	3	9	Higher definitions of flood risk. Not undertaken in Whangamata to date.	**N** - Undertake for Whangamata with definition of flood risk categories.
4	**Renewals/forward works program (Roading)**	Future works overlay	Spreadsheet	3	3	9	As above.	**N** - Required in order to determine synergies with future works in Sw/3 Waters.
5	**SW management devices**	Ponds, wetlands, raingardens, swales	Polygon	3	3	9	Does not exist.	**N** - Document devices from development engineers/asset team and record in GIS.
6	**Parks and Reserves**	Areas of council owned land designated as parks and reserves	Polygon	2	3	6	Areas feasible for public SW treatment devices. Some parks/recreation areas on aerial imagery are not indicated within GIS layer, and some are not parks (e.g. are carparks or buildings).	**N** - Update public and open spaces appropriate for future WSD devices.

Count	Dataset	Description	Type	Data Rating: Good = 1 Moderate =2 Poor/missing = 3	Criticality for SMP: High = 3, Moderate =2, Low =1	Overall Score	Data Gaps	Recommended Actions (N = now, P = progressively, A = accept risk)
7	**Utilities Plant**	Three waters infrastructure - pump and inspection locations.	Point	2	3	6	Need to separate out asset types in this layer to distinguish between valves and pump stations.	**N** – Check infrastructure located within flood risk areas and coastal erosion setback.
8	**Asset Management Plan data extract (asset finder)**	Detail on operational management of stormwater assets	Spreadsheet	3	3	9	Useful in order to determine synergies with future works in 3 Waters and the roading space. Has not been provided to date/ not available.	**P** – align if/when this is available.
9	**Renewals/for ward works program (SW)**	Future works overlay	Spreadsheet	3	3	9	As above. FWP being created as part of this SMP. Renewals has not been provided to date/ not available.	**P** – align if/when this is available.
10	**Sites of Significance to Maori**	Areas of significance to mana whenua	Polygon	3	3	9	No significant cultural areas for Whangamata recorded in data received.	**P** - Use iwi engagement to inform this.
11	**Structure plan**	Areas where Greenfields and intensification are proposed	Polygon	3	3	9	To understand rate of development and land use changes over time. Only one area marked as future growth.	**P** - Confirm with policy team for data.
12	**Historic heritage area**	Historical character retained	Polygon	2	3	6	No historic areas mapped for Whangamata. Use Stakeholder engagement to inform this.	**P** - Stakeholder engagement

Count	Dataset	Description	Type	Data Rating: Good = 1 Moderate =2 Poor/missing = 3	Criticality for SMP: High = 3, Moderate =2, Low =1	Overall Score	Data Gaps	Recommended Actions (N = now, P = progressively, A = accept risk)
13	**Geocoded complaints (RFS's Whangamata Geocoded)**	Flooding and OLFP complaints geocoded within Whangamata	Point	2	3	6	Opus 2005 data has not been digitised but comparisons have been made. Current 2019-2020 complaints missing. **Recognise users/owners who don't complain or who may have given up thinking their issues will be addressed.**	**P** - Use exiting complaints to overlay with proposed reticulated network upgrade layer (when developed) and in detailed design stages to determine if issues are being addressed.
14	**Sub-Catchments**	SW sub-catchments as demarcated within Opus Report	Polygon	2	3	6	SMP has now created model sub-catchments.	**P** - Ground truth progressively.
15	**Flood Hazard - Regionwide WRC**	Area of flood hazard at regionwide level	Polygon	2	3	6	Whangamata specific flood, rain and coastal inundation modelling.	**N/A** - SMP scope includes this. Review interactions with receiving environment models.
16	**Current building consents status**	Detail on building consents	Polygon	2	2	4	No dates. Has arbitrary fields for "in progress", completed and suspended" that mean very little without a date.	Current building consents status
17	**Current resource consents status**	Detail on resource consents	Polygon	2	2	4	No dates. Has arbitrary fields for "in progress", "monitoring" Flagged completed and suspended" that mean	Current resource consents status

Count	Dataset	Description	Type	Data Rating: Good = 1 Moderate =2 Poor/missing = 3	Criticality for SMP: High = 3, Moderate =2, Low =1	Overall Score	Data Gaps	Recommended Actions (N = now, P = progressively, A = accept risk)
							very little without a date or more detail	
18	**River environment - named waterways**	Lines of named major waterways	Polyline	1	3	3	Nil	Check if these receiving environment layers are as identified within the CSDC
19	**Contact recreation water bodies**	Water bodies utilized for recreation	Polyline	3	1	3	Nil	None defined in Whangamata Area
20	**Contours (LiDAR)**	Contours (LiDAR)	Polyline, Point	1	3	3	Nil	Use LIDAR to map stormwater sub-catchments and create OLFPs
21	**District Plan Zones**	Land use	Polygon	1	3	3	Nil	District Plan Zones
22	**Regional bore database for groundwater**	Point feature class of monitoring and water take and groundwater monitoring bores	Point	1	3	3	Nil	Overlay with potentially contaminated sites to identify possible GW contamination
23	**Sea or harbour or estuary**	Shape of the ocean, harbour and estuarine environments.	Polygon	2	1	2	Confirm upper limits of coastal influence using LiDAR and MHWS.	Check if these receiving environment layers are as identified within the CSDC
24	**Natural Protected Areas**	District protected and significant natural areas	Polygon	2	1	2	Data lacks a description of features that are significant. Species of interest e.g. birds	Ensure that these sites are monitored and protected from potential and current environmental effects

Count	Dataset	Description	Type	Data Rating: Good = 1 Moderate =2 Poor/missing = 3	Criticality for SMP: High = 3, Moderate =2, Low =1	Overall Score	Data Gaps	Recommended Actions (N = now, P = progressively, A = accept risk)
25	**Terrestrial Vegetation Types 2012**	Description of terrestrial habitat classifications.	Polygon	2	1	2	Nil	
26	**WW points**	WW Pipes and connection	Polyline	2	1	2	Missing a proportion of depths, no as-built reference	Fill progressively with capital works
27	**WW lines**	WW Manholes and chambers	Polyline	2	1	2	Missing a proportion of inverts and depths, no as-built reference	Fill progressively with capital works
28	**WS points**	WS valves and junctions	Point	2	1	2	Missing a proportion of depths, no as-built reference	Fill progressively with capital works
29	**WS lines**	WS Pipes and connections	Polyline	2	1	2	Missing a proportion of inverts and depths, no as-built reference	Fill progressively with capital works
30	**Potential Contaminated Land Sites**	Potential Contaminated Land Sites	Polygon	1	1	1	Nil	Overlay with GW bore layer to identify possible GW contamination - potentially contaminated sites
31	**3 Waters Area of Service**	Area of service	Polygon	1	1	1	Nil	Nil
32	**Beach amenity**	Restriction of building height and public notification requirement, to protect the amenity of the beach.	Polygon	1	1	1	Nil	Nil
33	**Outstanding natural**	Natural environment	Polygon	1	1	1	Nil	Check if these receiving environment layers are as

Count	Dataset	Description	Type	Data Rating: Good = 1 Moderate =2 Poor/missing = 3	Criticality for SMP: High = 3, Moderate =2, Low =1	Overall Score	Data Gaps	Recommended Actions (N = now, P = progressively, A = accept risk)
	features or landscapes	assessed by WRC to be outstanding and significant						identified within the CSDC.
34	**DoC Marine Habitat Types**	Description of marine habitat classifications.	Polygon	1	1	1	Nil	Overlap with SW points in order to determine intersection with discharge from outfalls